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A PRUDENT REGULATORY RESPONSE TO THE POTENTIAL HEALTH HAZARDS OF ELECTROMAGNETIC FIELDS

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Electricity is a vital part of modern society. At home, at work, wherever people go, they use electricity. However, studies increasingly suggest that electric and magnetic fields generated from electric power may pose a risk to human health. Researchers have linked electromagnetic fields ("EMF") to such problems as cancer, birth defects, growth abnormalities and other serious diseases.[1] The scientific research of EMF's effects are highly contradictory and inconclusive.[2] While billions of dollars have been spent on research, the exact risk posed by EMF is still unknown.[3]

Although research remains inconclusive, public concern about potential hazards from EMF has increased greatly in recent years. Numerous books, newspaper and magazine articles, television shows, and even movies have covered the issue.[4] Lawsuits have begun to focus on EMF, grassroots organizations have been organized to protest EMF, and public interest groups across the country have protested the siting of new

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1. Mohammad Harunuzzaman, *The EMF Issue: How Consumers, Utilities and Regulators Are Responding to a Growing Health Concern*, NAT'L REG. RES. INST. Q. BULL., Mar. 1991, at 47, 47.

2. John C. Boteler & William R. Hendee, *The Question of Health Effects from Exposure to Electromagnetic Fields*, 66 HEALTH PHYSICS, Feb. 1994, at 127, 127.

3. *Id.*

4. For example, the following newsletters have been developed to cover the EMF issue: MICROWAVE NEWS, VDT NEWS, EMF NEWS, and THE ELECTROMAGNETIC FIELD LITIGATION REPORTER. Roy W. Krieger, *On the Line*, 80 A.B.A. J., Jan. 1994, at 40, 41. Also, television shows such as CBS's *Street Stories*, ABC's *Good Morning America* and *Prime Time Live*, and CNN's *Larry King Live* have discussed the topic. The film DISTINGUISHED GENTLEMAN (Hollywood Pictures 1993) starring Eddie Murphy also featured EMF. Gene Pokorny, *EMF: The Process of Dialogue*, ELECTRIC PERSP., May/June 1993, at 68. Numerous newspaper articles have been written across the country, as well as several books, including the controversial book by Paul Brodeur entitled CURRENTS OF DEATH.

power lines.[5] Citizens are demanding action, and regulators are under great pressure to respond.[6] Because scientific studies are uncertain, however, the proper role of regulators is unclear. While policymakers must protect the public from potential health hazards, they must also consider society's increasing need for electric power.[7]

Nine states have imposed regulations concerning EMF.[8] The regulations range from setting standards to imposing moratoria, and implementing reporting requirements.[9] While strict laws are unnecessary given the current data, some action is warranted. In a report on EMF, the Office of Technology Assessment stated that the "implications of [the] interactions for public health remains unclear, but there are legitimate reasons for concern."[10] This paper argues that states should form a reasonable regulatory response such as Colorado's "prudent avoidance" approach.

Section II of this paper provides a brief background on EMF and describes the various studies that have tested the effects of EMF. Section III discusses the role of regulators in dealing with the potential health hazards of EMF and addresses the problems with current approaches while advocating prudent precautions. Section IV illustrates possible means of implementing a prudent avoidance approach. It also describes

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5. *See, e.g.*, Bill Richards, *Elusive Threat: Electric Utilities Brace for Cancer Lawsuits Though Risk Is Unclear*, WALL ST. J., Feb. 5, 1994, at A1. *See also Grassroots Movement Seeks to Ground Electromagnetic Fields*, PUB. CITIZEN, Jan./Feb. 1994, at 18; Michael McCabe, *Neighbors Fight GTE Phone Tower: Los Gato School Site Dropped*, S.F. CHRON., Feb. 28, 1994, at A13; Robert Snyder, *Power Tower Panic Grips WMS Parents*, S. SHORE REC., Feb. 10-16, 1994. Numerous power line sites have been opposed throughout the country, and lawsuits have been filed for personal injury, workers compensation, and property claims. Also, nine plaintiff firms have organized a group called the Electromagnetic Radiation Case Evaluation Team. *See* Krieger, *supra* note 4, at 44.

6. Frank S. Young, *EMF Is a Serious Issue and Needs a Serious Plan*, ELECTRIC LIGHT & POWER, June 1993, at 23, 23.

7. Louis Slesin, et al., *Electromagnetic Fields and Land-Use Controls*, AM. PLAN. ASS'N, Rep. No. 435, at 9 (1991).

8. Florida, Minnesota, Montana, New Jersey, New York, North Dakota and Oregon are among the states that regulate EMF. *See EMF Avoidance Starts Even with Lack of Evidence*, ELECTRIC LIGHT & POWER, Feb. 1993, at 10. *See also* Krieger, *supra* note 4, at 45.

9. Young, *supra* note 6, at 23.

10. INDIRA NAIR ET AL., OFF. OF TECH. ASSESSMENT, U.S. CONG., BIOLOGICAL EFFECTS OF POWER FREQUENCY ELECTRIC & MAGNETIC FIELDS—BACKGROUND PAPER, 75 (1989) [hereinafter BACKGROUND PAPER].

contemporary mitigation options and recommends taking an approach similar to that implemented by the Colorado Public Utilities Commission ("CPUC"), which requires utility companies to employ low cost measures designed to mitigate EMF from new transmission lines. Section V emphasizes the importance of communication. Given the number of lawsuits and inflammatory news reports about EMF, educating the public with balanced information is an important part of a prudent avoidance approach.

I. BACKGROUND OF EMF

A. What are EMF?

Electric and magnetic fields are located wherever electric power exists.[11] All power transmission and distribution lines, wiring at home and at work, battery powered devices, and electrical appliances contain electric and magnetic fields.[12] Electrical charges create the fields.[13] The intensity of the charge produces electric fields, while the motion of the charge generates magnetic fields.[14] Together, electric and magnetic fields are called EMF.[15] EMF around power systems are called "power frequency" or 60 hertz fields.[16]

Electric and magnetic fields also occur naturally.[17] For example, they include the earth's magnetic field, magnetic fields associated with deposits of magnetic ore, EMF found in living cells and nerve impulses, and those that cause static shocks when a person or a metal object is touched.[18] EMF associated with electrical power transmission, distribution, and use are generally stronger than naturally occurring fields.[19] The question is whether the stronger fields created by these commercial currents affect the human body.[20]

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11. *Id.* at 1.
12. VIRGINIA POWER, ELECTRIC & MAGNETIC FIELDS: A RESPONSE TO PUBLIC CONCERNS (1992).
13. BACKGROUND PAPER, *supra* note 10, at 1.
14. *Id.*
15. *Id.*
16. *Id.*
17. Boteler & Hendee, *supra* note 2, at 127.
18. *Id.*
19. *Id.*
20. *Id.*

EMF can be measured in various ways.[21] The electric field, commonly measured in volts per meter ("V/m"), quantifies the force that an electrically charged object exerts upon nearby electrical charges.[22] This field exists regardless of whether an electric current flows through the source.[23] The magnetic field, measured in gauss ("g"), exists only when an electrical charge flows through the source to produce an electrical current.[24] The measurement varies directly with the amount of current and inversely with the distance from the source.[25]

EMF produce non-ionizing radiation.[26] They are at the low end of the electromagnetic spectrum, which runs from non-ionizing radiation to ionizing radiation, and are referred to as extremely low fields ("ELF").[27] Some claim that household appliances may have more effect than powerline EMF because the radiation from appliances occurs higher on the electromagnetic spectrum than powerline EMF.[28] Exposure to appliances, however, usually lasts for short periods of time and normally is limited to only a portion of a person's body.[29] Exposure to powerline EMF, on the other hand, routinely occurs for longer durations over an individual's entire body.[30] Therefore, exposure to powerline EMF potentially has a greater effect than exposure to the EMF emitted by household appliances.[31]

B. Are EMF Harmful?

Investigation concerning the potential hazards of EMF is conflicting. Researchers have suggested numerous effects of exposure to EMF, but the exact risk posed is unknown because no basis exists for interpreting these effects. Though the debate over EMF's effects continues,

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21. John Weiss, *The Powerline Controversy: Responses to Potential Electromagnetic Field Hazards*, 15 COLUM. J. ENVTL. L. 359, 360 (1990).
22. *Id.* at 362.
23. Boteler & Hendee, *supra* note 2, at 127.
24. *Id.*
25. *Id.*
26. OFF. OF RADIATION & INDOOR AIR RADIATION STUD. DIV., U.S. ENVTL. PROTECTION AGENCY, EMF IN YOUR ENVIRONMENT: MAGNETIC FIELD MEASUREMENTS OF EVERYDAY ELECTRICAL DEVICES, 7 (1992).
27. *Id.* at 8. As with x-rays, ionizing radiation strips electrons from atoms, whereas non-ionizing radiation vibrates molecules, as with microwaves. *Id.*
28. Weiss, *supra* note 21, at 363.
29. *Id.*
30. *Id.*
31. *Id.*

an increasing number of studies have linked EMF to cancer, childhood leukemia and other serious diseases.[32]

The concern about the possible health effects of EMF began in the 1960s when Soviet scientists reported that electric company workers began experiencing health problems.[33] These reports received much skepticism because EMF were known to transfer smaller amounts of energy to human cells than ionizing fields, such as x-rays and gamma rays.[34]

Nancy Wertheimer and Ed Leeper reported a link between EMF and potential health hazards in 1979.[35] They compared 328 cases of cancer deaths in people eighteen or under with a control group of healthy people of the same age.[36] They found a significant positive association between the occurrence of cancer deaths and the size and proximity of powerlines.[37] Commentators criticized the report due to the complexity of the causes of childhood leukemia and the possible existence of elements not considered in the control group.[38]

Numerous studies have been done since the Wertheimer and Leeper report including both laboratory and epidemiological studies. Two types of laboratory studies have been done: "in vitro" studies and "in vivo" studies.[39] "In vitro" laboratory studies examine animal or human tissues or cell cultures exposed to ELF.[40] A significant number of these studies found that exposure to ELF affects cellular processes.[41] Scientists believe

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32. *See* Harunuzzaman, *supra* note 1, at 47 (noting suspicion that EMF may also cause birth defects and growth abnormalities).

33. Symptoms such as headaches, fatigue and reduced sexual potency were reported. Gordon L. Hester, *Electric and Magnetic Fields: Managing an Uncertain Risk*, 34 ENV'T Jan./Feb. 1992, at 7, 10.

34. *Id.*

35. E. Marcus Barnes, P.E., *Thirteen Years of EMF Epidemiology: Wire Codes, Calculated Fields and Childhood Cancer Risk*, Address at the Am. Indus. Hygiene Ass'n Prof. Conf. (Oct. 24, 1993) (on file with the *William and Mary Environmental Law and Policy Review*).

36. GEORGE B. LESLIE & F.W. LUNAU, INDOOR AIR POLLUTION: PROBLEMS AND PRIORITIES 268 (1991).

37. *See* Barnes, *supra* note 35, at 1.

38. *See id.*, at 4-5. *See also* LESLIE & LUNAU, *supra* note 36, at 268.

39. *See* Boteler & Hendee, *supra* note 2, at 128.

40. *Id.*

41. Observations included the following: effects on the flows of ions and proteins across cell membranes, effects on the synthesis of DNA in the cell nucleus and the transcription of RNA outside the nucleus, effects on the responses of cells to hormones and neurotransmitters, and effects on the immune response of cells. Hester, *supra* note 33, at 26.

that the fields may act as cancer promoters, as opposed to cancer initiators.[42] Studies also suggest that the fields may increase the risk of cancer by depressing immune responses that might otherwise have detected and removed cancer cells.[43] The effects, however, are not fully understood, and the relationship between EMF and harmful health effects is unclear.[44]

"In vivo" laboratory studies examine the effects of exposure to ELF on live animals and humans.[45] Research disclosed numerous biological effects, including effects on biological rhythms and early central nervous system development, behavioral changes, especially EMF avoidance, and modest changes in human heart rates.[46] As with "in vitro" studies, "in vivo" studies have not sufficiently proven that ELF exposure causes harmful effects.[47]

Laboratory studies pose difficulties because scientists do not have a firm hypothesis to test.[48] Thus far, studies have tested for general effects with varied results.[49] Although researchers have not determined whether exposure to ELF is a health hazard, the studies point toward important characteristics to consider should a risk exist such as the duration of exposure to ELF, the frequency of fields, waveform attributes and the orientation to the Earth's static field.[50] While scientists continue to test hypothetical connections between EMF exposure and adverse health impacts, they are far from developing a good theoretical model.[51]

Largely removed from the laboratory, epidemiological studies examine human populations exposed to ELF at home and at work.[52] Although the laboratory studies suggest possible health effects from ELF exposure, the epidemiological studies have caused the greatest amount of

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42. *See* BACKGROUND PAPER, *supra* note 10, at 33.
43. *See* Hester, *supra* note 33, at 26.
44. *Id.*
45. *Id.* at 24.
46. *Id.* at 26.
47. *Id.*
48. *See* BACKGROUND PAPER, *supra* note 10, at 25.
49. *Id.*
50. *See* Hester, *supra* note 33, at 26.
51. *See* BACKGROUND PAPER, *supra* note 10, at 25.
52. The main goal of epidemiology is to identify occurrences and patterns of diseases in populations and seek out associated agents and possible causes. *See* Barnes, *supra* note 35, at 4; Todd D. Brown, *The Powerline Plaintiff & the Inverse Condemnation Alternative*, 19 B.C. ENVTL. AFF. L. REV. 655, 663 (1992).

public concern.[53] Since the Wertheimer and Leeper report, numerous studies examining the association between EMF and childhood cancer have been completed.[54] Some studies found positive correlations between EMF and childhood cancer while others found no correlation.[55]

A study done in Denver by Dr. David Savitz of the University of North Carolina recreated the Wertheimer and Leeper report.[56] He also discovered a correlation between childhood cancer and EMF.[57] Savitz used a refined version of Wertheimer and Leeper's wire code system as a long-term field exposure surrogate, and also took limited spot measurements.[58] He found that the risk of childhood cancer was strongly associated with wire codes, but to a lesser degree with average spot measurements.[59] Savitz's study has been highly criticized. Savitz suggested his research was inconclusive and more research was needed; however, some scientists, including Savitz, believe these results corroborate the hypothesis that there may be a link between childhood cancer and EMF.[60]

Two other studies also show positive associations between childhood cancer and EMF. University of Southern California researchers London and Peters conducted the most thorough study to date in Los Angeles County.[61] The study, which was a residential investigation, included time-recorded field measurements, wire codes and spot measurements.[62] The results again showed a statistically significant correlation between risks of childhood cancer and wire codes as well as an exposure-response trend.[63] A residential study done in 1992 by Anders Ahlbom and Maria Feychting of the Karolinska Institutet in Sweden showed a significant association between calculated EMF field levels and childhood leukemia risk.[64]

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53. *See* Brown, *supra* note 52, at 663.
54. *See* Hester, *supra* note 33, at 10.
55. *Id.*
56. *See* Barnes, *supra* note 35, at 2.
57. *Id.*
58. *Id.*
59. *Id.*
60. *Id.*
61. *Id.*
62. *Id.*
63. *Id.*
64. ANDERS AHLBOM & MARIA FEYCHTING, *Magnetic Fields and Cancer in People Residing Near Swedish High Voltage Power Lines* 25 (Institutet for Miljomedicin, Karolinska Institutet) (1992).

Two other epidemiological studies, however, failed to show any association between childhood cancer and EMF. A Rhode Island study done by Fulton in 1980 utilized a similar design and methodology as Wertheimer and Leeper but revealed no correlation.[65] This study has been criticized for deficiencies in data collection and case/control analysis.[66] A United Kingdom study by Myers in 1980 relied upon powerline proximity, spot measurements and limited field calculations.[67] The findings also showed no correlation between childhood cancer and EMF.[68]

Epidemiological studies have also examined the relationship between occupational exposure to EMF and cancer.[69] At least thirty studies have tested the incidence of leukemia, brain tumors, lymphoid tumors and other cancers.[70] The studies are highly inconsistent and are criticized as having greater problems than the childhood cancer studies.[71] While more recent studies have improved exposure assessment, the results remain inconclusive.[72]

In March of 1994, researchers reported the results of a four-year study involving Canadian and French utility workers.[73] Dr. Gilles Thriault studied more than 223,000 male utility workers to determine if an association existed between occupational EMF exposure and an increased risk of cancer.[74] While Thriault did not find an association between EMF and male breast cancer, skin melanoma or prostate cancer, he discovered a statistically significant association between occupational exposure to EMF and a sub-type of leukemia.[75] Dr. Thriault suggested, though, that problems with the study may have resulted from difficulties in arriving at an accurate exposure estimate of each study subject and limited follow-up studies beyond age sixty.[76]

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65. Barnes, *supra* note 35, at 3.
66. *Id.*
67. *Id.*
68. *Id.*
69. *See* Hester, *supra* note 33, at 25.
70. *Id.*
71. *Id.*
72. *Id.*
73. *Cancer Risks Associated with the Occupational Exposure to ELF Magnetic Fields*, 139 AM. J. EPIDEMIOLOGY, 550, 550 (1994).
74. *Id.*
75. Associations were found between EMF exposure and ANLL (AML) type leukemia. *Id.*
76. *Id.*

Another study, reported in June 1994, involved the relationship between EMF and breast cancer in female utility workers.[77] Researchers at the University of North Carolina at Chapel Hill examined death certificates and found that women working in electrical jobs are thirty-eight percent more likely to die of breast cancer than women working in other fields.[78] This study, however, failed to take into consideration other possible contributing factors, and several studies found no correlation between EMF and breast cancer.[79]

Research has produced confusing and conflicting results. Although the evidence is inconclusive, the current trend suggesting possible associations between EMF and various health problems should not be ignored. As Gordon L. Hester, project manager at the Electric Power Research Institute in California, stated, "because the evidence is sufficiently suggestive of a possible risk from EMF exposure, it warrants further investigation and some degree of immediate concern about exposure to strong magnetic fields."[80] Numerous studies are underway at this time to examine the relationship between EMF and cancer.[81] The same difficulties of prior studies still exist, however, and an eventual understanding may depend upon more definitive results from years of more laboratory studies.[82]

II. THE ROLE OF REGULATORS

Policymakers must face the difficult decision of how to handle the EMF problem when the studies are far from conclusive.[83] With more studies linking EMF to health hazards, public concern has rapidly grown, and regulators feel pressure to take action.[84] Yet public concern sometimes surpasses scientific knowledge,[85] and policymakers must be careful not to regulate for erroneous reasons.[86] Although public concern may be

77. *See* Shari Rodavsky, *Electrical Jobs, Breast Cancer Linked to Study*, WALL ST. J., June 15, 1994, at B5.
78. *Id.*
79. *Id.*
80. Hester, *supra* note 33, at 125.
81. *See* Boteler & Hendee, *supra* note 2, at 131.
82. *See* Hester, *supra* note 33, at 31.
83. *See* Boteler & Hendee, *supra* note 2, at 133.
84. *See* Hester, *supra* note 33, at 30.
85. *Id.*
86. *Id.* at 30-31.

exaggerated, scientific studies provide reason for concern and cannot be ignored.[87] Whereas electric power should not be banned, some action by regulators is not only warranted but also needed.[88]

The federal government has taken a position on the EMF problem by authorizing a sixty-five million dollar research program on EMF[89] under the Energy Policy Act of 1992 ("Act").[90] The Act directs the National Institute of Environmental Health Sciences to study the mechanisms by which EMF interact with biological systems, and to undertake epidemiological research on the potential effects of such interactions.[91] While a federal role in mandating research represents an important step toward finding answers about EMF, experts state that uncertainty about potential dangers could last for years, and communities must ultimately decide what measures to take.[92] Most regulation of electric power and the land around powerlines occurs at the state and local level.[93] Therefore, state officials and regulatory agencies must be responsible for taking an active role in the EMF problem. Only nine states have enacted relevant policies or regulations at this time.[94] The issue has been handled in one of three ways: imposing field strength limits or proposing moratoria on the construction of new lines, taking a "wait and see" approach, or implementing a "prudent avoidance" approach.[95]

A. Field Strength Limits and Moratoria

In response to the concern over EMF hazards, several states have imposed electric field strength limitations on transmission line rights-of-

87. *See* Young, *supra* note 6, at 23.
88. *See* Hester, *supra* note 33, at 30-31.
89. 42 U.S.C. § 13478(j)(1). *See also EPA to Help Fund National Institute in Cancer-Focused EMF Research*, 21 ENERGY REP., No. 12, at 1 (1993).
90. Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (1992).
91. 42 U.S.C. § 13478(a)-(b). *See also EPA to Help Fund National Institute in Cancer-Focused EMF Research*, *supra* note 89, at 1.
92. *See* Peter Marks, *On Long Island, Fear from Electric Fields*, N.Y. TIMES, Jan. 6, 1994, at A1.
93. *Electric and Magnetic Fields: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 103d Cong., 1st Sess. 17 (1993) (testimony of Raymond R. Neutra, Acting Chief, Environmental Health Investigations Branch, California Department of Health Services).
94. *See supra* note 8.
95. Young, *supra* note 6, at 28.

way.[96] However, health hazards are more likely to result from magnetic fields than electric fields because electric fields can be shielded, whereas magnetic fields cannot.[97] Thus, limitations on electric field strength may be inappropriate for handling the EMF problem. Both Florida and New York have imposed field strength limitations on magnetic fields,[98] but these limitations are problematic as well. The standards assume that higher strengths cause greater problems, yet EMF do not have the higher strength-higher response relationship associated with most regulated environmental hazards.[99] Rather, scientists suggest that EMF's health effects may relate to their frequency and intensity.[100] Therefore, regulations on field strengths are ineffective in protecting the public from harm relating to EMF. Furthermore, by establishing field strength standards, many transmission line proposals will be approved because they meet the standards,[101] and examination of other possible factors such as the siting and construction techniques of the line may be overlooked.[102]

While some state officials have proposed putting moratoria on the construction of new lines,[103] this approach is premature and overaggressive. Community growth may demand additional power, while the surplus of power capacity that existed in prior years is decreasing.[104] Such a response may also raise legal problems.[105] For example, in 1990, a town in Rhode Island passed an ordinance banning the construction of high voltage power lines for three years.[106] The theory behind the ordinance was to wait for more conclusive scientific studies.[107] A local utility company challenged the moratorium in court when the utility's proposal to construct new power

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96. *See* Rob Thompson, *Should Electric and Magnetic Fields Be Regulated?*, PROF. SAFETY, Dec. 1993, at 28, 31.

97. *Id.* at 28.

98. Harunuzzaman, *supra* note 1, at 47.

99. *See* Sherry Young, *Regulatory and Judicial Responses to the Possibility of Biological Hazards from Electromagnetic Fields Generated by Powerlines*, 36 VILL. L. REV. 129, 182 (1991).

100. *Id.*

101. *Id.* at 182-83.

102. *Id.* at 183.

103. *See State by State*, 11 EMF HEALTH & SAFETY DIG., 6, 6 (1993) (discussing legislative activity in states which sought moratoria on the construction of new transmission lines).

104. *See* Slesin et al., *supra* note 7, at 9.

105. *Id.*

106. *Id.*

107. *Id.*

lines was rejected.[108] The court struck down the moratorium on the grounds that it violated both the Takings Clause and the Commerce Clause of the Constitution.[109] While other states have proposed similar measures,[110] a complete ban on powerline construction is also an ineffective method of dealing with the EMF problem.

B. The "Wait and See" Approach

Some states have adopted a "wait and see" policy which requires states to review EMF research periodically.[111] For example, Virginia and Washington require annual reports that review medical and scientific studies on potential health effects from power lines.[112] Many states have taken no action at all.[113] In 1993, twenty-eight bills relating to EMF were introduced in state legislatures, but only one passed.[114]

While further research is needed to understand the hazards related to EMF, the "wait and see" approach is an insufficient answer to the EMF problem. Studies could take years to develop definitive answers,[115] and in the meantime states need to take active measures in dealing with potential EMF hazards. As one journalist stated, "[t]he highly charged debate over EMF is likely to continue for years to come. When all the facts are in, however, we may witness a rewiring of America."[116] By taking reasonable precautions now, states may avoid the immeasurable expense of remedial actions if future studies show a definite hazard.

Furthermore, while science is often uncertain, society has chosen to regulate many environmental agents of which the risks have been

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108. *Id.*
109. *Id.*
110. *See State by State*, *supra* note 103, at 6-9.
111. Young, *supra* note 6, at 28.
112. *See* Weiss, *supra* note 21, at 379.
113. *See* Young, *supra* note 99, at 181.
114. For example, a bill in Maine that would have required public utilities to conduct EMF measurements and take corrective action died in committee on May 13, 1993. Also, no action has been taken on another bill in Illinois that would require "reasonable, cost effective measures and technology" to reduce EMF exposure. *See State by State*, *supra* note 103, at 6-9.
115. *See* Marks, *supra* note 92, at A1.
116. Anna Radelat, *Wired—Are Power Lines and Household Appliances Hazardous to Your Health?*, PUB. CITIZEN, May/June 1991, at 16, 20.

unclear.[117] For example, a large uncertainty exists about the health effects of the maximum concentration of trichlorene allowed in drinking water.[118] High uncertainty also exists about the health effects of the pesticide Alar, which was banned from use in recent years.[119] Whereas different considerations are involved in regulating potential hazards, uncertainty of specific aspects of the effects from EMF exposure should not prevent regulation.[120] Federal agencies have consistently moved to regulate health and safety hazards when the risk of death to any individual exceeded approximately one chance in twenty thousand per year.[121] Federal agencies rarely regulate hazards with risks of death below one chance in five million per year.[122] Given the existing research, the risks from EMF appear closer to the "must regulate" amount than the "rarely regulate" amount.[123] As H. Keith Florig of the Center for Risk Management for the Future stated, "[o]ne would have to be very skeptical of the EMF evidence to conclude on historical grounds that possible EMF risks are too small to consider in a regulatory context."[124] While studies do not yet indicate a need for such aggressive measures as setting standards or placing moratoria on the construction of powerlines, some action is warranted.

C. *The Prudent Avoidance Approach*

Several states have responded to the EMF problem by adopting a "prudent avoidance" or field management approach. For example, Colorado requires utilities to exercise prudent avoidance and consider all

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117. *Electric and Magnetic Fields, supra* note 93, at 38 (testimony of H. Keith Florig, Fellow, Center for Risk Management for the Future).

118. *Id.*

119. A one-million fold uncertainty exists in the health effects of trichlorene and a ten-thousand fold uncertainty exists in estimates on the health effects of Alar. *Id.*

120. Regulating trichlorene and Alar involved setting limits or banning use. Different considerations should be taken into account in regulating EMF because, as discussed earlier, standards based upon a theory that a higher dose creates more problems are inapplicable to EMF. Regulating these two substances, as well as others holding uncertain risks, suggests that the uncertainty surrounding EMF should not prevent reasonable precautions from being taken. *See supra* notes 96-102 and accompanying text; Young, *supra* note 99, at 182, 183.

121. *Electric and Magnetic Fields, supra* note 93, at 34.

122. *Id.*

123. *Id.*

124. *Id.*

options for limiting public exposure to transmission lines.[125] Although this approach is not as forceful as field strength limitations or moratoria, it may be the most effective measure at this time.

M. Granger Morgan, head of the Department of Engineering and Public Policy at Carnegie Mellon University, originally proposed the approach, calling it a "common-sense strategy for dealing with some difficult social and scientific dilemmas."[126] The theory behind prudent avoidance is to keep people away from EMF by undertaking avoidance activities that have a modest and well-defined cost.[127] Such activities include routing new transmission lines so as to avoid people, widening transmission line rights-of-way, designing distribution systems to limit EMF, developing new approaches to house wiring that minimize associated fields, and redesigning appliances to minimize or eliminate fields.[128]

The approach has generated a mixed response. Critics of prudent avoidance call it a simplistic and unscientific approach.[129] Others consider the theory a "cautious, conservative approach to possible EMF health risks that is justified, given the large number of uncertainties."[130] The American Planning Association ("APA") has advocated the idea.[131] In a report on EMF the APA stated that, by regulating EMF now, communities "may go a long way towards defraying future costs."[132] The report stressed that, "[o]ne does not need to stretch the imagination much further than the local landfill to see how community features that were once thought of as benign have turned out to become dangerous and expensive headaches for communities."[133] Thus, government can take reasonable precautions to protect the public from potential EMF hazards. Such precautions under a prudent avoidance approach is the most logical response to the EMF problem, given current uncertainties.

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125. *See infra* note 165 and accompanying text.
126. M. Granger Morgan, *Prudent Avoidance*, PUB. UTIL. FORT., Mar. 15, 1992, at 26.
127. *See* Boteler & Hendee, *supra* note 2, at 133.
128. *Id.*
129. *See* Morgan, *supra* note 126, at 26.
130. Earl Hazan et al., *EMF Dangerous?* 16 TRANSMISSION & DISTRIBUTION, June 1991, at 30.
131. Slesin et al., *supra* note 7, at iii.
132. *Id.*
133. *Id.*

III. IMPLEMENTING A PRUDENT AVOIDANCE STRATEGY

A difficulty in implementing a prudent avoidance approach is balancing the utility company's emphasis on prudence and the public's emphasis on avoidance.[134] An effective implementation of a prudent avoidance approach is to require that all new power line projects include reasonable, cost-effective steps toward mitigating EMF prior to obtaining construction approval. Because a number of low cost mitigation steps are available, such a regulation can be an efficient measure for policymakers to take.

A. Mitigation Options

The aim of magnetic field management programs is to minimize the impact of magnetic fields while maintaining the reliability, aesthetic value, safety and cost effectiveness of power systems.[135] Various mitigation options exist in attempting to reach this goal.

One possibility involves implementing low-field designs.[136] While engineers continue in their efforts to develop low-field designs, several techniques already exist. These designs pertain mostly to transmission lines. For example, by bringing transmission lines closer together, the fields produced by different conductors nearly cancel each other out.[137] This "compacting approach," however, has disadvantages such as increased radio interference, powerline noise and more difficult live line maintenance.[138] These disadvantages must be considered when evaluating cost and impact.[139]

Another design, phase splitting, involves going further with the compacting approach.[140] This method assigns multiple conductors to each

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134. The public's side of the argument is exemplified by an advertisement in a magazine which stated, "It may take several decades before a discovery of cause and effect is found, so you can choose to do nothing or make distance your best defense." ELECTROMAGNETIC ENV'T PREVENTION, Feb. 1994, at 10. Utilities argue, however, that attempting to regulate would be onerous. *Id.*

135. Wayne Beaty, *Minimize EMF with Management Programs*, ELECTRIC LIGHT & POWER, Mar. 1994, at 20.

136. *Id.*

137. *Id. See also* John Douglas, *Managing Magnetic Fields*, ELECTRIC POWER RES. INST. J., July/Aug. 1993, at 6, 8.

138. *See* Beaty, *supra* note 135, at 21.

139. *Id.*

140. *See* Douglas, *supra* note 137, at 8.

phase, providing more opportunities for fields to negate one another.[141] The design employs a traditional double circuit tower and stacks five conductors in a vertical configuration.[142] Although this technique further reduces EMF, phase splitting's greater expense may limit its application.[143]

Another field design is the delta configuration. This design strings conductors in a delta, or triangular, configuration. This results in significantly lower fields than the traditional flat design used in phase spacing.[144] Reverse phasing similarly reduces EMF from double circuit transmission lines but usually requires costly structural modifications.[145]

A reduction technique known as wire loops exists for short line lengths.[146] Loops of wire near the lines produce additional currents that cancel out opposite fields.[147] Because of the cost and other negatives, this technique would be practical only in areas where perceptions of health risks are great.[148] Still, the availability of wire loops and other previously described designs demonstrate that communities can utilize these low-field designs when constructing new powerlines.

Unfortunately, no such low-field designs exist for distribution lines.[149] Because many currents return to distribution transformers through the ground rather than through power lines, the magnetic fields produced are not negated.[150] Current research seeks to develop mitigation procedures for both overhead and underground distribution lines.[151]

Suggestions for reducing field exposure include both shielding and grounding EMF producing lines.[152] Shielding may be an effective means

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141. *Id.*
142. Beaty, *supra* note 135, at 28.
143. *Id.*
144. *Id. See also* Hester, *supra* note 33, at 28.
145. Hester, *supra* note 33, at 28.
146. Beaty, *supra* note 135, at 20.
147. *Id.*
148. *Id.*
149. Douglas, *supra* note 137, at 8, 11.
150. *Id.* at 8.
151. The Electric Power Research Institute ("EPRI") stated that its "search for field mitigation options for overhead distribution lines is focusing on ways to balance the currents associated with the various phases and thus reduce the net current." *Id.* The EPRI's "research for cables is beginning with efforts to determine more completely the operating characteristics of underground lines, develop suitable computer models, and find ways of balancing currents flowing through the various conductors." *Id.* at 11.
152. *See id.* at 11; Beaty, *supra* note 135, at 23.

of reducing the public's exposure to EMF, but this method is very difficult.[153] Shielding of electric fields can consist of materials such as thin metal sheets, wire mesh, and even walls.[154] Shielding magnetic fields, however, would require "thick plates of specially alloyed metal" that are normally prohibitively expensive.[155] The Electric Power Research Institute ("EPRI") is currently working on a two million dollar project to explore new shielding methods and materials.[156] While more effective and cost efficient means of shielding may be discovered in the future, shielding is not currently a prudent approach to reducing EMF. Presently, shielding should be reserved for use on existing lines only if EMF are found to be a serious health hazard.

Researchers have suggested burying transmission lines as an additional option for eliminating magnetic fields.[157] This method is not very effective, because magnetic fields penetrate the earth as easily as the air.[158] Yet, the further step of encasing underground transmission cables in oil-filled cases can result in extremely low fields.[159] Encased and grounded lines unfortunately are also very expensive to install and maintain and often will not be a feasible measure.[160] Although shielding and grounding may be premature methods of reducing fields, the low cost, low field designs mentioned above remain viable alternatives and should be considered in the construction of new power lines.

Another management approach toward reducing EMF exposure limits the utilization of space and time.[161] For example, some schools draw lines across their playgrounds corresponding to magnetic fields to insure the children's distance from EMF.[162] The International Radiation

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153. *See* Douglas, *supra* note 137, at 13.

154. *Id.*

155. *Id.*

156. *Id.* Although spending two million dollars on research may not seem like a prudent option, it may save a large amount of money if shielding becomes necessary. John Dunlap, project manager in the Electrical Systems Division of EPRI stated, "[f]or existing facilities, or for protecting workers temporarily in high-field areas, shielding may be the only viable option. A major breakthrough on a lower-cost shielding material is a worthwhile goal for research, but no real promise of this is now on the horizon." *Id.*

157. Hester, *supra* note 33, at 28.

158. *Id.* "[T]his practice is based, at least in part, on the erroneous conception that the Earth provides shielding from magnetic fields." *Id.*

159. *Id.*

160. *Id.*

161. Beaty, *supra* note 135, at 20.

162. *Id.*

Protection Association has suggested limits for the duration of occupational exposure to EMF sources.[163] Communities tackling the EMF problem can also choose to mandate the siting of powerlines away from sensitive areas such as schools.[164] While these approaches may protect public health, using design methods may be more effective in the long run because growing populations may build homes and offices near powerlines now located in lightly populated areas.

B. State Approaches

Few state regulatory agencies require utilities to mitigate EMF exposure, although numerous mitigation options exist. One approach that states should follow is that of Colorado. In mandating "prudent avoidance," the CPUC promulgated the following rule:

> The utility shall include the concept of prudent avoidance with respect to planning, siting, construction, and operation of transmission facilities. Prudent avoidance shall mean the striking of a reasonable balance between the potential health effects of exposure to magnetic fields and the cost and impacts of mitigation of such exposure, by taking steps to reduce the exposure at reasonable or modest cost. Such steps might include, but are not limited to: (1) Design alternatives considering the spatial arrangement of phasing of conductors; (2) Routing lines to limit exposures to areas of concentrated population and group facilities such as schools and hospitals; (3) Installing higher structures; (4) Widening right of way corridors; and (5) Burial of lines.[165]

This regulation requires utilities that apply for new transmission facilities to tailor their actions for prudent avoidance.[166] The CPUC adopted this rule following a decision by the Colorado Supreme Court upholding the CPUC's decision to attach mitigation requirements to the approval of a

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163. *Id.* (suggesting occupational exposure limits of 0.5 mT (5000 mG) in an eight hour period, and 5mT (50,000 mG) for a two hour period).

164. Slesin et al., *supra* note 7, at 11.

165. Co. Pub. Util. Comm'n, [4th] 137 Pub. Util. Rep. (PUR) 249 (Oct. 28 1992).

166. *Id.*

transmission line.[167] In that case, the CPUC estimated that the total costs of the required improvements would be five million dollars, a cost found to be within the limits of a "prudent" action.[168] State regulations similar to that embraced by the CPUC could be very effective, because such regulations would provide for necessary electric power while also taking steps to protect the public from potential harm.[169]

Two other states have enacted prudent avoidance regulations. These approaches, however, differ from the approach taken in Colorado. In California the public utilities commission required utilities to allot four percent of the total budgeted cost of transmission facility construction or upgrade projects to implement mitigation options.[170] This type of regulation represents a sound approach toward incorporating mitigation options into a prudent avoidance strategy because the law establishes a standard before utility companies may begin a new project. By adopting a more flexible approach, however, states can consider the needs of local communities when implementing the regulations.[171]

The Wisconsin Public Utilities Commission ("WPUC") requires utilities to "take into consideration" EMF exposure and to implement reasonable mitigation steps before proposing construction of new powerlines.[172] This approach, while similar to that taken in Colorado, may be less effective. The regulation allows the WPUC to evaluate mitigation options on a case-by-case basis but provides little direction in evaluating proposed plans. While all three states offer approaches that force utilities to consider mitigating EMF exposure when constructing new powerlines, the CPUC regulation presents the most logical, reasonable program for mitigating EMF exposure.

In testimony before the House Subcommittee on Energy and Power, Dr. Florig stated that a nationwide prudent avoidance approach may not be as costly as some fear.[173] He defined "prudence" as spending the same amount to reduce EMF risks as would typically be spent to reduce other

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167. *Id.* (*citing* Douglas County v. Pub. Util. Comm'n, 829 P.2d 1303 (Colo. 1992)). *See also* Slesin et al., *supra* note 7, at 16.

168. *See* Slesin, et al., *supra* note 7, at 16.

169. *Id.*

170. Cal. Pub. Util. Comm'n, [4th] 147 Pub. Util. Rep. (PUR) 361 (Nov. 2, 1993).

171. *See* Slesin et al., *supra* note 7, at 16.

172. *In re Advance Plans For Construction of Facilities*, [4th] 132 Pub. Util. Rep. (PUR) 193 (1992).

173. *Electric and Magnetic Fields*, *supra* note 93, at 39.

risks—for example, three dollars per a one-in-a-million risk.[174] If no greater risk exists than that suggested by present research, the most that could justifiably be spent would be ten billion dollars per year.[175] If ratepayers covered these mitigation costs, electric bills would increase approximately six percent.[176] Dr. Florig justified the cost of implementing these strategies by stating that fewer siting delays would occur, allowing ratepayers to "sooner reap the economic benefits of new lines."[177] He noted that modifying structures before they are built is much cheaper than changing the structures afterwards.[178] Taking mitigation steps now could thus prevent costly retrofits later.[179]

The enormous public concern over potential EMF hazards suggests that many might be willing to pay a six percent increase in electric bills to reduce EMF risks. Some people, however, may not be willing to pay higher electric bills to resolve a situation that they do not perceive to be a problem or that they do not believe affects them. The CPUC specifically endorsed the concept of relative or comparative risks.[180] The concept supports allocating scarce resources for problems which pose the greatest risks.[181] Based on the uncertainty of EMF risks, the CPUC settled on a policy of taking low-cost measures to mitigate EMF problems.[182] The CPUC stated: "[t]he Commission intends to be mindful of its responsibility to consider the costs and benefits of its rules on an integrated, societal basis."[183] By following the Colorado approach, states can evaluate on a case-by-case basis what measures are reasonable, given society's needs and available technology. The Colorado approach represents the most rational interim policy for protecting the public's health and the economy.

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174. *Id.*
175. *Id.*
176. *Id.*
177. *Id.*
178. *Id.*
179. *Id.*
180. *See* Co. Pub. Util. Comm'n, [4th] 137 Pub. Util. Rep. (PUR) 249 (Oct. 28 1992) (*citing with favor* RELATIVE RISK REDUCTION STRATEGIES COMM., U.S. ENVTL. PROTECTION AGENCY, REDUCING RISK: SETTING PRIORITIES AND STRATEGIES FOR ENVIRONMENTAL PROTECTION (1990)).
181. *Id.*
182. *Id.*
183. *Id.*

IV. THE IMPORTANCE OF COMMUNICATION

Another important aspect of the prudent avoidance approach requires that utilities educate the public about EMF risks. Although many utility companies have established communication programs, these programs tend to be passive, providing information only upon request.[184] A more advisable approach is to disseminate EMF materials actively.[185] For example, the Virginia Power Company published a book containing scientific studies, reports and a description of EMF.[186]

Educating the public may have many positive results. If accurate information is provided, public concern surrounding the EMF problem may be allayed. Furthermore, public pressure on policymakers would be grounded in scientific knowledge, making the public more confident in regulatory decisions.[187] Educating the public may also help to avoid potential litigation. Bill Paul, a correspondent for Technopolitics, a Public Broadcasting Service program, suggested to utility companies that if they took the time to warn the public now, they would be less vulnerable to liability in the future.[188] Paul stated at an Edison Electric Institute EMF Conference, "[t]o the best of my knowledge, there is no smoking gun, no report buried in the basement at [the Edison Electric Institute]. You're clean. Don't be so defensive. Get out ahead of the curve."[189]

A. The Effect of a Prudent Avoidance Approach on Litigation

Many utilities oppose the prudent avoidance approach because they fear that the adoption of such a policy would be an admission that a danger exists, thereby opening themselves to litigation.[190] With an increasing number of studies suggesting that there is a link between EMF and health problems, however, utility companies run a risk by ignoring the potential hazards. Michael W. Withey of the law firm Schroeter, Goldmark & Bender in Seattle, Washington, stated: "[t]he key question is why the

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184. BACKGROUND PAPER, *supra* note 10, at 77.
185. *Id.*
186. VIRGINIA POWER, *supra* note 12.
187. *See* Young, *supra* note 99, at 187.
188. *Critics: EMF Research Not Enough; Utility Must Be 'Public Defender,'* UTIL. ENV'T REP., May 29, 1992, at 6, 6.
189. *Id.*
190. *See* Harold R. Piety, *What We Don't Know About EMF*, PUB. UTIL. FORT., Nov. 15, 1991, at 14.

utilities in 1993 are not doing more to protect our children in child-care centers, schools and in their homes from the health hazards of power line magnetic fields?"[191] By following Colorado's approach, utilities could let an informed public know that they are taking reasonable steps to protect the public.

Numerous lawsuits have been filed against utility companies concerning the potential hazards of EMF. The suits range from trespass and nuisance claims to a recent increase in personal injury claims. EMF litigation has been called the next "asbestos."[192] In *Zuidema v. San Diego Gas and Electric*, the parents of a child who developed a kidney tumor sued the utility company, claiming that the tumor stemmed from exposure to powerline EMF surrounding their house.[193] The jury found that the power company was not negligent for failing to warn the public about alleged EMF risks prior to 1986 and that the power lines near the house were not a nuisance.[194] The verdict in *Zuidema*, however, has not deterred similar lawsuits.[195] In addition to many other EMF-related suits, three personal injury suits were filed after *Zuidema*.[196] Whereas the plaintiffs in *Zuidema* claimed that a kidney tumor resulted from EMF exposure, the three more recent personal injury suits all alleged some form of brain cancer as a result of EMF exposure.[197] While studies have not suggested any link between kidney tumors and EMF, research has shown a weak statistical relationship between EMF and brain tumors.[198]

Two of the personal injury suits arose in Connecticut, where state law requires that all companies "use every effort to properly warn and

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191. Mark T. Hoske, *San Diego G&E Wins EMF Trial; Number of Related Suits Will Increase*, ELECTRIC LIGHT & POWER, June 1993, at 1.

192. *See* Krieger, *supra* note 4, at 40.

193. Zuidema v. San Diego Gas & Electric Co., No. 638222 (Cal. Super. Ct. Apr. 30, 1993). *See* Hoske, *supra* note 191, at 12.

194. *Id.*

195. Joel Lamp of the law firm O'Connor, Cohn, Dillon & Barr, attorney for San Diego Gas & Electric, declared that utilities should expect "other plaintiffs to get their day in court." He stated that, just because the utility company won in this case, does not mean that other cases would be decided the same way. *SDG&E Verdict Will Not Stop New Lawsuits*, EMF NEWS, June 21, 1993, at 3, 3.

196. James R. Pierobon, *EMF Litigation: Three East Coast Lawsuits Go to Trial: Industry Braces for Shock Waves*, 207 ELECTRICAL WORLD, Dec. 1993, at 96, 96. Lawsuits are being filed at the rate of about one per month. *See* Krieger, *supra* note 4, at 45.

197. *See* Pierobon, *supra* note 196, at 96.

198. *Id.*

protect the public from danger and . . . exercise all possible care to reduce the hazard to which employees, customers, and others may be subjected by reason of its equipment and facilities."[199] The plaintiffs claim the utility company neither used every effort to warn about potential hazards nor exercised all possible care to reduce the hazards.[200]

The third case, filed in Georgia, involved a plaintiff who claimed that power lines near her house had caused a rare form of lymphoma.[201] The attorneys sought to prove that the utilities "stuck [their] head in the sand about the potential hazards of electromagnetic radiation."[202] Although the jury found that the powerlines did not cause the plaintiff's cancer, jurors later stated that they believed EMF could cause other forms of cancer.[203] They would have found for the plaintiff, they continued, had the claim involved childhood leukemia.[204]

On June 29, 1994, a worker's compensation claim was upheld, providing the first ruling recognizing an association between EMF and cancer.[205] The Washington Department of Labor and Industries ("WDL&I") awarded disability benefits to an aluminum worker for cancer resulting from EMF exposure at the worksite.[206] Despite having rejected many similar claims, a WDL&I spokesperson stated that a reason for accepting this claim was that the plaintiff's doctor testified that it was "more probable than not" that the cancer resulted from EMF exposure.[207]

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199. CONN. GEN. STAT. § 16-11 (1988) (*citing* Citerella v. United Illuminating Co., 266 A.2d 382 (1969)). *See* Bullock v. Northeast Util., No. CV-92-3266976 (Conn. Super. Ct. 1992).

200. *See* Pierobon, *supra* note 196, at 96.

201. *See* Jordon v. Georgia Power and Ogelthorpe Power, No. 91-4103 (Ga. Super. Ct. May 12, 1994), *appeal filed* (Ga. App. Ct. June 17, 1994); Krieger, *supra* note 4, at 45. *See also* Pierobon, *supra* note 196, at 96.

202. *See* Pierobon, *supra* note 196, at 96.

203. *See Plaintiffs' Lawyers in GA EMF Case Are Hopeful, Despite Recent Verdict*, UTIL. ENV'T REP., May 27, 1994, at 6. The case is currently being appealed. *See Georgia EMF Suit To Be Appealed*, UTIL. ENV'T REP., July 8, 1994, at 12.

204. *Id.*

205. *See* Bill Richards, *Cancer Link and Electromagnetic Fields Recognized in Washington State Ruling*, WALL ST. J., July 14, 1994, at B3.

206. *Id.*

207. *Id.* The utility has disputed the claim, stating that they had not had an opportunity to present their side of the claim due to timing misunderstandings. *See Wash. Agency Upholds Aluminum Worker's Claim that EMF on the Job Caused Cancer*, UTIL. ENV'T REP., July 22, 1994, at 3.

These cases exemplify the importance of communicating with the public and of taking reasonable measures to mitigate potential hazards. By doing so, utility companies not only protect the public but also avoid costly litigation. San Diego Gas & Electric ("SDG&E") spent two million dollars defending the suit against them in *Zuidema*.[208] If any of the plaintiffs win in the pending cases, utility companies could pay extremely high costs, not only in damages to the plaintiffs but also in increased insurance rates and possible changes in siting procedures.[209] A large influx of costly lawsuits might also be filed. Policymakers need to address the problem now. Joel Lamp, the attorney for SDG&E in *Zuidema*, stated that the jury believed that SDG&E had been "open and communicative" with the Zuidemas when they contacted the company about their concerns.[210] Thus, by requiring utility companies to take adequate steps to protect and communicate with the public, resources could be shifted toward EMF mitigation and research and away from litigation.

B. A. Duty to Warn

In April 1993, an EMF labeling bill was proposed by Representative Leslie Byrne of Virginia.[211] The bill, entitled the Electromagnetic Labeling Act of 1993, would require manufacturers to provide information about the strength of EMF emitting from their products.[212] Failure to do so would result in a one hundred dollar fine for each day the violation occurs.[213] No action on the bill has been taken at this time. Although the bill does not address the role of utility companies in providing such warnings, it does represent a trend toward recognizing a duty to warn the public about potential harms of EMF.

The danger in providing only information about a product's emission of EMF is that it may increase the public's fear. The public should be made aware of additional information, as with appliances, in which exposure to EMF occurs for shorter durations. By providing the public with accurate and balanced information about EMF, utility

208. *See* Hoske, *supra* note 191, at 12.
209. *See* Pierobon, *supra* note 196, at 96.
210. *See SDG&E Verdict*, *supra* note 195, at 3.
211. H.R. 1665, 103d Cong., 1st Sess. (1993).
212. *See EMF Levels Would Be Noted on Products Under Proposed Electromagnetic Labeling Bill*, 22 O.S.H. REP. (BNA) 1977 (1993).
213. *Id.*

companies could avoid creating unsubstantiated public fear and fulfill any duty to warn the public about potential hazards.

In summary, while no legal duty to warn the public about EMF currently exists, litigation and regulations are moving in that direction. Utility companies would be well advised to educate the public about EMF. By requiring communication with the public about potential hazards and steps being taken to reduce these hazards, policymakers may allay fears and encourage informed public participation in dealing with the EMF problem.

V. CONCLUSION

Policymakers have a duty to protect the public from potential health hazards, as well as a responsibility to safeguard society's need for electric power. Given the current information on EMF, the best way to fulfill these obligations is to follow the Colorado approach, requiring utility companies to take reasonable, low cost precautions in the design and siting of new powerlines. Several utility companies in Colorado have already successfully implemented low-field designs.[214] For example, reverse phasing has become a standard practice in new powerlines in Colorado.[215] Taking reasonable precautions now could prevent costly measures in the future, if research later confirms EMF harms. As M. Granger Morgan stated: "[i]f clear evidence of a risk comes before we are ready, a lot of dumb, expensive, and inefficient things could happen."[216]

Another important aspect of regulating EMF involves requiring utility companies to communicate actively with the public about EMF. Providing credible and balanced information could dissipate confusion about EMF and calm some of the exaggerated fears. By adequately educating the public, utilities could also save some of the high costs of cancellations and delays in the installation of powerlines and the even higher litigation expenses. These cost savings could be used for both precautionary measures and further EMF research.

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214. Telephone interview with Alven Michael, Manager of Electrical Engineering Services, Public Service of Colorado (Apr. 20, 1994). Mr. Michael stated that numerous low field designs have been used involving rights-of-way width, structure height and reverse phasing. He also stated that grounding has been used in some locations (employing a duct system), such as downtown areas, and is often the result of developer contributions. *Id.*

215. *Id.*

216. Morgan, *supra* note 126, at 29.

With an increasing demand for electricity and wide media coverage of the EMF issue, public concern is likely to continue to grow. Although studies have thus far produced inconclusive results, research suggests that some concern about EMF is not unreasonable. While aggressive regulation is premature, some action is needed. A prudent avoidance approach similar to that taken by the CPUC, coupled with the requirement that utilities educate the public, represents the most rational regulatory response to the potential hazards of EMF at this time.