The Skeptic

The Newsletter of The North Texas Skeptics

Volume 9 Number 9 **www.ntskeptics.org** **September 1995**

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Currents of fear

By John Blanton

Paul Brodeur has been a writer for *The New Yorker* for 35 years, and has published several books on issues of environmental hazards, including *Currents of Death*, *The Zapping of America*, and *Asbestos and Enzymes*. His book *The Great Power-Line Cover-up* (Little, Brown and Company, paperback, 351 pages, $12.95) was published in 1993, and an updated edition was released earlier this year.

The story according to Brodeur begins with “The Calamity on Meadow Street.” Two hundred and fifty yards long with only nine houses, Meadow Street in Guilford, CT, has had more than its share of cancer cases since the 1970s. It didn't take the residents long to spot the culprit, a prominent electric substation on the street. After explaining the travails of the Meadow Street residents, the author spends the remainder of the book detailing his evidence that man-made electromagnetic fields in general and power lines specifically are a cause of cancer in humans.

The unfortunate inhabitants of Meadow Street are not the only victims. Brodeur describes endangered sites as diverse as Slater Elementary School in Fresno, California, and Essex County Vocational Technical High School in West Caldwell, New Jersey, both of which are located adjacent to high voltage transmission lines. Throughout the book he seeks to show the magnitude of the risk. Using his relentless, well-crafted journalistic style, the author builds a powerful argument for the hazards of electromagnetic fields and for the cover-up he says is concealing the truth from the public. The book includes numerous interviews with residents, who recount their efforts to obtain redress from bureaucrats and elected officials. There are also quotes and interviews with scientists, who all this time have been having trouble finding a link between electromagnetic fields and human health problems.

In June the PBS television series *Frontline* aired a show called *Currents of Fear*, which dealt extensively with the subject of Paul Brodeur's book. The show features, among others, residents of Omaha, Nebraska, who perceive a correspondence between the incidence of cancer in their neighborhood and the presence of power lines. The program's treatment of the whole issue was so enlightening that it's worthwhile to present here some major excerpts from the transcript. The transcript reveals the nature of the fears of people like the Omaha group and the difficulty the scientific community has in dealing with those fears.
In the *Frontline* video resident Dee Hendricks describes the origins of their concerns:

> ". . . I knew, instantly, that this was not a normal thing going on. I wondered what it was in my neighborhood or in Omaha that could have possibly caused my son to have cancer, and driving home one night, I noticed that there were huge transmission towers that were scattered throughout the neighborhood." (From *Currents of Fear*)

Others in Omaha expressed their outrage and their frustration at the lack of public concern. One was Adrian Dendinger:

> "Those are people. My sister, dying of brain cancer. I've watched her rot in Mayo Clinic for a year. And then a head of a health department doesn't come to the meeting? That's baloney. We get lied to, we get ignored, we have to go get our own information, we have to make our own maps, we have to find out about substations. That is not what our elected officials are for. We're getting screwed from both sides." (From *Currents of Fear*)

The Omaha group went further. *Currents of Fear* featured a diagram, which I have attempted to simulate in Figure 1. The Omaha group performed a survey, and, in an effort to remove human bias, they correlated the incidence of cancer within postal ZIP codes with the presence of power lines within the zones.

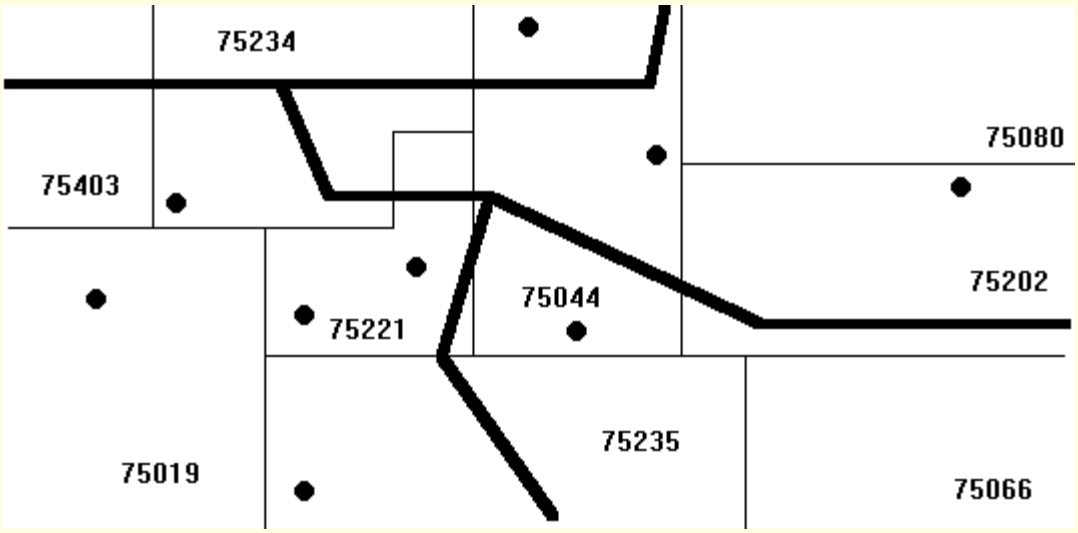

Figure 1. Power lines and ZIP codes

Figure 1 is not the real Omaha diagram, but it will illustrate the point. First, grant either that population densities for the different zones are the same, or else that some compensation is made if they are not. Zones 75044, 75202, 75221, 75234, and 75403 have power lines, and they have a higher average incidence of cancer than 75019, 75066, and 75080, which have no power lines. I will get back to this figure later. The residents considered that this qualified as scientific evidence that cancers were correlated with the presence of power lines.

As mentioned, the scientists were not so quick to pick up on this idea. First of all, there seemed to be no physical basis for a connection. William R. Bennett, Jr., a Ph.D. physicist at Yale University stated on the program:

> "The thing that struck me as most puzzling about it is that the fields these people were dealing with are absolutely minuscule. They're talking about fields of two or three milligauss, fields that are 1/200th or so of the earth's magnetic fields." (From *Currents of Fear*)

Further, the American Physical Society (APS) [see Note] earlier this year released a statement that "purported health effects of power line fields have not been scientifically substantiated, and the cost of mitigation and litigation `is incommensurate with the risk, if any.'" See the sidebar for a full statement from the APS.

Brodeur's book mentions many instances of fields much higher than this, but still only a fraction of the earth's magnetic field. Brodeur is not ignorant of this fact, and he has a response:

> "There is absolutely no reasonable biological comparison between the earth's magnetic field, in which we

> evolved as human beings and which, as some people think is responsible, at least partially, for the way our brains and central nervous systems develop, and the power frequency fields, which have only been with us, really, in a meaningful way for 50, 60, 70 years." (From *Currents of Fear*)

Who is right? Obviously Brodeur has not supplied a physical link, and the best physicists in the world have not been able to, either. However, good science tells us that even when a cause-effect relationship is not visible, the presence of a strong statistical correlation hints at some physical connection. Thus, the protesters present their epidemiological studies.

In his book Brodeur cites the results of a recent Swedish study. Epidemiologists there investigated the incidence of cancer among 436,503 people who had lived for at least one year within 1000 feet of Sweden's high-voltage transmission lines. The results were reported in 1992, and they were astounding. Children exposed to more than one milligauss experienced twice the risk of developing leukemia as children exposed to less than one milligauss. Exposure to more than two milligauss showed three times the risk, and those exposed to more than three milligauss had nearly four times the risk. Results for adults showed correlations for acute myeloid leukemia and chronic myeloid leukemia, but these were judged to be not statistically significant. A study of industrial exposure produced similar findings. In this case correlations with chronic lymphocytic leukemia and brain tumors were demonstrated.

If ever there was a smoking gun, this appeared to be one. However, as *Frontline* pointed out, something seemed to be wrong with the Swedish statistics. To scientists this seemed to be a case of “the multiple comparisons fallacy.” Quoting John Moulder, Medical College of Wisconsin:

> “The problem is, when you do as they did, hundreds and hundreds of comparisons, something in the neighborhood of 800 different comparisons, by the standard way we do statistics, we would expect 5 percent of those to be statistically elevated and 5 percent to be statistically decreased. And now you have a problem. If you find, by one measure of exposure, that leukemia is up in a group of kids, is that real, or is that the result of just random noise in the system?" (From *Currents of Fear*)

Moulder again:

> It is not scientifically reasonable to do all the measurements, but then only pick out the ones that give you the answer you want for publication. If I dredge through their original report, I can find situations which, looked at in isolation, without looking at the rest of the report, that if that was the only data I gave you, I could claim that that proved that power lines protected children against childhood leukemia." (From *Currents of Fear*)

Having said this, I ask you to go back and look at Figure 1. This is what is known in the jargon as a “cancer cluster.” What we have here is a small sample taken in isolation. It is possible that a quirk in the statistics produced the result the Omaha group was looking for. Closer inspection reveals more than was originally stated. Look at ZIP code 75066. Even though the power line runs right along its border, residents there seem not to have been effected. Zone 75234 has one case, but that one is not located very close to the power lines within its boundaries. It is clear that shifting the ZIP code boundaries a few blocks in certain directions would have radically altered the results of the survey.

This is not to say that the Omaha group used invalid methods. Naturally, using the actual proximity to the power lines, as the Swedish study did, would have resulted in a more accurate survey, but something like the ZIP code basis can be made to work, provided the sample is large enough.

Figure 2 shows the result of adding “noise” to some underlying signal. Here the signal might correspond to the actual effects of an environmental factor on health. The noise represents the fact that some people will get the disease even in the absence of the environmental factor, and some people do not get the disease, even in the presence of the environmental factor. In this computer simulation, I made the noise 20 times as large as the underlying signal. The graph shows what one would see if 100 samples are taken. With this “signal to noise” ratio, it is still not possible to see the underlying signal. The signal is just swamped by the random noise.

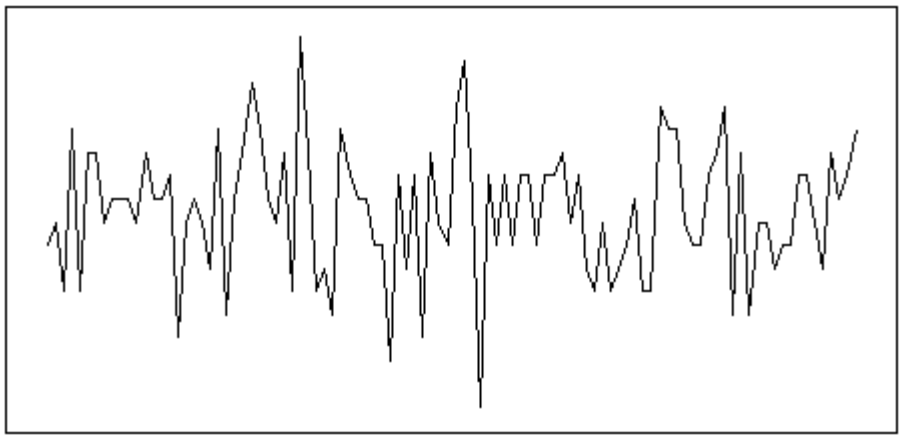

Figure 2. Noisy data with 100 sample points.

In Figure 3, 10,000 samples have been taken, and now the underlying signal becomes apparent. The effect the Omaha group saw was not this but was the result of finding a pattern within a random sample. If they had been able to duplicate their survey in several thousand additional, independent trials, the pattern they saw would have persisted only if there were a real correlation between presence of the power lines and the disease.

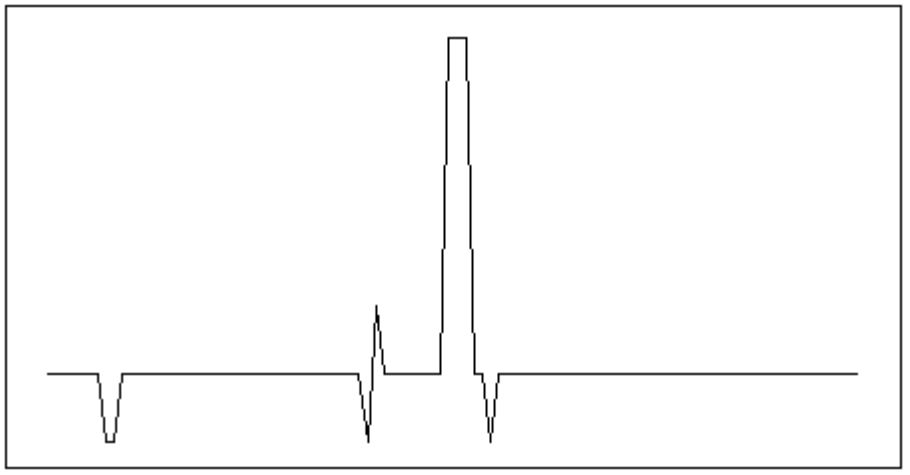

Figure 2. Noisy data with 10,000 sample points

The *Frontline* program further discussed some recent scientific tests that were conducted under controlled conditions in an attempt to find and measure any link between electromagnetic fields and health. Although the studies used laboratory animals, it is hard to see how the results would be different with people. Here is a summary of some results mentioned on the show:

- In a test of whether power line magnetic fields caused fetal abnormalities, no effects were found.
- In a study involving 12 litters from three generations of animals bred under magnetic fields, no effect on the reproductive cycle was found.
- In two studies using cancer-prone mice, no evidence was found that magnetic fields stimulated lymphoma production.
- In a study at the Pacific Northwest Laboratories in Washington State of whether magnetic fields could influence a specific cancer gene, the researchers were unable to replicate the results of an earlier New York study that had produced positive results, even after going to the New York laboratory and using their facilities.
- A study to determine if electromagnetic fields affect melatonin levels in humans found no effect.
- A study involving pregnant women and electric blankets was negative.
- The results of a test involving laboratory rats living their entire life span in electromagnetic fields will be available next year.

It is not likely that these arguments will persuade those affected that their fears are groundless. Quoting John Moulder:

> . . . [P]eople are less afraid of risks they think they control, and they're less afraid of risks that they understand, so the things that people are most afraid of is things they can't control and don't understand, and certainly power lines fall right in that category." (From *Currents of Fear*)

And still many people have a lack of understanding and a lack of trust in science. They do not see science as something in their everyday lives. Tell one of the Omaha mothers that science cannot explain why her child has cancer, but you are sure it is not because of the power lines. There are places where reason does not intrude.

Author Paul Brodeur is a different matter. Here is a guy who has been around the block a few times, so it is hard for him to claim naiveté.

In the *Frontline* program he expresses disdain for the physicists who assert there is no link between power line electromagnetic fields and health, and throughout his book points out that these scientists and others are tied to the electric power industry. He reminds us that he is the journalist who first alerted the American public to the dangers of asbestos, and he has now made power lines and electromagnetic fields a crusade of his:

> It's pervasive. You literally have millions of unsuspecting men, women and children exposed to power frequency magnetic fields that have already been associated in dozens upon dozens of studies conducted and published in the peer-reviewed medical literature, levels that are associated with the development of cancer. Never before has there been this much epidemiological evidence of the carcinogenicity of any agent, and that evidence subsequently declared to be invalid, and that agent subsequently declared to be benign." (From *Currents of Fear*)

The link between electromagnetic fields and health is a new issue, and it is just beginning to be studied seriously. Early on the proponents of this conjecture were motivated by the cancer cluster studies, and they have received recent encouragement by the Swedish survey and some others. All the while, scientific tests of the EMF-cancer link continue to report negative results.

Interested readers can obtain a complete transcript of the *Frontline* program for $5 from Journal Graphics, Inc., 1535 Grant Street, Denver, CO 80203-1843. Ask for *Frontline* Show #1319. A copy of the video can be obtained from PBS Video, 1320 Braddock Place, Alexandria, VA 22314. The July 1995 issue of *Physics Today* has a follow-up on their previous discussion:

> For an analysis of electromagnetic fields in the environment, see William R. Bennett Jr's *Physics Today* article *Cancer and Power Lines* (April 1994, page 23) and letters in response (January 1995, page 13, and March 1995, page 124). A background report by [California Polytechnic State University physics professor David] Hafemeister, as well as the complete text of APS's statement, can be found through the APS home page on the World Wide Web, http//aps.org/.

Further, the August/September issue of *APS News* carries two letters critical of the APS stance and the involvement of James Randi on the side of the APS. Robert Park of the University of Maryland has responded to these criticisms in the same issue. I will try to get permission to reprint these letters in a future issue of *The Skeptic*.

Note: John Blanton is a member of the American Physical Society — Editor

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Healthy skepticism

By Tim Gorski, M.D.

Silicone implants cleared again
Harvard Medical School researchers recently published their failure to establish an association between silicone breast implants and connective tissue disorders and/or symptoms. [*NEJM* 332:1666, 1995] Investigators found 87,501 women in the database of the ongoing Nurses Health Study who were free of connective tissue disease as of June of 1976. By May of 1990, when media reports of silicone breast implants' causing these disorders had become widespread, 516 women (.6%) had developed a connective tissue disorder. But only 3 of these were among the 1183 subjects (.25%) who had breast implants. All 3 were diagnosed with rheumatoid arthritis. Thus, no increased risk of connective tissue disease among women with breast implants could be established. Statistical analysis also showed no association between silicone breast implants and self-reported symptoms of connective tissue disease.

FTC nixes facilitated communication devices
The Federal Trade Commission obtained consent decrees in March of this year against Louis Blass, Inc., and its Glendale, Wisconsin, Crestwood Company and Chicopee, Massachusetts, Abovo, Inc. The firms had been marketing their Crestalk and Canon Communicator devices as enabling communication by autistic individuals. Both involved a controversial method known as Facilitated Communication, a technique that resembles the Ouija board game. Under the agreement, the companies pledge not to promote such devices as being aids for the communication of autistic or other disabled individuals.

New director takes charge of NIH OAM
The troubled Office of Alternative Medicine, which Congress foisted on the National Institutes of Health, finally installed a new director earlier this year. Wayne B. Jonas, M.D., is a family doctor who is said to have an interest in homeopathy as well as the use of herbs and other “alternative” methods. He had previously directed the Research Fellowship at Walter Reed Hospital's Institute of Research. It remains to be seen whether he will demand strict scientific methodology for taxpayer-funded studies sponsored by the OAM or continue to allow the office to drift into the role of a propaganda instrument for all manner of quackery and its supporters.

Kombucha tea rises to popularity
Drinking Kombucha “mushroom” tea is one of the newest self-remedies now being promoted and practiced. The brew is actually made from yeast cultures, though called “mushroom” because of its being, like them, a fungus. A variety of unsubstantiated health claims are made for the tea, but there are greater concerns about its safety. These include possible contamination of kombucha cultures with the unrelated fungus *Aspergillus*, which produces the potent cancer-causing substance aflatoxin B, the possible development of antibiotic resistance developing from exposure to kombucha's many constituents, and the fact that the tea contains a variety of plant acids.

With regard to this last, it was recently reported (in *American Medical News*, 5/8/95, page 9) that the April death of a Spencer, Iowa woman, may have been connected with consumption of the product. The woman's attending physician, Steven L. Wolfe, M.D., is quoted in the article as saying that he saw “no obvious explanation” (other than the tea) for the severely acidotic and comatose condition in which she was found. The FDA has taken no action in the matter, other than to ask that adverse effects from the remedy be reported to its Medwatch line, (800) 332-1088.

Fennel oil toxic, tea OK
Fennel, the pleasant-smelling dried fruit (“seeds”) of *Foeniculum vulgare Mill*., is a widely used, well-known folk remedy for flatulence and infant colic. In Europe it is also often a component of cough remedies because of its reputation for loosening phlegm. The active principle is the volatile oil, found to the extent of 2-6% in the dried fruit. Most of this is *trans-anethole*, with smaller amounts of fenchone, estragole, limonene, camphene, and -pinene. The oil has been experimentally shown to exert spasmolytic effects on smooth muscle, accounting for the herb's efficacy. The volatile oil itself, though, is not recommended for medicinal use. Small quantities - as little as 1 cc. (one thirtieth of an ounce) - have been reported to cause vomiting, seizures, and respiratory problems including pulmonary edema.

This information is provided by the Dallas/Fort Worth Council Against Health Fraud. For further information, or to report instances of suspected quackery and health fraud, please contact the Council's President, Tim Gorski, M.D., at (817) 792-2000 or write P.O.B. 202577, Arlington, TX 76006.

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Friday night, live!

By John Blanton

Say “epidemiology” three times really fast, and you will get an idea of my most recent contribution to the Skeptic's Cause. When I returned home after a day out of town spending your tax money there was a message on my machine from Susan Schewe of KERA-FM (90.1) radio. After playing phone tag for a while, I finally talked to her and learned that she is the producer of *The Evening Talk Show*, a daily evening talk program hosted by Glenn Mitchell, and she wanted the Skeptics on that evening, live!

Turned out we Skeptics never met a microphone we didn't like, and by seven that evening Joe Voelkering and John Thomas had joined me at the studio where we met Susan and Glenn. We were shown into a sound room with chairs, a padded table, four microphones, and a multiple-line telephone. Glenn questioned us briefly about the Skeptics and laid out the ground rules. One hour, no commercial breaks. I naturally declined the offer of a cup of coffee.

Straight off, there were two concerns that gnawed at me: Are we going to be able to talk for an hour without going completely through the English language and running out of words? What if I forgot to bring my words with me and could only get out an occasional `yup' and `nope'? Wouldn't you know it, there was absolutely nothing to worry on number two. The thought of my voice going out to thousands of hungry ears brought forth such a gush of convoluted syntax that at times I thought my companions would try to strangle me to shut off the flow. Also, in the hour to come there were the times I almost said *Hail Mary* for my good fortune in being able to contact Joe Voelkering and especially John Thomas in time to get them on the show. What the dickens is “kinesiology,” anyway?

Glenn got the whole thing going smoothly by introducing us to his audience and reciting some of the nice things about us that I had faxed to the station in advance. Then we started answering his questions and explaining to all of North Texas why we existed and what we were doing. Soon a third ugly doubt wedged itself into my brain: What if nobody phones in? I looked around at my companions to see if they showed panic, as well, and I looked at Glenn. Mr. Cool. Then I noticed the phone buttons. Glory, they were lighting up! Thanks, Mom.

OK, so I'm no Carson, and Ted Koppel is not looking for a new job yet. Just you try saying “epidemiology” cold for the first time of the day. You get the picture. Otherwise we all thought the hour went fairly well. People started phoning in, and here came a pleasant surprise: there are a lot of skeptics out there. One was obviously on a car phone. I just hope he pulled off the freeway before he started punching in the numbers. There were, of course, the *strange* ones. I'm sure people like Glenn get a lot of these, and once I saw him just shaking his head while the rest of us were pantomiming “Where did that come from?”

Our first concern (see above) evaporated quickly. Presently I glanced at my watch and thought, “Where has the time gone.” The hour was soon up. Glenn took a last caller then asked when and where our next meeting was going to be, and he pointed straight at me. Cronkite would have been proud. I didn't bat an eye. Just hammered out the description in a minimum of verbiage, and Glenn shut it down.

I suppose a big surprise was the absence of hate calls. Maybe the Christian Coalition doesn't listen to local public radio or maybe the producers are just skilled at diverting the more strident responses. Anyhow, based on the content of mail to *The Dallas Morning News*' letters column of late, I expected that when the subject got off onto Pandas and Plano, as happened twice, the creationists should have come storming out of the trenches. No such luck.

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From the APS

APS COUNCIL ADOPTS STATEMENT ON EMFS AND PUBLIC HEALTH

The APS Council approved a statement in April declaring that purported health effects of power line fields have not been scientifically substantiated, and the cost of mitigation and litigation "is incommensurate with the risk, if any." This is the strongest position on the issue taken by a major scientific society. Since electromagnetic fields (EMFs) were first linked to cancer in 1979, epidemiological evidence has grown ever fainter and proposed mechanisms more speculative. The Council action was a result of several years of discussion and monitoring of the issue by the APS Panel on Public Affairs, and was endorsed by the leaders of the APS Division of Biological Physics. Complete text of the statement follows:

> "Physicists are frequently asked to comment on the potential dangers of cancer from electromagnetic fields that emanate from common power lines and electrical appliances. While recognizing that the connection between power line fields and cancer is an area of continuing study by research workers in many disciplines in the United States and abroad, we believe that it is possible to make several observations based on the scientific evidence at this time. We also believe that, in the interest of making the best use of the finite resources available for environmental research and mitigation, it is important for professional organizations to comment on this issue.
>
> The scientific literature and the reports of reviews by other panels show no consistent, significant link between cancer and power line fields. This literature includes epidemiological studies, research on biological systems, and analyses of theoretical interaction mechanisms. No plausible biophysical mechanisms for the systematic initiation or promotion of cancer by these power line fields have been identified. Furthermore, the preponderance of the epidemiological and biophysical/biological research findings have failed to substantiate those studies which have reported specific adverse health effects from exposure to such fields. While it is impossible to prove that no deleterious health effects occur from exposure to any environmental factor, it is necessary to demonstrate a consistent, significant, and causal relationship before one can conclude that such effects do occur. From this standpoint, the conjectures relating cancer to power line fields have not been scientifically substantiated.
>
> These unsubstantiated claims, however, have generated fears of power lines in some communities, leading to expensive mitigation efforts and, in some cases, to lengthy and divisive court proceedings. The costs of mitigation and litigation relating to the power line/cancer connection have risen into the billions of dollars and threaten to go much higher. The diversion of these resources to eliminate a threat which has no persuasive scientific basis is disturbing to us. More serious environmental problems are neglected for lack of funding and public attention, and the burden of cost placed on the American public is incommensurate with the risk, if any."

For further information contact the APS Washington Office, 529 14th St. NW, Suite 1050, Washington, DC 20045; phone: (202) 662-8700; email: opa@aps.org.

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