Is Dirty Electricity Making You Sick?

Too many electromagnetic fields surrounding us—from cell phones, wifi, and commonplace modern technology—may be seriously harming our health. Here's how to minimize your exposure.

By Michael Segell November 3, 2011

In 1990, the city of La Quinta, CA, proudly opened the doors of its sparkling new middle school. Gayle Cohen, then a sixth-grade teacher, recalls the sense of excitement everyone felt: "We had been in temporary facilities for 2 years, and the change was exhilarating." But the glow soon dimmed. One teacher developed vague symptoms—weakness, dizziness—and didn't return after the Christmas break. A couple of years later, another developed cancer and died; the teacher who took over his classroom was later diagnosed with throat cancer. More instructors continued to fall ill, and then, in 2003, on her 50th birthday, Cohen received her own bad news: breast cancer. "That's when I sat down with another teacher, and we remarked on all the cancers we'd seen," she says. "We immediately thought of a dozen colleagues who had either gotten sick or passed away." By 2005, 16 staffers among the 137 who'd worked at the new school had been diagnosed with 18 cancers, a ratio nearly 3 times the expected number. Nor were the children spared: About a dozen cancers have been detected so far among former students. A couple of them have died.

Prior to undergoing her first chemotherapy treatment, Cohen approached the school principal, who eventually went to district officials for an investigation. A local newspaper article about the possible disease cluster caught the attention of Sam Milham, MD, a widely traveled epidemiologist who has investigated hundreds of environmental and occupational illnesses and published dozens of peer-reviewed papers on his findings. For the past 30 years, he has trained much of his focus on the potential hazards of electromagnetic fields (EMFs)—the radiation that surrounds all electrical appliances and devices, power lines, and home wiring and is emitted by communications devices, including cell phones and radio, TV, and WiFi transmitters. His work has led him, along with an increasingly alarmed army of international scientists, to a controversial conclusion: The "electrosmog" that first began developing with the rollout of the electrical grid a century ago and now envelops every inhabitant of Earth is responsible for many of the diseases that impair—or kill—us.

Milham was especially interested in measuring the ambient levels of a particular kind of EMF, a relatively new suspected carcinogen known as high-frequency voltage transients, or "dirty electricity." Transients are largely by-products of modern energy-efficient electronics and appliances—from computers, refrigerators, and plasma TVs to compact fluorescent lightbulbs and dimmer switches—which tamp down the electricity they use. This manipulation of current creates a wildly fluctuating and potentially dangerous electromagnetic field that not only radiates into the immediate environment but also can back up along home or office wiring all the way to the utility, infecting every energy customer in between. With Cohen's help, Milham entered the

school after hours one day to take readings. Astonishingly, in some classrooms he found the surges of transient pollution exceeded his meter's ability to gauge them. His preliminary findings prompted the teachers to file a complaint with the Occupational Safety and Health Administration, which in turn ordered a full investigation by the California Department of Health Care Services.

The final analysis, reported by Milham and his colleague, L. Lloyd Morgan, in 2008 in the *American Journal of Industrial Medicine*: Cumulative exposure to transients in the school increased the likelihood a teacher would develop cancer by 64%. A single year of working in the building raised risk by 21%. The teachers' chances of developing melanoma, thyroid cancer, and uterine cancer were particularly high, as great as 13 times the average. Although not included in the tabulations, the risks for young students were probably even greater.

"In the decades-long debate about whether EMFs are harmful," says Milham, "it looks like transients could be the smoking gun."

The Case against EMFs

Cancer and Electricity—could a disease whose cause has long eluded scientists be linked to perhaps the greatest practical discovery of the modern era? For 50 years, researchers who have tried to tie one to the other have been routinely dismissed by a variety of skeptics, from congressional investigators to powerful interest groups—most prominently electric utilities, cell phone manufacturers, and WiFi providers, which have repeatedly cited their own data showing the linkage to be "weak and inconsistent." Recently, however, in addition to the stunning new investigations into dirty electricity (which we'll return to), several developments have highlighted the growing hazards of EMF pollution—and the crucial need to address them.

The Evidence showing harm is overwhelming.

In 2007, the Bioinitiative Working Group, an international collaboration of prestigious scientists and public health policy experts from the United States, Sweden, Denmark, Austria, and China, released a 650-page report citing more than 2,000 studies (many very recent) that detail the toxic effects of EMFs from all sources. Chronic exposure to even low-level radiation (like that from cell phones), the scientists concluded, can cause a variety of cancers, impair immunity, and contribute to Alzheimer's disease and dementia, heart disease, and many other ailments. "We now have a critical mass of evidence, and it gets stronger every day," says David Carpenter, MD, director of the Institute for Health and the Environment at the University at Albany and coauthor of the public-health chapters of the Bioinitiative report.

Fears about the hazards of cell phones seem justified.

"Every single study of brain tumors that looks at 10 or more years of use shows an increased risk of brain cancer," says Cindy Sage, MA, coeditor of the report. A recent study from Sweden is particularly frightening, suggesting that if you started using a cell phone as a teen, you have a 5 times greater risk of brain cancer than those who started as an adult. The risk rises even more for people who use the phone on only one side of the head. While defenders of cell phone safety

claim no scientist can explain why EMFs may be harmful in humans, a body of reliable and consistent animal research shows that electromagnetic fields, equal to those generated by mobile phones, open the blood-brain barrier, causing blood vessels to leak fluid into the brain and damage neurons. Ironically, that research (by renowned Swedish neuro-oncologist Leif G. Salford, MD, PhD) began with the goal of finding a way to deliver chemotherapy to brain tumors. (See the worst time to use a cell phone.)

Other countries are revising exposure standards.

Members of the European Union, which has led the way on EMF investigations, are moving quickly to protect their citizens, particularly children and pregnant women. In the past 2 years alone, France, Germany, and England have dismantled wireless networks in schools and public libraries, and other countries are pressing to follow suit. Israel has banned the placement of cellular antennae on residences, and Russian officials have advised against cell phone use for children under 18.

Electrical hypersensitivity (EHS) is becoming more widespread.

Symptoms of EHS, a recently identified condition, include fatigue, facial irritation (resembling rosacea), tinnitus, dizziness, and digestive disturbances, which occur after exposure to visual display units, mobile phones, WiFi equipment, and commonplace appliances. Experts say up to 3% of all people are clinically hypersensitive, as many as one-third of us to a lesser degree.

Electrical pollution is increasing dramatically.

"For the first time in our evolutionary history, we have generated an entire secondary, virtual, densely complex environment—an electromagnetic soup—that essentially overlaps the human nervous system," says Michael Persinger, PhD, a neuroscientist at Laurentian University who has studied the effects of EMFs on cancer cells. And it appears that, more than a century after Thomas Edison switched on his first lightbulb, the health consequences of that continual overlap are just now beginning to be documented.

A History of Harmful Effects

Until Edison's harnessing of electricity, humans' only sources of EMF exposure were the earth's static magnetic field (which causes a compass needle to point north) and cosmic rays from the sun and outer space; over our long evolution, we've adapted to solar EMFs by developing protective pigment. "But we have no protection against other EMF frequencies," says Andrew Marino, PhD, JD, a pioneer in bioelectromagnetics who has done extensive EMF research and a professor in the department of orthopedic surgery at the Louisiana State Health Sciences Center. "How quickly can we adapt our biology to these new exposures? It's the most important environmental health question—and problem—of the 21st century."

Research into the hazards of EMFs has been extensive, controversial—and, at least at the outset, animated by political intrigue. A sampling:

- The Russians first noticed during World War II that radar operators (radar operates using radio frequency waves) often came down with symptoms we now attribute to electrical hypersensitivity syndrome. In the 1960s, during the height of the Cold War, they secretly bombarded the US embassy in Moscow with microwave radiation (a higher-frequency RF used to transmit wireless signals), sickening American employees. Radio wave sickness—also called microwave sickness—is now a commonly accepted diagnosis.

- When television (also radio wave) was introduced in Australia in 1956, researchers there documented a rapid increase in cancers among people who lived near transmission towers.

- In the 1970s, Nancy Wertheimer, PhD, a Denver epidemiologist (since deceased), detected a spike in childhood leukemia (a rare disease) among kids who lived near electric power lines, prompting a rash of studies that arrived at similar conclusions.

- In the 1980s, investigators concluded that office workers with high exposure to EMFs from electronics had higher incidences of melanoma—a disease most often associated with sun exposure—than outdoor workers.

- In 1998, researchers with the National Cancer Institute reported that childhood leukemia risks were "significantly elevated" in children whose mothers used electric blankets during pregnancy and in children who used hair dryers, video machines in arcades, and video games connected to TVs.

- Over the past few years, investigators have examined cancer clusters on Cape Cod, which has a huge US Air Force radar array called PAVE PAWS, and Nantucket, home to a powerful Loran- Cantenna. Counties in both areas have the highest incidences of all cancers in the entire state of Massachusetts.

- More recently, the new findings on transients—particularly those crawling along utility wiring—are causing some scientists to rethink that part of the EMF debate pertaining to the hazards of power lines. Could they have been focusing on the wrong part of the EMF spectrum?

Transients: The Post- Modern Carcinogen

Some earlier, notable—albeit aborted—research suggests this may be the case. In 1988, Hydro-Quebec, a Canadian electric utility, contracted researchers from McGill University to study the health effects of power line EMFs on its employees. Gilles Theriault, MD, DrPH, who led the research and was chair of the department of occupational health at the university, decided to expand his focus to include high-frequency transients and found, even after controlling for smoking, that workers exposed to them had up to a 15-fold risk of developing lung cancer. After the results were published in the *American Journal of Epidemiology*, the utility decided to put an end to the study.

That research commenced at a time when energy-efficient devices—the major generators of transients—were beginning to saturate North American homes and clutter up power lines. A telltale sign of an energy-efficient device is the ballast, or transformer, that you see near the end of a power cord on a laptop computer, printer, or cell phone charger (although not all devices have them). When plugged in, it's warm to the touch, an indication that it's tamping down current and throwing off transient pollution. Two of the worst creators of transient radiation: light dimmer switches and compact fluorescent lightbulbs (CFLs). Transients are created when current is repeatedly interrupted. A CFL, for instance, saves energy by turning itself on and off repeatedly, as many as 100,000 times per second.

So how does the human body respond to this pulsing radiation? "Think of a magnet," explains Dave Stetzer, an electrical engineer and power supply expert in Blair, WI. "Opposite charges attract, and like charges repel. When a transient is going positive, the negatively charged electrons in your body move toward that positive charge. When the transient flips to negative, the body's electrons are pushed back. Remember, these positive-negative shifts are occurring many thousands of times per second, so the electrons in your body are oscillating to that tune. Your body becomes charged up because you're basically coupled to the transient's electric field."

Keep in mind that all the cells in your body, whether islets in the pancreas awaiting a signal to manufacture insulin or white blood cells speeding to the site of an injury, use electricity—or "electron change"—to communicate with each other. By overlapping the body's signaling mechanisms, could transients interfere with the secretion of insulin, drown out the call-and-response of the immune system, and cause other physical havoc?

Some preliminary research implies the answer is yes. Over the past 3 years, Magda Havas, PhD, a researcher in the department of environmental and resource studies at Trent University in Ontario, has published several studies that suggest exposure to transients may elevate blood sugar levels among people with diabetes and prediabetes and that people with multiple sclerosis improve their balance and have fewer tremors after just a few days in a transient- free environment. Her work also shows that after schools installed filters to clean up transients, two-thirds of teachers reported improvement in symptoms that had been plaguing them, including headache, dry eye, facial flushing, asthma, skin irritation, and depression.

Transients are particularly insidious because they accumulate and strengthen, their frequency reaching into the dangerous RF range. Because they travel along home and utility wiring, your neighbor's energy choices will affect the electrical pollution in your house. In other words, a CFL illuminating a porch down the block can send nasty transients into your bedroom.

Something else is sending transients into your home: the earth. From your high school science texts, you know that electricity must travel along a complete circuit, always returning to its source (the utility) along a neutral wire. In the early 1990s, says Stetzer, as transients began overloading utility wiring, public service commissions in many states told utilities to drive neutral rods into the ground on every existing pole and every new one they erected. "Today, more than 70% of all current going out on the wires returns to substations via the earth," says Stetzer—encountering along the way all sorts of subterranean conductors, such as water, sewer, and natural-gas pipes, that ferry even more electrical pollution into your home.

A Pragmatic Proposal

Of course, these small studies—from Milham, Hydro-Quebec, and Havas—hardly constitute a blanket indictment of transients. "We're still early in this part of the EMF story," says Carpenter. Does that mean as evidence of their harm accumulates, officials will raise a red flag? Not likely, if past EMF debates are any indication. Power companies have successfully beaten back attempts to modify exposure standards, and the cell phone industry, which has funded at least 87% of the research on the subject, has effectively resisted regulation. One good reason has had to do with latency—how long it takes to develop a particular cancer, often 25 years or more. Cell phones have been around only about that long.

But does that mean we avoid any discussion of their *possible* dangers? Again, if the past is a guide, the answer appears to be "probably." American scientists worried about the hazards of smoking, the DES (diethylstilbestrol) pill (given to pregnant women, it caused birth defects), asbestos, PCBs (polychlorinated biphenyls)—the list is lengthy—but officially warned about exposure only after they could say with absolute certainty that these things were harmful. As for protecting ourselves from toxic radiation, we have a lax—and laughable—history. In the 1920s, just a few years after medical imaging devices were invented, physicians were known to entertain their guests by x-raying them at garden parties. In the 1930s, scientists often kept radium in open trays on their desks. Shoe stores used x-ray machines in the 1940s to properly fit children's feet, and radioactive wristwatches with glowing hour hands were popular in the 1950s.

All of which means that, absent prudent safety standards from both public officials and manufacturers (adding a protective filter would add 5 cents to the cost of making a CFL and $5 to the cost of a laptop), you'll have to protect yourself from EMFs. Here's a reasonable proposition: Practice what is known in Europe as the precautionary principle, which is pretty much what it sounds like. Don't expose yourself unnecessarily to EMF hazards. Don't buy a home next to a WiFi tower. Get a corded telephone instead of a cordless one. Don't let your teenager sleep with a cell phone under her pillow. Don't use your laptop computer in your lap. Treat your EMF-emitting devices with the same cautious respect you do other invaluable modern devices, like your car, which is also dangerous—and can kill. You don't drive in an unnecessarily risky fashion—at high speed or while talking on a cell phone (right?).

The sad truth is that until we have more epidemiologic evidence—whether from disease clusters like the ones at La Quinta and on Cape Cod or from long-term analyses of the health of the world's 4-billion-and-growing cell phone users—we won't know definitively whether electrical pollution is harming us. And even then, we are unlikely to know why or how. "In this country, our research dollars are spent on finding ways to treat disease, not on what causes it—which is to say, how we can prevent it," says Marino. "And that's a tragedy."

But that's also another story.

The Opposing View: "No need for regulation"

In 1993, the National Institutes of Health and Department of Energy began an extensive review of all studies on the possible health effects of electromagnetic fields. six years later they completed their project, called the Electric and Magnetic Fields research and public Information Dissemination (EMF RAPID) program, and reported their findings to Congress: scientific evidence of human health risk from EMF exposure is "weak," they concluded.

While acknowledging a link between both childhood and adult leukemias and EMFs, the researchers' laboratory studies with cells and animals failed to identify a mechanism—that is, how EMFs might cause cancer. (read the EMF RAPID report at prevention.com/links)

To longtime EMF investigators such as David Carpenter, MD, the NIH dismissal of EMF hazards was patently absurd then and even more so now, given the spate of new findings. "We don't know the mechanism for most carcinogens," he says. "there's this idea that anything that causes cancer must directly damage DNA, which is nonsense because most carcinogens don't directly damage DNA. and physicists are adamant that the energy in everyday EMF exposure is so low, it couldn't possibly do anything to biological systems. It's like saying the Earth is flat because you can't see over the edge."

In fact, biological impacts of EMFs—therapeutic ones—are well known. Low-level frequencies are commonly used to promote healing of wounds and bone fractures, and experimental studies show positive effects of pulsed EMFs in treating pain and depression. recently, Michael persinger, PhD, a cognitive neuroscientist at Laurentian University, found that pulsed magnetic fields also halted the growth of melanoma cells in mice.

In a neat twist of logic, many scientists believe that the more we document beneficial effects of EMFs, the better we'll understand their hazards. "If EMF at low intensities can heal," says environmental consultant Cindy sage, "then when we are constantly and randomly exposed to it from multiple sources, it may also be harmful, like any medicine used indiscriminately."

What was wrong with the La Quinta School?

According to epidemiologist Sam Milham, MD, the middle school was rife with the usual suspects—fluorescent lighting, electronic devices—whose toxic effects were exacerbated by an electrical supply overloaded with high-voltage transients.

Substandard wiring in the new school also undoubtedly played a role; officials have since added protective shielding to the electrical room. Milham also measured transient pollution along the transmission lines that fed power to the school. "I found it all the way from the substation to the school—more than a mile," Milham says. "There are three other buildings along the route that also serve children. I've reported it to the FCC and the utility, but they ignore the problem."

How electrical pollution harms

Here, a partial spectrum of the electromagnetic fields that surround us, from strong (waves of extremely high frequency and short length) to weak (waves of extremely low frequency and long length). In each category, you'll find sources that generate the EMF, and associated health risks from overexposure.

X-Ray [medical imaging devices] Used to diagnose illness	**RISK** Damages tissue and organs by breaking bonds
VISIBLE LIGHT [SUN] The only visible EMF	**RISK** Ultraviolet light can burn skin and cause cancer
MICROWAVE (a higher frequency RF) [CELL AND CORDLESS PHONES AND TOWERS] Can heat tissues and penetrate blood-brain barrier	**RISK** Increased risk of brain cancer, dementia, and heart disease
RADIO(RF) [RADIO AND TELEVISION SIGNALS] Can disrupt body's cellular interactions	**RISK** "Radio sickness" and electrical hypersensitivity syndrome
EXTREMELY LOW FREQUENCY (ELF) [POWER LINES] Can cause weak electric currents to flow through the body	**RISK** Exposure is associated with childhood leukemia