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The Real Junk Science of EMFs

Stop Electric Field Cancer Research, Say Industry Scientists

A decade after some of the world's leading epidemiologists agreed that exposure to power line EMFs could lead to childhood leukemia, the denial continues. Some people still believe that the studies that link EMFs to cancer are nothing more than junk science. Even those who should know better refuse to acknowledge the risks. The World Health Organization (**WHO**) says the association is so weak that it can be pretty much ignored, and the leading radiation protection group, the International Commission on Non-Ionizing Radiation Protection (**ICNIRP**), has refused to endorse precaution. Here in the U.S., the Environmental Protection Agency (**EPA**) scarcely acknowledges that EMFs are even a health issue.

As a result, money for research has dried up, and any number of promising avenues that might have moved the issue forward remains unexplored.

How did this happen? The answer has a lot to do with junk science, but not the kind often associated with EMFs. No one would deny that the EMF literature is peppered with poor studies—those that claim to show effects that can't be repeated. This happens with EMFs, as well as all other types of research. In this case, we are referring to industry's own brand of junk science that promotes misinformation and confusion and presents a distorted picture of EMF science.

The story that follows illustrates how electric utilities play the junk science game. It shows how two of its long-time operatives are corrupting the EMF literature. **Leeka Kheifets** and John Swanson, together with two utility associates, are calling for an end to research on the links between power-line electric fields and cancer.

In a **paper** that will appear in the February 2010 issue of *Bioelectromagnetics*, Kheifets and Swanson argue that studies on electric fields and cancer have come to a dead end and that its time to close the book on them. There is "little basis for continued research," they claim. In fact, it is just the opposite. Epidemiologic studies on electric field effects on workers have produced some of the most provocative findings in the entire EMF cancer literature. This work has been ignored for years and now Kheifets and Swanson want to bury it for good.

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A Brief History of Electric Field Occupational Studies

Kheifets and Swanson are industry scientists. Kheifets spent the bulk of her professional career at **EPRI**, the electric utility research group, and now serves as a freelance consultant. Swanson works for **National Grid**, a huge electricity delivery company that operates in the U.K. and the U.S. Their new paper was bought and paid for by Energy Networks Association (**ENA**), a U.K. power-line trade group. On its Web site, the ENA **states**, “The overall case that power-frequency electric fields are causally linked to human cancer... can reasonably be called non-existent.”

To support the ENA position, Kheifets and Swanson offer a review of the electric field literature that is astonishingly selective and brief. All the laboratory and animal studies are covered in a single paragraph that runs little more than 100 words. The heart of their new paper is about the epidemiology: studies of people who have been exposed to electric fields at home and at work. The residential studies, they concede, don’t tell us very much. Their entire argument to stop research boils down to just one set of studies—those of workers exposed to electric fields on the job. There are only six of them.

Much of the concern over EMFs began in the early 1970s when reports came out of the Soviet Union that workers in electrical substations were suffering from numerous health problems, everything from heart palpitations and sexual dysfunction to general irritability and loss of appetite. The Soviets blamed electric fields and most of the follow-up studies—here and there—focused on those types of EMFs. That all changed in 1986 when David Savitz **repeated** Nancy Wertheimer and Ed Leeper’s **landmark study** linking childhood leukemia to magnetic fields. Almost overnight, electric fields were written off as everyone’s attention shifted to magnetic fields. This went on for the next ten years, and then in 1996, **Tony Miller** of the University of Toronto brought electric fields back into play, if only very briefly.

In a major epidemiological **study** of electric utility workers, Miller found that when he took into account ex-

posures to both electric and magnetic fields, he saw a much higher risk of developing leukemia than when he looked at magnetic fields alone: He reported increases that were up to 11 times the expected rate. “This study suggests that electric fields are potentially critical to cancer risk,” Miller told *Microwave News* at the time (see **MWN, J/A96**, p.1).

Miller’s study was part of a joint Canadian and French project. Later that year, the leaders of the French team, Marcel Goldberg and Pascal Guénel of the National Institute of Health and Medical Research (**INSERM**) in Paris, **reported** that, while they did not see a leukemia risk, they did find an up to sevenfold increase in brain cancer among those exposed to electric fields for 25 years or more. This association, they said, was “remarkable” (**MWN, J/F97**, p.4).

Miller’s findings caused a stir when they were published. “It’s alarming,” the head of the **Power Workers’ Union** told a Canadian newspaper. He called “for immediate employer and government action to protect workers.” Ruth Greey of **Ontario Hydro**, the local electric utility whose employers had been surveyed by Miller, tried to calm everyone down by promising more research on electric fields, and urging patience until Miller’s results could be confirmed. “We would be irresponsible at this point to change anything or alarm anyone until the study is replicated,” she said. EPRI issued its own statement stating, “further studies are needed.”

Ontario Hydro never did a replication study. Neither did EPRI. Instead, Kheifets, then an EPRI project officer, embarked on a much cheaper—and meaningless—effort to take the heat off electric fields. Her plan involved resurrecting some old data to discredit Miller’s findings. A few years earlier, Kheifets had managed an epidemiological study of leukemia among electrical workers under the direction of **John Peters** and **Stephanie London** at the University of Southern California (USC) in Los Angeles. Because it was an EPRI project, she had free access to the USC study files.

Kheifets had to overcome a major problem: The USC researchers had done a magnetic field not an electric field study. They had relatively few electric-field measurements—for only about a quarter of their study population. They did not have a single measurement for power line workers, the group with the highest exposures. All in all, Kheifets had electric field information for just six utility employees.

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Louis Slesin, the editor of *Microwave News*, has published a “**Comment**” on Leeka Kheifets and John Swanson’s call to stop electric field research. It appears in the same February 2010 issue of *Bioelectromagnetics* as their paper. Kheifets and Swanson declined to respond to Slesin’s charge that their paper was “little more than industry disinformation.”

Three Cases of Alleged Scientific Misconduct

Three high-profile cases of alleged lapses of scientific integrity have come to light over the last ten years. None of them is the same league as Leeka Kheifets and John Swanson's electric-field gambit. Here's a quick rundown:

- Robert Liburdy of the Lawrence Berkeley National Lab (**LBL**) fudged some graphs that were published in **two 1992 papers**. Seven years later, the U.S. Office of Research Integrity (**ORI**) **forced** him to withdraw those figures—but not his scientific results—and barred him from receiving federal research money for three years (see *MWN, J/A99*, p.1). Soon afterwards, Liburdy resigned from the LBL and pursued a new career in patent law.

- **Jim Lin**, of the University of Illinois in Chicago, faced an ORI investigation after being accused of including experimental results generated by other scientists into an NIH grant application without proper acknowledgment. He denies the alleged misconduct. (His project wasn't funded.) In a 2006 **settlement**, ORI mandated tighter oversight of Lin's government-sponsored work and he was barred from serving on certain advisory and peer review panels. Lin remains at the University of Illinois and continues to serve as the editor-in-chief of *Bioelectromagnetics*.

- Hugo Rüdiger of the **Medical University of Vienna** was accused of using falsified data in **two papers** which show that cell phone radiation can cause DNA breaks. The head of the medical school referred the case to its Council on Ethics in Science. In November 2008, following a six-month inquiry, the panel reported that it had found no proof that any of the data was fabricated. Rüdiger had retired from the university some months before the investigation began. Neither paper has been withdrawn.

These are the bare-bone facts. In all three cases, what went on behind the scenes provides some much-needed perspective.

Liburdy and Lin may well be guilty of sloppiness but not much more. Their real "mistakes" had more to do with imperiling industry agendas than sci-

entific misconduct. The two Liburdy papers that were at the center of the investigation were minor works that are rarely cited. At about the same time they appeared in print, Liburdy published another **paper** in the *Journal of Pineal Research* that had the potential to cause major problems for the electric utilities. The work showed that very weak magnetic fields could influence the growth of breast cancer cells. By the time the allegations against him had surfaced in public, others had repeated this experiment and the work looked solid. Liburdy now had a repeatable, low-level effect that was in direct conflict with the industry claim that such effects are impossible (see "**When Enough Is Never Enough**," *MWN*, November 23, 2005). Activists started using it to argue that the old paradigm had to change. If such weak EMFs could modulate breast cancer, they argued, those same fields could also promote childhood leukemia, Alzheimer's and Lou Gehrig's disease.

The realization that Liburdy had some powerful enemies became apparent when news of his case showed up on the front page of the *New York Times* under the headline, "**Data Tying Cancer to Electric Power Found To Be False**." The story, though written by a veteran science reporter, **Bill Broad**, was stunningly inaccurate. It had clearly been planted. The two Liburdy papers in dispute had nothing to do with cancer. Curiously, Broad had made a Freudian slip of sorts because, as many believe, it may well have been the breast cancer work that ruined Liburdy's career: That study does in fact tie electric power to cancer. The only catch is that no one has ever suggested that Liburdy had doctored the breast cancer experiment.

Lin's infraction of the rules was even less serious than Liburdy's. "It was relatively minor," **John Dahlberg**, a senior ORI investigator told us. "We felt this case should not have come to us," he said. Lin had, in fact, permission to use the disputed figure and its original owners had no quarrel with what he had done.

In this case, just as in Liburdy's, unseen forces were at work. Grant proposals are supposed to be

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Three Cases of Alleged Scientific Misconduct (continued from p.3)

confidential yet some reviewer—here again, no one knows who—sounded the alarm. Once Lin's reputation was in play, the knives came out. Motorola operatives tried to have him removed as the editor of *Bioelectromagnetics*. Lin's real crime was not unlike Liburdy's: He had become a threat to industry—in this case, the cell phone manufacturers.

Lin is an insider, not a radical. He is a member of **ICNIRP**, one of the most exclusive EMF clubs. A couple of years earlier, he had taken a principled stand and argued publicly against an industry scheme to adopt a more lenient cell phone exposure standard (see **MWN, J/A00**, p.8). Separately, Lin had also dared question whether **industry funding** could affect research outcomes. Motorola and others in the industry wanted to relax the limit and resented Lin's interference. In the end, the industry campaign against Lin failed, but only by a very thin margin.

The Rüdiger affair is more complicated, but he, like Lin, is seen as a threat by the cell phone indus-

try. The two Rüdiger papers that have been under siege are widely cited as supporting the work of Henry Lai and N.P. Singh who had **reported** similar effects on DNA ten years earlier. Together the Rüdiger and Lai-Singh experiments have been cited to support the claim that cell phones could lead to brain cancer.

The attacks on Rüdiger came from two different directions, both with strong ties to industry. A number of industry-friendly scientists waged a fierce and nasty crusade against Rüdiger (some, like **Alex Lerchl** continue today) on the grounds that his data were statistically suspect and therefore the experiment had to have been rigged. Later, one of Rüdiger's medical university colleagues, who is also allied to industry, joined the fray and **accused** Rüdiger's lab tech of falsifying the results. In the end, despite all the charges, no one could come up with any evidence of misconduct.

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In contrast, Miller's team had sampled electric and magnetic field levels for 260 unique job titles at 140 different electric utility sites.

Kheifets moved forward regardless. She published a three-and-a-half-page **paper** in 1997, claiming that there is "little support for an association between occupational electric field exposure and leukemia." There could be no doubt that this paper was her brainchild. She herself is the lead author—not Peters or London, the principal investigators on the original project. The USC **magnetic field paper**, published three years earlier, runs 16 pages and has eight authors; Kheifets is not among them.

The Kheifets-USC study was industry's last word on electric fields—that is, until last summer when she and Swanson called for research to stop. The Canadians, on the other hand, carried on. Paul Villeneuve, a graduate student working on his doctoral thesis at the University of Toronto, took a second look at Miller's data. He found that workers exposed to high electric fields for many years suffered what he called "dramatic increases in leukemia." Writing in the June 2000 issue of the *American Journal of Industrial Medicine*, Villeneuve **reported** that those who had worked for

Ontario Hydro for at least 20 years in electric fields that were often above 10-20 V/m had up to ten times more leukemia. In a second paper published at about the same time in *Occupational and Environmental Medicine*, he **noted** elevated risks of non-Hodgkin's lymphoma among the same group of workers exposed to high electric fields.

Villeneuve's papers are significant for two reasons. First, they emphasized once again the urgency of investigating electric fields, not just magnetic fields, as Miller had recommended four years earlier. **David Savitz**, then chairman of the department of epidemiology at the University of North Carolina School of Public Health, told *Microwave News* at the time that Villeneuve's results prompt the need to take a fresh look at electric fields (see **MWN, M/J00**, p.1).

Second, Villeneuve showed how new measures of classifying exposure could clarify cancer risks. Up to that time, epidemiologists had rarely looked beyond simple average field levels. Many had seen elevated cancer rates, but the increases were generally not that big. Now by separating out those workers whose exposures exceeded certain thresholds for many years, much higher risks emerged. Villeneuve's hypothesis makes intuitive sense: Those exposed

to higher doses would be at greater risk. In retrospect, it seems all too obvious, but no one had yet tested the idea. (A short time later, De-Kun Li at Kaiser Permanente in California, using a related exposure index for magnetic fields,

saw a link to miscarriages among women exposed above a certain threshold (16 mG), (see **MWN, M/J01**, p.1.) After Villeneuve, no one would again investigate thresholds in an EMF-cancer study.

Stacking the Data

Of the six occupational studies reviewed by Kheifets and Swanson, four are from the same Canadian-French project of electric utility workers. All four point to unprecedented increases in leukemia, lymphoma and/or brain cancer.

The **fifth** is an epidemiological study of Norwegian railroad workers. Its relevance is questionable. Norwegian railways operate at $16^{2/3}$ Hz, while U.S. and European electrical systems operate at 60 Hz and 50 Hz respectively. Kheifets and Swanson neglect to mention this inconvenient fact. Another important omission: The Norwegians did not actually measure worker exposures to electric fields. Writing in the *American Journal of Epidemiology* in 1994, Tore Tynes's team cautioned that their estimates of electric field exposures were not reliable.

The sixth and last **paper** was Kheifets's own analysis of the meager USC electric field data. **Joe Bowman**, an industrial hygienist now at **NIOSH** in Cincinnati, was responsible for the USC measurements. When recently asked to compare the USC study to Miller's, he replied: "The study designs are not in the same league; Miller's is far superior. To claim that Miller's findings were not replicated on the basis of my data is ridiculous."

Bowman explained that it is "very difficult" to measure electric-field exposures, because the very presence of the workers can distort the ambient fields. Kheifets and Swanson acknowledge this problem but use it selectively to try to discredit the meter—the Positron—used in the

Canadian-French project. "[A]n association reported in these but not other studies is highly unlikely due to more accurate measure of exposure," Kheifets and Swanson write. Given that there was a total of only six measurements of electrical utility workers in those "other studies"—those by Tynes and Kheifets herself—their argument is, to be blunt, absurd.

The **Positron meter** was designed by **Paul Héroux** when he was working for IREQ, the research arm of Hydro-Québec, in the 1980s. Héroux, who is now at McGill University's medical school, rejects Kheifets-Swanson's criticism. "Exposures based on Positron electric field measurements are more precise, even when perturbed by the body, than those based on unperturbed spot measurements," he told *Microwave News* this fall. "There is inevitable inaccuracy in any form of exposure assessment, but dosimeters provide the best estimates." Bowman agrees. "In reality, the Positron studies are the best ever electric field studies of utility workers," he said.

Héroux reserves his most damning criticism for Kheifets and Swanson's abuse of their positions as technical experts. "They are providing a twisted view of measurement methods in a way that can only be interpreted as favoring a political agenda," he said. "It would appear that they want to belittle scientific data that their employers find embarrassing."

Bowman, Héroux, Miller and Villeneuve all say that

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research on electric fields should have continued. Miller, who retired in 1996, is back at the University of Toronto, where, as the associate director for research at its School of Public Health he hopes to stimulate increased collaborative research on environmental issues, including EMFs. “I am disappointed that other people did not follow through and repeat my study,” he said in a recent interview. “It needs to be pursued. It definitely needs to be pursued.”

Villeneuve, who now has a faculty appointment at the

University of Toronto, strongly agrees. “The magnitude of the risk and the accompanying dose-response we found are very provocative,” he told *Microwave News* not long ago. “Further research should be done.”

There is nothing surprising about researchers wanting others to follow in their footsteps, but to hear such unanimous and passionate calls for replication so many years later is extraordinary.

Junk Science in Demand

The Miller-Villeneuve studies are arguably the most important in the EMF occupational literature. They have long demanded more serious attention and might not have been ignored if members of the EMF community—indeed, anyone—had spoken out for public health. In the mid-1990’s, when she was at EPRI, Kheifets was one of the few people in America who was in a position to fund a replication effort. Instead, she published a junk paper and dressed it up as a refutation. Now she and Swanson are trying to use that same paper to finish the job.

Actually, Kheifets and Swanson’s paper is worse than junk science, it’s fraud. The paper seeks to give the electric industry a major prize by taking electric fields off the EMF health agenda. This is, by any reasonable definition, scientific misconduct, and is far more serious than any of the cases that have been pursued by those who police scientific integrity (see “Three Cases of Alleged Scientific Misconduct” on p.2).

Far from ever being challenged, Kheifets has been and continues to be in great demand. She has helped shape every major EMF risk evaluation in recent memory. Swanson has been invited to attend many of the same meetings.

ICNIRP, which touts itself as being free of industry ties, has had Kheifets on its Standing Committee on Epidemiology for the last seven years. The committee publishes influential literature reviews on health risks, including the possible links between power lines and cancer.

Back in 2001, **IARC**, the International Agency for Research on Cancer, though fully aware that Kheifets worked for EPRI, invited her to sit on its committee evaluating **EMF cancer risks** as a full voting member. IARC also welcomed Swanson to sit in as an observer. According to those who were at the meeting, Swanson participated in the deliberations no differently than he would have as a member of the committee.

Soon afterwards Kheifets joined **Mike Repacholi** at **WHO’s EMF Project** in Geneva. EPRI continued to support her while she was at the WHO, even though this was in apparent violation of WHO rules governing conflicts of interest (see “**\$50,000 for a Literature Review?**” *MWN*, August 9, 2005). One of Kheifets’s responsibilities at WHO was helping Repacholi write and coordinate what would become the organization’s official position on power-line health risks, a document known as the **Environmental Health Criteria**. In the fall of 2005, Kheifets and Repacholi invited eight observers to attend a meeting where the final conclusions would be hammered out. All eight had close ties to the electric utility industry (see “**WHO Welcomes Electric Utility Industry To Key EMF Meeting,**” *MWN*, September 22, 2005).

Swanson was one of the eight invited guests at the WHO meeting. Another was Michel Plante, a medical doctor at Hydro-Québec, a Canadian utility with headquarters in Montreal. Plante had been the manager of a third component of the same Canadian-French project that produced the Miller, Villeneuve and Goldberg-Guénel electric-field cancer papers. **Gilles Thériault** of McGill University was the leader of this part of the project. Like his co-investigators, Thériault uncovered highly credible and significant cancer risks among workers at Hydro-Québec, but in this case, he implicated a different type of EMF, high-frequency transients sometimes referred to as dirty electricity. (The Positron meter can also measure these fields.)

Thériault’s study was the first to link transients to cancer and, like the project’s studies on electric fields, threatened to open a new front in EMF research. Hydro-Québec moved quickly to block it. With Plante’s help, the utility forced McGill to return all the information he had collected on the utility workers and their EMF exposures. Thériault was never allowed to see the data again.

None of the papers from the Canadian-French project that implicate electric fields or transients—those by Miller, Villeneuve, Goldberg-Guénel and Thériault—are cited in

WHO's EMF Environmental Health Criteria document. It is as if those studies never happened.

Corruption in Our Midst

Mike Repacholi, the former head of both ICNIRP and the WHO EMF Project, likes to reassure his critics that he has always been guided by the science and only the science. “Throughout my time at the WHO I can say unreservedly that all decisions were based on the science by committees of experts,” he said in an interview not long after his retirement. **Paolo Vecchia**, the current chair of ICNIRP, professes to be similarly moved. “Restrictions [on EMF exposures] are based on science: Only established effects are considered,” he **told** a London conference organized by the **U.K. Radiation Research Trust** last year.

It's a hard sell. The WHO EMF Project would never have existed without the backing of industry money. In return, Repacholi opened his doors to industry so that its people could have a seat at the table and help shape the reports coming out of Geneva. When he needed an assistant to help him run the project, he again turned to industry, hiring Kheifets from EPRI. Similarly, Vecchia appears to have no qualms about having Kheifets sit on one of ICNIRP's key expert committees. (See also “**Repacholi and Sound Science**,” *MWN*, August 3, 2005; and “**WHO and Electric Utilities: A Partnership on EMFs**,” *MWN*, October 1, 2005.)

The history of electric field epidemiology shows how easy the science can be manipulated. Important studies are paid lip service, and then never repeated. Sometime later, they are buried away. Effects can never be established and acted upon if they are ignored and misrepresented. Those that are successfully repeated are endlessly questioned.

The childhood leukemia link has been forever marginalized. There is no mechanism and because we can't explain it, the association can't be true, so goes Repacholi's, Vecchia's, Kheifets's and Swanson's argument. What gets lost is that if EMFs can bring on childhood leukemia, it may lead to other types of cancer too—especially adult leukemia—perhaps by some other mechanism. If it's not impossible for childhood leukemia, other nasty things may follow too.

All this hypocrisy is not lost on those who are left outside looking in. Discontent and contempt are widespread. This led to the founding of the International Commission

for Electromagnetic Safety (**ICEMS**) to promote research and assess health risks. ICEMS is designed to serve as a counterweight to the WHO and ICNIRP. A number of its members put together the **BioInitiative Report**, an alternative interpretation, of the EMF health literature. On a lighter note, last summer, activists translated their frustrations into satire: They circulated a promo for “**ICNIRP in Concert**,” a mock CD. “Would I Lie to You?” was among the promised songs. It was a huge hit on the EMF circuit.

Distorting the public health literature is not a victimless crime. Workers who will be exposed to higher EMFs face, according to Miller and Villeneuve, an up to tenfold greater cancer risk than if precautions were to be taken. Kheifets and Swanson's fraud is no different from that which helped suppress the cancer risks of cigarette smoke, asbestos and many, many chemicals. Yet these industry scientists continue to be welcomed at the highest levels as fair and balanced experts.

Why doesn't anyone speak out against the corruption in our midst? Over the last few years, Germany's **Alex Lerchl** has made a career out of demanding that Hugo Rüdiger be punished for scientific misconduct, which has never been substantiated (see “Three Cases of Alleged Scientific Misconduct” on p.2). When we asked Lerchl about his motives some time ago, he replied, “I don't like rubbish being published.” On that we can agree. But why then isn't he—or anyone else—up in arms against Kheifets and Swanson's electric field rubbish? Why are industry scientists never held to account for their actions, even as they pursue others whose crimes are petty in comparison? Perhaps because the work of those other scientists challenges industry's interests. The playing field is far from fair.

It's time for industry scientists to be held to the same standards and suffer the same penalties as they would apply to others. At the very least, those who deceive through scientific misconduct should no longer be able to receive government research grants or sit on advisory and peer review panels.

EMFs will never be taken seriously as long as no one is willing to acknowledge the real junk science all around us.