FCC Comments on Docket 19-226 for Electrosensitivity Evaluation of New Human Exposure Safety Standards for Radiofrequency Electromagnetic Fields

From Cindy Lee Russell MD
To : Federal Communications Commission
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Please consider this science on biological impacts of 5G and Higher frequencies from 6 GHz to 1 THz that is non-thermal. Links hereby incorporated by reference.

Electrohypersensitivity Overview

Microwave-generating equipment, most notably radar, originated during World War II. In the ensuing decades, many reports of "microwave sickness" were published by Soviet scientists with NASA reporting similar findings in 1981. (1,2) Microwave sickness has since been referred to as "electrosensitivity" or "electromagnetic hypersensitivity (EHS)".

To be clear, all humans are electrochemical organisms. The brain, heart and gut are electrically and chemically activated organ systems-all the way down to voltage-gated ion channels on cell membranes, in which an electrical signal can lead to chemicals entering the cell that alter that cell's function. As such, we are all "electrosensitive". The term "electromagnetic hypersensitivity" is thus reserved for a subset of people who have developed a pathological hypersensitivity, often as a result of some triggering event or exposure-be it electrical, chemical, infectious or physical. There are individual genetic differences which can also influence the development and/or severity of electrohypersensitivity.

People with EHS can present with an array of symptoms when exposed to electromagnetic fields (EMF). Those with more severe EHS can become symptomatic at EMF levels commonly found in most modern houses and buildings. EMF that may induce a reaction include low frequency electric and magnetic fields, medium frequency distortions of house electricity ("dirty electricity"), and high frequency radiowaves. For those with EHS, the types of EMF that induce symptoms will vary, as do the symptoms that each person develops. Symptoms can range from mild to severe. Reported physical symptoms include headache, difficulties with concentration or memory, dizziness, sleep disturbances, irritability, rashes, vision changes, heart palpitations, muscle twitching, fatigue, tinnitus, and others. Psychological symptoms, such as anxiety and depression, are commonly in response to the burden of physical symptoms, though excess stimulation of the neurological system may also play a role.

Prevalence of Electrosensitivity

Several population-based studies have documented a varied prevalence rate for electrosensitivity: 1.5% in Sweden (Hillert, 2002); 3.2% in California (Levallois, 2002); 5% in Switzerland (Shreier, 2006); 9% in Germany (Infas, 2006); 4% in the United Kingdom (Eliti, 2007); 3.5% in Austria (Schröttner, 2008); and 13.3% in Taiwan (Tseng, 2011). (3-9) The questionnaires used varied between studies, making it difficult to reach definitive conclusions about temporal or geographic shifts in prevalence of electrosensitivity. The World Health Organization has noted that "approximately 10% of reported cases of EHS were considered severe". (10)

Electrosensitivity as a Recognized Functional Impairment

Electrosensitivity support groups now link thousands of people worldwide. In 2002, Sweden was the first country to recognize EHS as a functional impairment. A similar conclusion was reached in 2002 by the United States Access Board (the federal agency devoted to accessibility issues for people with disabilities), in 2007 by the Canadian Human Rights Commission, and in 2009 by the European Parliament. Courts have awarded disability claims to people with EHS in Australia, France, Spain, United Kingdom, and United States. (11-15) Also of note, EMF researchers and physicians have authored more than 20 position papers and resolutions cautioning about EMF health risks (e.g. in 2016, 220 scientists from 42 countries signed an International Appeal directed to the United Nations and the WHO, calling for protection from non-ionizing EMF exposure). (16)

What Causes Electrosensitivity?

The cause of EHS has been a contentious issue for many years, with EHS sufferers and many physicians and scientists attributing symptoms to EMF exposure, while others would deny this is so. In 2004, the World Health Organization (WHO) sponsored the International Workshop on EMF Hypersensitivity. Soon after, in December 2005, the WHO published its "Fact sheet N°296" (17), which concludes: "EHS is characterized by a variety of non-specific symptoms that differ from individual to individual. The symptoms are certainly real and can vary widely in their severity. Whatever its cause, EHS can be a disabling problem for the affected individual. EHS has no clear diagnostic criteria and there is no scientific basis to link EHS symptoms to EMF exposure."

Curiously, Fact sheet N°296 has remained posted on the WHO website without update for over a decade. This is consistent with the WHO's continued stance that radiowave injury can only occur at levels sufficient to cause a person to be measurably heated. To the contrary, mounting extensive scientific evidence has demonstrated that non-thermal effects are seen at lower levels of exposure—not only in EHS sufferers, though most markedly so in such people. See **BioInitiative 2012** for a comprehensive review of relevant studies. (18)

Respected researchers, including Dr. Neil Cherry in 1999 and Dr. Lennart Hardell in 2017, have questioned the independence of WHO recommendations about EHS and related safety issues of EMF, given the existence of strong ties between the WHO, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and military, telecommunication and power industries. (19, 20)

Science of Biologic Harm Continues to Grow

Mounting scientific evidence of biologic harm caused by EMF (see this website's Executive Summary) and the increasing number of credible case reports (see this website's **An Overview of Relevant Research**) have made it clear that EHS is a real EMF-induced medical entity. While more research is needed, we encourage physicians to consider EHS as a possible explanation for vague chronic symptoms such as insomnia, headache or mental fatigue.

To delve more deeply, visit either of these two additional PST webpages:

- **Overview of Relevant Research**
- **Clinical Approach to EHS**

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Electrosensitivity: Review of Relevant Research

A Sample of Early Studies

Johansson did important early work with people in Sweden who had developed skin- and mucosa-related symptoms (itching, pain, heat sensation, redness, rashes) when exposed to visual display terminals and other electromagnetic devices—a condition he called “screen dermatitis”. (21) As an example, in one of several related studies, he found a profound increase in mast cells in facial skin samples from people with this form of EHS.

Sandström, Hansson Mild and Lyskov published a series of studies, from 1994 to 2003, of people with skin and/or neurasthenic symptoms. (22) They found evidence for autonomic nervous system dysfunction compared to control groups. EHS sufferers had increased sympathetic activity, with higher resting heart rates and hyper-responsiveness to flickering light and audio stimulation, and also had night-time parasympathetic inefficiency.

Is Electrosensitivity Real?

Rubin and colleagues published two reviews of EHS provocation studies, evaluating 31 experiments in 2005 and 15 new studies in 2010. (23, 24) In the 2005 article, Rubin concluded: "The symptoms described by 'electromagnetic hypersensitivity' sufferers can be severe and sometimes disabling. However, it has proved difficult to show under blind conditions that exposure to EMF can trigger these symptoms." Their 2010 study reached a similar conclusion.

Of Rubin's work, Marino writes: "The experiments designed to detect EHS had been based on the assumption that if it existed, it was a linear phenomenon, whereas EHS is actually a nonlinear phenomenon." Marino adds: "If EMFs created disease in precisely the same way with every person (e.g., induction of migraine headaches), then a cause-effect relationship between EMFs and disease would easily be detectable using linear methods. The tradeoff for capitalizing on the sensitivity of linear methods is the likelihood of a false-negative result if the determinism in the system under study is nonlinear." (25)

At issue, then, is whether or not EHS represents a single, linear phenomenon. If EHS is non-linear—that is, it's comprised of a variety of related conditions, each with their own unique EMF trigger(s), pathophysiology, array of symptoms, and time to onset of symptoms—then any study designed to properly confirm or deny its existence would need to be done on a case-by-case basis.

See the **Genius and Lipp article** for a more detailed review of the unique challenges faced in studying the relationship between EMF exposure and EHS symptoms. (26)

A Tale of Three Physicians

Dr. Gro Harlem Brundtland is perhaps the world's most famous person who has reported being hypersensitive to EMF. Dr. Bruntland served three terms as Prime Minister of Norway from 1981 to 1996, was Director-General of the World Health Organization from 1998 to 2003, and was U.N. Special Envoy on Climate Change from 2007 to 2010. Months after becoming the WHO Director-General, Bruntland suffered severe eye damage during a microwave oven accident, which she believes caused her electrosensitivity. Ironically, she went public with her self-diagnosis of EHS while still heading the WHO, while the agency was refusing to acknowledge that EHS symptoms were directly caused by EMF exposure. In 2002, she had the following to say in a Norwegian newspaper interview (translated here into English): "It's not the sound, but the waves I react on. My hypersensitivity has gone so far that I even react on mobiles closer to me than about four metres . . . In the beginning, I felt a local warmth

around my ear. But the agony got worse, and turned into a strong discomfort and headaches every time I used a mobile phone . . . And in order not to be hysterical—that someone should believe that this was just something I imagined—I have made several tests: People have been in my office with their mobile hidden in their pocket or bag. Without knowing if it was on or off, we have tested my reactions. I have always reacted when the phone has been on—never when it's off. So there is no doubt." (27)

Dr. Scott Eberle, a hospice physician in Northern California, has published two articles describing his own development of a severe version of EHS. Like Bruntland, Eberle constructed a blinded self-study to confirm the diagnosis. "At home I had a router with wireless and wired options. I sat with eyes closed a few feet from the router and, at an unknown time, a friend turned on the silent wireless function. About ten minutes into the trial, I started having a piercing headache: sharp and pointy going up the middle of my brain just left of midline. My friend confirmed that he had turned on the router less than a minute before I had become symptomatic." After many months of "meticulously testing [his] environment [and] keeping a detailed journal about exposures and symptoms", Eberle identified a repeatable pattern for lower-level radiofrequency exposures. "Within an hour," he writes, "my brain feels unnaturally activated, like a shot of mental caffeine. An hour or two later, a headache starts and mental function slows, followed by a night of poor sleep. The next day I awaken feeling mentally washed out. It takes me 24 hours to feel okay and 48-72 hours to return to normal." (28)

McCarty and colleagues (including Marino) have taken Bruntland's and Eberle's blinded approach one step further, performing a double-blinded EMF provocation study to test an unnamed third physician who, like Bruntland and Eberle, was self-diagnosed with EHS. (29) First the researchers conducted preliminary studies to identify what kind of EMF triggered her symptoms and what those symptoms were. As Marino says, "We assumed any symptoms triggered by the controlled field would be specific to the subject (not a universal reaction similar in nature and intensity to the reactions of all true EHS sufferers)." They then used methods designed to minimize unintentional sensory cues while repeatedly exposing the subject to the identified type of EMF trigger: a 60-Hz electric field of 300 V/m, comparable to a typical environmental-strength EMF. "[T]he subject developed temporal pain, headache, muscle-twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($P < 0.05$)" despite having "no conscious perception of the field". She reported symptoms in 100% of these electric field exposures and never during periods of not being exposed. The researchers conclude that EMF hypersensitivity is "a *bona fide* environmentally-inducible neurological syndrome".

Rubin sent a letter-to-the-editor critique of the McCarty article, with his primary objection being the language used by the subject to describe her symptoms. (30) Marino, representing the McCarty group, offered a published response, describing in detail how his group had well-handled this issue of symptom reporting. (31)

Biomarkers for Electrosensitivity

In 2015, Belpomme and colleagues published a comprehensive study of 1,216 people with environmental sensitivities: 71.6% had EHS, 7.2% had multiple chemical sensitivity (MCS), and 21.2% had both conditions. (32) They documented abnormal findings in an array of reliable biomarkers, with positive results being found for five different serum markers in 15%-40% of subjects (as one example, nearly 40% of subjects had elevated serum histamine levels suggesting a chronic inflammatory process in this subset of subjects). They also found a deficit in melatonin metabolic availability in all investigated cases, and capsulothalamic hypoperfusion and blood-brain barrier opening on brain imaging.

Heart Rate Variability as a Possible Marker

Havas and colleagues published a double-blind study measuring heart rate variability in response to a cordless phone provocation. (33) The 25 subjects had perceived levels of electrosensitivity ranging from "extremely electrically sensitive" to either "not sensitive" or "no opinion". Four of 25 subjects (16%) had a significant increase in heart rate during microwave exposure compared to sham exposure (an increase of 10 to 93 beats per minute). Focusing on the most dramatic example, they write: "The heart rate for subject 25 jumped from 61 bpm to 154 bpm (with real provocation) and returned to 64 bpm (with sham provocation)." They also monitored heart rate with positional changes and found that "the sympathetic/parasympathetic balance changed for an additional 6 subjects (24%) while they remained in a supine position." They conclude: "Orthostatic HRV [heart rate variability] combined with provocation testing may provide a diagnostic test for some EHS sufferers when they are exposed to electromagnetic emitting devices." This study echoes earlier work done by Bellieni and colleagues who found a statistically significant change in HRV in neonates when exposed to the EMF produced by incubators while turned on compared to when the incubators were turned off.

Electrosensitivity as a Nonlinear Condition

Returning to Marino's analysis: "[T]he symptoms of EHS vary in terms of physical location in the body, may linger after the stimulus is turned off, appear to depend not only upon the field strength but also upon changes of the field ('pulse' vs. 'continuous'), and are quite likely to be amplified by other factors, including the subject's emotional response to the suffering". (34) The variable biomarker results in Belpomme's study support Marino's assessment and suggest that this nonlinear phenomenon may be comprised of a variety of related conditions, each with their own unique EMF triggers, pathophysiology, array of symptoms, time to onset of each symptom, and measurable biomarkers.

That EHS is a non-linear condition is also suggested by the three physician case histories presented above. Bruntland and Eberle report something similar—headaches soon after being exposed to radio-frequency EMF, though Eberle also describes a more delayed and prolonged reaction different from Bruntland's. In contrast, McCarty's physician subject developed her headaches after exposure to a low-frequency electric field rather than radio-frequency EMF. Of further note, all three of these cases are very different from the screen dermatitis described by Johansson, and all three may or may not exhibit the heart rate changes reported in the Havas study.

Side-by-side provocation studies of multiple EHS sufferers, in a fashion similar to the McCarty study, would be needed to confirm if there are multiple versions of EHS, each with its own unique and reproducible combination of EMF triggers and time-course of symptoms.

Considering the current body of research, and direct experiences with those who are electrosensitive people, we conclude that electrosensitivty is a verified electromagnetically-induced medical entity.

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A Clinical Approach to Electrohypersensitivty

We encourage practicing physicians to evaluate carefully any concerns a patient may have about whether presenting symptoms are being caused by EMF exposures (and/or other environmental issues). In particular, a physician is in a unique position to educate and support a patient to use a blinded approach—not unlike that employed by Bruntland and Eberle—in determining if they are truly reacting to some kind of EMF.

We recommend the following articles to physicians who encounter patients who might be electrosensitive:

- **EUROPEAN EMF Guideline 2016 (35)**: A comprehensive review for evaluating a person with possible EHS, which includes sections on history, exam, labs, measurement of EMF exposure, prevention or reduction of EMF exposure, diagnosis, and treatment.
- **Eberle's physician recommendations (36)**: Another outline of how to approach the care of a person with suspected EHS, compatible with the Austrian guidelines.
- **Genuis and Lipp's review article (37)**: They, too, offer both an overview of EHS and an approach to the management of the condition.
- **Belpomme's article(38)**: Potentially useful for directing which biomarkers might be measured.
- **Eberle's second article, "An Underworld Journey" (39)**: Helpful for understanding the profound psychological sequelae that may result from this biophysical sensitivity.

Summary Recommendations Derived from These Five Sources

- **Take the patient's symptoms seriously**: This alone will have a positive impact on the patient's care.
- **Take a full history and physical:** The history should include identifying all suspected symptoms, variations of health problems depending on time and location, an assessment of EMF exposures, and an evaluation for other possible environmental sensitivities. The EUROPAEM (European Academy of Environmental Medicine) guidelines note that there are no specific findings on physical exam to confirm or deny a suspected case of EHS.
- **Consider tests as indicated:**
    -
    - Pursue an appropriate non-EHS work-up as indicated by a patient's symptoms.
    - The Austrian guidelines outline a comprehensive approach to a lab work-up for someone who may have EHS.
    - The Havas study suggests a possible diagnostic provocation study for those reporting sensitivity to radio-frequency EMF.
    - The Belpomme article suggests EHS biomarkers that might be worthy of measurement (e.g. checking serum histamine levels may help direct the therapeutic use of antihistamines).
    - Genuis and Lipp reference work that suggests an elevated prevalence of thyroid dysfunction and liver disease occurs in people with EHS.
- **Recommend a diagnostic "EMF vacation".** This is most easily achieved by camping without electricity or electronic devices in a remote natural setting. Avoidance of other people and their own electronic devices is key. A radio frequency meter can also help to confirm the environment is clear of this type of EMF. If symptoms improve dramatically during the "vacation", only to return soon after coming home, then an environmental cause is possible. Further investigation will then be needed to determine what in the environment may be a trigger for symptoms.
- **Have the patient keep a detailed symptom diary:** This is essential for helping to tease out if EMF exposures are the cause of a person's symptoms.
- **If indicated, encourage the patient to have EMF levels evaluated at home and/or work.** Some will choose to do this themselves by ordering the necessary meters (measurements should be done for electric fields, magnetic fields, "dirty electricity" and radio-frequency radiation). Given the complexity of the issue, however, getting EMF consultation from a reliable expert may be the

preferred approach. See the Austrian guidelines for specific recommendations about this kind of testing.

- **Use a physician's understanding of blinded studies to help the person design exposure experiments.** As with the physician case histories described above, this will help identify triggers and then direct potentially beneficial interventions. Meter(s) measuring the type(s) of EMF being tested will be essential to insure the quality of this self-study.
- **Encourage the person to avoid excess EMF exposure.** Here are simple, first-pass changes to consider: 1. minimize use of cellphones and be sure to turn them off at night; 2. Change any cordless phones to landline phones; 3. Use a wired internet connection and keep the computer in airplane mode; 4. Place the internet router far from the bedroom and/or turn it off when not in use; 5. Avoid the use of microwave ovens; and 6. consider calling your utility company and having nearby "smart meters" turned off or shielded. See the Austrian guidelines and/or the Genuis and Lipp article for a more detailed review of first-pass strategies.
- **If indicated, consider a more radical approach to avoidance and shielding:** For people with a severe form of EHS, the above first-pass changes may not be adequate. Arranging EMF consultation, as mentioned above, may be critical in developing more advanced strategies. For example, while EMF shielding can be hugely beneficial in creating a safe haven, it can also make an environment less safe if the shielding is not done properly.
- **Encourage a healthy lifestyle.** This includes a quality diet and aerobic exercise (if not contraindicated) especially after a significant exposure. In addition, sleep is especially important to highlight (as per Belpomme's work, melatonin production is commonly altered and insomnia is often a problem). Interventions to consider include (1) making the bedroom into a safe EMF haven is essential, (2) using melatonin supplementation, and (3) avoiding excess blue light exposure (e.g. computer and TV screens), which can delay the circadian rhythm and disrupt sleep.
- **Support the patient's exploration of complementary therapies.** In particular, *a functional medicine* evaluation may be useful. The Austrian guidelines highlight that EMF exposure in electrosensitive people may cause a reduction of "oxidative and nitrosative regulation capacity" and thus they recommend "anti-oxidative and anti-nitrosative therapies including trace elements, vitamins and amino acids." The Genuis and Lipp article makes similar recommendations focused on the remediation of a person's nutritional and biochemical status.
- **Refer for counseling and/or recommend a support group as indicated.** See Eberle's "Underworld Journey" article (39) for a harrowing account of what a person with severe EHS may encounter psychologically, beginning with overwhelm, fear and shame. Don't misinterpret these difficulties as being part of a psychosomatic illness. On the contrary, they are *the sequelae* of the sensitivity, not *the cause*. As profound as these psychological difficulties may be, they should be addressed in parallel with the physically-oriented approaches outlined above.
- **Use existing diagnostic codes as indicated.** The EUROPAEM EMF Guideline 2016 recommends the following diagnostic codes from the International Classification of Diseases (ICD), ICD-10-WHO 2015:
    - Electromagnetic hypersensitivity (EHS): use existing codes for the different symptoms **plus** code R68.8 "Other specified general symptoms and signs" **plus**code Z58.4 "Exposure to radiation" and/or Z57.1 "Occupational exposure to radiation".
    - EMF-related health problems (except EHS): use existing codes for the different diseases/symptoms **plus** code Z58.4 "Exposure to radiation"
    - and/or Z57.1 "Occupational exposure to radiation"

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ELECTRO-HYPERSENSITIVITY STORIES

Dr. Scott Eberle– Hospice physician- **"What's the Diagnosis Doctor?"** Dr. Scott Eberle. SCCMA Bulletin Nov 2016. http://www.sccma.org/Portals/19/Whats%20the%20Diagnosis%20Doctor.pdf?ver=2016-12-09-152046-290

Alison Main- Freelance writer- **Electrosensitivity- When the Modern World Hurts. Modern World Hurts** https://bestselfmedia.com/electrosensitivity/

Jolie Jones- Concert producer- **Jolie Talks: Taking Back Her Power. Jolie Talks https://www.jolietalks.com/news/2017/3/19/taking-back-her-power**

Video of Jolie Jones, actress and musician as well as daughter of musician, record producer and film producer Quincy jones, discussing the development of her electrosensitivity with an interview of researcher Olle Johansson. **Jolie Jones Interview**

Ann Mills chronicles her journey developing electro sensitivity in her book, "**All EMF*d Up* (Electromagnetic Fields): My Journey Through Wireless Radiation Poisoning and How You Can Protect Yourself. (2019)**". The onset of strange symptoms, in a strange country, in the middle of the night led the author to more than a diagnosis of microwave illness. After suffering months of unexplained nausea, insomnia, ringing in the ears, fatigue and body aches she consulted with a German doctor to help her figure out what was happening. Her diary reads like Anne Frank. Chilling and a warning to us all.

Dr. Brad Harding and Dr. Meg McMorrow-Connecticut Practioners**-Area Couple's Status: Cell Tower Regugees.** Cell Tower Refugees http://www.countytimes.com/news/area-couple-s-status-cell-tower-refugees/article_f18e56a6-db83-5ffc-87e4-ac28b6152a0f.html or **PodCast** at Bioneer's conference by Dr. Harding and Dr. McMorrow, Wireless Technology and Human Health

Testimony in opposition to AB57 in California in 2015 Senat Governance and Finance Committee , July 15, 2015. https://www.youtube.com/watch?v=DxXfOwvB8so&feature=emb_logo

Magda Havas, PhD, Associate Professor of Environmental & Resource Studies at Trent University

Cell Tower Microwave Radiation Presentation by Magda Havas with testimony from electrosensitive person and firefighter
https://www.youtube.com/watch?time_continue=10&v=AEOcB7Svhvw&feature=emb_logo

Jeromy Johnson: Ted Talk Wireless Wake-up Call"

https://www.youtube.com/watch?time_continue=329&v=F0NEaPTu9oI&feature=emb_logo