

EVIDENCE COMPENDIUM

Response to the U.S. Department of Health and Human Services Request for Information on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure

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Introduction and Purpose

Europeans for Safe Connections (ESC) submits this evidence compendium in response to the U.S. Department of Health and Human Services (HHS) Request for Information on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure, Federal Register Document No. 2026-19252 (91 FR 59792).

This submission addresses only part of the questions posed by the HHS and gives additional attention to scientific evidence regarding potential adverse health effects associated with RF radiation exposure at levels below current federal exposure limits, and includes scientific evidence regarding potential adverse environmental effects associated with RF radiation.

The request focuses on RF-EMFs. However, ESC is also concerned about LF and ELF-EMFs, although current public concern about EMFs focuses primarily on RF-EMFs. Many scientific studies have investigated so-called dirty electricity in the electrical grid and reported health effects extending beyond childhood leukaemia. The epidemiologist Samuel Milham has produced approximately 100 scientific reports on this issue, and his views, based on this body of research, were compiled in his book *Dirty Electricity*.

In this Compendium we use the term Electro Hyper Sensitivity although other terms are used for this, like Microwave Illness and Electro Magnetic Radiation Syndrome (EMR syndrome).

Public Experiences and Reported Potential Adverse Health Effects

Q2 Perspective of our response

The perspective of our response: Europeans for Safe Connections is a non-governmental organization founded in 2023 in response to inadequate protection against NIR (non-ionizing radiation) and the growing number of people suffering from electromagnetic hypersensitivity (EHS).

Q3 Share experiences regarding potential adverse health effects associated with exposure to RF/EMFs

Research shows that EHS affects up to 5% or more of the population, with approximately 0.65%

experiencing such severe symptoms that participation in everyday social life becomes impossible. *(References: French public agency responsible for food safety and health risk assessment ANSES' study, Bevington, and more recent research.)*

Despite the significant impact on those affected, adequate support, healthcare, and protection remain lacking. This is partly due to ongoing uncertainty among authorities regarding the causal relationship between exposure to electromagnetic fields (EMFs) and reported health effects.

However, there is sufficient scientific evidence that NIR have non-thermal biological effects that are noticeable to many people. There is also sufficient scientific evidence that EHS is a physical illness. Scientific understanding of the underlying mechanisms of EHS and approaches to its diagnosis is continuing to develop.

See references below. This list of references does not include provocation studies, although many such studies have been conducted. The scientists who designed these studies did not consider the physiological processes that might underlie the ability of people with EHS to discern the presence of EMFs. Physiological responses normally take considerably longer than the few minutes allowed in these provocation tests. Sensory responses, however, can occur very quickly. Nevertheless, there is no reason to believe that humans have a sense that enables them to detect EMFs. Scientists studying EMFs are now considering organic physiological responses, such as impaired detoxification systems, calcium signaling, and oxidative stress, as a basis for developing a diagnostic approach.

But beyond the scientific evidence, under the UN Convention on the Rights of Persons with Disabilities, people with EHS have the right to participate in society. Governments should do all that is reasonable to limit radiation to enable people with EHS to participate. In his contribution to this Request for Information to HHS, Dr. Olle Johansson presents his perspective on this approach and on the impact of EMFs on people with EHS.

Q3 References:

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[https://www.academia.edu/27218695/Electromagnetic field reduction restores health of electro sensitive people](https://www.academia.edu/27218695/Electromagnetic_field_reduction_restores_health_of_electro_sensitive_people)
5. Yael Stein MD, Iris G. Udasin MD - Electromagnetic hypersensitivity (EHS, microwave syndrome) – Review of mechanisms – 2020 – DOI: <https://doi.org/10.1016/j.envres.2020.109445>
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Exposure Standards and Risk Assessment

Q5 What existing national and international exposure standards, guidelines, or regulatory frameworks should federal health agencies consider when evaluating the potential adverse health effects of human exposure to RF/EMF?

Q5 n,o The changes needed and the need for additional research

Current exposure limits are designed to prevent excessive heating. However, people report experiencing effects from EMFs at exposure levels well below the official limits.

Based on many years of experience, building biologists have drawn up practical guidelines <https://buildingbiology.com/building-biology-standard/>. When people with EHS adhere to these guidelines by avoiding and shielding themselves from sources of EMF, their symptoms disappear or are alleviated.

The European Academy of Environmental Medicine (EUROPAEM) has also developed guidelines on EMFs based on scientific findings. EUROPAEM aims to provide preventive measures and protective strategies against the potential health risks of electromagnetic fields.

The newly established International Commission on the Biological Effects of EMFs (ICBE-EMF) is working on new exposure standards: <https://icbe-emf.org/>.

Below you will find references to alternative exposure standards based on practical experience and scientific findings.

Q5 n, o References:

1. Institut Für Baubiologie + Nachhaltigkeit Standard of Building Biology Testing Methods SBM <https://buildingbiology.com/building-biology-standard/>
2. The European Academy of Environmental Medicine EMF Guide from EUROPAEM: Protection & Prevention <https://europaem.eu/emf-guide-from-europaem-protection-prevention/>
3. P.J.B. Ishaq et al. - Applying the Precautionary Principle to Wireless Technology: Policy Dilemmas and Systemic Risks – 2024 - <https://doi.org/10.1080/00139157.2024.2293631>
4. J.C. Lin - RF Health Safety Limits and Recommendations [Health Matters] 2023 - [IEEE Microwave Magazine](#) (Volume: 24, [Issue: 6](#), June 2023)

Q5 p How, if at all, should a classification system account for exposure-related characteristics, including operating frequency, power density, specific absorption rate (SAR), electric- and magnetic-field strength, modulation and pulse characteristics, duty cycle, beamforming, simultaneous exposure to multiple frequencies, duration of exposure, distance from the source, proximity to the body, and cumulative exposure over time?

We agree with the assertion in this question that many more characteristics than just frequency and power density/SAR values play a role in the biological effects of electromagnetic fields. Next to others, K. Marha already mentioned this in 1969 in the book 'Electromagnetic Fields and the Living Environment'. (Ref. 1 under V12) We believe that all the characteristics mentioned above may be relevant and should be taken into account when assessing biological effects.

Many well-conducted scientific studies report harmful health effects to varying degrees, whilst others report no harm at all. See the reference to scientific studies included under question 12. A possible explanation for the differences in the results of individual studies may lie in the varying methodological approaches and characteristics of the EMF sources used. Studies that simulate exposure under real-world conditions – that is, using EMFs with characteristics corresponding to normal use – provide more relevant insights into the effects on humans. By contrast, some laboratory studies use sources with inadequately described parameters, missing signal components (for example, no modulation) or exposure models that deviate significantly from real-world conditions. These differences may contribute to the inconsistency of the results obtained to date.

Given that the mechanisms by which electromagnetic fields influence biological systems and the significance of individual EMF characteristics have not yet been fully elucidated, we consider it important to take particular care to ensure that exposure conditions correspond as closely as possible to those encountered in practice. Such an approach can contribute to a better understanding of the biological effects of electromagnetic fields and their implications for human health.

Dedicated research into the effects of these various characteristics is needed to get a full picture. A well-designed review of scientific studies that clarify the characteristics of the EMFs used, may shed more light on this most important issue.

However, waiting for the results of further research before revising the current exposure limits is not acceptable. Sufficient evidence is already available to support substantially lower exposure limits, as demonstrated by the biological effects reported in numerous scientific studies.

Q5 p References:

1. Dimitris J Panagopoulos, Olle Johansson, George L Carlo - Polarization: A Key Difference between Man-made and Natural Electromagnetic Fields, in regard to Biological Activity -2015 - <https://pubmed.ncbi.nlm.nih.gov/26456585/>
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Q6 What scientific evidence exists about potential adverse health effects caused by current exposure limits?

ESC is focusing on scientific evidence of adverse health effects below the current exposure limits.

Our reply is entered as a response to Question 12. In the answer to question 3 we gave a view on the risk for the current EMFs for EHS people.

Measuring Human Exposure and Public Health Surveillance

Q9 What, if any, technical and exposure-related information should be disclosed to consumers, residents, workers, schools, healthcare providers, and local governments?

Technical and exposure-related information should be disclosed, including the peak values. As the official standards presume only the heating of tissue and the mean values of NIR have importance, peak values are ignored, while many studies precisely clarify the great importance of these peak values and long-term exposure.

Radiation levels vary constantly, especially when beamforming techniques, as used in 5G, are applied. These variations are so wide-ranging that measurement techniques need to be adapted. In Europe, we see requirements to inform the public about the locations of public antennas, including their height, frequency, direction, and radiation levels. But information on peak values is missing in Europe.

Exposure information inside buildings is also needed to protect vulnerable people in public spaces, such as hospitals, medical facilities, nursing homes, daycare centers, and schools.

Q11 Should exposure assessment or risk evaluation differ for sensitive populations such as those noted below? Please explain.

The scientific finding referenced under Q12, indicate that EMFs may influence and disrupt a range of physiological processes. Man-made EMFs may contribute to or cause various illnesses. People with certain limitations or impairments may be more vulnerable than others, including children, pregnant women, older adults, and people who are ill, both at home and, in particular, in hospitals.

The expansion of local and global wireless networks should be reduced, and safer wired networks should be used instead of wireless technologies to protect susceptible members of the public.

The specific characteristics of child biology

Scientific experts warn that current guidelines may not adequately protect children from RF/EMF exposure [30, 31, 33], as they do not account for:

- Children's specific anatomy and developmental stages, including prenatal development [3, 29, 30, 32].
- Potential non-thermal effects of RF/EMF.
- Chronic exposure, cumulative effects of multiple RF/EMF sources, or interactions with other environmental hazards [66].
- Children's greater vulnerability to harmful substances [37, 67–69] and potential differences in tissue radiation absorption due to anatomical and developmental factors [21–29, 59], with possible effects on neurological function, brain development, stem cells [12, 14] and reproductive organs [15].

Existing Evidence

Q12 What scientific evidence exists regarding potential adverse health effects associated with RF radiation exposure at levels below current federal exposure limits?

Much research has been done to establish the effects of EMFs. Many scientists found adverse effects and over the years many scientific appeals have been made to the authorities to take this into account before applying new generations of wireless technologies. We counted over the years since the beginning of this Millenium up to 55 appeals, resolutions and declarations. Some links to recent appeals and statements of scientists and doctors: <https://www.5gappeal.eu/> - <https://emfscientist.org/> - <http://appel-de-paris.com/?lang=en> - <https://phiremedical.org/2020-nir-consensus-statement-read/> -

Based on the science available in 2011, an important political sign was given by the council of Europe: <https://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994>

In 2007 the Bio Initiative Report already mentions the importance of modulation for the biological impact of EMFs. Scientific studies mention the importance for biological effects of extreme and ultra-low-frequency components of RF-EMFs.

The official institutions responsible for assessing the health risks of NIR also regularly state that, if harmful effects occur, the mechanisms by which NIR affects organisms are unknown. Yet multiple replicated studies have found that NIR causes oxidative stress, which is considered in science to be a cause of many diseases.

We would like to highlight some of the latest scientific studies in the references below, and then draw your attention to “Historical scientific research in Central and Eastern Europe” and the historically different approaches to the biological effects of non-ionizing radiation in Central Europe and the United States, as it is precisely these historical decisions that have shaped current exposure standards in most countries.

Non-thermal effects of RF/EMF are long-term document. Some biological research and studies on RF/EMF effects on humans are presented here:

- Oxidative stress in cells [5, 6, 7, 35, 38, 65]
- Adverse effects on the cardiovascular system [8, 9, 10, 63],
- DNA repair disorders [12], influence on cellular processes [61, 62],
- Adverse effects on human neurons [55, 59], brain waves [13], nervous system [1, 2, 10, 14], sleep disorders, memory [56], migraines, impacts on mental and emotional well-being of children and youth [8, 10, 56],
- Damage to reproductive organs and cells [15, 36], the incidence of oxidative stress in the umbilical cord blood of pregnant women [64]
- Increased body vulnerability to other toxic substances from the environment when exposed to RF/EMF [66]
- Reported findings on exposure to mobile network base stations in human volunteers, human cells, and populations:

- Higher cancer risk [50-53], higher type 2 diabetes risk in children [11],
- Increased occurrence of chromosomal cell aberrations [54] and effects on white blood cells [49,57],
- Significantly higher number of reports on specific health problems such as sleep disorders, fatigue, headaches, irritability, depression, nausea, loss of appetite, vision problems; delays in fine and gross motor skills, spatial working memory and attention in school adolescents – for persons living near mobile transmitter antennas in France, Sweden, India, Spain, Germany, Iraq, Poland, Egypt. [39-49] (Collectively, there are surely more than 60 studies on effects on people near base stations.)
- The International Agency for Research on Cancer classified RF/EMF radiation as a „possible“ carcinogen [Class 2B] in 2011 [16], low-frequency EMF in 2002 (Class 2B) [19] and the WHO EMF project report from 2021 (p. 2, para. 4) acknowledges adverse effects of RF/EMF on mitochondrial DNA, reproductive organs, and brain. [20]
- Leukaemia risk in children with strong low-frequency EMF sources. [17-18]

Studies on Animals

As many studies were conducted on animals, there is even more proof that nature suffers from man-made EMFs. [70-88]

Historical research in Central Europe

As early as the late 1960s and throughout the 1970s, two fundamentally different approaches existed: the Central European approach, which recognized the non-thermal effects identified by biological research as the basis for protective exposure limits, and the Western approach, in which the so-called “thermal dogma” prevailed. This difference was not merely an academic curiosity—it shaped the way exposure limits were set, and these limits, unfortunately, continue to underpin today’s international guidelines.

In Czechoslovakia and Eastern Europe during the 1960s and 1970s, research was conducted on the effects of radiofrequency electromagnetic fields (RF/EMF) on the nervous system, physiological functions, and the health of exposed workers. For example, based on biological research and scientific publications from numerous countries, including the Soviet Union, the ability of non-thermal effects of RF-EMF to cause adverse health impacts was unequivocally recognized. Foremost among these is the review publication by Dr. K. Marha’s team, *Electromagnetic Fields and Their Impact on the Environment* (1971) [1]. In it, the authors noted that electromagnetic fields can affect living systems even without heating (non-thermal effects), through mechanisms such as ionic currents in the body, molecular resonance of water and proteins, rectification of alternating current in cells, and changes in cellular potential affecting nerve cells.

We also refer, for example, to the study by Svačina and Pleskot (1963), which found symptoms of neurasthenia and autonomic nervous system disorders in radar operators [2], as well as other publications: Klimková-Deutschová (1963, 1964), Figar (1963), Marha (1963) and Musil (1974) [88 - 93]. Based on these and other biological findings, significantly stricter protection standards were established [4], including for the former German Democratic Republic and other Eastern European countries.

However, this situation was not unknown to Western countries, including the United States. The scope of the research at that time is also documented by the reports of Zorach R. Glaser, who

compiled more than 2,000 studies in 1971 [94] , and in a 1977 update, that number exceeded 4,600. They included findings on behavioural, cardiovascular, neurological, ocular, and endocrine effects, including the aforementioned publications from European countries. Nevertheless, many countries paid no attention to these findings and clung exclusively to the thermal dogma. To the best of our knowledge, the limits in the U.S. are based on military research and, in particular, on Schwan's theoretical calculations regarding body heat tolerance (ANSI C95.1-1966), rather than on epidemiological data. Further development of the standards was linked to behavioural studies on a very small number of monkeys and rats (De Lorge 1980, 1984) [95,96], which measured only core body temperature. This approach became the basis for U.S. limits and, through the ICNIRP, for most international guidelines—despite warnings from numerous experts who described these limits as “outdated and insufficiently protective”.

We regret that today's FCC standards (1996) and ICNIRP recommendations have been adopted by the U.S. military-industrial bodies based on a purely thermal model, rather than on a framework that acknowledges all observed biological effects. This historical issue has a direct impact on the current protection of the public against long-term exposure to RF/EMF.

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Q14 What scientific evidence exists regarding potential adverse environmental effects associated with RF radiation?

In our answer to Question 12, we also referred to studies involving animals, as animals serve as models for humans, primarily for ethical reasons. However, these studies also have direct implications for understanding the effects of man-made EMFs on nature. We therefore refer to the above list for the relevant scientific evidence.

Mark Broomhall, an Australian naturalist and ethnobotanist, produced a report documenting the disappearance of species from the Mt. Nardi area of the Nightcap National Park World Heritage Area over a 15-year period (2000–2015). The report describes the correspondence between the disappearance of species in the Mt. Nardi–Mt. Matheson area of the World Heritage Site and the increasing deployment of electromagnetic technologies emitting electromagnetic radiation (EMR) and using electromagnetic frequencies.

The report was sent to the United Nations Educational Scientific and Cultural Organization (UNESCO) and the International Union for the Conservation of Nature (IUCN).

As we were unable to locate the report online, we are uploading it separately. The report provides an unprecedented view of the impact of EMFs on nature, as the disappearance of species occurred only within an area extending a few miles around the antennas erected in the park.

Federal Research Priorities

Additional Information

We are particularly concerned that European legislation requires mobile network operators to provide coverage across 98% of the area. Operators have chosen technical solutions that rely on direct wireless communication between mobile phones and public antennas, including when phones are used indoors. As a consequence, radiation levels are rising rapidly, leading to additional health impacts on people.

This approach is being pursued despite recommendations from government health advisory bodies, such as the Dutch Health Council, to apply the ALARA principle (as low as reasonably achievable).

To the best of our knowledge, no report has been published specifically addressing how the ALARA principle can be implemented in the concerned technical solutions. There should be an 'ALARA principle by design'. The technical system should be designed to minimise the radiation levels, not to maximise the reach. Wireless applications should be minimised and preference should be given to wired solutions. The radiation levels should be as low as technical achievable and combining various technics to arrive at a low radiation level.

As we have argued, information is needed to understand and accept the health effects of various properties of electromagnetic fields. The aim of such research would be to develop and apply electromagnetic fields that are not harmful to humans or the natural environment.