APPENDIX B

Response to HHS Request for Information

HHS-OASH-2026-0397, HHS-OASH-2026-0397-0001, 2026-19252

Devra Davis PhD, MPH, Fellow American College of Epidemiology, Fellow Collegium Ramazzini, Founder and Acting President, Environmental Health Trust, former Honorary Professor Medicine, London School of Hygiene and Tropical Medicine, former Professor of Medicine, Mt. Sinai School of Medicine and elsewhere

Introduction

Since its founding in 2007, Environmental Health Trust and numerous experts and expert groups have repeatedly advised governments, through docket filings and briefings of Federal Communications Commission (FCC), Food and Drug Administration (FDA), and other officials, that science-based policy updates are urgently needed to reduce microwave-radiation exposure, especially for young children and the environment. According to Common Sense Media, forty percent of U.S. two-year-olds own some form of two-way microwave-radiating tablet. Outdated 20th century approaches such as those relied on by ICNIRP cannot provide valid means for evaluating fast-moving 21st century technologies.

At the same time, the recent issuance of separate requests for information by both HHS and the FCC highlights the lack of a coherent federal policy framework. It also reflects the ongoing tension between the Department of Commerce's technology leadership, which is tasked with accelerating wireless deployment, and HHS and FDA officials, who are responsible for evaluating the evidence, supporting research on potential health risks, and advising the FCC on appropriate regulatory policies.

Microwave-radiating devices can provide social, safety, and economic benefits, but their risks have not been adequately considered in standards governing manufacture, testing, use, surveillance, and disposal.

Consequently, billions experience repeated, avoidable RF radiation through lifetime use of simultaneously operating phones, tablets, personal monitors, and other two-way microwave-radiating devices, increasing risks of chronic illnesses documented over five decades, much of the research conducted outside the U.S. We therefore welcome the Department of Health and Human Services (HHS) and FCC Request for Information (RFI) on health and environmental impacts.

This compendium of selected recent studies (2020-26) on the impact of microwave radiation on human health and the environment completed since the U.S. Circuit Court for the District of Columbia ruled in Environmental Health Trust et al. v. FCC, 2021, in response to queries within the RFI from HHS.

In response to question 5, we note that current standards for cell phones and other two-way microwave-emitting devices are based largely on studies conducted to avoid heating a small number of rats and mice more than 30 years ago. These outdated standards primarily seek to prevent thermal (heating) effects in the body of a tall adult male and do not reflect exposure patterns experienced by billions of children and smaller-bodied individuals worldwide. They

also do not account for the substantial body of research showing adverse effects of microwave radiation on plants, insects, birds, migratory species, mammals, and the ecosystems on which life depends.

Phonegate Alert[1] contends that current phone radiation tests, like diesel-engine tests, are fraudulent. We concur. As a result of these efforts, the European Union recently changed its test protocol to 0mm distance from the body. We advise that more stringent exposure limits in high tech nations is evidence per se of the need to update 3-decade old U.S. standards.

In response to question 6, major research gaps exist relating to chronic long-term impacts on the young, those with co-morbidities, and the elderly, the need to employ realistic experimental exposure scenarios that take account beam-forming of 5G and 6G, pulsed multiple sources of exposures to multiple frequencies with devices kept close to or onto the body. Reliance on the ICNIRP approach is ill-advised; vide criticism of Davis, 2010, 2023, Melnick et al., 2023, 2024, 2025[2] Phonegate Alerte and others).

Despite repeated advice from U.S. government entities over three decades, including the National Academy of Sciences (2008), Government Accountability Office (2012), and National Toxicology Program (2018-22), and others to sustain and support research, multidisciplinary training, and surveillance on microwave radiation, implementation has lagged. We comply with this RFI hoping it will produce concrete support and not enter the dustbin of history as have others.

Question 7, No single method accurately captures all RF exposure. A credible assessment should combine direct measurement, source information, typical use patterns and exposure scenarios, activity data, and computational dosimetry.

Question 8 Exposure assessment should move beyond short, stationary solitary measurements of compliance testing conducted under limited operating configurations to an integrated, time-resolved approach that captures exposure as people use devices in daily life. The SAR compliance approach using the Specific Anthropomorphic Mannequin (SAM)—a simplified adult-head phantom with homogeneous dielectric properties—does not model tissue-specific absorption patterns or the anatomy of infants and young children and therefore cannot, by itself, characterize localized exposure including hotspots within the developing brain. Moreover that SAM model best tests when antenna is located at the top of the phone and not relevant to current models with multiple antennas

---

[1] The **European Commission** published in the Official Journal, on **September 7, 2026**, its decision recognizing the new standard **EN 50566:2017/A2:2025**. This measure concerns devices worn close to the body. It comes six years after France's formal objection filed in 2020 to obtain trunk SAR tests at contact (0 mm) rather than at a distance (5 mm).Phonegatealert.org

[2] Devra Davis, *Disconnect*, Basic Books, 2010, EHT revised 2024; Ronald L. Melnick et al., The WHO-Commissioned Systematic Reviews on Health Effects of Radiofrequency Radiation Provide No Assurance of Safety, 24 Env't Health, art. 70 (2025), https://doi.org/10.1186/s12940-025-01220-4., vide infra.

Question 9 EHT has long argued that consumers have a right to know clear information about each device's antenna locations, transmitting frequencies, maximum and typical output power, specific absorption rate or absorbed-power-density results, simultaneous-transmission configurations, tested body-separation distances, adaptive power-control behavior, and instructions for reducing exposure. We worked successfully with the Cities of San Francisco and Berkeley to pass bills providing a Right to Know about cellphone radiation, and appropriate labeling and displays that should be restored. In addition, residents, schools, healthcare facilities, and local governments should have access to real time monitoring of:

- All cell tower and antenna locations, heights, frequencies, maximum authorized and typical operating power, beamforming characteristics, estimated coverage and shape of plume of radiation, and dates of activated or modified.
- As in several European nations, modeled and measured RF levels should be available online in real time, including peak and time-averaged values, measurement methods, uncertainty, and the contribution of major frequency bands.
- Information on planned installations and material changes before deployment.
- Procedures for requesting independent measurements and reporting interference, suspected overexposure, or health concerns.
- Guidance for people with implanted or wearable medical devices
- Worker protection devices and needs for safer distances while installing, operating or repairing facilities.

Question 10, There are no reliable data sources or, surveillance systems that monitor potential adverse health effects associated with RF radiation exposure, despite the existence of readily available software and hardware to provide that information, vide Waterford Corporation and SCM Advisors.

Question 11, Exposure assessment and risk evaluation differ for sensitive populations identified in the RFI and highlighted by the Court in EHT et al v. FCC, 2021, including young and school-age children, pregnant women, those with co-morbidities or implanted medical devices, as well as the physical environment on which our lives depend, i.e., honeybees, migrating animals, and trees..

Scientific Publications on RF Impacts in Humans, Flora and Fauna 2020 to 2026

The peer-reviewed publications below appeared after the FCC closed dockets ET 13-84 and ET-03-137 in late 2019 and supplements copious submissions of EHT and others through meetings, docket filings, and EHT et al. v. FCC (2021).

For nearly five decades, the Government Accountability Office (GAO) has repeatedly recommended research and policies to determine whether cell phones pose risks and what precautions are appropriate.

More Protection From Microwave Radiation Hazards Needed. HRD-79-7. November 30, 1978. Publicly released December 11, 1978, requested by Representative John E. Moss that addressed microwave-emitting products and systems, including radar, communication

relays, ovens, and medical devices, examined deficiencies in federal protection and recommended research to be undertaken and policies to be developed on exposure standards and radiation-control responsibilities.

U.S. General Accounting Office. November 4, 1994; publicly released November 22 Telecommunications: Status of Research on the Safety of Cellular Telephones. Rep. Edward J. Markey, Chairman, Subcommittee on Telecommunications and Finance, House Energy and Commerce Committee. That report concluded that available research was insufficient to determine whether portable cellular phones posed a health risk. GAO recommended federal participation to strengthen the usefulness, independence, and objectivity of industry-sponsored research. Despite "95" in the report number, publication was in 1994.

U.S. General Accounting Office May 7, 2001; publicly released May 22 Telecommunications: Research and Regulatory Efforts on Mobile Phone Health Issues. Sen. Joseph I. Lieberman and Rep. Edward J. Markey. This report updated the 1994 assessment. Research had not demonstrated harmful health effects, but information remained insufficient to establish absence of risk. The report identified shortcomings in standardized exposure testing and consumer information, and examined oversight of industry-funded research.

U.S. General Accounting Office July 24, 2012; publicly released August 7 Telecommunications: Exposure and Testing Requirements for Mobile Phones Should Be Reassessed. Reps. Henry A. Waxman, Anna G. Eshoo, and Edward J. Markey. This report recommended that FCC formally reassess its RF exposure limit and testing requirements, particularly for phones held against the body. GAO found that testing might miss maximum exposures in likely usage conditions and recommended additional methods be developed.

GAO's current record lists both recommendations as "Closed – Not Implemented."

Subsequent studies carried out by the FCC in 2019 – but not disclosed – confirmed concerns expressed in the GAO 2012 report, finding that all phones exceeded the outdated exposure limits when tested at a distance of 2 mm against the body. These results were not made public until EHT filed a request for records of any and all such testing.

In a letter acknowledging these tests in response to a Freedom of Information Act request from Theodora Scarato of EHT in 2020, the FCC stated: "We observed that at a 2 mm separation distance, the FCC RF exposure limits were exceeded . . . With this letter, we release our 2 mm separation distance test results with the caveat that the 2 mm separation distance test results are inconsistent with FCC practice, and are misleading because they reflect extreme conditions." (italics added).

Thus, the FCC claimed that testing phones closer to the body is a reflection of "extreme conditions." We are forced to ask: is it extreme to keep phones in the pocket when it is on? Is it extreme to keep phones in the sports bra or athletic clothing when engaged in activities? These questions belie the fact that the European Union is now embarked on and has issued new regulations to require testing of phones in ways that mimic real world conditions which they do not deem "extreme."

Evidence on the need to create more realistic test conditions can be found in multiple submissions that corroborate the judgment of GAO, 2012 in this compendium below.

1. Fetal dosimetry and metal objects — published September 25, 2025.

Niyazi İl et al., Investigation of Fetal Exposure to Electromagnetic Waves Between 2.45 and 5 GHz During Pregnancy, 201 Radiation Prot. Dosimetry 1188 (2025), https://doi.org/10.1093/rpd/ncaf110.

Numerical simulations of a pregnant anatomical model found that a belly-button piercing increased specific absorption rates from wireless radiating devices in fetal tissues under certain modeled exposure configurations, consistent with previous modeling of other metal containing objects submitted to the docket of FCC prior to 2020.

2. Prenatal exposure and genetic damage — published July 9, 2026.

Elif Gelenli Dolanbay et al., Prenatal 3.5 GHz Radiofrequency Exposure Induces Renal Histological Changes and DNA Damage in 6-Month-Old Rats, 164 Histochemistry & Cell Biology, art. 56 (2026), https://doi.org/10.1007/s00418-026-02504-7.

Male offspring of rats exposed during pregnancy developed structural abnormalities of the kidney, increased DNA fragmentation, and changes in autophagy-related markers at six months of age. The findings provide additional evidence that prenatal-exposure can lead to genetic and other damage to males, including earlier studies showing impairment of testicular proteome, reduce hippocampus and a range of prenatal impacts previously submitted to the FCC docket that was closed peremptorily in 2019.

3. Schoolchildren and genetic biomarkers — published July 9, 2026.

Raihanah Chokeli et al., Environmental Radiofrequency Exposure and Genotoxic Biomarkers in Schoolchildren: A Cross-Sectional Analysis, Sci. Reps., art. 31538 (July 9, 2026) (advance online publication), https://doi.org/10.1038/s41598-026-60822-1.

Among 200 primary schoolchildren at eight schools, higher measured ambient RF exposure was associated with higher micronucleus frequency in buccal cells, including after adjustment for measured covariates and school clustering. All exposure measurements were below international public limits, but the authors characterize the results as exploratory because the cross-sectional design and school-level exposure estimates limit causal inference. These results mirror earlier reports finding biochemical markers of inflammation and impaired cell repair submitted to FCC record by EHT prior to 2019.

4. Oxidative stress and DNA repair — published August 25, 2025.

Jana Haidar et al., Impact of In Vitro Exposure to 5G-Modulated 3.5 GHz Fields on Oxidative Stress and DNA Repair in Skin Cells, 15 Sci. Reps., art. 31214 (2025), https://doi.org/10.1038/s41598-025-15090-w.

Human skin-cell experiments tested 5G exposure alone and alongside chemical oxidative stressors or UV-B radiation, at specific absorption rates up to 4 W/kg. The researchers found no significant increase in oxidative stress, adaptive oxidative response, or impairment of UV-

induced DNA-lesion repair under the tested conditions. However, the tested conditions used only 24 hours of exposure and thus did not mimic typical exposures that can occur to humans.

5. Chemical co-exposure and DNA damage — first published January 28, 2026.

Ying Zhu et al., Exposure to Hexavalent Chromium and 1800 MHz Electromagnetic Radiation Can Synergistically Induce Intracellular DNA Damage in Mouse Embryonic Fibroblasts, 804 Biochemical & Biophysical Rsch. Commc'ns, art. 153360 (2026), https://doi.org/10.1016/j.bbrc.2026.153360.

Under controlled nonthermal conditions, 15 minutes exposure to 1800 MHz RF alone did not produce detectable DNA damage or significantly enhance damage from hydrogen peroxide, cadmium, or 4-nitroquinoline-1-oxide. Combined RF and hexavalent chromium exposure did significantly increase DNA damage, extending evidence for synergistic-exposure and genotoxicity. The short period of exposure does not provide a useful indication of the impact of current typical exposure scenarios, even recognizing the limits of working with in vitro systems. The finding of synergy given this limited exposure seems especially noteworthy.

6. Brain-cell effects of 5G modulation — published March 28, 2026.

Emilie Puginier et al., Biological Effects of 5G-Modulated 700 MHz RF-EMF Exposure on Neuronal and Glial Cell Models Under Isothermal Conditions, 16 Sci. Reps., art. 10767 (2026), https://doi.org/10.1038/s41598-026-43960-4.

Researchers exposed primary rat astrocytes and human neuroblastoma cells to 700 MHz 5G signals while controlling temperature for 1 hour or 24 hours, with no effort to test chronic exposure conditions such as those that occur in the real world. With these short exposures, they found no measurable oxidative stress, apoptosis, or proliferation changes under the tested conditions.

7. Millimeter waves and human brain activity — first published November 18, 2025.

Lisa Michelant et al., Millimeter-Wave High Frequency 5G (26 GHz) Electromagnetic Fields Do Not Modulate Human Brain Electrical Activity, 289 Env't Rsch., art. 123349 (2026), https://doi.org/10.1016/j.envres.2025.123349.

A randomized, triple-blind crossover experiment compared EEG activity during real and sham 26 GHz exposure for 26 minutes in healthy young adults. The researchers found no significant changes in the assessed EEG frequency bands, with conclusions limited to the brief exposure and population studied. The use of such a short period of exposure provided a research design that was unlikely to produce a positive finding of relevance to human experience.

8. Cognition and pulsed RF exposure — published September 22, 2026.

Adam Verrender et al., Exposure to Pulse Modulated Radiofrequency Electromagnetic Fields Does Not Affect Sternberg Working Memory Performance, Int'l J. Radiation Biology 1 (Sept. 22, 2026) (advance online publication), https://doi.org/10.1080/09553002.2026.2733658.

A randomized experiment involving 48 healthy adults tested whether a 920 MHz GSM-like signal reproduced an earlier reported improvement in working-memory reaction time. Neither RF exposure nor a comparison infrared exposure affected the measured performance outcomes, and the authors did not replicate their earlier findings and attributed their earlier positive finding to chance.

9. Electromagnetic hypersensitivity — first published September 1, 2025.

Kun-Hua Li & How-Ran Guo, Prospective Long-Term Follow-Up of Patients with Idiopathic Environmental Intolerance Attributed to Electromagnetic Fields After a Provocation Trial, 303 Ecotoxicology & Env't Safety, art. 118944 (2025), https://doi.org/10.1016/j.ecoenv.2025.118944.

Long-term follow-up of 35 patients and 35 comparison participants found that 62.9% of patients reported recovery and 60% would consider another explanation for their symptoms. The authors viewed the results as consistent with spontaneous recovery and possible nocebo contributions, although substantial loss to follow-up and self-reported outcomes limit that interpretation. The provocation method seeks immediate measurable responses, whereas adverse biochemical alterations may require longer exposure.

10. Reproductive-cell metabolism and exposure patterns — published September 19, 2025.

Xia Miao et al., Differential Metabolic Responses of Mouse Leydig and Spermatogonia Cells to Radiofrequency Electromagnetic Field Exposure, 13 Frontiers Pub. Health, art. 1623701 (2025), https://doi.org/10.3389/fpubh.2025.1623701.

Metabolomic analysis found that continuous and intermittent RF exposure affected different pathways in mouse Leydig cells, including amino-acid, glutathione, fatty-acid, and purine pathways. Spermatogonia cells were less sensitive. The study raises reproductive-health and exposure-pattern questions but leaves organism-level fertility consequences unresolved.

11. Leydig-cell proliferation and endocrine relevance — published March 25, 2026.

Pooja Jangid et al., Radiofrequency Radiation-Induced Changes in Leydig Cell Function, 16 Sci. Reps., art. 14999 (2026), https://doi.org/10.1038/s41598-026-39244-6.

Mouse Leydig cells exposed to mobile-phone radiation or 1800/2450 MHz signals showed morphological changes, reduced DNA synthesis, and altered cell-cycle distributions varying with frequency and duration. These cells support testosterone production and spermatogenesis, indicating potential male reproductive harm consistent with longer-term studies and evidence EHT submitted before 2019.

12. Male reproduction — first published June 25, 2026; systematic review.

Nushin Naderi et al., Influence of Radiofrequency Electromagnetic Radiation on Spermatogenesis and Sperm Function in Rodent Models: A Systematic Review, 144 Reprod. Toxicology, art. 109300 (2026), https://doi.org/10.1016/j.reprotox.2026.109300.

This review evaluated 88 rodent studies covering sperm parameters, hormones, oxidative stress, DNA damage, apoptosis, and testicular histology. Although some reported reproductive and oxidative changes, heterogeneity and weaknesses in blinding, allocation, dosimetry, and outcome assessment prevented uniform causal interpretation. Its selection and combination of brief with few chronic-exposure studies may bias results toward no effect; ICBEMF analyzes these limitations, which EHT also raised in the pre-2019 FCC record.

13. Reproductive outcomes — published September 29, 2025; umbrella review.

O. Lamzouri et al., Impact of Electromagnetic Field Exposure on Reproductive Health: An Umbrella Review and Meta-Analysis of Systematic Reviews, 30 Middle E. Fertility Soc'y J., art. 42 (2025), https://doi.org/10.1186/s43043-025-00258-1.

This synthesis of nine reviews reported reduced sperm motility and viability and discussed hormonal changes, oxidative stress, and adverse pregnancy outcomes in studies of humans. EMF exposure adversely affects reproductive health, particularly sperm quality and hormonal balance, with oxidative stress serving as a plausible mechanism that may account for a range of adverse impacts. We concur with the authors that public health strategies should prioritize exposure mitigation.

14. Environmental and school exposure — published August 20, 2025.

Kenneth Deprez et al., 5G RF EMF Spectral Exposure Assessment in Four European Countries, 46 Bioelectromagnetics, art. e70019 (2025), https://doi.org/10.1002/bem.70019.

Researchers performed 146 standardized RF measurements in Belgium, Switzerland, Hungary, and Poland, including educational institutions and urban and rural environments. All measurements were within ICNIRP guidelines, with lower exposure in rural settings and no consistently substantial reduction around schools compared with other public locations. This study does not provide information on peak exposures, nor does it address the fact that ICNIRP guidelines focus on avoiding short term impacts and cannot address safety of longer chronic exposures.

15. Adolescents' personal exposure — first published May 22, 2026.

Hamed Jalilian et al., Personal Radio Frequency Electromagnetic Field Exposure Among Swiss Adolescents in the 5G Era, 304 Env't Rsch., art. 124775 (2026), https://doi.org/10.1016/j.envres.2026.124775.

Personal monitoring of 143 adolescents found that Wi-Fi/Bluetooth and broadcast signals contributed the largest shares of measured exposure, with higher average levels during transport than at home or school but could not provide information on phones, tablets and other devices typically used close to the body for hours daily. The authors note: "However,

this should not be interpreted as a direct causal estimate of the independent effect of 5G deployment. Personal measurements underestimate exposure contributions from sources emitting close to body."

16. Animal Cancer Experiments – first published May 2025.

Meike Mevissen et al., Effects of radiofrequency electromagnetic field exposure on cancer in laboratory animal studies, a systematic review, 199 Env't Int'l, art. 109482 (2025), https://doi.org/10.1016/j.envint.2025.109482; Meike Mevissen et al., Corrigendum to "Effects of radiofrequency electromagnetic field exposure on cancer in laboratory animal studies, a systematic review", Env't Int'l, art. 110368 (2026), https://doi.org/10.1016/j.envint.2026.110368.

This WHO-commissioned review reported high-certainty evidence that animal experiments showed increased gliomas and malignant heart schwannomas in male rats. Experimental exposures differ from human use, limiting direct risk extrapolation, but humans and rats share roughly 90% of protein-coding genes and many orthologous genes retaining similar functions, including signals regulating growth, cell division, and immune responses.

17. Evidence appraisal — published October 2, 2025.

Ronald L. Melnick et al., The WHO-Commissioned Systematic Reviews on Health Effects of Radiofrequency Radiation Provide No Assurance of Safety, 24 Env't Health, art. 70 (2025), https://doi.org/10.1186/s12940-025-01220-4.

The authors critically evaluate twelve WHO-commissioned RF-health reviews, challenging their study-selection decisions, evidence integration, risk-of-bias assessments, and certainty ratings. The article provides robust criticism of biases within the WHO-associated reviews and notes that ICNIRP fails to take into account a substantial human and experimental literature that provides substantial evidence that current exposures can be damaging to human health. The authors note: The report of harmful effects (e.g., cancer, reproductive toxicity, etc.) at doses below the adverse health effect threshold claimed by ICNIRP demonstrates that current exposure limits to RF-EMF, which were established by applying arbitrary uncertainty factors to their putative adverse threshold dose, lack scientific credibility."

RF Responses in Plants and Insects Publications 2020 to 2026

Scope. Fifteen experimental publications covering whole plants, living insects, cultured seedlings and plant callus. This is a selected review, not an exhaustive systematic review; positive, mixed and null findings are included.

Exposure-duration caution. Exposures of 15 minutes to 24 hours cannot establish effects or safety over weeks, seasons, or generations; even 48-hour experiments remain short-term. Frequency, intensity, modulation, heating, and species affect environmental relevance. Other publications submitted to the FCC reported adverse plant growth and development in some species.

1. Plants and photosynthesis — published June 12, 2026.

Julian Keller & Uwe Geier, Reduced Photosynthetic Efficiency of Tilia (Tilia tomentosa) Exposed to Radio Frequency Electromagnetic Field (RF-EMF)—JIP-Test Analysis, 15 Plants, art. 1824 (2026), https://doi.org/10.3390/plants15121824.

Tilia plants exposed to DECT and Wi-Fi frequency ranges showed reduced photosynthetic efficiency and changes indicating impaired photosynthetic electron transport. Observations over 102 days also showed accelerated leaf aging, directly extending the document's plant-effects literature while remaining specific to the species and experimental exposure conditions. Faster early growth can lead to earlier aging of plants as has been frequently observed.

2. Wild plants: growth and aging — published 2023.

Michał Czerwiński et al., Do electromagnetic fields used in telecommunications affect wild plant species? A control impact study conducted in the field, 150 Ecological Indicators, art. 110267 (2023), https://doi.org/10.1016/j.ecolind.2023.110267.

Ten wild plant species were grown outdoors under 866–868 MHz exposure for four months, from germination to maturity. Most species showed weak or no effects, while Trifolium arvense showed early growth changes followed by earlier leaf aging; the experiment does not establish damage across plant communities but does indicate some community specific concerns and vulnerabilities.

3. Lettuce: photosynthesis and flowering — published February 28, 2023.

Nam Trung Tran et al., Impacts of Radio-Frequency Electromagnetic Field (RF-EMF) on Lettuce (Lactuca sativa)—Evidence for RF-EMF Interference with Plant Stress Responses, 12 Plants, art. 1082 (2023), https://doi.org/10.3390/plants12051082.

Whole lettuce plants received continuous exposure to 1890–1900 MHz DECT and 2.4 and 5 GHz Wi-Fi signals for approximately two to five weeks. Indoor effects were small, whereas outdoor plants showed reduced photosynthetic efficiency and earlier flowering, suggesting that growing conditions influence the response. The difference between indoor and outdoor effects should be further studied.

4. Silver linden: photosynthesis and leaf aging — published June 12, 2026.

Julian Keller and Uwe Geier, Reduced Photosynthetic Efficiency of Tilia (Tilia tomentosa) Exposed to Radio Frequency Electromagnetic Field (RF-EMF)—JIP-Test Analysis, 15 Plants, art. 1824 (2026), https://doi.org/10.3390/plants15121824.

Potted silver linden plants received 1890–1900 MHz DECT and 2.4 and 5 GHz Wi-Fi exposure in an experiment dated June 28–September 19, 2022, with leaf-aging observations separately reported over 102 days. Exposed plants showed reduced photosynthetic performance and faster leaf aging, but the 102-day observation period should not automatically be described as 102 days of RF exposure. This study is consistent with observational studies reported to the FCC from Western Europe that found impaired tree crown growth after years of real-world exposure to cell-phone antennas, submitted to the FCC record prior to 2020.

5. Rice: repeated exposure and stress signaling — published 2021.

Ardhendu Kundu et al., Electromagnetic Irradiation Evokes Physiological and Molecular Alterations in Rice, 42 Bioelectromagnetics 173–185 (2021), https://doi.org/10.1002/bem.22319; Ardhendu Kundu et al., Erratum: Electromagnetic Irradiation Evokes Physiological and Molecular Alterations in Rice, 42 Bioelectromagnetics 337-436 (2021), https://doi.org/10.1002/bem.22351.

Whole rice plants received 1837.50 MHz exposure for six hours daily for up to 32 days. Researchers reported physiological changes and altered activity of genes involved in stress, calcium signaling and light responses; exposure-intensity information should be read with the published erratum cited above, which noted that the exposures used were in fact an order of magnitude lower than first reported.

6. Arabidopsis: two-day exposure — published October 2024.

M. D. H. J. Senavirathna and Zumulati Maimaiti, Assessing the biochemical and genotoxic effects of low intensity 2.45GHz microwave exposure on Arabidopsis thaliana plants, 43(4) Electromagnetic Biology and Medicine (2024), https://doi.org/10.1080/15368378.2024.2411629.

Young Arabidopsis plants received continuous-wave 2.45 GHz exposure for 48 hours, at approximately 1 W/m^2. Pigment and biochemical responses changed without detected loss of genetic stability in the assays used, but a two-day experiment cannot establish growing-season effects.

7. Cultured seedlings: stimulation without measured oxidative damage — published June 24, 2020.

M. D. H. J. Senevirathna, I. S. P. Nagahage and Guligena Muhetaer, Stimulatory effect of exposure to low-power-density 2.45 GHz microwaves on Arabidopsis thaliana seedlings in vitro, 43 Brazilian J. Botany 459–467 (2020), https://doi.org/10.1007/s40415-020-00618-3.

Seeds and seedlings grown in culture received continuous-wave 2.45 GHz exposure for 48 hours, at approximately 1 W/m^2, with some later outcomes measured in 10-day-old seedlings. Pigments and several biochemical measures changed, but the authors found no oxidative-stress pattern or change in germination or subsequent fresh weight; this was a short culture experiment.

8. Plant callus: RF processing and extract activity — published February 2, 2023.

Won Kyong Cho et al., Comparative Transcriptome Profiles of Human HaCaT Cells in Response to Gynostemma pentaphyllum Extracts Obtained Using Three Independent Methods by RNA Sequencing, 13 Life, art. 423 (2023), https://doi.org/10.3390/life13020423.

Gynostemma plant callus cells grown in culture received 360 kHz treatment for 20 minutes daily on three days, before their extracts were tested on human skin cells. The extracts produced different skin-cell gene-expression patterns, but this indirect experiment does not

demonstrate plant injury, and its treatment frequency differs greatly from cellular and Wi-Fi frequencies.

9. Honeybees: homing, brood and survival — published June 28, 2023.

Manuel Treder et al., Defined exposure of honeybee colonies to simulated radiofrequency electromagnetic fields (RF-EMF): Negative effects on the homing ability, but not on brood development or longevity, 896 Sci. Total Env't, art. 165211 (2023), https://doi.org/10.1016/j.scitotenv.2023.165211.

Honeybee colonies received simulated 2.4 and 5.8 GHz signals, with exposure systems operating continuously for 12 weeks in 2020 and 14 weeks in 2021. Long-term exposure was associated with poorer return-to-hive performance, while brood development and worker longevity showed no detected adverse effect. As fewer bees returned to hive, less honey will be produced and the hive will undergo stress.

10. Honeybees: year-long oxidative-stress study — published May 20, 2024.

Marinko Vilić et al., Oxidative Stress Response of Honey Bee Colonies (Apis mellifera L.) during Long-Term Exposure at a Frequency of 900 MHz under Field Conditions, 15 Insects, art. 372 (2024), https://doi.org/10.3390/insects15050372.

Honeybee colonies were followed under 900 MHz field exposure for one year, with antioxidant defenses and lipid-damage markers measured in larvae, pupae and adult midguts. Several markers changed, especially in larvae, but responses were not uniformly dose-dependent and differences between field locations limit causal interpretation. Prior submissions to the docket of the FCC noted that queen bees were also harmed by continuous exposures to RF and that worker bee defensive behavior, piping and dancing were significantly reduced, with fewer bees returning to exposed hives.

11. Fruit flies: mobile DNA and genetic instability — published December 13, 2022.

Ugo Cappucci et al., WiFi Related Radiofrequency Electromagnetic Fields Promote Transposable Element Dysregulation and Genomic Instability in Drosophila melanogaster, 11 Cells, art. 4036 (2022), https://doi.org/10.3390/cells11244036.

Laboratory fruit flies received 2.4 GHz Wi-Fi-related exposure from embryo to adult in developmental tests and for 10 days in an adult behavioral test. Researchers reported increased reactive oxygen species, disrupted control of mobile DNA sequences, genetic instability and behavioral changes, without establishing population decline under outdoor exposure. Thus, the population may have remained of similar size but with major pathology.

12. Fruit flies: no detected activity or reproductive effect — published December 1, 2025.

Pieterjan De Boose et al., Behaviour and reproduction of Drosophila melanogaster exposed to 3.6 GHz radio-frequency electromagnetic fields, 20 PLOS ONE, art. e0336228 (2025), https://doi.org/10.1371/journal.pone.0336228.

Adult fruit flies received 3.6 GHz exposure for 12 hours daily on five days, with five-day baseline and recovery periods; a separate egg-laying experiment used 48 hours of exposure.

No significant effects were detected on movement, daily activity rhythms or egg production under these conditions, which cannot exclude effects from longer or different exposures. However, the authors used continuous exposure while real telecommunication networks use modulated signals to transmit information. Follow-up studies will use modulated signals to fully emulate RF-EMF exposure in telecommunication networks.

13. Mosquitoes: larval development and heating — published December 25, 2025.

Eline De Borre et al., Exposure to 5G-NR electromagnetic fields affects larval development of Aedes aegypti mosquito, 16 Sci. Reps., art. 2972 (2026), https://doi.org/10.1038/s41598-025-32816-y.

Aedes aegypti larvae received continuous-wave 3.6 GHz exposure for five days, at approximately 46 or 183 V/m, despite the title's reference[3] to 5G-NR. Development changed with exposure level and food supply, with heating contributing at the higher level, while mortality and body asymmetry were unchanged; these strong laboratory fields should not be equated with typical ambient exposure, but suggest possible adverse impacts at lesser levels of intensity.

14. Bluebottle flies: development after two-day exposure — published online 2022; journal issue 2023.

Samantha De Paepe et al., Pilot study of a new methodology to study the development of the blue bottle fly (Calliphora vomitoria) under exposure to radio-frequency electromagnetic fields at 5.4 GHz, 99 Int'l J. Radiation Biology, 1439–1455 (2023), https://doi.org/10.1080/09553002.2022.2113838.

Bluebottle fly pupae received 5.4 GHz exposure for 48 hours, at approximately 19.4 or 55 V/m, followed by observation of development and adult emergence. Size and mass were similar across groups, while emergence timing and success varied and the sham setup also affected timing, limiting a simple RF-specific interpretation.

15. Brief experiment: Arabidopsis metabolism — published 2023.

Alexis Porcher et al., Non thermal 2.45 GHz electromagnetic exposure causes rapid changes in Arabidopsis thaliana metabolism, 286 J. Plant Physiology, art. 153999 (2023), https://doi.org/10.1016/j.jplph.2023.153999.

Whole Arabidopsis plants received a single 30-minute exposure to modulated 2.45 GHz fields, at approximately 100 V/m, with tissue temperature monitored. Rapid metabolic and stress-signaling changes occurred without appreciable heating, providing evidence of immediate responses rather than chronic growing-season effects.

Concerns About Exposure Standards

International Commission on the Biological Effects of Electromagnetic Fields, Scientific evidence invalidates health assumptions underlying the FCC and ICNIRP exposure limit

[3] Devra Davis, *Disconnect*, 2010, revised 2024; Ronald Melnick et al., on behalf of the International Commission on the Biological Effects of Electromagnetic Fields, cited infra.

determinations for radiofrequency radiation: implications for 5G, 21 Env't Health, art. 92 (2022), https://doi.org/10.1186/s12940-022-00900-9.

ICBE-EMF argues that limits based mainly on avoiding short-term heating and brief behavioral effects do not adequately address chronic effects or wildlife. Compliance with ICNIRP human-exposure limits therefore does not establish ecological or human-health safety. Signal intensity, polarity, frequency, power, and other often poorly standardized parameters may explain variation among studies.

Research Priorities Indicated by Recent Publications

In 2009, with support from the National Institute of Environmental Health Sciences and private donors including Lucy R. Waletzky and Marion Weber, EHT convened an international expert forum on wireless radiation and health in Washington, D.C., alongside a bipartisan Senate hearing. It produced priorities for in vitro, in vivo, clinical, and epidemiological research; many remain. Government should review work by EHT, ICBE-EMF, GAO, the Institute of Medicine (now the National Academies of Sciences), NIEHS, and others.

Replicated experiments should cover full life cycles and multiple generations of animals, using measured environmental exposure patterns, suitable sham controls, temperature monitoring and independent exposure units. A biochemical change does not automatically establish ecological harm, while an unchanged outcome in one short experiment does not establish long-term safety. There is a compelling need for real-world, testing and evaluation, continuing surveillance and testing of devices as they are in the marketplace rather than in the highly constrained environments that have been used for the past 30 years.

We sincerely look forward to the next steps to be taken to promote and fund long-term multidisciplinary training, research, monitoring and surveillance programs by HHS and hope that industry will be providing newly improved devices that compete on safety by making major advances in hardware and software to reduce exposures from microwave radiating devices to As Low As Reasonably Achievable (ALARA), a standard employed by pediatric radiologists to protect the young.