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

Prepared by: Elektrosmog a zdravie, NGO
Date: 20 October 2026
Primary contact: petra.bertova.sk@protonmail.com

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Introduction and Purpose

Elektrosmog a zdravie 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).

The purpose of this document is to provide HHS with a structured collection of slovak and czech scientific evidence.

Response to Question 12 from Slovakia

Question 12: "What scientific evidence exists regarding potential adverse **health effects** associated with RF radiation exposure at levels below current federal exposure limits?"

ID	SKh2009_01
Year	2009
MLA citation	Orendácová, Judita et al. "Immunohistochemical study of postnatal neurogenesis after whole-body exposure to electromagnetic fields: evaluation of age- and dose-related changes in rats." *Cellular and molecular neurobiology* vol. 29,6-7 (2009): 981-90. doi:10.1007/s10571-009-9385-3
Population / sample	newborn rats (P7) and senescent rats (24 months)
Frequency	2.45 GHz
Power flux density	2,8 mW/cm^2 (28 W/m^2)
Time duration	4 hours x 2 days and 8 hours x 3 days
Study design	[Cohort / case-control / **experimental** / systematic review / meta-analysis / other]
Link	https://pubmed.ncbi.nlm.nih.gov/19305951/
Main result	Our results indicate that the concerns about the possible risk of EMF generated in connection with production, transmission, distribution, and the use of electrical equipment and communication sets are justified at least with regard to early postnatal neurogenesis.

ID	SKh2011_01
Year	2011
MLA citation	Orendáčová, Judita et al. "Effects of short-duration electromagnetic radiation on early postnatal neurogenesis in rats: Fos and NADPH-d histochemical studies." Acta histochemica vol. 113,7 (2011): 723-8. doi:10.1016/j.acthis.2010.09.009
Population / sample	young rats
Frequency	2.45 GHz
Power flux density	2,8 mW/cm^2 (28 W/m^2)
Time duration	2 hours
Study design	**experimental**
Link	https://pubmed.ncbi.nlm.nih.gov/20950843/
Main result	age-related changes in the production of nitric oxide, which may lead to different courses of the proliferation cascade in newborn and young adult neurogenesis.

ID	SKh2018_01
Year	2018
MLA citation	Misek, Jakub et al. “Heart rate variability affected by radiofrequency electromagnetic field in adolescent students.” *Bioelectromagnetics* vol. 39,4 (2018): 277-288. doi:10.1002/bem.22115
Population / sample	high school students
Frequency	1788 MHz
Power flux density	7 735 000 μW/m^2
Time duration	18 minutes
Study design	[Cohort / case-control / **experimental** / systematic review / meta-analysis / other]
Link	https://pubmed.ncbi.nlm.nih.gov/29469164/
Main result	Short-term RF EMF exposure of students in a lying position during the ortho-clinostatic test affected ANS with significant increase in parasympathetic nerve activity compared to sham exposed group.

ID	SKh2019_01
Year	2019
MLA citation	Durdik, Matus et al. “Microwaves from mobile phone induce reactive oxygen species but not DNA damage, preleukemic fusion genes and apoptosis in hematopoietic stem/progenitor cells.” Scientific reports vol. 9,1 16182. 7 Nov. 2019, doi:10.1038/s41598-019-52389-x
Population / sample	umbilical cord blood cells
Frequency	
Power flux density	like GSM900/UMTS mobile phone
Time duration	1 h and 3 h
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/31700008/
Main result	increased ROS level after 1 h of UMTS exposure

ID	SKh2019_02
Year	2019
MLA citation	Šimaiová, Veronika et al. “The effect of 2.45 GHz non-ionizing radiation on the structure and ultrastructure of the testis in juvenile rats.” Histol Histopathol (2019) 34: 391-403; DOI: 10.14670/HH-18-049
Population / sample	rats
Frequency	2.45 GHz
Power flux density	2,8 mW/cm^2 (28 W/m^2)
Time duration	9 and 14 embryonic days
Study design	**experimental**
Link	https://www.hh.um.es/Abstracts/Vol_34/34_4/34_4_391.htm
Main result	irregular shape of seminiferous tubules with desquamated immature germ cells in the lumen, a large number of empty spaces along the seminiferous epithelium and dilated and congested blood vessels in the interstitial tissue of the testis

ID	SKh2020_01
Year	2020
MLA citation	Gulati, Sachin et al. “Effects of different mobile phone UMTS signals on DNA, apoptosis and oxidative stress in human lymphocytes.” Environmental pollution (Barking, Essex : 1987) vol. 267 (2020): 115632. doi:10.1016/j.envpol.2020.115632
Population / sample	human lymphocytes
Frequency	1923, 1947.47, and 1977 MHz
Power flux density	like 3G mobile phones
Time duration	1 h and 3 h
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/36430865/
Main result	inhibition of a bulk RNA expression was found

ID	SKh2022_01
Year	2022
MLA citation	Zastko, Lucián et al. “Intermittent ELF-MF Induce an Amplitude-Window Effect on Umbilical Cord Blood Lymphocytes.” International journal of molecular sciences vol. 23,22 14391. 19 Nov. 2022, doi:10.3390/ijms232214391
Population / sample	Umbilical Cord Blood Lymphocytes from healthy newborns
Frequency	7.8 Hz
MF intensity	6 μT - 24 μT
Time duration	72 h
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/36430865/
Main result	amplitude and frequency windows confirmed

ID	SKh2022_02
Year	2022
MLA citation	Andrašková, Sandra et al. “The potential adverse effect of 2.45 GHz microwave radiation on the testes of prenatally exposed peripubertal male rats.” *Histology and histopathology* vol. 37,3 (2022): 287-299. doi:10.14670/HH-18-402
Population / sample	prenatally exposed peripubertal male rats
Frequency	2.45 GHz
Power flux density	1,73 W/kg (28 W/m^2)
Time duration	2 hours a day during pregnancy
Study design	**experimental**
Link	https://pubmed.ncbi.nlm.nih.gov/34854072/
Main result	Our results revealed that the prenatal exposure to MR had an adverse effect on the postnatal testicular development in rats.

ID	SKh2023_01
Year	2023
MLA citation	Parizek, D et al. “Electromagnetic fields - do they pose a cardiovascular risk?.” Physiological research vol. 72,2 (2023): 199-208. doi:10.33549/physiolres.934938
Population / sample	30 university students
Frequency	f=2400 MHz (Wi-Fi) and f=2600 MHz (4G)
Power flux density	E=58V/m (9 000 000 μW/m2)
Time duration	5 min
Study design	[Cohort / case-control / **experimental** / systematic review / meta-analysis / other]
Link	https://pmc.ncbi.nlm.nih.gov/articles/PMC10226401/
Main result	Our results revealed a shift in cardiac autonomic regulation towards sympathetic overactivity and parasympathetic underactivity.

ID	SKh2024_01
Year	2024
MLA citation	Gulati, Sachin et al. “Evaluation of oxidative stress and genetic instability among residents near mobile phone base stations in Germany.” *Ecotoxicology and environmental safety* vol. 279 (2024): 116486. doi:10.1016/j.ecoenv.2024.116486
Population / sample	People in germany
Frequency	GSM and LTE spectrum
Power flux density	160 m from BTS and 490 m from BTS
Time duration	non-stop
Study design	observational comparative study
Link	https://pubmed.ncbi.nlm.nih.gov/38820877/
Main result	Increased rates of chromosomal aberrations as linked to excess exposure with ionizing radiation may also occur with non-ionizing radiation exposure.

ID	SKh2024_02
Year	2024
MLA citation	Popovičová, Alexandra et al. “Effect of microwave radiation on adult neurogenesis and behavior of prenatally exposed rats.” *IBRO neuroscience reports* vol. 17 235-244. 27 Aug. 2024, doi:10.1016/j.ibneur.2024.08.007
Population / sample	pregnant rats
Frequency	2.45 GHz
Power flux density	2,8 mW/cm^2 (28 W/m^2)
Time duration	2 hours a day during the whole pregnancy
Study design	**experimental**
Link	https://pubmed.ncbi.nlm.nih.gov/39286040/
Main result	Morphological alterations in neurogenesis were accompanied by changes in animals’ behavior.

ID	SKh2025_01
Year	2025
MLA citation	Holovská, Katarína et al. “The effect of Wi-Fi on elastic and collagen fibres in the blood vessel wall of the chorioallantoic membrane.” ACTA VET. BRNO 2025, 94: 137–144; https://doi.org/10.2754/avb202594020137
Population / sample	chicken embryo
Frequency	2.4 GHz
Power flux density	300 μW/m^2
Time duration	9 and 14 embryonic days
Study design	**experimental**
Link	https://actavet.vfu.cz/media/pdf/actavet_2025094020137.pdf
Main result	a significant decline of collagen fibres

Response to Question 14 from Slovakia

Question 14: "What scientific evidence exists regarding potential adverse **environmental effects** associated with RF radiation?"

ID	SKe2023_01
Year	2023
MDPI citation	Šofranková, L.; Baňas, M.; Pipová, N.; Majláth, I.; Kurimský, J.; Cimbala, R.; Pavlík, M.; Mateos-Hernández, L.; Šimo, L.; Majláthová, V. Effects of Electromagnetic Radiation on Neuropeptide Transcript Levels in the Synganglion of Ixodes ricinus. Pathogens 2023, 12, 1398. https://doi.org/10.3390/pathogens12121398
Population/sample	180 male a 180 female *Ixodes ricinus*
Frequency	900 MHz
Power flux density	2 V/m (10 000 μW/m^2) and 40 V/m (4 000 000 μW/m^2)
Time duration	10 min, 1 h, 3 h and 24 h
Study design	**experimental**
Link	https://www.mdpi.com/2076-0817/12/12/1398
Main result	The first report on the effects of the abiotic environment on tick neurophysiology.

Response to Question 12 from Czech republic

Question 12: “What scientific evidence exists regarding potential adverse **health effects** associated with RF radiation exposure at levels below current federal exposure limits?”

ID	CZh1994_01
Year	1994
MLA citation	Pafkova, H, and J Jerabek. “Interaction of MF 50 Hz, 10 mT with high dose of X-rays: evaluation of embryotoxicity in chick embryos.” Reviews on environmental health vol. 10,3-4 (1994): 235-41. doi:10.1515/reveh.1994.10.3-4.235
Population / sample	chick embryos
Frequency	50 Hz
MF intensity	10 mT
Time duration	
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/7724884/
Main result	reduction of X-ray teratogenicity

ID	CZh1996_01
Year	1996
MLA citation	Pafková, H et al. “Developmental effects of magnetic field (50 Hz) in combination with ionizing radiation and chemical teratogens.” Toxicology letters vol. 88,1-3 (1996): 313-6. doi:10.1016/0378-4274(96)03755-1
Population / sample	chick and rat embryos
Frequency	50 Hz
MF intensity	10 mT or 6 microT
Time duration	
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/8920754/
Main result	changes in theta oscillations, influencing the central nervous system

ID	CZh2005_01
Year	2005
MLA citation	Barcal, J et al. “Effect of whole-body exposure to high-frequency electromagnetic field on the brain electrogeny in neurodefective and healthy mice.” Prague medical report vol. 106,1 (2005): 91-100.
Population / sample	mice
Frequency	frequency corresponding to cellular phones
Power flux density	corresponding to cellular phones
Time duration	
Study design	experimental
Link	https://pubmed.ncbi.nlm.nih.gov/16007915/
Main result	changes in theta oscillations, influencing the central nervous system

ID	CZh2007_01
Year	2007
MLA citation	Barcal, J et al. “Effect of whole-body exposure to high-frequency electromagnetic field on the brain cortical and hippocampal activity in mouse experimental model” NeuroQuantology: An Interdisciplinary Journal of Neuroscience and Quantum Physics 2007; 5 (3): 292-303
Population / sample	mice
Frequency	880–890 MHz
Power flux density	
Time duration	40 min
Study design	experimental
Link	https://www.emf-portal.org/en/article/17209
Main result	changes in theta oscillations

ID	CZh2007_02
Year	2007
MLA citation	Vozeh F et al. “Study of high-frequency electromagnetic field effect on some somatic and neuro-behavioral characteristics in healthy and neurodefective mice” The Environmentalist 2007; 27 (4): 501-504
Population / sample	mice
Frequency	870 MHz
Power flux density	
Time duration	2.5 h/day, for 21 days and 3 h/day, for 30 days
Study design	experimental
Link	https://www.emf-portal.org/en/article/15819
Main result	Significant lower swimming speed

Response to Question 14 from Czech republic

Question 14: “What scientific evidence exists regarding potential adverse **environmental effects** associated with RF radiation?”

ID	CZe2007_01
Year	2007
University	Lukáš Fojt, Master thesis, MASARYKOVA UNIVERZITA BRNO
Population / sample	bacteria, yeasts and cell cultures
Frequency	50 Hz
Intensity of MF	2.3 - 10 mT
Time duration	
Study design	experimental
Link	https://is.muni.cz/th/jn57p/
Main result	Magnetic field killed about 20 – 40% of cells (compared to the control ones), and the effect is strain-dependent.

ID	CZe2023_01
Year	2023
University	Kristína Briediková, Master thesis, MASARYKOVA UNIVERZITA BRNO
Population / sample	Pyrrhocoris apterus and Periplaneta americana
Frequency	
Intensity of MF	50 μT and 120 μT
Time duration	
Study design	experimental
Link	https://is.muni.cz/th/eufm3/
Main result	altered the rhythm of the insect clock

ID	CZh2023_02
Year	2023
University	Juraj Markuš, Master thesis, MASARYKOVA UNIVERZITA BRNO
Population / sample	Pyrrhocoris apterus and Periplaneta americana
Frequency	
Intensity of MF	50 μT and 120 μT
Time duration	
Study design	experimental
Link	https://is.muni.cz/th/cx12x/
Main result	the effects were present in complete darkness, the effects of both static and oscillating EMF on circadian periods of insects.

Response to Question 12 from Czechoslovakia

Question 12: “What scientific evidence exists regarding potential adverse **health effects** associated with RF radiation exposure at levels below current federal exposure limits?”

ID	CSSRh1963_01
Year	1963
Name	The Effect of Centimeter-Wave Electromagnetic Radiation (Radar) on the Central Nervous System of Soldiers: Our Experience
Population / sample	50 radar workers aged in the majority from 20 to 25 years
Frequency	3 - 10 GHz (10 to 3 cm)
Power flux density	0,2 mW/cm^2 (2 W/m^2)
Time duration	2.4 to 3.4 hours daily
Study design	Cohort
Link	https://mmsl.cz/pdfs/mms/1963/04/09.pdf
Main result	26 reported symptoms of mostly neuras-thenic character, 9 Subjects reported various complaints occurring only during the time of the exposure. In 29 instances physical examination revealed a neurotic and vegetative symptomatology. In 3 instances minute organic neurological signs were noted.

ID	CSSRh1980_01
Year	1980
Name	Soviet and Eastern European Research on Biological Effects of Microwave Radiation
Population / sample	
Frequency	
Power flux density	
Time duration	
Study design	review
Link	https://www.avaate.org/IMG/pdf/mcree80_rev_soviet.pdf
Main result	