



Biological Effects of AC Magnetic Fields Measured in Milligauss (mG)

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(Courtesy of Stephanie Sage Kerst, EMRS – www.sageliving.us)

9040 mG Institute of Electrical and Electronics Engineers (IEEE) Recommended Limit for Public Exposure (there are no US federal standards for limiting ELF-EMF AC magnetic field exposure)ⁱ

2000 mG International Commission on Non-Ionizing Radiation Protection (ICNIRP) Recommended Limit for Public Exposureⁱⁱ

16 mG Intermittent exposure to AC magnetic fields results in an 80% increased risk of miscarriage for pregnant women (Li et al 2002)ⁱⁱⁱ

> 5 mG Building Biology Severe Concern Level^{iv}

≥ 4 mG A 560% increased risk of all major cancers in Danish children living near high voltage power lines (Olsen et al 1993)^v

3-4 mG In 2001, ELF-EMF (AC magnetic fields) classified as a Class 2B possible carcinogen by the International Agency for Cancer Research (IARC) of the World Health Organization based on an increased occurrence of childhood leukemia (Kheifets, 2005)^{vi}

≥ 3 mG Children in remission from leukemia had a 450% increased risk of dying when recovering in homes with 3 mG or greater (Foliat 2006)^{vii}

> 3 mG An 87% increased risk of hematological cancer in adults living near high voltage power lines (Youngson 1991)^{viii}

> 2 mG Magnetic field exposure during pregnancy results in a 3.5 fold increased rate of asthma in child (Li et al 2011)^{ix}

≥ 2 mG A 710% increased risk of childhood leukemia in children under four years of age sleeping in 2 mG or above (Michaelis 1997)^x

1.9 mG A 70% increased risk of acute myeloid leukemia and chronic myeloid leukemia for adults living near high voltage power lines (Feychting 1994)^{xi}

≥ 1.4 mG A 570% increased risk of leukemia in children under six years of age than for children with exposure under 0.3 mG (Green 1999)^{xii}

≥ 1.3 mG A 200% increased risk of ADHD diagnosis in children living in homes ≥ 1.3 mG; a 338% increase when ADHD persists into adolescence (Li et al 2020)^{xiii}

1-5 mG Building Biology Severe Concern Level^{xiv}

1 mG Bioinitiative 2007 Precautionary Target Level^{xv}

0.2-1 mG Building Biology Slight Concern Level^{xvi}

ⁱ IEEE SCC 28 (now ICES). IEEE C95.6-2002. US Environmental Protection Agency (EPA) on Lack of Federal Standard: <https://www.epa.gov/radiation/radiationresources-outside-epa#powerlines>

ⁱⁱ ICNIRP statement—guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz) Health Physics vol 99 pp 818-836 2010

ⁱⁱⁱ Li DK, Odouli R, Wi S, et al. A population-based prospective cohort study of personal exposure to magnetic fields during pregnancy and the risk of miscarriage. *Epidemiology*. 2002;13(1):9-20. doi:10.1097/00001648-200201000-00004

^{iv} Building Biology Institute Guidelines SBM2008. <https://buildingbiologyinstitute.org/wp-content/uploads/2019/03/SBM-2008C-v3.6.pdf>

^v Olsen JH, Nielsen A, Schulgen G. Residence near high voltage facilities and risk of cancer in children. *BMJ*. 1993;307(6909):891-895. doi:10.1136/bmj.307.6909.891.

^{vi} Kheifets L Shimkhada R. 2005. Childhood Leukemia and EMF: Review of the Epidemiological Evidence. *Bioelectromagnetics Supplement #7*, 1-7.

^{vii} Foliart DE, Pollock BH, Mezei G, et al. Magnetic field exposure and long-term survival among children with leukemia [published correction appears in *Br J Cancer*. 2006 Mar 27;94(6):940]. *Br J Cancer*. 2006;94(1):161-164. doi:10.1038/sj.bjc.6602916.

^{viii} JHAM Youngson et al. A case/control study of adult hematological malignancies in relation to overhead powerlines. *Br J Cancer* 63:977-985. 1991.

^{ix} Li, D. K., Chen, H. & Odouli, R. Maternal Exposure to Magnetic Fields During Pregnancy in Relation to the Risk of Asthma in Offspring. *Arch.Pediatr.Adolesc.Med.* (2011).

^x Michaelis J, Schüz J, Meinert R, et al. Combined risk estimates for two German population-based case-control studies on residential magnetic fields and childhood acute leukemia. *Epidemiology (Cambridge, Mass.)*. 1998 Jan;9(1):92-94. DOI: 10.1097/00001648-199801000-00014.

^{xi} Feychting M, Ahlbom A. Magnetic fields, leukemia and central nervous system tumors in Swedish adults residing near high voltage power lines. *Epidemiology* 1994. 5:501-509.

^{xii} Green LM, Miller AB, Agnew DA, et al. Childhood leukemia and personal monitoring of residential exposures to electric and magnetic fields in Ontario, Canada. *Cancer Causes Control*. 1999;10(3):233-243. doi:10.1023/a:1008919408855.

^{xiii} Li D, Chen H, Ferber JR, Hirst AK, Odouli R. Association Between Maternal Exposure to Magnetic Field Nonionizing Radiation During Pregnancy and Risk of Attention-Deficit/Hyperactivity Disorder in Offspring in a Longitudinal Birth Cohort. *JAMA Netw Open*. 2020;3(3):e201417. doi:10.1001/jamanetworkopen.2020.1417

^{xiv} BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) at www.bioinitiative.org, August 31, 2007.

^{xv} BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Radiation at www.bioinitiative.org, December 31, 2012.

^{xvi} Building Biology Institute Guidelines SBM2008. <https://buildingbiologyinstitute.org/wp-content/uploads/2019/03/SBM-2008C-v3.6.pdf>

For further reading: Briefing Report on Electromagnetic Fields: Health Effects, Public Policy and Site Planning by CL Sage, MA and SA Sage, BS. *J. Aust. Coll. Nutr. & Env. Med.* Vol. 25 No.2 (August 2006) pages 3-6 & 9.