

To: NNSA Los Alamos Field Office ATTN: EPCU Project NEPA 3747 West Jemez Road Los Alamos, NM 87544 emailed to: EPCUEA@nnsa.doe.gov

Comments on the Electrical Power Capacity Upgrade Project at Los Alamos National Laboratory (LANL).

Comment period: February 20, 2024.

Comments on Draft Environmental Assessment for the Los Alamos National Laboratory Electrical Power Capacity Upgrade Project (DOE/EA-2199).

High voltage power lines have extremely low frequency (ELF) electromagnetic fields (EMF) emissions. Although this type of EMF is non-ionizing, hundreds of studies have documented adverse effect to animals and plants from ELF-EMF exposure¹. An ever growing body of

¹ Bandara, P., & Carpenter, D. O. (2018). <u>Planetary electromagnetic pollution: It is time to assess its impact.</u> *The Lancet Planetary Health*, 2(12), e512–e514; Belpomme, D., Hardell, L., Belyaev, I., Burgio, E., & Carpenter, D. O. (2018). <u>Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective.</u> *Environmental Pollution*, 242, 643–658; Lai H, Levitt BB. (2023) <u>Cellular and molecular effects of non-ionizing electromagnetic fields.</u> Rev Environ Health; Panagopoulos, D. J., Johansson, O., & Carlo, G. L. (2015). <u>Polarization: A Key Difference between Man-made and Natural Electromagnetic Fields, in regard to Biological Activity.</u> *Scientific Reports*, *5*, 14914; Panagopoulos, D. J. (Ed.). (2022). <u>Electromagnetic Fields of Wireless</u> <u>Communications: Biological and Health Effects</u> (1st ed.). CRC Press.



research shows harmful impacts from cancer², to DNA damage³, oxidative stress⁴, epigenetic changes⁵, impacts to neurotransmitters⁶ and the endocrine system⁷ and more.⁸ As a review by <u>Karimi et al 2020</u>⁹ found, "accumulated epidemiologic evidence indicates a correlation between exposure to ELF-EMF and childhood cancer incidence, Alzheimer's disease (AD), and miscarriage

The majority of this comment focuses on the need for the EA to adequately address ELF EMF but in addition, issues regarding radiofrequency (RF) EMF from wireless antennas are also included due to the common practice of placing cell antennas on transmission towers. This practice would increase levels of environmental RF in addition to the ELF from the transmission lines and needs to be considered.

² Brabant, C., Geerinck, A., Beaudart, C., Tirelli, E., Geuzaine, C., & Bruyère, O. (2022). Exposure to magnetic fields and childhood leukemia: A systematic review and meta-analysis of case-control and cohort studies. *Reviews on Environmental Health*; Malavolti M, Malagoli C, Wise LA, Poli M, Notari B, Taddei I, Fabbi S, Teggi S, Balboni E, Pancaldi A, Palazzi G, Vinceti M, Filippini T. Residential exposure to magnetic fields from transformer stations and risk of childhood leukemia. Environ Res. 2023 Dec 23:118043; Seomun, G., Lee, J., & Park, J. (2021). Exposure to extremely low-frequency magnetic fields and childhood cancer: A systematic review and meta-analysis. *PLOS ONE*, *16*(5), e0251628; Sun, J., Tong, Y., Jia, Y., Jia, X., Wang, H., Chen, Y., Wu, J., Jin, W., Ma, Z., Cao, K., Li, X., Chen, Z., & Yang, G. (2023). Effects of extremely low frequency electromagnetic fields on the tumor cell inhibition and the possible mechanism. *Scientific Reports*, *13*(1), Article 1.

³ Lai, H. (2021). <u>Genetic effects of non-ionizing electromagnetic fields</u>. Electromagnetic Biology and Medicine, 40(2), 264–273.

⁴ Georgiou, C. D., & Margaritis, L. H. (2021). <u>Oxidative Stress and NADPH Oxidase: Connecting Electromagnetic Fields, Cation Channels and Biological Effects</u>. *International Journal of Molecular Sciences, 22*(18), 10041; Schuermann, D., & Mevissen, M. (2021). <u>Manmade Electromagnetic Fields and Oxidative Stress—Biological Effects and Consequences for Health</u>. *International Journal of Molecular Sciences, 22*(7), 3772.

⁵ Giorgi G, Del Re B. <u>Epigenetic dysregulation in various types of cells exposed to extremely low-frequency</u> <u>magnetic fields</u>. Cell Tissue Res. 2021 Oct;386(1):1-15. doi: 10.1007/s00441-021-03489-6.;Manser, M., Sater, M., Schmid, C. *et al.* <u>ELF-MF exposure affects the robustness of epigenetic programming during granulopoiesis</u>. *Sci Rep* 7, 43345 (2017). https://doi.org/10.1038/srep43345

⁶ Chung YH, Lee YJ, Lee HS, Chung SJ, Lim CH, Oh KW, Sohn UD, Park ES, Jeong JH. <u>Extremely low frequency</u> magnetic field modulates the level of neurotransmitters. Korean J Physiol Pharmacol. 2015 Jan;19(1):15-20. doi: 10.4196/kjpp.2015.19.1.15. Epub 2014 Dec 31. PMID: 25605992; PMCID: PMC4297757.

⁷ Alkayyali, T., Ochuba, O., Srivastava, K., Sandhu, J. K., Joseph, C., Ruo, S. W., Jain, A., Waqar, A., & Poudel, S. (2021). <u>An Exploration of the Effects of Radiofrequency Radiation Emitted by Mobile Phones and Extremely Low Frequency Radiation on Thyroid Hormones and Thyroid Gland Histopathology. *Cureus*, 13(8); Rauš Balind S, Manojlović-Stojanoski M, Šošić-Jurjević B, Selaković V, Milošević V, Petković B. <u>An Extremely Low Frequency Magnetic Field and Global Cerebral Ischemia Affect Pituitary ACTH and TSH Cells in Gerbils.</u></u>

Bioelectromagnetics. 2020 Feb;41(2):91-103. doi: 10.1002/bem.22237. Epub 2019 Dec 11. PMID: 31828821. ⁸ Carpenter DO. Human disease resulting from exposure to electromagnetic fields. *Rev Environ Health*.

^{2013;28:159–172.}

⁹ Karimi, A., Ghadiri Moghaddam, F., & Valipour, M. (2020). <u>Insights in the biology of extremely low-frequency</u> magnetic fields exposure on human health. Molecular Biology Reports, 47(7), 5621–5633



The Electrical Power Capacity Upgrade Project for Los Alamos National Laboratory of high-voltage power lines running more than 500 miles will increase levels of environmental EMF and the draft EA omits adequate review of the environmental impacts of EMF emissions from the project.

The only mention of EMF in the Draft EA is on page 3-30 which state that, "Based on multiple scientific studies, no evidence exists that EMFs affect or disrupt livestock conception, calving, growth rate, or survival (Angell et al. 1990; Renaud 1999)."

Later the draft EA states, "The proposed transmission line is not likely to have short- or long-term impacts to livestock because the project would not permanently alter allotment functions or disrupt livestock conception, calving, growth rate, or survival (Wolf et al. 2017)." However, <u>Wolf et. al 2017</u> is not about EMFs.

These two outdated studies referenced regarding EMF were:

Effects of high-voltage direct-current transmission line on beef cattle production. Bioelectromagnetics 11(4); 273–282

Two herds of beef cattle were maintained beneath a +/-500 kV direct-current transmission line during a 30-month period and were compared with two similar herds maintained away from the transmission line. Productivity and health status of cows and calves were found to be similar between lines and control treatments.

France Renuad. 1999. Effects of Electric and Magnetic Fields on Livestock Health and Productivity. Retrieved from:

http://www.hydroquebec.com/fields/pdf/pop_24_01.pdf

This non peer reviewed document is authored by the electric company Hydroquebec and references mostly studies funded by the electric power companies.

1. The EA should include the report of estimated ELF-EMF and (if applicable) RF -EMF levels from the proposed infrastructure. How can there be a conclusion of no impact without numerical data on the current and projected EMF levels?

1. Include the full report on electromagnetic fields (EMF) measured or simulated levels in the Environmental Assessment. Measurements of both magnetic and electric fields as well as static electric fields should be evaluated directly underneath the equipment and



power lines as well as at multiple distances away from the lines extending out (such as at 10, 20, 50, 100, 500 feet etc until background levels). Current EMF levels need to be documented to understand what the increased EMF levels will be after the equipment is in place. Further, the impact to EMF levels from future upgrades also needs to be noted. All measurements should be included in the EA and publicly posted.

- 2. The EA needs to note if the infrastructure also has wireless transmitters (cell antennas) mounted on the transmission towers as this can be common along high voltage transmission lines? If so please provide details on the facilities as well as radiofrequency (RF) radiation compliance information.
- 3. Regarding the possible addition of wireless antennas to the project, if such installations are not a part of this current project, *could the addition of such equipment be a potential modification later*? The EA needs to address this question because often wireless antennas are easily added post transmission line deployment and such wireless facilities do not necessarily require transparency nor adequate community participation in the decision-making process.
- 4. Please also clarify the process by which wireless antennas could or would be added to the transmission towers or in any position on the property.
- 5. If smart meters or other RF emitting utility meters are included in the project, please provide details including numbers, location(s), make and model, RF emission information etc.

2. The EA should include up to date research regarding impacts from EMF exposure, not simply two studies from the 1990s. Additionally, the sole focus on livestock as potentially being impacted by the project omits consideration of EMF effects on all other plants and animals.

Recommendations for the final EA regarding documentation on EMF.

- 1. The EA should show adequate review and reference the more recent research on EMF effects rather than only the two 34-year-old articles referenced in the draft EA.
- 2. The EA should consider potential impacts to all species (not just cows) in the vicinity including bees, pollinators, insects, birds, mammals (bats) amphibians etc based on up to date a range of research studies on biological impacts of EMF.

3. The draft EA statement in regards to EMFs that "no evidence exists" is simply inaccurate and must be corrected.



Hundreds of scientists¹⁰ recommend reducing environmental EMF exposures due to the growing evidence that nonionizing EMF can adversely impact flora and fauna. Yet only 2 outdated research articles were included in the draft EA and one was an industry document.

Scientific evidence on non-ionizing EMF impacts to wildlife shows impacts.

A three-part landmark research review by U.S experts of over 1,200 studies on the effects of non-ionizing radiation to wildlife entitled "Effects of non-ionizing electromagnetic fields on flora and fauna" found adverse effects <u>in all species studied</u>, at even very low intensities.^{11,12,13}

Numerous studies across all frequencies and taxa indicate that current low-level anthropogenic EMF can have myriad adverse and synergistic effects, including on orientation and migration, food finding, reproduction, mating, nest and den building, territorial maintenance and defense, and on vitality, longevity and survivorship itself. Effects have been observed in mammals such as bats, cervids, cetaceans, and pinnipeds among others, and on birds, insects, amphibians, reptiles, microbes and many species of flora. Cyto- and geno-toxic effects have long been observed in laboratory research on animal models that can be extrapolated to wildlife.

Levitt et al 202314 states

As noted in Panagopoulos et al. (54), natural and manmade EMF are significantly and fundamentally different. Unlike natural EMF, all anthropogenic EMF is polarized, meaning it is more biologically active via the ability to amplify intensities (called constructive interference) as well as alter cellular charged/polar molecule oscillations into parallel planes in phase with the applied field. This can result in irregular gating in

¹⁰ Kelley, Elizabeth & Blank, Martin & Lai, Henry & Moskowitz, Joel & Havas, Magda. (2015). <u>International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure</u>. European Journal of Oncology. Volume 20. pp. 180-182;Hardell L, Sage C. <u>Biological effects from electromagnetic field exposure and public exposure standards</u>. *Biomed Pharmacother*: 2008;62:104–109; <u>2020 Consensus Statement of UK and International Medical and Scientific Experts and Practitioners on Health Effects of Non-Ionising Radiation (NIR)</u>

 ¹¹ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions. *Reviews on Environmental Health*.
¹² Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment. *Reviews on Environmental Health*, 37(1), 81–122.
¹³ Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment. *Reviews on Environmental Health*, 37(1), 81–122.

fauna, Part 2 impacts: How species interact with natural and man-made EMF. Reviews on Environmental Health, 37(3), 327–406.

¹⁴ Levitt BB, Lai HC and Manville AM II (2022) <u>Low-level EMF effects on wildlife and plants: What research tells</u> <u>us about an ecosystem approach.</u> Front. Public Health 10:1000840. doi: 10.3389/fpubh.2022.1000840



cell membrane ion channels and thereby disrupt the normal cellular electrochemical balance. In other words, manmade EMF can capture, entrain, and manipulate living cells' basic functioning architecture unlike natural EMF with which most living things have evolved."

Bees and pollinators are at risk from transmission line EMF exposures.

Biologists have long cautioned that non ionizing electromagnetic radiation is a critical factor in the decline of pollinator and insect populations.¹⁵ A 2023 <u>systematic review and meta-analysis</u> <u>of studies</u> on the biological effects on insects of non-ionizing electromagnetic fields, including both powerline as well as cellular radiation, was published in the journal Reviews on Environmental Health, documenting a range of effects to insects such as impacts to behavior, orientation, reproduction, metabolism and immune health.¹⁶ The study concludes that:

"The biological effects of non-thermal EMF on insects are clearly proven in the laboratory, but only partly in the field, thus the wider ecological implications are still unknown. There is a need for more field studies, but extrapolating from the laboratory, as is common practice in ecotoxicology, already warrants increasing the threat level of environmental EMF impact on insects."

As an example of some of accumulated studies on non ionizing EMF, the study <u>Electromagnetic</u> <u>fields disrupt the pollination service by honeybees</u> by Molina-Montenegro et al 2023 published in Scientific Advances assessed the effect of EMF from high voltage transmission towers on honeybee behavior and seed production by the honey bee-pollinated California poppy under field conditions. They found EMF exposure exerted strong physiological stress on honeybees and affected the expression levels of behavior-related genes. Moreover, California poppy individuals growing near EMF received fewer honeybee visits and produced fewer seeds than plants growing far from EMF. The study concludes that:

We propose that honeybees' exposure to EMF disturbs their foraging capabilities by altering their magnetic navigation, learning, decision-making mechanisms, flight, and foraging, thus impairing pollination activity... Our study provides conclusive evidence of detrimental impacts of EMF on honeybee's pollination behavior, leading to negative effects on plant community.

¹⁵ Balmori A. (2021) <u>Electromagnetic radiation as an emerging driver factor for the decline of insects.</u> Science of the Total Environment. 767: 144913

¹⁶ Thill A, Cammaerts MC, Balmori A. Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis. Rev Environ Health. 2023 Nov 23



The study "Extremely Low Frequency Electromagnetic Fields impair the Cognitive and Motor Abilities of Honeybees" by Shepherd et al 2018¹⁷ published in Scientific Reports simulated the exposure of flying bees in the field crossing an EMF boundary of a powerline and concludes:

The results of our analysis show that acute exposure to ELF EMFs impacts upon the motor and cognitive abilities of bees and reduces feeding. We show, for the first time, that acute exposure to ELF EMFs causes a dose dependent reduction in olfactory learning. High levels of ELF EMFs, that can be experienced close to power lines, modify tethered flight by increasing wingbeat frequency. In addition, we show that exposure to low-level fields, at intensities found at ground levels below power lines, significantly reduces the number of successful foraging flights to a food source, and also leads to reduced feeding in bees.

ELF EMF exposure was found to reduce learning, alter flight dynamics, reduce the success of foraging flights towards food sources, and feeding. The results suggest that 50 Hz ELF EMFs emitted from powerlines may represent a prominent environmental stressor for honey bees, with the potential to impact on their cognitive and motor abilities, which could in turn reduce their ability to pollinate crops.

5. Inaccurate statements related to "emerging scientific consensus" are wrong and should be corrected. In fact, the emerging consensus among non industry supported scientists is that powerline EMFs are harmful to human health.

The draft EA paragraph needs to be corrected. It currently states, "Broader concerns of public interest, such as EMFs and the potential for triggering wildland fires, have also been considered. A magnetic field is generated when electric current flows through any line or wire. Given the common sources and ubiquitous nature of EMFs in modern settings, nearly everyone is exposed to a wide range and complex mix of these fields every day. A growing body of research has not been able to establish a causal relationship between EMFs and human health; emerging scientific consensus is that power lines are not likely responsible for adverse public health effects (PSC 2013).

¹⁷ Shepherd S, Lima MAP, Oliveira EE, Sharkh SM, Jackson CW, Newland PL. <u>Extremely Low Frequency</u> <u>Electromagnetic Fields impair the Cognitive and Motor Abilities of Honey Bees</u>. Sci Rep. 2018 May 21;8(1):7932.



The draft EA sites a decade old Wisconsin PSC report which is inadequate to substantiate the statement and further, the statement is not backed by up to date science. The <u>PSC</u> <u>document</u> does not even have any scientific references on EMF. It only links to one website page *which is a broken link*.

Documentation on non-ionizing EMF and human health.

In 2001 the World Health Organization's <u>International Agency for Research on Cancer</u> concluded that exposure to power-line frequency ELF-EMF is a "possible" human carcinogen- a decision based largely on evidence of an increased risk for childhood leukemias with residential exposure. This classification was based on pooled analyses of epidemiological studies demonstrating a consistent pattern of a two-fold increase in childhood leukemia associated with average exposure to residential power-frequency magnetic field above 3 to 4 milligauss magnetic field.¹⁸

The studies linking magnetic fields to childhood cancer have only increased since this date. For example, a <u>2021 meta-analysis¹⁹</u> by Seomun and Park 2021 which identified 33 studies that concluded "significant associations were observed between exposure to ELF-MFs and childhood leukemia. Furthermore, a possible dose-response effect was also observed."

The study <u>Residential extremely low frequency magnetic fields and skin cancer²⁰</u> published in Occupational and Environmental Medicine concluded that, "The results of this study suggested an association between childhood ELF MF exposure and adult melanoma. This is in agreement with previous findings suggesting that the carcinogenic effects of ELF MFs may be associated particularly with childhood exposure."

¹⁸ International Agency for Research on Cancer. (2001). Press Release <u>IARC finds limited evidence that residential</u> <u>magnetic fields increase risk of childhood Leukaemia</u>. Retrieved from <u>http://archive.li/pZXs3#selection-601.0-601.97</u>;

World Health Organization International Agency For Research On Cancer. (2002). <u>Non-ionizing radiation, part 1:</u> <u>Static and extremely low-frequency (elf) electric and magnetic fields</u>. Lyon: World Health Organization.

¹⁹ Seomun, G., Lee, J., & Park, J. (2021). <u>Exposure to extremely low-frequency magnetic fields and childhood</u> cancer: A systematic review and meta-analysis. PLOS ONE, 16(5), e0251628.

²⁰ Khan MW, Juutilainen J, Naarala J, et al <u>Residential extremely low frequency magnetic fields and skin</u> <u>cancer</u>Occupational and Environmental Medicine 2022;79:49-54.



The Ramazzini Institute study "Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats" (2016)²¹ found that ELF exposed rats had statistically significant increased incidence of several types of malignant tumors when combined with a known carcinogen.

In addition to leukemia, research is documenting other types of cancer. The journal Environmental Research published a 2020 study entitled "<u>Residential proximity to power lines</u> and risk of brain tumor in the general population" which found an increased risk of brain tumors was associated with living near power lines.²²

As an example of the non cancer studies on people living near power lines, <u>Huang et al 2013</u>²³ found children attending a school near 500 kV HVT lines had poorer performance on the computerized neurobehavioral tests compared to children attending a school that was not in close proximity to HVT lines.

Miscarriage and Prenatal Impacts

Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only increased <u>miscarriage</u>²⁴ and but also increased <u>ADHD</u>²⁵, <u>obesity</u>²⁶ and <u>asthma</u>²⁷ in the woman's prenatally exposed children.

 ²¹ Soffritti, M., Tibaldi, E., Padovani, M., Hoel, D., Giuliani, L., & Bua, L. et al. (2016). <u>Life-span exposure to</u> sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats. International Journal Of Radiation Biology, 92(4), 202-214. https://doi.org/10.3109/09553002.2016.1144942
²² Carles, C., Esquirol, Y., Turuban, M., Piel, C., Migault, L., & Pouchieu, C. et al. (2020). <u>Residential proximity to</u> power lines and risk of brain tumor in the general population. Environmental Research, 185, 109473. https://doi.org/10.1016/j.envres.2020.109473

²³ Huang, J., Tang, T., Hu, G., Zheng, J., Wang, Y., & Wang, Q. et al. (2013). <u>Association between Exposure to</u> <u>Electromagnetic Fields from High Voltage Transmission Lines and Neurobehavioral Function in Children</u>. Plos ONE, 8(7), e67284. https://doi.org/10.1371/journal.pone.0067284

²⁴ Li, D.-K., Chen, H., Ferber, J. R., Odouli, R., & Quesenberry, C. (2017). <u>Exposure to Magnetic Field</u> <u>Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study</u>. Scientific Reports, 7(1), 17541.

²⁵ Li, D.-K., Chen, H., Ferber, J. R., Hirst, A. K., & Odouli, R. (2020). <u>Association Between Maternal Exposure to</u> <u>Magnetic Field Nonionizing Radiation During Pregnancy and Risk of Attention-Deficit/Hyperactivity Disorder in</u> <u>Offspring in a Longitudinal Birth Cohort</u>. *JAMA Network Open*, 3(3), e201417.

²⁶ Li, D.-K., Ferber, J. R., Odouli, R., & Quesenberry, C. P. (2012). <u>A Prospective Study of In-utero Exposure to</u> <u>Magnetic Fields and the Risk of Childhood Obesity</u>. Scientific Reports, 2(1), 540.

²⁷ Li, D.-K., Chen, H., & Odouli, R. (2011). <u>Maternal Exposure to Magnetic Fields During Pregnancy in Relation to</u> the Risk of Asthma in Offspring. Archives of Pediatrics & Adolescent Medicine, 165(10), 945–950.



A <u>2020 systematic review and meta-analysis</u>²⁸ concluded that exposure was associated with increased risk of miscarriage in the first trimester of pregnancy. The authors conclude, "It may be prudent to advise women against this potentially important environmental hazard. Indeed, pregnant women should receive tailored counseling."

The French Government <u>ANSES 2019 Report: Health effects associated with exposure to</u> <u>low-frequency electromagnetic fields</u> recommends not to build new facilities attended by vulnerable people (hospitals, schools, etc.) immediately next to very-high voltage power lines, or running new power lines over these facilities as well as limiting exposure. The report also stresses the need to better manage occupational exposure for employees who could be exposed to high levels of electromagnetic fields, particularly pregnant women. In some scenarios of occupational exposure, it has been shown that the induced current density in the fetus may exceed the limits recommended for the general public.

The majority of studies show adverse impacts.

Dr. Henry Lai, Professor Emeritus at the University of Washington, <u>Editor Emeritus</u> of the journal, Electromagnetic Biology and Medicine, and an emeritus member of the <u>International</u> <u>Commission on the Biological Effects of EMF</u>, has compiled summaries of the research on the biological effects of exposure to EMF in studies from 1990 to January 2024. Dr. Lai reports to Dr. Joel Moskowitz that the preponderance of research has found that exposure to RFR or ELF EMF produces oxidative effects or free radicals, damages DNA and has found significant effects

²⁸ Ghazanfarpour, Masumeh, Kashani, Zahra Atarodi, Pakzad, Reza, Abdi, Fatemeh, Rahnemaei, Fatemeh Alsadat, Akbari, Pouran Akhavan and Roozbeh, Nasibeh. "Effect of electromagnetic field on abortion: A systematic review and meta-analysis" Open Medicine, vol. 16, no. 1, 2021, pp. 1628-1641. <u>https://doi.org/10.1515/med-2021-0384</u>



on genetic, neurological and reproductive outcomes has found significant effects..²⁹ Specifically in regards to extremely low frequency (ELF) and static electromagnetic fields he found:

- 91% (n=286) of 316 ELF/static EMF oxidative effects (or free radical) studies published since 1990 reported significant effects.
- 84% (n=288) of 344 ELF/static EMF genetic effects studies published since 1990 reported significant effects including 95% (n=168) of 177 studies of gene expression.
- 91% (n=315) of 345 ELF/static EMF neurological studies published since 2007 reported significant effects.
- 75% (n=65) of 87 ELF/static EMF reproduction and development studies published since 1990 reported significant effects.

The final EA should:

- 1. Reference the WHO/IARC classification
- 2. Reference the growing science showing harmful impacts from cancer to DNA damage oxidative stress⁻ impacts to neurotransmitters⁻ and the endocrine system. All biological endpoints need to be examined in the EA. Explain how the high voltage powerlines will compare to these studies in terms of exposure levels.
- 3. Reference the human health studies finding increased cancer, miscarriage, <u>ADHD</u> <u>obesity</u> and <u>asthma</u> in the woman's prenatally exposed children and explain how the high voltage powerlines will compare in terms of exposure levels.
- 4. Correct the inaccurate characterization of the state of science and opinion of scientists to clarify that associations have been found and numerous experts recommend reducing EMF exposure to people and in ecologically sensitive areas.

- <u>RFR Genetic Effects studies</u>
- <u>RFR Neurological Effects studies</u>
- <u>RFR Reproduction / Development studies</u>
- ELF Oxidative Effects studies
- ELF Genetic Effects studies
- ELF Neurological Effects studies
- ELF Reproduction studies
- List of static / ELF low flux density studies that found effects
- Intermediate Frequency studies

²⁹ Links to download each set of abstracts compiled by Dr. Henry Lai. From Effects of Exposure to Electromagnetic Fields: Thirty years of research

^{• &}lt;u>RFR Oxidative Effects studies</u>



6. The EA should note the industry sponsorship of cited research as studies show that industry funding impacts study results.

For example, the draft EA referenced "<u>Effects of Electric and Magnetic Fields on Livestock</u> <u>Health and Productivity</u>" references mostly industry funded studies. It referenced an Oregon State University, coordinated by F. Stormshak "sponsored by Bonneville Power Administration, Hydro-Québec and four other American utilities." The "Québec Study of Dairy Cows" states, "The choice of study type (controlled environment) was made jointly by Hydro-Québec, McGill University, MAPAQ and the Comité des bovins laitiers du Québec (Québec Dairy Committee)."

Note: The Quebec study found EMF exposure affected the quantity of feed consumed, the fat content of milk, the progesterone content of blood plasma during gestation and the length of the estrous cycle. The study itself states, "The EMF caused a biological response in dairy cows that affected milk fat percentage, DMI, and blood progesterone. No indications of health hazards to dairy cattle were found by the exposure to IO-kV/m and 30-pT EMF. Nevertheless, the strong association between these changes and the EMF warrants further research."

However, the Hydro-Québec brochure minimizes these findings by stating that "although there was a statistical effect, the result obtained when the cows were exposed to EMFs is not abnormal, as it did not exceed 4.5%. The same applies to the other variables."

David Carpenter MD Director of the Institute for Health and the Environment at the University at Albany has published the study <u>"Extremely low frequency electromagnetic fields and cancer:</u> <u>How source of funding affects results"</u> in Environmental Research that found that source of funding impacted study findings and when bias was addressed, "the evidence that magnetic fields increase risk of cancer is neither inconsistent nor inconclusive. Furthermore, adults are also at risk, not just children, and there is strong evidence for cancers in addition to leukemia, particularly brain and breast cancer."



EMF is an environmental pollutant. insurance companies generally exclude coverage³⁰ for EMFs as the market standard.

Complete Markets "Electromagnetic Fields (Utilities) Liability Insurance" states:

- "Classified alongside chemicals, smoke, and asbestos as "pollutants" electromagnetic fields (EMF) poses a high risk to various persons such as users of electrical power, electrical power generating companies, power transmission companies, and large generators. Sources of possible EMF health risks include radio frequencies, extremely low frequencies, and static magnetic fields. In homes, EMF exposures come from electrical appliances. The public has targeted cell phone manufacturers and electric power lines as likely EMF targets. Electromagnetic Fields (Utilities) Liability Insurance is a way for prudent companies to minimize exposure to vexatious litigation and adverse publicity.
- "Electromagnetic field exclusions" are clear and common in most insurance companies. It is applied as a market standard. This exclusion serves to exclude cover for illnesses caused by long-term EMF (non-ionizing radiation) exposure. For EMF liability insurance cover you have to purchase additional "Pollution Liability" coverage. EMF liability insurance covers claims brought by third parties for body injuries and property claims by third parties. This policy does not pay for damage caused by artificially generated electromagnetic, magnetic and electrical energy that damages, disrupts or interferes with any device, appliance, system, electronic wire or network utilizing satellite or cellular technology."

7. The draft EA must address the cumulative impact of the EMF exposure to plants as studies have showed numerous impacts to plants from non-ionizing EMF exposure.

³⁰ As an example, <u>City of Ann Arbor Michigan Insurance Policy: Electromagnetic Radiation Exclusion</u> says, "In this policy declaration, the electromagnetic radiation exclusion is part of several exclusions to exposures such as asbestos, lead, mold, and nuclear energy. The electromagnetic radiation exclusion not only excludes mitigation and harm from electromagnetic radiation but also excludes paying for the defense of "any supervision, instruction, recommendation, warning or advice given or which should have been given in connection with bodily injury, property damage, abatement and/or mitigation etc. (page 14)



<u>Hafeez et al 2020³¹</u> states, "The reviewed literature suggests Magnetic Fields have a role in changing physiological processes, such as respiration, photosynthesis, nutrient uptake, water relations and biochemical attributes, including genes involved in ROS, antioxidants, enzymes, proteins and secondary metabolites."

8. ICNIRP and IEEE limits cannot provide safety for wildlife because these limits are designed for humans, not animals or plants.³² The EA must explain how it determined safety thresholds for plants and animals and compare the levels of adverse effects to the projected EMF measurements from the project.

Thank you for the opportunity to comment.

Theodora Scarato Executive Director Environmental Health Trust <u>EHTrust.org</u>

³¹ Hafeez MB, Zahra N, Ahmad N, Shi Z, Raza A, Wang X, Li J. <u>Growth, physiological, biochemical and molecular changes in plants induced by magnetic fields: A review.</u> Plant Biol (Stuttg). 2023 Jan;25(1):8-23. doi: 10.1111/plb.13459; Thoradit T, Thongyoo K, Kamoltheptawin K, Tunprasert L, El-Esawi MA, Aguida B, Jourdan N, Buddhachat K, Pooam M. <u>Cryptochrome and quantum biology: unraveling the mysteries of plant magnetoreception.</u> Front Plant Sci. 2023 Oct 4;14:1266357; Maffei ME. <u>Magnetic field effects on plant growth, development, and evolution.</u> Front Plant Sci. 2014 Sep 4;5:445. doi: 10.3389/fpls.2014.00445. PMID: 25237317; PMCID: PMC4154392; Lee, S., Oh, MM. <u>Electric field: a new environmental factor for controlling plant growth and development in agriculture. *Hortic. Environ. Biotechnol.* 64, 955–961 (2023). https://doi.org/10.1007/s13580-023-00525-y</u>

³² Jérémy S. P. Froidevaux, Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park <u>Addressing</u> <u>Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action</u> Environmental Science & Technology Letters