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The English version is a summary of the more extensive situation report bulletin in Finnish.

Situation Report Bulletin on Animals Exposed to Power Lines



Situation Report on Animals Exposed to Power Lines / 2016 – published 17 February 2016

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No. 01

Editorial

This situation report on power lines and animals was initiated in a Board discussion in which a regular situation report bulletin was reviewed prior to its publication. The question of potential effects of power lines on animals keeps coming up from time to time, and we found



that, at least in Finnish, not much has been published on this topic. This gave us the idea to compile a special situation report dedicated to studies on animals.

The studies summarized in this bulletin focus exclusively on animals exposed to power lines, with all other animal-related studies left out of consideration. Emphasis was put on recent studies, and a variety of database searches were carried out to achieve extensive coverage. More time was spent on this than usual, as the search spanned a time period of a considerable number of years.

One result of the search was the 2015 Anses report “Conséquences des champs électromagnétiques d’extrêmement basses fréquences sur la santé animale et les performances zootechniques” (Avis de l’Anses, Rapport d’expertise collective). This report is available online for free.

The first paper in this bulletin discusses bee hives in the vicinity of power lines. It reviews a number of previous studies and draws conclusions based on the findings. The Finnish guidelines recommend that bee hives should be located at the edge of a right-of-way. Also, hives reinforced with metal should, where necessary, be provided with electric-field shielding in the form of wire mesh connected to the ground.

The article on bees is followed by several on dairy cows, investigating, for example, milk production in pregnant and non-pregnant cows, and hormone levels. The last article looks at the effects of extremely low-frequency magnetic fields on the seasonal variation of melatonin levels in calves. In Finland, there are no restrictions imposed, with regard to electromagnetic fields, on grazing in the vicinity of power lines.

For me, the scientific papers we found for this situation bulletin on animals are all quite interesting, even more so because many of the studies involved experiments in real-world conditions. Studies on power lines are focused on humans rather than animals, but a convenient and sufficient number of papers, especially on dairy cattle, could be found to provide a good overview of the topic. Articles have been published before about other animals as well, such as horses and sheep, but these were not included this time, to keep the emphasis on the most recent studies.

I hope you enjoy reading this summary in English!

Leena Korpinen
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The Finnish situation report bulletin includes summaries of the following publications, preceded by the editor-in-chief’s comments.



No. 02

How Far Should Bees Be Located from High-Voltage Power Lines?

Editor-in-chief's comment: This paper summarized the results of a number of studies on the effects of electromagnetic fields on the behavior and physiology of bees. Field exposure seemed to affect the nervous system of bees, causing abnormal behavior, agitation, and irritability. The author, therefore, suggested that the standard protection distances from power lines, specifying the area within which humans and domestic animals are forbidden to stay constantly, should obligate honeybee colonies as well.

Source:

Lipinski Z. How far should bees be located from the high voltage power lines? *Journal of Apicultural Research* 45 (2006) 240–242.

No. 03

Blood Melatonin and Prolactin Concentrations in Dairy Cows Exposed to 60 Hz Electric and Magnetic Fields

Editor-in-chief's comment: The research group conducted two experiments to investigate the effects of electromagnetic fields on the endocrine responses of dairy cattle, focusing on blood melatonin and prolactin concentrations. The results provided some support for the hypothesis that field exposure may affect the endocrine functions of dairy cows and modify their response to photoperiod. The authors suggested that their findings make interesting topics for further studies.

Source:

Rodriguez M, Petitclerc D, Burchard JF, Nguyen DH, Block E. Blood Melatonin and Prolactin Concentrations in Dairy Cows Exposed to 60 Hz Electric and Magnetic Fields During 8 h Photoperiods. *Bioelectromagnetics* 25 (2004) 508–515.

No. 04

Effects of Exposure to Extremely Low-Frequency Electromagnetic Fields on Circadian Rhythms and Distribution of Some Leukocyte Differentiation Antigens in Dairy Cows

Editor-in-chief's comment: This study was carried out to investigate the health effects of extremely low-frequency electromagnetic fields by focusing on some leukocyte differentiation antigens in dairy cows. Based on the results, the authors suggested that exposure to electromagnetic fields may induce abnormal temporal variation and distribution of some hematological and immunological parameters. They also suggested that the results could be useful in the development of new study protocols.



Source:

Stelletta C, De Nardo P, Santin F, Basso G, Michielotto B, Piccione G, Morgante M. Effects of Exposure to Extremely Low Frequency Electro-magnetic Fields on Circadian Rhythms and Distribution of Some Leukocyte Differentiation Antigens in Dairy Cows. *Biomedical and Environmental Sciences* 20 (2007) 164–170.

No. 05

Plasma Concentrations of Thyroxine in Dairy Cows Exposed to 60 Hz Electric and Magnetic Fields

Editor-in-chief's comment: The research group carried out experiments to assess the effects of electromagnetic fields on blood thyroxine in dairy cows. The different exposure treatments produced mixed results. The researchers concluded that the observed day-dependent variation in thyroxine levels could not be attributed to electromagnetic fields in this study.

Source:

Burchard JF, Nguyen DH, Rodriguez M. Plasma Concentrations of Thyroxine in Dairy Cows Exposed to 60 Hz Electric and Magnetic Fields. *Bioelectromagnetics* 27 (2006) 553–559.

No. 06

Responses of the Estrous Cycle in Dairy Cows Exposed to 60 Hz Electric and Magnetic Fields

Editor-in-chief's comment: The research group carried out experiments to assess the effects of electromagnetic fields on the estrous cycle of dairy cows. The researchers concluded that exposure to electromagnetic fields may have an impact on the duration of the estrous cycle, while the mechanisms behind the increased duration are not understood. Also, they speculated that the experimental conditions may have played a role in the results.

Source:

Rodriguez M, Petitclerc D, Burchard JF, Nguyen DH, Block E, Downey BR. Responses of the estrous cycle in dairy cows exposed to electric and magnetic fields (60 Hz) during 8-h photoperiods. *Animal Reproduction Science* 77 (2003) 11–20.

No. 07

Effect of 10 kV, 30 μ T, 60 Hz Electric and Magnetic Fields on Milk Production and Feed Intake in Non-pregnant Dairy Cattle

Editor-in-chief's comment: The research group carried out experiments to assess the potential effects of electromagnetic fields on milk production in dairy cattle. The experimental conditions were similar to those encountered by dairy cattle standing continuously under a



735 kV power line. According to the researchers, field exposure resulted in an average decrease of just below 5% in milk yield and an increase of approximately the same amount in dry matter intake.

Source:

Burchard JF, Monardes H, Nguyen DH. Effect of 10 kV, 30 μ T, 60 Hz Electric and Magnetic Fields on Milk Production and Feed Intake in Nonpregnant Dairy Cattle. *Bioelectromagnetics* 24 (2003) 557–563.

No. 08

Effect of 60 Hz Electric and Magnetic Fields on Production, and Levels of Growth Hormone and Insulin-Like Growth Factor 1, in Lactating, Pregnant Cows

Editor-in-chief's comment: According to the research group, previous studies had shown that dry matter intake and milk production increase in dairy cattle in response to long photoperiods. Since exposure to electromagnetic fields has been shown to suppress the release of melatonin in some species, it was hypothesized that the effects of field exposure would resemble those of exposure to long days. The researchers observed an increase in dry matter intake and IGF-1 during exposure, while there appeared to be no effect on the components of milk and no immediate effect on milk yield.

Source:

Rodriguez M, Petitclerc D, Nguyen DH, Block E, Burchard JF. Effect of Electric and Magnetic Fields (60 Hz) on Production, and Levels of Growth Hormone and Insulin-Like Growth Factor 1, in Lactating, Pregnant Cows Subjected to Short Days. *Journal of Dairy Science* 85 (2002) 2843–2849.

No. 09

Exposure of Pregnant Dairy Heifer to 60 Hz, 30 μ T Magnetic Fields

Editor-in-chief's comment: Since the observed effects of field exposure on the hormone levels of dairy cattle cannot reportedly be attributed to electric fields, this research group focused on magnetic fields. Based on the results, exposure to magnetic fields produces only slight effects. According to the researchers, the absence of abnormal clinical signs and the absolute magnitude of the significant changes under the experimental conditions of this study make it plausible to preclude any major animal health hazard.

Source:

Burchard JF, Nguyen DH, Monardes HG. Exposure of Pregnant Dairy Heifer to Magnetic Fields at 60 Hz and 30 μ T. *Bioelectromagnetics* 28 (2007) 471–476.



No. 10

Lack of Effect of 10 kV/m, 60 Hz Electric Field Exposure on Pregnant Dairy Heifer Hormones

Editor-in-chief's comment: The research group carried out experiments to assess the effects of electric fields on heifer hormones. Exposure to electric fields did not seem to cause any variation in the experimental variables, with the exception of melatonin. As there was, however, inconsistency in the melatonin response, with a decrease observed in one experiment, an increase in another, the researchers stressed that caution should be exercised in the interpretation of the results.

Source:

Burchard JF, Nguyen DH, Monardes HG, Petitcherc D. Lack of Effect of 10 kV/m 60 Hz Electric Field Exposure on Pregnant Dairy Heifer Hormones. *Bioelectromagnetics* 25 (2004) 308–312.

No. 11

Effect of Exposure to Extremely Low-Frequency Magnetic Fields on Melatonin Levels in Calves is Seasonally Dependent

Editor-in-chief's comment: The authors investigated the effects of magnetic fields on melatonin levels in calves to find a potential link to childhood leukemia.

Source:

Kolbabová T, Malkemper EP, Bartoš L, Vanderstraeten J, Turčáni M, Burda H. Effect of exposure to extremely low frequency magnetic fields on melatonin levels in calves is seasonally dependent. *Scientific Reports* 5, Article number 14206 (2015).

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