

News Editor: Medical, Health, and Agricultural Interests.

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### **Immune System of Cows Impaired by Electric and Magnetic Fields**

Cows exposed to electric and magnetic fields (EMF) had lower melatonin and higher progesterone in blood than when not exposed according to Dr. Javier A. Burchard, Veterinarian and Professor of Animal Science at McGill University. Dr. Burchard presented his findings in a report on "Electric and Magnetic Field Research at McGill University" Sainte-Anne de Bellevue, Quebec, Canada. The report is in Proceedings from a conference "Stray Voltage and Dairy Farms" at Camp Hill, Pennsylvania, April 9-11, 2003. The proceedings are available from Natural Resource, Agriculture, and Engineering Services (NRAES) Cooperative Extension Service, P.O. Box 4557, Ithaca, New York.

Melatonin is a hormone produced by the pineal gland located in the area of the brain. It provides oncostatic benefits (inhibits cancer); provides immunological assistance as a bacterial endotoxin inhibitor; and it has strong antioxidant properties as a scavenger of free radicals in the blood. Dr. Burchard acknowledged that they had reported no change in blood melatonin in an earlier report but reexamination of the data indicates EMF had a significant effect in cows and heifers.

In the Canadian experiment cows were exposed to electric and magnetic fields for 28-day periods. The intensity of the electric fields was 10 kV/m and the magnetic field was 30 microTesla, which the researchers said is equivalent to cows standing under a 735,000 Volt (735 kV) transmission line carrying a maximum load of 2000 amperes of current.

Exposure to EMF caused other physiological effects to the cows: (1) Fat content of milk increased, while milk yields were not different from cows exposed for 28 days. (2) Dry matter intake of exposed cows was higher than of cows not exposed to EMF. (3) A hormone IGF-1 (Insulin-like Growth Factor) increased in cows exposed to EMF. This increase is consistent with the hypothesis of EMF inhibition of melatonin secretion, since changes in melatonin may directly influence IGF-1 secretion, according to the report. (4) Growth hormone (GH) mean concentrations in blood were not different. However, a treatment by hour interaction was observed. For the first 16 hours of the sampling period, GH concentrations were generally lower for the exposed group, whereas, for the last 8 hours GH was higher in the exposed cows, indicating an influence on the timing of changes observed in GH concentrations over a 24-hour cycle. (5) Cows exposed to EMF gained more body weight than cows not exposed. The increase in body weight may be attributed to increased dry matter intake. However, increased IGF-1 may have influenced the change in body weight by causing a shift in energy or protein metabolism. (6) Progesterone concentrations of blood were higher in lactating pregnant cows exposed to EMF. (7) Estrus cycles were longer when cows were exposed to EMF (Controls 22.0 days, EMF 25.3 days) suggesting a possible relationship to reproductive efficiency. (8) The mineral elements magnesium decreased, while calcium and phosphorus increased in blood of cows exposed. (9) Concentrations of iron and manganese decreased in cerebrospinal fluid (CSF) of cows exposed to EMF. (10) Quinolinic acid (a protein) significantly increased, and a trend toward an increase in tryptophan in CSF occurred when cows were exposed to EMF. These findings were consistent with a marginal weakening of the blood-brain barrier due to 60 Hertz EMF exposure, according

to the investigators.

Intensity of electric fields in the McGill experiments (10 kV/m) were lower than on dairy farms in Wisconsin, Michigan, and Minnesota where investigators found 60-Hertz E-fields averaged 11.7 kV/m and ranged from 7.8 to 15.3 kV/m measured for periods up to 204 days. Maximum intensities ranged from 14.7 to 36.9 kV/m on farms where behavior and milk production of cattle were affected by EMF from transient and harmonic voltage or current produced within utility company circuits and carried to farms on power lines.

These radiation effects conflict with claims by utility experts that so-called "stray voltage" affects cows only if the cow is shocked by touching electrically charged metal such as water bowls or pipes, stall dividers, stanchions, milk lines, or metal feeding equipment. The Canadian experiments show that radiation effects occurred by electrons passing through the air, since the cows were not touching metal conductors.

The Michigan Public Service Commission (MPSC) dismissed a complaint (November 25, 2003) brought by the Attorney General of Michigan against Consumers Energy in which the Attorney General alleged that stray voltage in rural areas of Michigan has been adversely affecting the health and milk production of dairy cattle.

The MPSC determined that the scientific evidence and expert testimony presented by the parties was inconclusive on factual issues, so that it could not make findings as to whether the utility's electric distribution facilities are causing stray voltage to be present in quantities sufficient to impair farm livestock.

The MPSC, however, also determined that the potential for harm was significant enough to justify further examination of these issues. Therefore, the MPSC is opening a new docket in case No. U-13934. In the new docket the MPSC is soliciting comments due April 1, 2004 and reply comments regarding whether it should promulgate new stray voltage standards that would be applicable to all electric utilities in Michigan.