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Conspicuous behavioural abnormalities in a dairy cow herd near a TV and Radio transmitting antenna

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SUMMARY: In addition to a considerable reduction of milk yield and increasing occurrences of health problems, behavioural abnormalities that have not yet been examined, have been observed over the last two years in a herd of dairy cows maintained in close proximity to a TV and Radio transmitting antenna. The evaluation of possible factors which could explain the abnormalities in the livestock did not disclose any factors other than the measurable high-frequency electromagnetic fields. An experiment in which a cow with abnormal behaviour was brought to a stable in a different area resulted in normalisation of the cow within five days. The symptoms returned, however, when the cow was brought back to the stable in close proximity to the antenna in question. In view of the previously known effects of electromagnetic fields it may be possible that the observed abnormalities are related to the electromagnetic field exposure.

Key words: transmitting antennas, electromagnetic fields, milk yield, behaviour, cow.

Introduction

Because of the ubiquitous usage of electric power and the increasing spread of high-frequency transmitters for mobile communication and TV & Radio broadcasting, humans and animals in highly industrialized countries are these days exposed to electrical and magnetic fields to a degree which exceeds the natural tension levels of relevant fields by a magnitude and presents a new influencing quantity in the evolutionary history of humans and animals (Katalyse 1994). For a long time the possibility of an influence of weak electrical and magnetic fields on the well-being of humans and animals has simply been ignored. The limits were only relating to acute cases of health impairment which can occur at some workplaces under extremely high exposure rates. The ever increasing knowledge of the biological effects of even weak electrical and magnetic fields as well as numerous epidemiological studies with the focus on a possible increase in the risk of cancer through field exposure have, however, led in the last ten to fifteen years to an altered discussion of the possible risk potential of such fields (Adey 1993; Hendee and Boteler 1994; Katalyse 1994; Meinert and Michaelis 1996; Robert 1993; Savitz 1995; Shaw and Croen 1993; Sobel et al. 1996; Wertheimer and Leeper 1994). As one can be protected well from electrical fields in contrast to magnetic fields, the effects of such fields on human and animal health are rarely the focus of scientific research. In comparison, low-frequency magnetic fields can practically penetrate any matter without being slowed down, and high-frequency electromagnetic fields and waves can cause biological effects - even in greater distance from their source - which are possibly connected to health risks (Katalyse 1994). Fields of this type which are a necessity of civilisation and have certain health effects are commonly known as "Electrosmog".

The question of a possible risk of cancer which today cannot be discounted mainly because of numerous findings based on experiments with animals (Liburdy and Löscher 1997;

Löscher and Mevissen 1994), occupies the foreground of public debate about possible health risks through exposure to low-frequency magnetic or high-frequency electromagnetic fields. In addition, there are extensive indications of interactions of magnetic fields with the hormonal balance, biorhythm, immune system, nervous system, behavioural patterns and psychological functions, interactions which can have a detrimental effect on health (Katalyse 1994; Liburdy u. Löscher 1997; Löscher u. Liburdy 1998). In this connection it is often forgotten that not only humans but also pets and farm animals who are exposed can suffer such impairments to their health because of field exposure, for example in the vicinity of high tension pylons or transmitting antennas (Marks et al. 1995). Similarly to epidemiological studies on humans with field exposed workplaces the risk of breast cancer for hundreds living in apartments with high flux densities of low-frequency (60 Hertz) magnetic fields was seven times higher in comparison with animals that were not exposed (Reif et al. 1995), a finding that can be explained by the "Melatonin Hypothesis" of magnetic field effects (Löscher and Mevissen 1997).

A series of earlier studies looked at the effect of magnetic fields on farm animals. Lee et al. (1997) discovered that sheep which had been grazing in close proximity to a high tension mast, showed an impaired immune system. Examinations of dairy cows that had been exposed to magnetic fields resulted in inconsistent findings which ranged from no influence at all to a reduction in milk yield, changed milk composition and fertility problems (Algen and Hultgren 1985a, b, 1987; Amstutz and Miller 1980; Angell et al. 1990; Burchard et al. 1996; Marks et al. 1995; Martin et al. 1986). The predominant share of the examinations on dairy cows was conducted under exposure to low-frequency (50 or 60 Hertz) fields, whereas only few studies deal with the effect of high-frequency electromagnetic fields, for example in the vicinity of transmitting antennas.

A recently publicized study discovered a significant increase of micronuclei in erythrocyte in the blood of cattle grazing on a farm near a transmitting facility. This is an indication of a genotoxic effect of the exposure (Balode 1996).

In the case described by this study a farmer asked a veterinary department for help after he had experienced major problems with his herd of dairy cows since the previous year. The farm is situated in close proximity to a transmitting tower with several transmitters (see Table 1 and Figure 1). The problems with the herd described in the following started after several transmitters for mobile radio communication had been installed in addition to the already existing TV transmitting antennas. As the farmer himself and his family were experiencing considerable health problems since the additional transmitters were installed, and none of the medical tests conducted had shed any light on the source of these health problems, the farmer came to the conclusion that the high-frequency electromagnetic fields that were produced by these transmitters had to be the cause of the problems including the problems experienced by his dairy cow herd. The relevant veterinary department then conducted observational studies and research which were complemented by measurements of the electromagnetic fields, with its focus on the dairy cow herd.

Table 1: Transmitting antennas in close proximity of the farm (all installed in the TV tower of Figure 1)

Transmitting Antenna	Frequency	Performance
39 directional radio transmitters (Mean)	2.2 – 18.7 GHz	124 W
C-Net	461 MHz	34 W
D-Net	935 MHz	25 W
B-Net	160 MHz	20 W
Cityruf	460 MHz	50 W
Eurosignal	87,361 MHz	2 kW
TV-Channel 2	510 MHz	20 kW
TV-Channel 3	734 MHz	20 kW
Modacom	427 MHz	15 kW

Ground Plan for Measurements outdoors

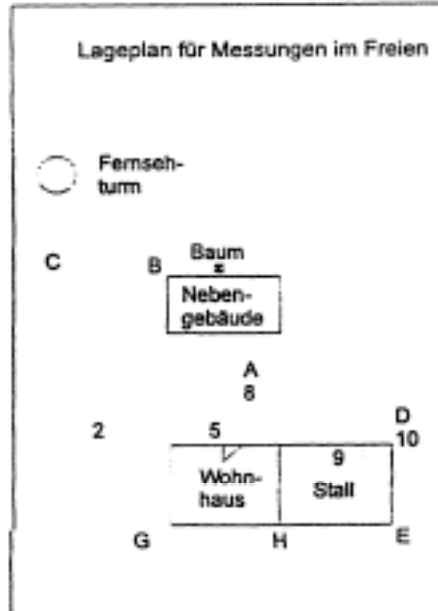


Figure 1: Ground plan for the measurements of electromagnetic fields in the vicinity of the transmitting antennas (for examples re the measurements see Table 2 and 3).

Observations of the dairy cow herd

Many of the biological effects and discussed health risks of electromagnetic fields are similar to the effects of chronic stress pressure (Blank 1995; Smith 1996). Apart from apparent problems caused by stress such as increased aborting without detectable causes, frequent fertility disorders in the form of an acyclic tendency and reduction in milk yield all of which have already been observed in herds grazing in close proximity to high tension lines (see overview in Burchard et al. 1996), the following abnormalities occurred in the affected dairy cow herd:

Most of the cows in this herd displayed conjunctivitis with heavy flood of tears (continuously wet cheeks) and itching (some cows rubbed their eye areas continuously against items in the stable within reach as well as against neighbouring cows).

Several animals were pushing their heads against the chest area of neighbouring cows turning their heads in the same direction (away from the transmitting antenna). One cow showed very conspicuous behaviour by shuffling backwards and forwards moving her head continuously (Weaving). Resting phases alternated with the described behaviour which often lasted more than 30 minutes.

Cows in calf as well as dry cows that were put out on pasture land close to the farm, only grazed for a few minutes each time then taking "cover" from the transmitting tower in or behind an outbuilding.

Cows that have calved three or four times showed rapid decline. When these cows tried to get up their hind legs showed trembling and over time they found getting up increasingly difficult. The decline continued and led to their death after only a few weeks.

Conducted Examinations

1. Fodder analysis and feeding calculation

To exclude that a feeding fault had caused any metabolic disorders which in turn could be responsible for causing other health problems, a fodder analysis and feeding calculation was initiated by the relevant agricultural authority. The research and calculation yielded that the fodder was of high quality and that the amount of feed stuffs administered by the farmer was in relation to the performance of the dairy cows.

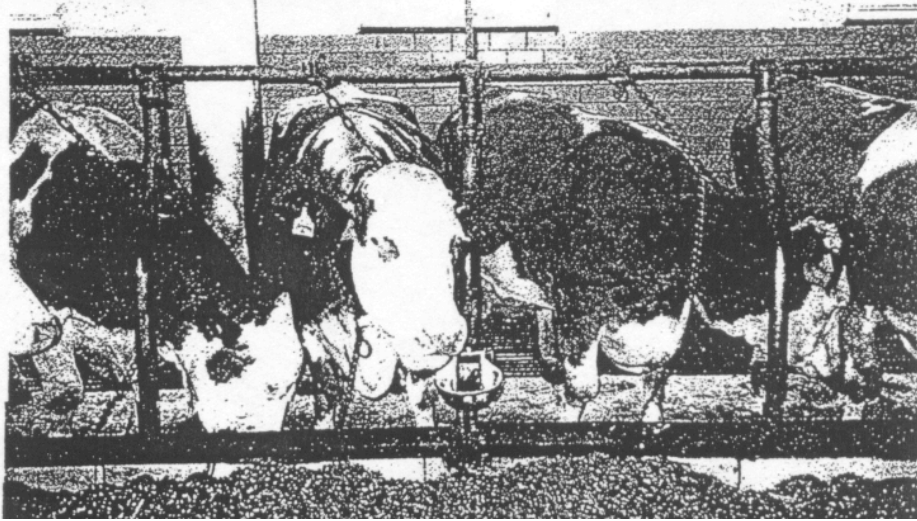


Figure 2: Typical turning of the head (away from the transmitting antennas) displayed by cows of the herd in question (see detailed description in text).

2. Autopsy of a perished dairy cow

The autopsy of a four-year-old cow that had died in the stable building and had previously displayed symptoms of the same illness as described above, provided the following result: Death from acute heart & circulatory collapse with bleeding from several organs. No indication as to the cause, in particular no acute or chronic inflammatory changes to organs. The autopsy was kindly performed by Dr. Geisel, Institute of Animal Pathology at the University of Munich.

3. Examination of aborted foetal material

The examination of aborted foetal material at the Landesuntersuchungsamt für das Gesundheitswesen Südbayern (Federal Examination Authority for the Health Service of Southern Bavaria) did not disclose any indication of pathogenic causes for aborting the foetus based on the microscopic and cultural examination and on the serological tests performed.

4. Switching stables

To obtain further indications with regard to the causes for the behavioural changes the dairy cow which displayed very obvious changes in behaviour and which was described under 3 in the section Observations of the dairy cow herd, and another dairy cow were separated from the original herd and joined another dairy cow herd in an identically partitioned stable which was approx. 20 kilometres away from the original location. After five days in the new stable the affected dairy cow did not show any of the conspicuous behavioural abnormalities any more. Both cows were relocated to the original stable after approximately two weeks. The previously affected cow displayed the described conspicuous behavioural abnormalities again after only a few days.

5. Measurement of the electromagnetic fields

Measurements of the electromagnetic fields in front of and on the farm property itself were conducted by the Bundesamt für Post und Telekommunikation (Federal Office for Postal Services and Telecommunication) and by the Abteilung für Elektronik und Radar der Universität der Bundeswehr München (Department of Electronics and Radar of the University of the German Federal Armed Forces in Munich). The most important results of these measurements are displayed in Table 2 and 3. The measurement values are considerably below the limits set out in the 26. Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über elektromagnetische Felder; 26. BImSchV) (26. Ordinance/Decree** for the Implementation of the Federal Air Pollution Laws (Ordinance/Decree for electromagnetic fields; 26. BImSchV (Abbreviation for 26th Bundes-Immissionsschutzgesetz)) dated 16. December 1996.

Discussion

The health disorders and behavioural abnormalities described in this paper as well as the results of the conducted examinations point to the electromagnetic tension as the cause of the occurrences in the affected herd of dairy cows. The main problem in conducting an definitive assessment is the constant change in circumstances/ conditions because the farmer is forced to continue to run his farm and to keep the losses as small as possible. Therefore he tries to have cows which display the first signs of being affected such as worsening general condition after calving, either slaughtered early or taken to alternative grazing paddocks which are situated about 10 kilometres away from his farm. The relocation and exchange of dairy cows continuously creates a new situation because every cow reacts to the electromagnetic tension in an individual manner. Only a scientifically structured test of the affected dairy cow herd with set parameters could provide more definite findings in this case. Such a test of the affected herd is planned to clarify the causes of the observed behavioural abnormalities and health problems further. A causal relation could best be determined in this case by switching off the transmitting antennas for the mobile radio communication temporarily.

Table 2: Measurements of the electromagnetic field output in the attic storey of the farm house

Attic window	Frequency	Signal	Level (dBm)	Power density ($\mu\text{W}/\text{cm}^2$)
closed	512.2	TV-2	- 12.8	0.044
closed	464.2	C-Network	- 43	0.00003
closed	936.2	D-Network	- 46.8	0.000051
closed	735.7	TV-3	- 15.8	0.04
open	511.4	TV-2	- 13.2	0.035
open	735.7	TV-3	- 7.6	0.26

Table 3: Measurements of the electromagnetic field output at different sites in the vicinity of and in the stable and living area (see Figure 1 for the measurement locations). The measurements were predominantly conducted at one frequency (512 MHz) because all other signals can be put in relation to the measurements inside the farm house (see Table 2) if we assume that the attenuation values through the wall of the building will not differ much within the relatively narrow frequency band (see Figure 1).

Measurement	Location	Frequency (MHz)	Level (dBm)	Power density ($\mu\text{W}/\text{cm}^2$)
In the stable	Entrance (10)	512	- 9.6	0.08
In the stable	Middle part	512	- 24	0.003
In the stable	Rear part	512	- 26	0.002
Surrounding area	A	512	- 10.6	0.06

Surrounding area	B	512	0	0.7
Surrounding area	C	512	- 3.2	0.35
Surrounding area	F	512	- 10.8	0.06
In front of stable	D	512	- 3.8	0.36
Beside the stable	E	512	- 22.4	0.004
Beside the house	G	512	- 2	0.46
Behind the stable	H	512	- 13.4	0.03
Inside the house		735.7	- 15.8	0.04
In front of the house	5	88.8	- 4.8	0.006

Should the scheduled examination confirm the correlation described above between exposure to magnetic fields and health disorders or behavioural abnormalities then this would provide further indications that the limits set out in the 26. BImSchV (Abbreviation for 26th Bundes-Immissionsschutzgesetz = 26th Federal Air Pollution Laws) are too high and require correction (see Karus u. Nießen 1996). In this case one has to take into consideration that even though the measurements for the different electromagnetic fields turned out to be below the limits set out in the 26. BImSchV, interactions between the fields when animals and humans were exposed to them cannot be excluded because of the multitude of existing fields with different frequencies. Synergic interactions between electromagnetic fields with different frequencies have already been described on a cellular level (Löscher and Liburdy, 1998) and should not be neglected in future discussions regarding any limits of this kind.

After the above case had been published by the media and agricultural magazines more farmers have come forward describing similar cases. The above case description is mainly intended to alert the Veterinary Association to the obvious possibility of behavioural abnormalities and health problems caused by electromagnetic field exposure of animals.

Expression of Thanks

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