CONTINUOUS EXPOSURE OF CHICKS TO ELECTROMAGNETIC FIELDS

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Abstract

Homogeneity trials indicate that growth depressions previously reported on chicks exposed to a UHF field are from controlled environmental conditions. Measurements of power density support previous hypotheses that the observed biological responses from exposure to the UHF field resulted from "non thermal" effects.

Introduction

Growth depression in chicks [1]-[3] and in rats [4] due to the exposure to continuous low level electromagnetic radiation at a frequency of 880 MHz and at a frequency of 260 MHz has been previously reported [5]. Similar biological responses were also observed in chicks continuously exposed to electric or magnetic fields at 60 Hz and 45 Hz [6], [7]. Results of these experiments are summarized and additional findings are reported.

Objectives and Results

Much evidence has been presented to show that treated and control groups in all of these experiments have been kept in nearly identical environments. This evidence, however, has not been sufficient to positively eliminate the possibility that observed biological responses may have resulted from causes other than exposure to the various fields. A homogeniety trial was designed to determine if the biological responses previously observed were the result of exposure to the various fields used. Positive results were obtained.

Measurements on power density were obtained in the UHF exposure facility operating at a frequency of 915 MHz [8]. The same applied power as that used in the exposure experiments resulted in a calculated input average power density of 33 $\mu W/cm^2$. Survey of the field inside the unloaded exposure facility (with no chicks) indicated the predominance of a TE_{10} mode. The calculated input power density at the center of the cage when only a TE_{10} mode is present should be twice the average power density, that is, 66 $\mu W/cm^2$. For 100% reflection from the metallic floor of the cage, the electric field at a maximum position of the standing wave should be twice that of the incoming wave. For a non-perturbing power density meter, with indications proportional to the square of the electric field, the power density measured at this position should be four times that of the incoming wave, or 264 $\mu W/cm^2$. Measurements with an unloaded system (no chicks) yielded a value of approximately 550 $\mu W/cm^2$, only twice that anticipated by the calculations. This difference could be attributed to either imprecision in measurements, or to some very low-Q resonance of the system.

Power density measurements with concentrated and spread loading (with day-old chicks) were also obtained. These results have shown that the measured power density decreases in proportion to the loading. With spread loading, for example, the maximum power density at the center of the cage was approximately 250 $\mu W/cm^2$. Waterer and feeder location and shape may also have an influence in the field distribution inside the cage. They could have been responsible for the "hot spot" observed at the center of the cage at a height of 9.5 cm from the floor. The power density at this point was found to be equal to 900 $\mu W/cm^2$, more than ten times smaller than the safe power density level of 10 mW/cm^2. This was the only position inside the exposure facility where the field was found to be substantially higher than the typical value of 500 $\mu W/cm^2$.

Conclusion

Because the power levels measured are much below the safe level of 10 mW/cm^2, which was based on thermal effects, it is concluded that the observed growth depression resulted from "non thermal" biological responses.

Acknowledgement

The authors are greatful for the kind assistance offered by Dr. J. W. Frazer and Dr. A. E. Gass from Brooks Air Force Base, Texas, in obtaining the power density measurements.

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8. These measurements were obtained with an Electromagnetic Leakage Monitor Surveyor, Narda 8100.