A UBIQUITOUS POLLUTANT

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ABSTRACT

High frequency voltages present on the electrical power wires in homes, offices, schools and factories should be considered a potential pollutant. An inexpensive and simple to use instrument is described for measuring these voltages.

The letter of May 4, 1999, by Kenneth Olden which accompanied the *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields (1)* contains the following paragraph:

The lack of connection between the human data and the experimental data (animal and mechanistic) severely complicates the interpretation of these results. The human data are in the "right" species, are tied to "real life" exposures and show some consistency that is difficult to ignore. This assessment is tempered by the observation that given the weak magnitude of these increased risks, some other factor of common source of error could explain these findings. However, no consistent explanation other than exposure to ELF-EMF has been identified.

This report suggests that the "some other factor" is high frequency currents, i.e., much higher frequency than the power line frequency. High frequency voltage can cause currents to flow in humans by direct contact, or by capacitive coupling capacitive coupling. The effects on humans will depend on the magnitude, wave form, duration, and path taken through the body. The voltage causing these currents should be considered a pollutant.

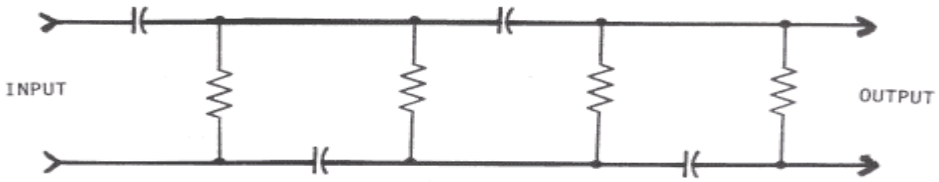
The presence of a pollutant is often obscured by the presence of much larger quantities of non-pollutants. Low level high frequency voltages are often obscured by the large power frequency voltages, but low level high frequency voltage compared to the power line voltage does not imply that they do not cause detrimental health effects in humans.

It is always a problem as to where to measure a pollutant such as high frequency electric fields. An instrument has been developed to do a very simple measurement. The measured voltage is that present at the standard household electrical outlet. A filter (Figure 1) is used to remove the power line frequency and its harmonics. The remaining voltage is applied to an RMS digital voltmeter. The frequencies that are measured are determined by the filter and the characteristics of the meter. The FLUKE 79 III meter responds to frequencies above 10,000 Hz. The voltage amplitude measured will be that present on wires and electrical equipment in that home, office, school or factory. *(2)* The amount capacitively coupled to a human will depend on many variables, but a larger voltage at the outlet will result in larger currents in the humans. The high frequency voltage originates in modern electrical equipment, particularly high efficiency electrical equipment. The level of this high frequency voltage will vary with what electrical equipment is on at that location and with the time of day, due to the varying load on the electrical utility system which also contributes to this pollution.

Experiments are being performed to improve the design of this instrument and the interpretation of the readings.

If the effect on humans is caused by the high frequency voltages and currents, it would be important that the experiments with 60 Hz voltages and currents use voltages and currents that are not contaminated with these high frequencies.

FILTER



INPUT from Ubiquitous AC Outlet

OUTPUT to FLUKE 79 III meter set to VOLTS AC

All capacitors are .01 microfarad

All resistors are 10 kilohm

Figure 1

Footnotes

(1) *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. Prepared in Response to the 1992 Energy Policy Act (PL 102-486, Section 2118)*, National Institute of Environmental Health Sciences, National Institutes of Health Publication No. 99-4493.

(2) Exploratory measurements of this voltage varied from tens of millivolts to hundreds of millivolts. The voltage induced by a two milligauss 60 Hz magnetic field passing through a one square meter area is less than 0.1 millivolt.

References

[1] Donald G. Fink and H. Wayne Beaty, editors. *Standard Handbook for Electrical Engineers*, 13th Edition, McGraw-Hill, 1993.

[2] Charles Polk and Eliot Postow, editors. *Handbook of Biological Effects of Electromagnetic Fields*, 2nd Edition, CRC Press, 1996.

[3] J. Patrick Reilly, Applied Bioelectricity: From Electrical Stimulation to Electropathology. Springer-Verlag New York, Inc., 1998.