INTRODUCTION

The concept of dirty electricity has been the focus of studies with respect to its possible association with certain diseases, for example cancer and diabetes [Milham and Lloyd Morgan (2008)] [Havas (2008)]. Yet, there is no definition of the term dirty electricity in the electrical engineering literature, although it has been suggested by some to be transient voltages on electrical wires occurring in the frequency range 4–100 kHz. The instrument offered to measure dirty electricity is the Graham-Stetzer Microsurge meter, which gives readings in Graham-Stetzer Units (GSUs). Unfortunately, no derivation of the GSU is provided by the manufacturer of the instrument in terms of other scientific units, making interpretation of the GSU difficult. Obviously, since dirty electricity is a voltage on the wires, it would be of interest to know what a GSU reading represented in terms of ambient fields in the home since this is the only mechanism for these voltages to interact with the human body (other than through direct contact with the wires, which would result in electric shock).

MATERIALS AND METHODS

A GS Microsurge meter was modified to power from an external supply allowing operation independent of the mains (normally the meter powers itself from the mains). This allowed the meter to be characterized in terms of its response to sinusoidal voltages of different amplitudes and frequencies. A calibration chart was constructed to give the number of millivolts required to produce a given GSU reading for selected frequencies in the range 4-100 kHz. To illustrate the use of this chart, the case of a 13 W Compact Fluorescent Lamp (CFL) was chosen. Electronically ballasted CFLs operate at frequencies within the stated range of the GS meter and usually provide ample GSU readings. Measurements of the dirty electricity produced by the CFL were made in 2 separate homes, in a number of rooms. For the two homes in question, all appliances were turned off and GSU readings were taken with and without the CFL operating.

In order to relate the dirty electricity voltages to ambient fields, laboratory measurements of the electric field generated by standard 14 gauge house wiring were made at a nominal frequency used by CFL ballasts but at larger voltage amplitudes to make the measurements easier. In addition, the CFL itself gives rise to an electric field at the ballast frequency originating from the gas discharge. This field was measured in the laboratory and used for comparison with the dirty electricity-generated fields.

RESULTS

The GS Microsurge meter consists of a digital millivolt meter whose input is preceded by a high pass filter followed by a peak detector. The high pass filter operates in its 6 dB per octave slope over the 4-100 kHz band. Thus a GSU reading will be related to both the
amplitude and frequency of the input signal as shown in the GSU calibration chart in Fig.1 (each line corresponds to a different frequency thus indicated).

Dirty electricity measurements in two separate homes with the 13 W CFL gave a worst case reading of 650 GSU at a ballast frequency of 54 kHz. This translated to a value of approximately 75 mV of dirty electricity on the house wiring. Measurement of electric field versus distance generated by a 2.44 m length of 14 gauge/2 conductor electric cable, excited by 1 V at 50 kHz, is shown in Fig.2. At a distance of 20 cm from the cable, the dirty electricity-generated electric field caused by 75 mV is approximately 0.45 V/m per V multiplied by 0.075 V or 0.034 V/m. The E-field attenuates with distance as in Fig. 2 and would probably be further reduced by the partial shielding effect of drywall in the home. The electric field produced by the gas discharge in the CFL was measured to be 34.5 V/m at a distance of 20 cm from the lamp with an inverse square attenuation rate with distance. When extrapolated to further distances, the electric field strength produced by the gas discharge exceeds the 20 cm dirty electricity-generated fields from the cable at all distances up to 5.5 m from the lamp.

**CONCLUSIONS**

In the case of CFLs, dirty electricity voltages on house wiring are in the millivolt range and have the same frequency as the ballast signal. The electric fields produced by the dirty electricity voltages on the house wiring are small in comparison to the electric fields produced by the gas discharge in the lamp. Since both are at the same frequency, they would be indistinguishable from one another. It can be concluded that for CFLs, the dirty electricity-generated E-fields are a minor or insignificant contributor to the total ambient fields in the home.

**REFERENCES**
