

netic-field measurements carried out and the basic philosophy and design of the study.

Perry *et al.* made spot measurements of power-frequency magnetic fields outside the front door of the residences of 590 suicides and a similar number of controls (drawn at random from the electoral register). They found an apparent excess of suicides at addresses with magnetic fields greater than 1 mG (148 suicides, 107 controls) and between 0.2 and 0.4 mG (220 suicides, 173 controls).

Suicide rates are known to vary between different sections of the population: they vary, for example, between men and women (by a factor of about 2), between different age groups (by a factor of 3 between ages 15 and 65) and between different socio-economic groups (twice as high for unskilled workers as for the population at large) (Ad75). There are also significant urban/rural gradients. Unless it is shown to be otherwise, these kinds of differences must be assumed to be reflected in the type of house a suicide occupies and in the magnetic field which characterises it. This question is ignored by Perry *et al.* in their study, although 93% of all their addresses are houses.

Turning to the measurements of magnetic field, these were taken alternately between case and control addresses. They were apparently not made "blind" and may therefore be subject to a variety of unconscious biases. A single reading was taken outside each dwelling, up to 10 yr after the suicide had taken place, a procedure which we suggest is quite inadequate to characterize the average level of magnetic field to which the occupant had been exposed. Such a spot measurement takes no account of the substantial variations (several hundred per cent) which normally occur from place to place in and around a dwelling and from minute-to-minute or from hour-to-hour at any given place. This point assumes special importance in view of the significance which the authors attach to relatively small differences in measured magnetic fields in the analysis of their results.

Deficiencies in control selection, possible measurement bias and inadequate measurement technique could all have operated to give the observed statistical anomalies in suicide rates at the low levels of magnetic field concerned.

It is worth remarking that the authors' median measured magnetic field (0.4 mG) is about twenty times smaller than that experienced under an electric blanket and 1000 times smaller than the steady magnetic field of the Earth. Simply walking about in the Earth's field will induce time-varying electric fields in the body which are comparable with those induced by the power-frequency magnetic fields measured in the study. We note incidentally that the

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Comments on "Environmental Power Frequency Magnetic Fields and Suicide"

Dear Editors:

WE WISH to make a number of critical comments on the paper by Perry *et al.* published in the August 1981 issue of your journal (Pe81). These authors present a case/control study which claims a significant correlation between weak power-frequency magnetic fields and the location of suicidal deaths in the West Midlands of England between 1969 and 1976.

Our criticisms concern the selection and suitability of the controls, the relevance of the mag-

authors' calculation of the magnitude of such electric fields is in error by four orders of magnitude.*

Our final criticism, however, is more fundamental. It relates to the basic philosophy of the study and to the failure to postulate any plausible biological mechanism for the causal relationship the authors assume to exist between magnetic-field exposure and suicide. No single biological mechanism could indeed be valid, since suicide is an *event* and not a disease.

Suicides are due to a highly heterogeneous group of disorders with very little common biology. They may result from schizophrenia, manic depression, drug or alcohol addiction, chronic disease, or a series of "major lifestyle events". The authors do not address this question; they do not, for example, select any single suicide group for study. They are thus wrongly led to link suicide, the ultimate event, with a single putative cause.

In summary, the paper fails to report work which can usefully address the questions which it raises. The statistical correlation deduced by the authors could have appeared by chance or through one or more of the possible sources of bias in the study. The evidence presented in their paper does not allow us to say.

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Pe81 Perry F. S., Reichmanis M., Marino A. A. and Becker R. O., 1981, "Environmental Power-Frequency Magnetic Fields and Suicide", *Health Phys.* 41, 267.

*Using the authors' formula and values, i.e. angular frequency $\omega = 315$ radians/sec, body radius $r = 1.5$ metres (sic), magnetic field $B = 400$ micro-gauss (0.04 microtesla), we have:

$$E = \frac{\omega Br}{2} = \frac{315 \times 1.5 \times 0.04 \times 10^{-6}}{2} \text{ V/m}$$

$$= 9.4 \times 10^{-6} \text{ V/m} (0.94 \times 10^{-4} \text{ mV/cm})$$

which compares with the authors' result of 0.94 mV/cm.

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Reply to Comments on "Environmental Power-frequency Magnetic Fields and Suicide"

(Accepted 26 February 1982)

Dear Editors:

IT IS INDEED well known that suicide rates vary significantly among different sections of the population. Bonnell *et al.*, have simply ignored our extensive discussion of the possible affects of these factors in so far as they might effect the subject's choice of residence. As we described in our report (Pe81), the evidence indicated that there were no apparent differences in type of housing or geographical distribution between the two groups of addresses. We specifically pointed out, however, that the possibility of such differences cannot be completely ruled out until a more detailed survey is conducted.

The measured power-frequency magnetic field strength varies over time at any location, in some cases by an order of magnitude or more. However, provided that there were no differences between the two groups in the times (hour, day, month) at which the measurements were made, these fluctuations can be considered simply as a source of additional variability in the data. As such, they would tend to increase the spread of the measured field strengths in both groups, and render it *more* difficult than otherwise to observe a real difference between the two groups. Thus, the data seem particularly supportive of the conclusion that there is an nexus between suicides and magnetic fields.

No valid purpose is served by analogizing the magnitude of the magnetic field that we measured to either electric blankets, or the earth's magnetic field. Human beings have walked in the earth's d.c. magnetic field for perhaps a million years, and it might be presumed that the resulting induced currents and fields are not a health risk. On the other hand, neither the CEGB's power-lines nor electric blankets are entitled to the same presumption.

Our calculations were correct: the interested reader is referred elsewhere for a more detailed analysis (Ha82).

We did not either assume or conclude a causal relation between magnetic-field exposure and the event of suicide: we simply described a statistical

correlation. It would be premature, in our view, to speculate on the mechanism of action that might be involved. Rather than do this, and perhaps elicit unbound and emotional reactions, we think it prudent to wait until more data has been obtained.

Dr. Bonnell is an industry representative on at least two committees dealing with possible health risks from exposure to electromagnetic fields of high voltage transmission lines. The gist of his position has been that there has been "no evidence" of any adverse effects (Jo78). In point of fact there is evidence (Pe81; As66; No70; We79; Fi78; Ha81; Be82), even though Dr. Bonnell personally accepts none of it (Bo80). We think it is incumbent upon the CEEB, and other power companies, to provide no-strings-attached support to independent investigators so that the safety question can be independently resolved to everyone's satisfaction.

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Household Magnetic Fields and Suicide

(Accepted 27 April 1982)

Dear Editors:

THE ARTICLE relating 50-Hz magnetic fields to suicides by Perry *et al.* (Pe81) in your issue of August last was stimulating and intriguing. It is apparent that the collection and analysis of the data on 1184 cases represented a major effort. Commendable, too, is the inclusion of sufficient data in the article that the reader can perform additional analysis.

The conclusory thrust of the authors' analysis is that 50-Hz magnetic (H-field) fluxes near domiciles of 590 individuals who had committed suicide tended to be higher than those near domiciles of 594 control cohorts. However, if one simply addresses the association between the strength of the H field and the incidence of suicide, a different conclusion might follow.

Drawing from data presented in Table 8 of the authors' article, I note a high and reliable *negative* correlation between median levels of the H field at the domiciles of the deceased and number of suicides (the Pearson r is -0.64 ; $P < 0.05$). That is, all entries of ranges of H-field strength in Table 8 for which a median is determinate were regressed against the corresponding number of suicides, which yielded the negative correlation.

The possibility that more intense fields in one's home environment militate against suicide must be

tempered by the long intervals—as many as 10 yr—that elapsed between time of suicide and measurement of H fields at the domiciles of the deceased. However, if the negative association is real—is not a statistical artifact—I venture an explanation.

There are well-established relations between economic (and social) disadvantage and suicide. Those less able to afford the basic amenities of modern life, including kilowatt hours, are doubtless predisposed to the melancholia that so often foreshadows self-annihilation.

Since kilowatt hours are a rigorous index of the electrical current used in a household, which in turn provide a readily quantifiable measure of the average (monthly) magnetic flux therewithin, the authors might wish to consider an extension of their previous works: At time of suicide by an individual, secure from his utility company a record of the monthly consumption of electrical energy in the household of the deceased over, say, a 2–3 yr period preceding time of death. Accession of data on a thousand such cases could provide a highly accurate indication of the *real* relation—positive, negative or nil—between averages and trends of strength of domicillary H fields and incidence of suicide.

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Reference

- Pe81 Perry F. S., Reichmanis M., Marino A. A. and Becker R. O., 1981, "Environmental Power-Frequency Magnetic Fields and Suicide", *Health Phys.* **41**, 267–277.

simply establishes that very few residences were found with magnetic field strength readings in the upper ranges. In any group of measurements, most will tend to cluster about the mean, and very few will be found at the extreme of the range. In fact, an even *stronger* negative correlation exists between the median field levels at the control addresses and the number of such addresses ($r = -0.81$, $P < 0.05$).

The power-consumption analysis suggested by Dr. Smith requires the cooperation of the Midlands Electricity Board and the Central Electricity Generating Board (the English power companies).

Unfortunately, based on our experience, this requirement makes the study impossible.

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Reply to comments of Robert F. Smith

(Accepted 27 April 1982)

Dear Editors:

DR. SMITH'S computation is interesting but we wonder about its practical significance because it