

# Centre for Radiation, Chemical and Environmental Hazards



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## APPENDIX 10

Health Protection Agency

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12 December 2007

Dear Mr Deans,

**Ref: Planning Application CUM/NHI/20107-X  
New Housing Development, Land off Fogwell Road and Tilbury Lane, Botley, Oxford.**

I am writing in response to your request to review an Electromagnetic Field Survey Report produced on the 4<sup>th</sup> of April 2007 by WSP Environmental UK. I understand that the report has been submitted to Vale of White Horse District Council in support of the above planning application. You have also requested comments on a letter dated 11<sup>th</sup> of June 2007 received from Mr Bowell in relation to the same planning application. I have addressed these two issues separately below.

### **Report from WSP Environmental UK**

The report from WSP Environmental UK contains general information about the biological effects of power frequency electric and magnetic fields, but relatively little detail regarding the instrumentation and survey techniques employed during their assessment of the site. The instrument used is not one with which I am familiar. However, a search of the internet indicated that it is a small hand-held device that purports to be suitable for the measurement of low frequency electric and magnetic fields. The authors of the report do not indicate how the instrument was used, but it certainly would not be possible to obtain meaningful measurements of electric field strength if it was hand-held; the presence of the surveyor's body would perturb the field. Moreover, some of the electric field strengths assessed during the survey appear to have been beyond the range of the instrument. Indeed the specification of the instrument quoted on the internet suggests that it would not be suitable for measuring either electric field strengths or magnetic flux densities that were significant fractions of the relevant reference levels. It is possible that the report does not accurately reflect the surveying technique adopted, but taken at face value it does not inspire confidence that the surveyors are experienced in this type of measurement.

The principal outcome of the survey is an assessment of magnetic flux density. The values presented are plausible for this type of situation. The magnetic flux density produced by the overhead lines will be dependent on the load on the line, so the measurement results should not be regarded as absolute values, but rather indicative of 'typical' flux densities. In his letter, Mr Bowell expresses concern that the measurements may underestimate peak magnetic flux densities as they were probably carried out in daylight when domestic demand is likely to be lower. However, it should be noted that commercial and industrial demand is often higher during the day. Without actual load data, which the report indicates is not available, it is not possible to comment further on relationship between the measured values and maximum flux densities.

The interpretation of the measurement data is conservative. The Health Protection Agency currently has responsibility for providing advice on exposure restrictions for electromagnetic fields, a function

formerly exercised by the National Radiological Protection Board (NRPB). This advice was last reviewed in 2004 and as a result it was recommended that the UK adopt the guidelines of the International Commission on Non-ionizing Radiation Protection (ICNIRP) for limiting exposure to electromagnetic fields between 0 and 300 GHz. These are intended to avoid established adverse effects of excessive exposure and for power frequencies the guidelines set basic restrictions in terms of induced current density in the tissues of the central nervous system. As the basic restrictions are not easily measurable, the guidelines also set derived reference levels, set in terms of external field strengths and magnetic flux densities. The magnetic flux density reference level for public exposure at power frequencies is set at 100  $\mu$ T.

It should be noted that European Member States have formally adopted a European Union Recommendation as a framework for limiting public exposures. This document incorporates the ICNIRP public exposure guideline values.

Hence the advice of the Health Protection Agency is that provided that 50 Hz magnetic flux densities are below 100  $\mu$ T, there is no requirement for further action. In the report, WSP Environmental UK recommend a precautionary approach based on the epidemiological observation that time-weighted average exposures above 0.4  $\mu$ T is associated with a small increase in the absolute risk of leukaemia in children from about 1 in 20,000 to 1 in 10,000 per year. It has been concluded that currently the results of these studies, taken individually or as collectively reviewed by expert groups, are insufficient either to make a conclusive judgement on validity or to quantify appropriate exposure restrictions. However, such studies taken together with people's concerns provide a basis for considering the possible need for further precautionary measures in addition to the application of quantitative restrictions on exposure to electromagnetic fields. This appears to be the approach recommended by WSP Environmental UK in its report. In addition, to adopting a precautionary approach based on 0.4  $\mu$ T, the authors of the report further suggest that a reduction of 0.1  $\mu$ T should be made to allow for a contribution to exposure from domestic wiring and appliances. It is difficult to estimate such a contribution with confidence as it varies considerably from property to property; in locations remote from overhead power lines background flux densities are generally in the range of 0.01 to 0.2  $\mu$ T, though it is known that fields in some properties will exceed this range. Hence the value assumed by WSP Environmental UK (0.1  $\mu$ T) is towards the upper end of the range typically encountered in domestic properties and is therefore reasonably conservative, but cannot really be regarded as a 'worst case'.

#### **Letter from Mr Bowell**

I have consulted with my colleague Dr Sienkiewicz in relation to Mr Bowell's letter. Our comments are given below.

In his letter, Mr PJ Bowell, a local resident, raises numerous objections to the outline planning application, and opposes the new housing development off Fogwell Road and Tilbury Lane in Botley due to the possible impact of power frequency electric and magnetic fields (EMFs) on health.

In summary, Mr Bowell considers that EMFs at levels commonly found in the environment poses a substantial risk to health of both adults and children. He notes the occurrence of several serious illnesses that have occurred in his neighbourhood over the last 40 years or so, which he attributes to EMFs. In particular, he objects to the conclusions of the review from the independent Advisory Group on Non-ionising Radiation (AGNIR) on EMFs and the risk of cancer which was published in 2001. The AGNIR review was much cited in the WSP report (called the Doll report).

Mr Bowell's concerns are representative of a minority, but highly vocal opinion that exists in the UK and elsewhere regarding the impact of EMFs. They are expressed by campaign and activists' groups, as well as a few scientists and academics, regarding the health effects posed by both power lines and mobile phone masts. However, these views do not represent scientific orthodoxy nor reflect the prevailing scientific consensus.

In addition, they do not agree with the specific advice on EMFs from the Radiation Protection Division of the Health Protection Agency (formally the National Radiological Protection Board, NRPB), or those of the government as expressed through the Department of Health. Similarly, these views are at odds with the advice from the World Health Organization (WHO) and are inconsistent with the guidance from international scientific bodies, such as the International Commission on Non-ionizing Radiation Protection (ICNIRP) who are responsible for setting exposure standards worldwide. The views of these bodies and agencies are consistent with those expressed by AGNIR.

ICNIRP is an autonomous scientific body recognised by WHO. ICNIRP published its most recent guidelines for limiting human exposures to EMFs in 1998. These are intended primarily to prevent adverse effects resulting from induced electric fields and currents, including stimulation of nerves and muscles, and subtle effects on brain function.

The values recommended by ICNIRP are 500  $\mu\text{T}$  and 10  $\text{kV m}^{-1}$  for workers, and 100  $\mu\text{T}$  and 5  $\text{kV m}^{-1}$  for members of the public. The lower levels for the public allow for the inclusion of children, and for people with differing health status. These values are not limits *per se*, and higher levels may be permissible under some circumstances. Following a comprehensive review of the available scientific information, NRPB in 2004 suggested that the ICNIRP guidelines be adopted in the UK, and this was endorsed by government.

Concerns about the health effects of electric and magnetic fields (EMFs) generally began in 1979 when it was first suggested that the incidence of cancer in children might be related to the magnetic fields from the power lines near their homes. Since that time other concerns have arisen, including increased risks of various types of adult cancer, miscarriage, neurodegenerative diseases, suicide and depression, and negative impacts on well being.

These and other endpoints have been the subject of much research worldwide: many laboratory and epidemiological studies have investigated the potential of EMFs to cause disease or affect biological processes.

As detailed by the AGNIR report, only one reasonably consistent association of an adverse health effect has so far been linked with exposure to EMFs. This indicates that exposure to average magnetic fields in the home of 0.4  $\mu\text{T}$  and above is associated with a small increase in absolute risk of leukaemia in children, but not in adults. If causal, this would contribute several additional cases to the annual total of about 500 in the UK. Exposures below 0.4  $\mu\text{T}$  were not associated with any increased risk, suggesting a threshold may exist.

This association comes from a pooled analysis of data from a number of well-conducted epidemiological studies, particularly from the USA and Scandinavia, and including the UK Childhood Cancer Study (UKCCS). However, the evidence is not strong enough to justify a firm conclusion that such fields cause leukaemia. There is little evidence for any raised risks of other cancer type in children or for any type of cancer in adults. In addition, laboratory studies have not provided any consistent evidence that magnetic fields are genotoxic or have a carcinogenic effect.

Nevertheless, following a comprehensive and in-depth review of the available data by a multinational team of 21 scientific experts, the International Agency for Research on Cancer (IARC) in 2002 classified power frequency magnetic fields as a possible human carcinogen (Class 2B), as Mr Howell rightly indicates in his letter. However this does not mean that magnetic fields are a definite cause of cancer: many common substances, coffee for example, are also classified as Class 2B. IARC could not classify electric fields due to the paucity of data.

More recently, a large case-control study was published by Prof Draper and colleagues from the Childhood Cancer Research Group at Oxford University. It found higher rates of leukaemia (but not other cancers) among children whose home address at birth was close to major high voltage power lines compared with those who lived further away. While the study identified a significant increase in the relative risk for leukaemia, it is unclear whether this was related directly to magnetic field exposure.

So overall, there are suggestions that long-term exposure to either elevated levels of magnetic fields in homes, or possibly proximity to power lines, may be associated with an increased risk of childhood leukaemia. However, having a statistical association does not imply that exposure causes childhood leukaemia, and the possibility that confounding or some bias in the data may provide an explanation cannot be yet ruled out.

In contrast to the data on childhood leukaemia, and the assertions of Mr Bowell, the results of studies investigating other cancers and non-cancer outcomes have generally been inconsistent and difficult to interpret. It is generally agreed that the evidence for these other diseases being associated with EMFs is very weak, far weaker than that for childhood leukaemia. In addition, laboratory studies have not produced any good evidence of field-related effects with exposures below about 100  $\mu$ T.

There is general consensus amongst scientists and others regarding the IARC assessment of magnetic fields, but far less agreement regarding the implications of this assessment.

The Stakeholder Advisory Group on Extremely low frequency EMFs (SAGE) was set up, managed by the Department of Health, to explore the implications of a precautionary approach to EMFs and then to make practical recommendations. The group has representation from public concern groups, the electricity industry, government, and from HPA. Objectives include highlighting ways that people can reduce exposures by taking action within their own homes, and producing options for reducing exposures from power lines. The first recommendations from SAGE were published in April 2007 (available from <http://www.rkpartnership.co.uk/sage>).

SAGE was not set up to review the scientific evidence about the health effects of EMFs. Rather, it took as its starting point the advice of NRPB in 2004 to "consider the possible need for further precautionary measures". However, the state of the scientific evidence is a material concern in decisions on whether to adopt the SAGE advice.

SAGE identified two broad viewpoints on the science. In one, exposure to EMFs was assumed to be a risk factor (possibly causal) for childhood leukaemia. This was termed by SAGE the "WHO/HPA" position. The other viewpoint allowed for a larger number of illnesses possibly attributable to EMF exposure (including adult leukaemia and brain tumours, miscarriage and amyotrophic lateral sclerosis). This viewpoint was short-handed as the "California" position in the SAGE report. The view of HPA on the scientific evidence is broadly in line with that described as the WHO/HPA position in the SAGE report.

SAGE made two recommendations in their report. Firstly, it was recommended that electricity companies be encouraged to choose the optimal phasing (usually transposed phasing) for all new lines, and also be encouraged to convert existing lines where possible and justifiable. Secondly, it was recommended that more information be provided to members of the public about exposures and the actions they could take themselves to reduce exposures if they wished.

Neither option would result in material reductions in exposures. Hence SAGE identified that the best-available option for obtaining significant exposure reduction (in fact, reduce future exposures that would otherwise occur) was to stop building any new buildings for residential use (and some other uses including schools) within specified distances of overhead power lines, and to stop building new overhead power lines within the same specified distances of existing such buildings. The corridor option for high voltage power lines was not supported by the cost benefit analysis on the basis of childhood leukaemia alone. The absolute benefit in terms of cases of leukaemia and lives saved under this model was very small (of around five cases per year, according to estimates by Draper and colleagues) but the costs and opportunity costs are considerable.

SAGE also offered other measures for existing houses near high voltage power lines, and for decreasing exposures from domestic wiring and household appliances.

The HPA has produced a formal response to the SAGE First Interim Assessment and this will be put in the public domain in due course.

Mr. Powell raises the question about EMFs affecting melatonin, a hormone produced by the pineal gland, and thus influencing the risk of cancer. There are good reasons to believe that breast cancer could be most susceptible to changes in melatonin, and this question was thoroughly examined by AGNIR (in a sub group whose members included experts on breast cancer and melatonin). An extensive report was published in 2006 which is available from the HPA website.

The report concluded that overall the evidence did not support the hypothesis that exposure to magnetic fields was associated with an increased risk of breast cancer. Plus it was concluded that magnetic fields did not appear to affect the production or biological action of melatonin. Prof. Henshaw, a physicist from the University of Bristol, has disagreed with these conclusions, although he does not have expertise either in breast cancer or melatonin physiology.

Regarding the possible interactions and impact of EMFs with particulate pollutants, AGNIR have examined the issue of particle deposition in the vicinity of power lines and possible effects on health. A report was published in 2004, which is also available from the HPA website. The report concluded that while corona discharge from high voltage power lines may produce clouds of negative or positive ions that are readily blown downwind over several kilometers, it seemed unlikely that these corona ions would have more than a small effect on the long-term health risks associated with particulate air pollutants, even in individuals who are most affected. However biological and other uncertainties mean that it is not possible to estimate the impact precisely.

Overall, the ICNIRP guidelines provide protection against the known adverse effects of EMFs. At power frequencies, ICNIRP recommend values for members of the public of 100  $\mu\text{T}$  for the magnetic field and of  $5\text{kV}\text{m}^{-1}$  for the electric field."

In summary, the conclusions of the WSP Electromagnetic Field Survey Report carried out in relation to Planning Application CUM/NHI/20107-X are consistent with the current scientific understanding of Electromagnetic Field's (EMF's) on health and current UK EMF exposure guidelines. The suggested distance of 74m from the centre of the power line inside which it is recommended that residential development is not located is in fact very conservative in terms of current UK EMF exposure guidelines.

If you have any questions concerning this response please do not hesitate to contact me.

Yours sincerely,

Nigel Cridland