

## **Planning Application Merton Ref: 03/P2408**

Land bounded by Plough Lane, Durnsford Road, Weir Road, Brickfield Road and the River Wandle (Site of former Wimbledon Football Club and 55-61 Durnsford Road, London SW19).  
Redevelopment of the site to provide 570 flats.

### **Submission from M J O'Carroll**

**8 November 2004**

#### **1. Résumé of M J O'Carroll MA MSc PhD CMath FIMA**

1.1 I hold the MA degree of Cambridge University in mathematics with physics, an MSc in mathematical existence theory and a PhD in computational fluid dynamics. I am a Chartered Mathematician, a Fellow of the Institute of Mathematics and its Applications, and Professor Emeritus at the University of Sunderland, following my retirement as Pro Vice-Chancellor. As an applied mathematician and executive manager I have a background of experience in multidisciplinary research and policy evaluation.

1.2 In the areas of electro-magnetic fields (EMF) and public health, over the last ten years I have published a number of articles and conference papers and a couple of letters in leading academic journals, have supervised postgraduate work and have acted as academic referee. I am a member of the EC/WHO working group on The Application of the Precautionary Principle to EMF, and a member of the stakeholder group SAGE (and its steering group) working with the Department of Health to develop precautionary policy for EMF.

1.3 I have acted as an expert witness and representative of public groups at a number of public inquiries, and have been chairman of the public interest group "Revolt". In doing so, I have sought to present concerns compatibly with a balanced assessment of the scientific evidence base. This response is not part of any campaign, but is provided as a personal contribution and opinion, aiming for balance and objectivity and based on relevant experience.

#### **2. Scope of this submission**

2.1 This submission addresses the health and precautionary issues arising from proposals to build housing near powerlines and telecoms masts, in order to inform the consideration of planning permission. I recognise that a planning committee would not be an appropriate body to undertake a full scientific investigation, and it must rely on advice, with emphasis on statutory advice. This submission therefore only goes far enough to identify key issues and verdicts, and to examine what statutory advice does or doesn't say.

2.2 I am advised that the above proposal would be to build social housing close to an existing powerline, including an 8-storey block of apartments within about 20 metres of the line, with likely exposures of the order of 8 microTesla. This submission does not depend on the accuracy of that advice (which I have not investigated). However that advice would be compatible with my own experience and measurements in housing close to powerlines elsewhere.

2.3 Powerlines and telecoms masts involve a range of measurable physical exposures many times above normal background levels. The question is whether such exposures, separately or together, may be harmful. The main relevant exposures are:

- magnetic fields from powerlines;
- electric fields from powerlines;
- emissions of charged particles and aerosols from powerlines;
- (non-ionising) electromagnetic radiation from telecoms masts;
- pulsed radiation from telecoms masts.

2.4 While keeping the range of exposures in mind, this submission will focus largely on the magnetic fields from powerlines, usually measured as magnetic flux density in microTesla ( $\mu\text{T}$ ), since this has been the subject of the widest research and the magnetic fields more readily penetrate houses and are easily detectable for example in children's bedrooms near to powerlines.

### **3. Key issues**

3.1 Key issues addressed here are:

- (a) the current state of government and regulatory policy (this is to clarify and not to contest government policy, for that would fall outside the scope of planning decisions);
- (b) the current state of scientific evidence;
- (c) risk;
- (d) precaution.

### **4. Government and regulatory policy**

4.1 The statutory advisory body to government is the NRPB, which has determined reference levels for exposure restrictions, and last year brought these into line with international levels.

4.2 For magnetic fields from powerlines the NRPB reference level is 100  $\mu\text{T}$ , above which the possibility of harm is sufficiently established so that exposure restrictions apply. Below this level, The NRPB recognises evidence associating exposure at average levels above 0.4  $\mu\text{T}$  with a doubling of the risk of childhood leukaemia, but does not accept this as establishing cause, and does not advise one way or the other on precaution in respect of such exposures.

4.3 Although NRPB has been silent on precaution for power frequency fields, the government has in the past taken this as a basis for rejecting precaution. For example, in a written response [Hansard 21.2.94] to Mr Alex Carlisle's question "To ask the SoS for Health if she will make it her policy to encourage the enactment of a prudent avoidance policy with regard to electrical powerline work ...": Mr Sackville: "... On the basis of present evidence, the two bodies [NRPB and COMARE] have not recommended the adoption of a policy of prudent avoidance ..." Policy for many years was then to disregard health considerations when considering planning applications near powerlines. Since that time, the perception of health risks, whether proven or not, has been accepted as a planning consideration, although perhaps a weak one in practice.

4.4 Following key research publications in 2000, and recognition by IARC (the WHO International Agency for Research in Cancer) of EMF as a possible carcinogen, precaution has become better recognised. The existence of the SAGE group hosted by Department of Health, and the WHO EMF group and its statements on precaution, acknowledges the case for precaution for magnetic field

exposures below 100  $\mu\text{T}$  and in particular in the region of 0.4 $\mu\text{T}$ , though they have not yet formulated advice on the precautionary action which would be appropriate.

4.5 Government is therefore presently acknowledging the case for precaution at exposure levels below 100  $\mu\text{T}$ . The SAGE group is the vehicle for developing advice on precautionary measures below 100  $\mu\text{T}$ . Judging by the latest WHO statement, and NRPB's position that evidence does not justify exposure restrictions below 100  $\mu\text{T}$ , it may be that precautionary policy below 100  $\mu\text{T}$  will fall short of outright exposure restrictions, although this is not decided. There are low-level exposure restrictions in a few other countries, but the main international bodies have not recommended them.

4.6 Exposures from telecoms masts usually fall below the relevant reference levels set by the NRPB and other bodies. Telecoms electromagnetic radiation is different from power-frequency fields. There is a similarity in regulatory response to the two types of exposure in that reference levels are based essentially on the relatively crude idea of thermal effects, i.e. effects due to the macroscopic energy imparted by the radiation through induced electric currents or otherwise, whereas the public concerns are at much lower levels of non-thermal effects on biological control systems. Powerline fields are recognised by IARC as category 2B (possible) carcinogens, whereas environmental telecoms fields are not. Nevertheless, the WHO EMF group considered both as appropriate for precaution, and the principal UK advice, in the Stewart Report, recommended precaution in respect of children using mobile phones.

4.7 In summary, government policy, while not yet clearly articulated, has moved to recognise the need for precaution with EMF exposures below the reference levels in statutory advice, particularly in the case of powerlines.

## **5. Scientific evidence**

5.1 Although phrases such as "there is no evidence" or "no good evidence" are commonly used to dismiss concerns, there is extensive evidence relating to low-level exposures from powerlines and telecoms radiation including many hundreds of peer-reviewed scientific papers. The evidence is mixed and the science still far from clear in many respects, but there is an accumulation of evidence sufficient to give rational grounds for concern, although not sufficient to establish proof of cause to the high level required by many official bodies.

5.2 Evidence for a cause of harm falls into two main groups: epidemiological evidence about the incidence of harm among the exposed population, and evidence of a mechanism by which the harm could be caused. In the case of powerlines, there is a persistent epidemiological finding of a doubling of incidence of childhood leukaemia, which is accepted as unlikely to be wholly due to chance or bias, but for which a clear mechanism is not generally accepted.

5.3 Causation of cancer is multi-factorial, and with multiple potential outcomes, so that a simple direct mechanism may not be expected. Potential indirect mechanisms have been identified. As one example, the interference by EMF upon the production of the hormone melatonin, an anti-carcinogen, is one potential factor for which there is evidence in peer-reviewed papers. The NRPB has not considered all the evidence in relation to such potential mechanisms. For example, in a paper to the EC/WHO group last year I cited 26 scientific papers leading to such a mechanism, yet only 9 were cited in a subsequent NRPB survey. The latest NRPB review of the science (document 15-3, 2004) similarly fails to cite key references on melatonin, and likewise fails completely to cite

lead authors on the radical pair mechanism. I do not consider that NRPB has properly assessed the scientific evidence relating to possible mechanisms.

5.4 Risks of childhood leukaemia from EMFs are likely to be understated by current epidemiology on which NRPB and others rely. One reason for this is that the most relevant exposure measure is not known, and so measures which are taken may not be well tuned to show the effect. In particular the melatonin hypothesis would suggest that night-time exposure is critical, as that is when the pineal gland produces melatonin, yet exposure measurements have usually been 24-hour weighted averages, so diluting or losing the possible effect. Another reason is that research has not focused on susceptible groups; epidemiological studies on the whole population can dilute or lose such effects, yet it is known that there are highly susceptible groups with readily identifiable genetic precursors (caused by genetic damage in utero).

5.5 The NRPB reference levels for power frequency and telecoms fields are based on thermal (energy) effects. Information effects, which might interfere with control mechanisms such as in the immune, neurological and cell control systems, are discounted. Yet there is good evidence for such effects, for example the inhibition of melatonin and also the radical pair mechanism, at exposures well below the reference levels. Further evidence comes in the discovery of a mechanism which detects light (and influences melatonin) without using the rod-and-cone system, and in studies of birds' navigation systems. If an exposure can be detected it can have an information effect.

5.6 Several other outcomes have been associated with powerline EMF exposures, besides childhood leukaemia, though generally the evidence is less extensive or strong, sometimes for lack of research funding. Examples include: adult leukaemia, brain cancer, depression, suicide, miscarriage, headaches and insomnia. In some cases there is statistically significant evidence of association but the evidence is generally inadequate to prove causation. In the case of all cancers taken together, findings have shown no association. Such a picture may suggest casting around for any slight effects, and finding some by chance (the "fishing trip" effect), though this can be accounted for statistically.

5.7 Some biological processes may be influenced cumulatively by a variety of different stresses. For example, DNA damage, which is critical to cancer, may to an extent be accommodated without harm to cell or system function, yet may accumulate through several stages of incremental damage until it finally precipitates malfunction and possibly cancer. Other subjects of possible incremental and cumulative stresses include oxidative damage and disruption of anti-oxidants (like melatonin) and immune control systems. It is therefore plausible that stresses arising from low-level EMF, chemical pollution, infection, nutritional deficiency, circadian disruption and so on, may act cumulatively. It is only necessary to show that an exposure such as EMF may cause some biological disruption (such as melatonin inhibition), or may be a factor associated with increased incidence of disease (such as childhood leukaemia), to give rational grounds for concern that the exposure may also be a source of incremental stress for other harmful effects.

5.8 The evidence for harm from telecoms systems does not have the extent of epidemiological support as with powerline EMFs. However concerns were sufficiently credible for the Stewart report to recommend precaution with children's use of phones. Studies by the leading epidemiologist Professor Anders Ahlbom to be published this month are said to show no association of general cancer with mobile phone use in the previous ten years, but do show, after ten years use, a quadrupling of the incidence of acoustic neuroma on the side of the head where the phone is used. Such long-term results are only just becoming available.

5.9 Public exposures from telecoms masts will generally be much lower than those from hand-held phones, although there may be exceptions, such as where a mast is very close and at a similar height to an apartment, practically beaming in through the window.

5.10 In summary, there is extensive scientific evidence which gives rational grounds for concern about exposures from powerlines, recognised by WHO and IARC, though it is not accepted by most official bodies as proof of cause. Evidence of potential harm from base stations is less clear, although evidence of harm from longer term mobile phone use is emerging. The principal illness cited is childhood leukaemia from powerlines, although there is some statistically significant evidence of other diseases, and recent evidence of acoustic neuroma from long-term mobile phone use. There are grounds to suspect that multiple exposure to EMFs from powerlines and masts may contribute incrementally and cumulatively to potentially harmful biological stresses and hence to a number of illnesses.

## **6. Risk**

6.1 The Royal Society defined risk as the numerical probability of harm occurring from a proven cause. That approach has been used as a semantic denial of risk from uncertain causes, even when there are evidence-based rational grounds for suspicion of harm. In ordinary language an uncertain risk is still a risk, and warrants a precautionary approach.

6.2 To assess uncertain risks, there are three main factors: impact (per unit occurrence), incidence (frequency of attributable occurrence) and credibility (confidence in causation). In uncertain risks these factors may not be assessable with precision, and may rely on subjective expert assessment of the credibility of causation. NRPB does not consider such matters and does not offer any such assessment, although the California Department of Health in a major report in 2001 does so.

6.3 As an indicative illustration, consider the uncertain risk of childhood leukaemia from powerlines. The impact is a now often curable disease, with severe treatment effects and about 20% fatality. Although the economic value of a working life is typically approaching a million pounds (40 years at £25,000 per year), an “actuarial” value of the life of a child may be of the order of 10 million pounds, bearing in mind impact on the family and social acceptability. For this very approximate illustration, the impact of an incidence of childhood leukaemia may then be around 4 million pounds.

6.4 The additional incidence of childhood leukaemia attributable to EMF exposure above 0.4  $\mu\text{T}$  is about 1 per 20,000 exposed child population per year. For this illustration, take the population of 570 flats to be 1,000 to 2,000, including 200 to 400 children, in proportion with the general population. About half might receive such exposure levels, but some apartments may be exposed at higher levels, up to 8  $\mu\text{T}$ , some 20 times the identified risk level. Some evidence suggests a dose-response relation, but it is not clear that it would be linear. Taking an average incidence of 5 in 20,000 on some 150 children, gives roughly 1 attributable case per 25 years.

6.5 The California Department of Health assessment rated confidence in causation for this effect from 55% to 95%, whereas the IARC “possible carcinogen” may be interpreted roughly as 10% to 50%. In the light of growing evidence relating to melatonin, I would judge something over 50%, but on the balance of views for the purposes of illustration let us take 50% as a rough estimate of the chance that there is a causal process.

6.6 We can now combine the factors for impact, incidence and credibility as 4 million pounds per annum x 1/25 x 0.5, that is about £80,000 per year. Bear in mind that leukaemia is a rare disease and this is a very rough estimate for the purpose of illustration.

6.7 Other cancers for which there is evidence of a relation to EMF exposure include adult leukaemia and adult brain cancer. The California report assessed confidence in causality at 40-80% and 50-98% respectively. Take a conservative credibility factor at 50%, as we did with childhood leukaemia. The relative risks are low (1.2) but the incidence in the UK is higher, giving about 12 and 2 cases per 100,000 exposed adult population attributable to EMF (using DH data). If we again allow a factor of 5 for the exceptionally high exposure levels up to 8 µT, and accept half the adult population in the flats (some 600) as exposed at the implicated levels, then there will be about 1 attributable case every two and a half years. The adult cancer impact will depend on age, but may be comparable with the childhood leukaemia impact with its 80% cure rate, again at about 4 million pounds. The overall impact for these two classes of adult cancer together, multiplying impact per case, incidence and credibility factors, would be some £800,000 per year.

6.8 Other potential risk outcomes may have greater incidence, and sometimes lower credibility or lower impact. Health outcomes identified as uncertain risks for EMF exposure include miscarriage, depression and suicide, as well as minor ailments such as headaches and sleep disorder. Minor ailments may be much more common, even up to 10% of those exposed from my experience, but the unit impact may be very low, a few lost work days per year and general discomfort. The product of high incidence and low impact can still be significant.

6.9 Further factors to consider include:

- likely understatement of incidence of attributed leukaemia as explained above;
- cumulative incremental effects from exposures from masts and powerlines;
- vulnerability and general health risk in social housing occupants.

These factors together may justify an order of magnitude (factor of 10) increase in the risk assessment.

6.10 In summary, taking all of the uncertain risks into account, the gross impact can be reasonably estimated as well over a million pounds per year on a conservative assessment, and, with the identified further factors taken into account, well over 10 million pounds per year, although any such assessments involve many approximations and uncertainties.

## **7. Precaution**

7.1 In EC, WHO and UK approaches to precautionary policy, some principles are emerging, including proportionality, consideration of social factors and susceptible groups, and cost-benefit assessment of alternatives.

7.2 The proposal in question raises questions of

- the need for social housing in the area;
- the availability and cost of alternatives;
- EMF exposure levels at different parts of the development;
- the selection criteria for people to be housed there;
- children and other potentially susceptible groups;
- the ability of tenants to reject the housing;
- compensation for those who become ill;

- avoidance measures, including re-siting or undergrounding or increasing heights.

7.3 The estimated impact sum would justify undergrounding the powerlines and moving the masts, or radically revising the proposed development. To estimate the value of the development, for the purpose of illustration, take 570 apartments, albeit social housing, to be of the rough order of magnitude of 100,000 pounds per unit, i.e. a total of the order of 50 million pounds. The whole development would then be of a similar scale to the (capitalised) risk impact.

7.4 The burden of the cost of precautionary measures should normally fall to the developer who stands to gain from the development, following the EU principle of internalisation of environmental costs, in determining the viability of the project. However, the polluter-pays principle would suggest that the owners of the powerline and masts might share the cost, at least insofar as they benefit from an improved asset.

## **8. Recommendations**

8.1 The planning authority should give careful consideration to the evolving government policy and should recognise the need for a precautionary approach in respect of the scientifically uncertain risks from powerlines and telecoms masts. In particular the questions listed in 7.2 above should be considered.

8.2 A development for social housing on this site should not be approved without measures to reduce or remove exposures, such measures being proportionate to the (uncertain) risk considered in the light of the factors listed in 6.9 above.

8.3 Possible measures, which might where possible be prescribed as planning conditions, might include:

- not housing any children on the site;
- not housing people from potential risk groups on the site, e.g. epileptics, cancer survivors, sufferers from any chronic disease, pregnant women, the mentally ill or the very elderly;
- not having an 8 storey apartment building within 100 metres of masts or powerlines;
- leaving the most exposed areas as open space;
- raising the height of masts so that they do not beam into apartments;
- undergrounding the powerline;
- restricting the power flow on the powerline, particularly at night.

## **9. Conclusion**

9.1 The EC, WHO and UK government now recognise that a precautionary approach is appropriate for electro-magnetic field exposures from powerlines and other sources. The proposed development is likely to create residential exposures with evidence-based but uncertain risks which can be reasonably assessed at over a million pounds per year. The development should not be approved except with proportionate measures to reduce exposures, such as undergrounding the powerline and repositioning the masts.