Response to invitation to provide evidence to the
Parliamentary Commission on Childhood Leukaemia and EMF
from Professor Emeritus M J O'Carroll
12 June 2007

Thank you for the invitation to provide evidence. I will focus on the specific questions in your invitation.

1. Introduction

I was a participant in the SAGE process from its inception and before that in its embryonic predecessor organised through the Environment Council on the initiative of National Grid. I was a member of the SAGE Steering Group (later called the Co-ordinating Group) throughout its duration, which ended in December 2006. I was a member of the SAGE Powerlines and Property Group throughout its duration, and within that I took full part in the informal subgroups on Cost Benefit Analysis and on Exposure Metrics.

My response to the public, in question-and-answer form, to the SAGE First Interim Assessment of 27-3-07 (the "Report") was issued on 27-3-07 and is provided herewith as Attachment 1. My 250-word comments, which also appear in the Report, are at Attachment 2. My editing comments (not accepted) to the penultimate draft Report are at Attachment 3.

2. The outcomes of the SAGE Report.

2.1 Cost-benefit analysis

This is explained in section 2.4 of the Report and in the cited Supporting Papers.

It is important to note that "*cost-benefit analysis is just one tool*" and "*we have regarded cost-benefit analysis as important but not providing a definitive answer on its own*" from section 2.4. Some participants, including me, would be reluctant to recommend a measure which could confidently be assessed as grossly disproportionate in cost, unless there were special good reason.

One such good reason would be if costs were small and affordable, albeit disproportionate to the estimated benefit. In the work on measures for internal wiring and appliances, this view prevailed. However with powerlines, costs are higher, though the question of affordability should be considered relative to the general costs of transmission and of end-user electricity; SAGE did not get as far as considering that.

A good cost-benefit consideration might address what is meant by gross disproportion, and in turn the level of precision or imprecision in the analysis. While I raised these issues, there was little response. In my view there is gross imprecision, and much subjectivity, in the cost-benefit analysis, which is to be expected. There is also much uncertainty, for example in impacts on property, which compounds the imprecision, and in impacts beyond childhood leukaemia (what we called CL+).

2.2 Criteria in decision making

SAGE was not well structured in decision making. Of course, it is only to advise, but it has to decide what to advise. There was a structured approach to selecting options, as described in sections 2.3 and 5.2 of the Report. A process called "dominance analysis" was used to select options, after assessing

them in a matrix against a list of criteria, which included cost and effectiveness and, for powerlines, visual impact. However, decisions about the nature of advice and when to recommend were more subjective.

2.3 Omissions in decision making.

General omissions included a failure to clarify when to determine a recommendation and how to take account of available information. This emerged late in the process after the earlier dominance analysis had been quite superficial and had not included cost-benefit analysis.

There was also confusion over the role of criteria and assumptions, that is omission to maintain clear definition of their purpose. Initially they were accepted, in view of their crudeness, only as aids to comparing options one against another. Later, by default, they were used as hard assumptions in supporting a cost-benefit analysis. As a result, crude assumptions, such as the threshold exposure-response assumption for any potential effect, were used to imply too firm a basis to the very imprecise cost-benefit analysis.

The main omission in cost-benefit analysis was that of potential health impacts beyond childhood leukaemia. We called that CL+. There is a large body of significant evidence supporting rational concerns on CL+. Professor Henshaw and I have set out such evidence, with cost-benefit assessment (that is, of the benefit of avoiding exposure) in our paper, which we may have presented to the Commission last year, at
<www.electric-fields.bristol.ac.uk/ocarroll/>.

Even in the early stages of SAGE, I had introduced such cost-benefit assessment of CL+ to the cost-benefit subgroup. Without discussion or debate about the detail or merits, it was essentially ignored in principle. A rift developed between participants who felt CL+ should be discussed and those who wished, in effect, to censor it. There was no proper dialogue on CL+, rather division and acrimony. This led eventually to the split in which alternative positions are briefly set out in the Report. Eventually it was acknowledged in the Report that such impacts may be assessed as of the order of a hundred times greater than the impact for childhood leukaemia alone, while relegating this assessment to the status of an alternative view.

These considerations should not be seen as alternatives. All the evidence should be considered in combination. In the cost-benefit analysis which I presented, there were uncertainty factors to allow for the uncertainties in the science. These were not arbitrary, but came from the external and systematic California review. The WHO/HPA approach fails to allow for these uncertainties at all, and instead dismisses entirely the evidence-based potential impacts of CL+ because they have not received the "ticket" of an IARC 2B rating.

A further omission was in failing to consider or acknowledge other, at least equally plausible, models besides the crude threshold model of exposure-response. This point is explained very briefly in my 250-words as attached herewith. It would be important in valuing measures for reducing internal fields in homes, whether or not the homes are above the artificial threshold of 0.4 μT. Instead, a factor of 0.001 (i.e. 0.1%) is used in the Report to reduce the benefit per home from £1,000 to £1 (Supporting Paper S10) on the basis of the threshold assumption. If a progressive exposure-response relation were used, such as Linear-No-Threshold, then every reduction of exposure would be seen to have value, not just those reductions taking a home below the artificial threshold of 0.4 μT. Since the options were of low cost, and therefore recommended anyway, this point is perhaps not material to the house wiring decisions. It would be material to powerline options, particularly for the benefits of undergrounding, which is explained in Attachment 4.

Other important omissions in the decision process include:

- failing to consider properly the existing exposures from powerlines; Attachment 4 outlines a practical approach to existing exposures from powerlines;
- failing to investigate costs of undergrounding or the case for burying 110 and 132 kV lines; see my 250-word comment at Attachment 2;
- failing to assess properly the "corridor" option reduced in application to land not yet zoned for building, so as to reduce the cost of the option, as is the policy in Switzerland for example;
- failing to take due account of the great uncertainty in assessing property costs of the Best Avaialble Option for powerlines, as reflected in gross last-minute changes to figures in the draft Report; though this is very uncertain, it comprises the essence of the cost of that Option.

2.4 Fairness of assessment of weight of cost-benefit analysis

I have said enough in the above sections to show that there are features in the assessment which lacked fairness. The final weight given to cost-benefit assessment would have varied among participants in SAGE, with a number seeming to treat cost-benefit analysis as the final determination. I feel that is unfair, given its implicit imprecision and different views.

There is also the question of the balance of costs and benefits for the Best Available Option for powerlines. The benefits are in public health for people with exposures imposed on them involuntarily. The costs are principally in loss of property value for speculative development in the corridor area. No allowance has been made for the different values which might attach to public health and to speculative development.

3. Options in the report (specifically for powerlines)

3.1 Options considered

For powerlines, the options are discussed in Supporting Paper SP18.

3.2 The process of reaching the Best Available Option for powerlines

This option, with its 60 metre corridor separating 275/400 kV lines from homes etc., emerged from the dominance analysis of options against criteria as a clear "Preferred Option". The other two powerlines options recommended in the Report were rejected in comparison, and were not at that time identified as recommendations.

After cost-benefit analysis of this Preferred Option, on the basis of childhood leukaemia alone and with the crude threshold assumption accepted originally just for comparison of options, the option was described as having "failed cost-benefit". At that point, some participants felt the Preferred Option could not be recommended, or even "preferred", and the description was changed to "best available".

In my view that was inappropriately treating a very imprecise cost-benefit analysis, based on assumptions accepted for another purpose, and excluding potential impacts supported by a large body of evidence, as if it were an absolute assessment of the option.

Section 5.5 of the Report sets out alternative advice. The WHO/HPA view would "*tend not to favour*" the corridor option, whereas the "California" view would "*tend to favour*" it. That is well described. It would be unreasonable to claim definitively, whether on grounds of science or status, that one view is right and the other wrong.

I had promoted a "non-aligned" view, which would say that government should take account of a range of views and assessments, including these two, and should make a decision on balance taking account of political and other factors.

3.3 The two recommendations

The two recommendations made in the Report (section 5.5) emerged as afterthoughts, after participants failed to agree on whether to recommend the "Preferred Option" as it was first called. Discussion that there should be something more tangible than an ambivalent presentation of alternative views, after so much time, led to these minor and relatively passive options being promoted as recommendations.

3.3 Reasons for the Best Available Option.

The corridor option (Best Available Option) emerged from the dominance analysis described in Section 5.2 of the Report. This was before any analysis of undergrounding of 132 kV and lower voltage lines, and without investigation of a European Commission Background Note on Underground Cables, which had identified cost-benefit considerations and had listed cost-ratios for underground versus overhead lines which were much lower in other EU countries than in the UK. So underground options were rejected on the basis of NG data for costs of undergrounding at 275 and 400 kV only.

4. Concluding comments

The Report gives an incomplete basis for considering policy options. Additional evidence is likely to favour precaution more, not less. In considering the Report, the Commission might be mindful of its incompleteness and omissions, and of the need to address existing exposures, proportionately, as well as to avoid increasing exposures in new developments.

Attachments

1. Public response to SAGE report.
<EMF SAGE-FIA response.doc>

2. 250-word comment included in the SAGE report.
<EMF SAGEv6-2-250.doc>

3. Editing comments to the penultimate draft SAGE report.
<EMF SAGEv6-2comments.doc>

4. Discussion draft 11-6-07 for SAGE on existing exposures.
<EMF SAGE existing2.doc>