NRPB Consultation Document 1.5.03
Proposals for Limiting Exposure to EMF (0-300 GHz)

Response from Professor M J O'Carroll
July 2003

Notation: references from the consultation document will be cited as (Ahlbom 2000) *using round brackets; references to paragraph numbers in the consultation document will use curly brackets* {57}; *references in square brackets* [1-5] *are to my own supporting papers which will be supplied with this response. I do not repeat all the details here, but do ask that the supporting papers be read with this response.*

1. Basis for this response

1.1 I have read much, but not all, of the consultation document, together with key references such as the two NRPB Doll Reports (AGNIR 1992 and AGNIR 2001a) and the Stewart Report (IEGMP 2000). I have read only a small number of the listed papers, but I have studied some key papers in depth, e.g. Feychting & Ahlbom 1993 (strangely not listed), and read several others not in the list.

1.2 As an applied mathematician and executive manager I have a background of experience in multidisciplinary research and policy evaluation. I have not undertaken research projects nor submitted academic papers for publication directly in the areas of EMF and Health, though I have in this area over the last ten years published a number of articles and conference papers and a couple of letters in leading academic journals, supervised postgraduate work and have acted as referee.

1.3 Over the last ten years I have acted as an expert witness and representative of public groups concerned with related issues, at a number of public inquiries, and have been chairman of the campaign 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.

1.4 I am a member of the EC/WHO working group on The Application of the Precautionary Principle to EMF, which met in Luxembourg this year. I have therefore read the associated papers and contributed to the evolving statements.

2. Scope of this response

2.1 This response is principally concerned with public exposure to power frequency and RF fields, though the understanding will be informed by occupational studies. I have ignored static fields.

2.2 While I am more concerned with the overview and especially precautionary policy outcomes, rather than with the minutiae of detailed research, I do offer some comments on specific points, partly by way of example. This response is not intended to be exhaustive.

3. General response to the consultation document.

3.1 There is much to be welcomed in the movement by NRPB towards recognition of precautionary considerations, and in the increased recognition of the association between power frequency fields and childhood leukaemia, and of possible non-thermal effects.

3.2 However, this is overdue. Much of the present position could and perhaps should have been taken in the previous decade, or at least after Ahlbom 2000 and IEGMP 2000.

3.3 There has been strong evidence-based criticism of NRPB in previous years. The consultation document is a significant step forward against the background of NRPB's earlier statements. However, the outcome, in the form of its proposals, is little changed, being principally to justify the move to ICNIRP guidelines.

3.4 There remains a gap in the precautionary approach proposed. That is between precautionary (slight) reduction of exposure restriction levels and proposing further research. Precautionary measures between those two are not proposed, nor even articulated, but left to the potentially very long process of stakeholder consultation. While such a process is a welcome advance, it does not address timeliness and the possibility of interim proportionate measures. Indeed the consultation document does not consider (as far as I read) proportionate measures between exposure restrictions and further research at all.

3.5 As an example within that gap, a central question remains unanswered. What proportionate precautionary measures might be appropriate to the exposure of children to power frequency fields at 0.4 μT in present or future developments? This is an obvious and prominent question, so it is disappointing that it is parcelled off to a potentially nebulous process. But it is a step forward from, in effect, denying that there is a case to consider without further research.

3.6 Just as disproportionate precaution should not frustrate beneficial innovation, so disproportionate process should not frustrate timely and proportionate precaution. The precautionary principle in the Rio declaration, and elsewhere, seeks to avoid "postponing" preventive measures for lack of full scientific certainty. Likewise interim measures should not be unduly delayed by lack of full process. This is a point discussed at the EC/WHO workshop in Luxembourg this year, with some agreement, along the lines that, pending full process, interim measures should be based on outline assessment.

3.7 The consultation document does give a wide-ranging and detailed consideration to the background of scientific evidence, with attention to uncertainties. However, it is not a complete consideration. One important gap is the lack of a systematic approach to uncertainty, and in particular to the grades of confidence in causation. In this respect the California Department of Health EMF Report 2002 was much better, and further reaching, warranting closer attention from NRPB, though it does not seem to be considered nor listed in the references.

3.8 As a simple test of the extent of coverage of the scientific literature in the consultation document, I checked the references in Appendix 1 to [5], concerning melatonin. Of 26 references, only 9 were cited in the consultation paper, although some other papers by some of the authors were cited. However, 17 of the 26 were not cited directly, even though many of then had been referred to NRPB in Professor Henshaw's paper to the consultation held on 5.12.02. The consultation paper

does address the melatonin hypothesis, though not as searchingly as I would have preferred to see. It would be helpful if NRPB could consider the hypotheses outlined in Appendix 1 to [5].

3.9 The broad approach of the consultation document to uncertainty seems to be, at the level of each paper or issue, to consider the strength of findings and then to offset that by caveats regarding aspects such as the Bradford Hill criteria. These considerations are often careful and detailed, but sometimes are hasty and partial, e.g. regarding the work of Li on miscarriage, as explained in [3] and inadequately reported in the document {117}. This "caveat approach" to uncertainty tends to reject or suppress findings in a fragmentary way, while lacking a system to weigh them cumulatively.

3.10 Some caveats refer to uncertainties in choice of exposure metrics, health outcomes or susceptible groups. Rather than being caveats to dismiss findings, such uncertainties should heighten the importance of weak results, since they will generally obscure or understate a genuine relation.

3.11 Some caveats concern failed attempts at replication being seen as contradictory results. Again, rather than being caveats to dismiss findings, there should be a more careful analysis of differences in the studies which might have led to the apparently contradictory results. For example the animal studies of Loscher were vigorously challenged (by alleged partisans) following apparently contradictory studies, but the differences were subsequently understood (relating to laboratory animal differences) without negating the original work. This is inadequately and misleadingly presented in the document {159}. There is a general lesson here for the caveat approach (a meta-caveat?) which is nicely reported in Microwave News J/A 2002, page 19.

4. The past position of NRPB and UK government.

4.1 In evaluating NRPB assessments and the advice to be given to government, it is important to understand the past form of NRPB and criticisms of it, and to understand the way in which government has used that advice to intervene, directly or indirectly, in local planning policy and national developments.

4.2 Evidence-based criticism of NRPB has suggested spin, bias, selectivity and omissions, for example [1-4] which also refer to criticism by others. Examples of rather unscientific and hasty knee-jerk reactions made by NRPB as public statements, occur firstly in reaction to Henshaw's work on radon products and charged aerosols [1] and [footnote to 4], and secondly in the NRPB website comment on the work of Li and Lee on miscarriage, which was later amended without disclosing that fact, to which Professor Henshaw and I responded in detail [3].

4.3 The UK government has taken the absence of NRPB recommending precaution, even when NRPB had not considered precaution, as a basis for blocking precaution in the form of prudent avoidance [5]. The government position has not been simply passive, but has in effect prevented local authorities from adopting precautionary planning policies relating to EMFs [5] and has actively favoured developers, for example by upholding planning appeals.

4.4 There are questions of levels of independence and conflicts of interest in governments and government-appointed bodies relating to scientific advice and its interpretation [5]. Such questions have a long history. It will be very important to recognise the structural limitations of NRPB and its

long-serving AGNIR. For example they are structurally less independent than was IEGMP. The new more open consultative approach is therefore welcomed and very important. NRPB must not assume it is the entire guardian of correct or balanced scientific judgement.

5. Specific responses to the Overview of the consultation document

5.1 In paragraph 5 of the Overview {O-5}, the document refers to the WHO keystone that "exposure guidelines should be based on thorough reviews of the science". From the discussions at the WHO Luxembourg workshop, this should not be taken to mean based exclusively on such reviews, but rather informed by them. The science is necessarily approximate and the reviews variously reflect the interests and structural dependencies of the reviewing bodies. Having said that, my own inclination is to give very serious weight to such reviews, but not to let them be used as a gatekeeper to block precautionary action, particularly interim measures, until harmful effects are established to the satisfaction of such reviewing bodies. The NRPB delegate in Luxembourg seemed to be zealously promoting, with agitation, just such a gatekeeper role for bodies such as the NRPB.

5.2 {O-7} says the government (and NRPB) responded positively to the Stewart Report (IEGMP 2000) recommendation to adopt ICNIRP guidelines. It does not balance this with reports of the other IEGMP recommendations, so puts rather a false picture into the Overview.

5.3 {O-9} and {5} report the adoption of a precautionary approach for the purpose of advising on quantitative restrictions. This is a limited approach, and does not address lesser measures.

5.4 The NRPB view in {O-11}, regarding public concerns, is very welcome.

5.5 {O-14} refers to scientific knowledge insufficient "to make a judgement on causality". There are times when a judgement might be made, given a graded form of assessment about confidence in causality, even if causality can not be firmly established. In this respect the NRPB has much to learn from the California Department of Health.

5.6 The view of NRPB in the last sentence in {O-14} is very welcome.

5.7 While the document in {O-15} declares it does not address interference with pace-makers, such interference should be an added consideration for precautionary measures.

5.8 I welcome and concur with {O-16} and {O-17}, but note 3.11 above on replication.

5.9 {O-18} claims the degree of caution in interpreting scientific evidence is a matter of professional judgement. Care is needed with the interpretation of that sentence, so as to avoid the gate-keeper effect (5.1 above). The science in question may sometimes be highly specialised, in which case specialist expertise would be more important than professional engagement. On the other hand it may be inter-disciplinary and calling for breadth of experience.

5.10 The judgement of NRPB in {O-19} is supported and welcome.

5.11 The recognition in {O-26} of the 0.4 μT - childhood leukaemia association as "reasonably consistent" is a step forward. I have had difficulty in correspondence with government in having this accepted as an association (as a statistical fact) rather than only as a potential association. It is

of course only a potential cause, but should now be accepted as an established association, given its persistence. I accept the wording that it is the "only one reasonably consistent epidemiological association of adverse health outcome …", including the "only". That is not to deny other evidence may give rational grounds for suspicion of other harmful effects, nor to deny that there are other indicative epidemiological findings with some consistency.

5.12 The concluding view of NRPB in {O-29} is welcome. It does not need to be justified by reference to public concern; it should follow from the scientific evidence in the light of the "reasonably consistent association", the biological evidence, and the IARC classification.

5.13 Reference in {O-30} to the WHO/EC process is welcome, but it should not be used as a device to delay precautionary measures, particularly where these are simple and may even save rather than cost money (examples were given in Luxembourg regarding wiring at schools in California).

5.14 {O-31} and {O-32} together may give an impression that precaution depends on (unscientific) public concern. Public concern may itself be based on science. But the countervailing features here, to weakness of evidence so far, are the potential for long-term effects which cannot be quickly investigated, and the very large scale of use of mobile phones, especially by children. A precautionary approach should include mobile phone usage as well as exposure from masts, and should embrace interim measures before the full WHO/EC process.

6. Specific responses to selected points in the main document.

6.1 {14} says that indirect effects (other than direct exposure to fields) are considered "where appropriate scientific data are available". In contrast, it excludes "putative effects". In this way, the potential effects of charged particles, e.g. arising from corona ions, are excluded. While it is right to declare the exclusion, and to refer to the ongoing consideration by AGNIR, this presentation misrepresents the work on charged particles, since there is a sound scientific base in physics for their generation, transport and deposition, though not for the health effects. Such potential health effects, and established physical effects, should be additional considerations in a precautionary approach.

6.2 {38} nicely summarises the problem of multiple hypotheses. It should not mean that findings arising from testing multiple hypotheses, or even from post hoc formulation, are invalid. The number of hypotheses can be compensated statistically, and the probability of one of them showing positive by chance can be properly taken into account. A case in point is NRPB's rush to dismiss the findings of Li, where the metric in question was not purely post hoc and the multiple hypothesis issue had been taken into account by the authors (see 3.9 above).

6.3 {39} refers to Bradford Hill (1965) on testing for causality in the context of epidemiology. The theme is pursued in {48} and {49} in the context of biology, with a further reference to Bradford Hill (1965) which makes it look as though his criteria were for the strength of association. Yet his guidelines for establishing causality included biological plausibility. But it was not a necessary criterion. A cautionary extract from his much-used text book is given in [5].

6.4 {117} is misleading. See 3.9 above and [3] for a fuller account.

6.5 The wording of {123} reflects that of the AGNIR 2001a and related NRPB press releases. This is misleading, as explained in [2].

6.6 An element of {159} is misleading. See 3.11 above. Anderson (2000) is co-authored by Loscher among others, and is not simply a contradiction of Loscher's work, as implied in {159}.

6.7 Notwithstanding the caveats in {261}, the findings of Hardell et al (2002) and (2003) of raised brain tumour risk among mobile phone users may be a landmark in the accumulation of evidence, somewhat like the Feychting and Ahlbom studies on power frequency exposure. There is scope for refinement of metrics and analysis of susceptible subgroups, which should tend to increase the findings if there is a real effect. The overall trend in recent years of findings related to cancer and mobile phones suggests increasing, rather than decreasing, grounds for concern.

6.8 Regarding uncertainties such as the poor measures of exposure {267}, see 3.10 above.

6.9 The use of the phrase "does not indicate" in the box on page 60 seems unduly negative, bearing in mind that "indicate" is not conclusive. Perhaps "gives only slight and uncertain indication" would have been better.

6.10 The failed attempt at replication of results of Lai & Singh is given prominence in {315}. Caution and more replication studies are needed before dismissing the Lai & Singh results on those grounds, particularly when replication attempts are from only one team. See 3.11 above.

6.11 Likewise, an attempt to replicate Repacholi's study should be treated with caution {319}.

6.12 The box on page 75 seems very strongly worded on the side of dismissal of or resistance to the possibility of harmful effects, in the light of the caveats and uncertainties. Such wording contrasts with the seemingly begrudging descriptions on the side of upholding concerns about possible effects, such as the "only one reasonably consistent epidemiological association".

6.13 {473} considers precaution, or "caution", as leaning towards the side of safety in interpreting scientific data. I am not sure that has been applied throughout the preceding chapters, but support the idea provided that the interpretation stays within the bounds of scientific plausibility. Precaution is not only to be applied in the interpretation of scientific evidence, but also in the choice of policy response, which should not be exclusive to scientific experts.

6.14 The phrase "precautionary approach" does not sit easily with its restriction to the interpretation of evidence, as indicated in the report of EC policy in {474}, alongside the complementary role of the Precautionary Principle assigned to policy response. If this meaning is intended throughout the consultation document, it is likely to confuse. "Precautionary interpretation" would be a better phrase than "precautionary approach", in the stated EC sense.

6.15 The discussion of "further precautionary measures" in 6.3 {487 etc.} addresses the key point, identified in 3.4 above as a gap, of measures between restrictions and further research. The summaries of the world, EC and UK positions are helpful. I support those broadly consistent and convergent positions, including the combination of both "threat" and "lack of full scientific certainty" in the Precautionary Principle.

6.16 I agree with the points in {507} to {509} relating to ILGRA (2002). I also support the EC/WHO working group position that "invoking" the Precautionary Principle is an inappropriately dramatic term. Rather there is a wide range of states of uncertainty and an equally wide range of

(active or passive) precautionary measures, so that precaution may be a universal consideration. There is not a sudden jump in the state of scientific uncertainty to warrant a sudden invocation, nor a sudden shift of the burden of proof as suggested in ILGRA (2002). {508} is a better approach.

6.16 The thrust of the previous paragraph is therefore that precaution should be considered for all EMF exposures, even though it may not warrant intervention in all cases. The passive provision of balanced public information could be justified as a mild measure across the range of these EMF issues, as hinted in {517}. In situations where the "threat" is better founded, but still uncertain, there is scope for such mild measures as guidance on voluntary reduction of exposures, control of advertising, and requirements for product information and labelling, and ultimately for stronger measures such as development control and exposure limits. {510} should be interpreted in this light.

6.17 I welcome the position taken in {510} to {514}. While {515} is reasonable, the rather jerky concept of "triggering" precaution is a shadow of "invoking" the PP. The issue of EMFs across the range of ELF and RF does warrant serious consideration of precaution, which should be more of a continuous process than an invocation or triggering. I find some support in {516}. However more immediate consideration is needed of interim precautionary measures, involving stakeholders but without the potentially excessive delay of awaiting generic frameworks and full process.

6.18 Most of 6.3.4.2 has been seen earlier and welcomed. Apart from the two cases identified {534}, the case of excessive use of mobile phones by children should also be considered, not least since there may be simple and cheap steps which could be taken, for example to provide explicit advice, to control advertising and to require exposure labelling.

6.19 The sentence in {549} and elsewhere that data on other possible health effects examined lack plausibility, coherence and consistency is a sweeping overstatement, particularly with regard to the "reasonably consistent epidemiological association" admitted.

6.20 I have addressed the points in {585} to {589} elsewhere.

7. Verdict

7.1 The consultation paper represents a significant movement of NRPB in recognising precaution and in accepting the strength of some of the scientific evidence. One and a half cheers!

7.2 I hope to submit ideas for interim measures separately.

Enclosures:

[1] M J O'Carroll, The radon effect in electromagnetic fields, Appendix 4 to evidence given at City of Lincoln Local Plan Public Inquiry, April 1997.

[2] M J O'Carroll, Summary of NRPB EMF Report, March 2001.

[3] D L Henshaw, Letter 25.3.02 to Sir Richard Doll with comments from M J O'Carroll.

[4] M J O’Carroll, Precaution in Practice, presented at Children with Leukaemia meeting “Powerlines and Health”, Birmingham, 5.12.02, in association with the NRPB consultation on the same occasion.

[5] M J O’Carroll, If, When and How - PP for EMF, presented to WHO/EC workshop, Luxembourg 24-26.2.03.