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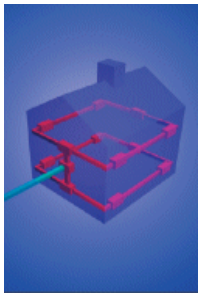
STAKEHOLDER ADVISORY GROUP ON ELF EMFS (SAGE)



RECORD OF THE SCIENCE FORUM

12 MARCH 2010

THE HATTON, 51 – 53 HATTON GARDENS, LONDON EC1N

Golder Associates

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DISTRIBUTION:

Copies to - Meeting Participants for comment

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March 2010

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Nature of the Report

This document is the report of the SAGE Science Forum (SF), held on 12th March 2010. It is not a full transcript record. Rather, it is a summary for people that did not attend as well as a record for those that did and the discussion has therefore been summarised and – in some cases – collated so that the arguments can be followed. It has been circulated in draft form to participants before publication.

Nothing in this report should be taken as representing a collective SAGE view. The views recorded were for the most part expressed by individual participants and even where the report indicates that an agreement has been reached, this has the status only of a working agreement for the particular meeting or work stream and should not be quoted as a SAGE view.

1.2 Attendee List

Adrian Todd	Kilmorack Community Council
Anne Silk	Independent Health Researcher
Anthony Barker	Institution of Engineering and Technology
Brenda Short	Powerwatch
Caroline Hampden-White	CHILDREN with LEUKAEMIA
David Renew	National Grid Company
Graham Philips	Electromagnetic Radiation Research Trust
Jill Meara	Health Protection Agency
John Swanson	National Grid Company
Patricia Keep	Department of Health
Roger Coghill	Coghill Research Laboratories
Stuart Conney	Department of Health

Support / Technical Reporter	Pete Wilkinson
Support / Technical Reporter	David Collier

Apologies received from: Alasdair Philips; Peter Roberts; and Richard Hughes.

1.3 Objectives of the Meeting

The following objectives were circulated in advance and confirmed on the day:

- Use the suggestion of a single experiment that has the potential to change people's minds as a focus for exploring how we regard experimental evidence, why different people view it as having different weight, and what it would in fact take for each of us to change our present position on the EMF issue.
- Use our collective knowledge to update our information on what policy measures have been taken in different countries, particularly in view of the latest European developments, and to identify any trends and any lessons from our understanding of why countries have adopted the measures they have that we can apply in the UK.

Participants agreed that the discussion on 'joint working' on a laboratory experiment should be within the context of SAGE's role in providing advice to government on public health and ELF EMFs. It was also agreed that the debate should take account of field levels associated with transport as well as power lines.

1.4 Agenda

10.00 Welcome and introductions
Laboratory experiments (led by John)
Coffee break
The experiment that would make us change our mind
Lunch
(Continued:) the experiment that would make us change our mind
Overseas developments (led by Stuart and Pat)
What to add from today into 2IA
16.00 Close (changed from original 15.15 by agreement)

1.5 Ground Rules

All SAGE events run under the ground rules used at the SAGE Main Group meeting of 14th October 2008.

2. PRELIMINARIES

2.1 Meeting Format

The aim of the first session (led by John Swanson) would cover laboratory evidence and the potential for a jointly-agreed experiment. The second session (run by Pat Keep & Stuart Conney from DOH) would consider information on how other countries regulated ELF EMFs. Participants would then decide what from the day should be included in the Second Interim Assessment (2IA). The notes were taken by Pete Wilkinson and David Collier.

2.2 Previous Report

No further comments were submitted at the meeting on the draft SF report from the meeting of 12th January 2009.

2.3 Actions from the Last Meeting

There were no specific actions on SF Participants from the last meeting. All actions passed on to the Process Group had been dealt with by that body.

3. LABORATORY SCIENCE

The key questions in respect of laboratory evidence were: what laboratory evidence already exists, how does it fit with other evidence, and what do participants of SAGE think of it? Secondly, in connection with the proposed experiment, the questions were: what would it take to change minds, what sort of experiment would it be, how would it have to be set up, and was there any merit in joint working, regardless of the experiment itself?

3.1 Proposed approach for discussion

Step 1. The first step would be to suggest generic types of work or categories (animal experiments, cellular work etc) which would then be arranged in order of relevance.

Step 2. The second exercise would examine the relative strengths or weaknesses of the types of work identified in terms of characteristics such as repeatability, degree of difficulty, control etc. Participants would arrange the issues in terms of strength and weaknesses.

Step 3. In the next step, participants would be asked more generally what made existing information and data on EMFs more or less believable from their perspective.

Step 4. The final step would be to ask participants what kind of experiment would be capable of changing minds.

3.2 General categories of evidence

Brainstorming produced a list of detailed categories of research which contributed to the evidence base. These were then placed in order of diminishing importance – See Appendix 1.

Some experiments were more 'realistic' in terms of field characteristics and exposure conditions. It was suggested that these would be more convincing but it did not prove easy to reach consensus as to what 'realistic' meant in detail. There was discussion about frequencies and harmonics, what might be learned from non-ELF studies, and about the relevance of work with different field strengths. There was, however, consensus that for many people it was important that experiments used fields representative of those that might be associated with power lines.

Participants discussed the potential limitations of laboratory experiments in taking account of proposed secondary mechanisms such as power line 'corona effects' and of complex interactions between personal predispositions, different environmental factors, promoters and initiators - all of which were potentially relevant to SAGE's work.

There was a brief debate about the usefulness of ranking. Some also felt that the relevance of the categories was difficult to determine without the appropriate expertise in the room. However, participants generally accepted that that there was enough expertise if the discussion was kept at a generic level – such as between human, cellular and animal evidence – and that even this level of categorisation would make subsequent steps easier. The list in Appendix 1 was then condensed into five categories (in order of diminishing importance):

- Animal;
- Cellular;
- Cell-free;
- Human (Human non-epidemiology, short term rather than long term);
- Magneto reception and navigation.

Some still felt that these categories were too simplistic, because there was a wide range of relevance for different types of experiment in each category and this made them difficult to rank. This was generally agreed to be true, but most felt the categories were still useful for promoting discussion.

All categories of research were said to have strengths and weaknesses in this context. For instance, some felt that cell-free work said little about the impact on a functioning organism but may shed light on potential mechanisms. Cellular studies cannot easily be used to study chronic exposure but might provide a 'baseline' of results which can be explored and elaborated in other work.

It was suggested that cellular experiments are often difficult to carry out and susceptible to variation in cell line and in the analysis phase, but that if the conditions are controlled and accurately set up they can give very useful data. Some were concerned that cellular experiments alone can never be sufficiently robust, or demonstrate sufficient of the relationship between ELF EMFs and health impact, to allow people to change their minds, but others argued that this was not the case.

Animal experiments addressed the 'whole organism problem' and might offer insights into the complexities of predisposition etc. but were still not directly translatable to humans living in real world situations.

Although there was some variation in view, human experiments were ranked relatively low. Health concerns mainly revolved around chronic exposure but, although in theory experiments could be designed to look at chronic effects, human experiments in practice were normally focussed on acute impact. Some suggested that if there was an effect, something should be observable even in acute experiments but others argued that it was not necessarily the case. Also, there were naturally limits to the potential risk that experimental subjects could be exposed to.

In relation to magneto reception, it was noted that receptor cells exist in humans and animals. Opinions varied but it was suggested that - although at first sight, there may be little direct relevance – people should not jump to conclusions until we know more about the ability of animals to navigate; work in this area may tell us something relevant to EMF work about animal biology.

There was further discussion of mechanisms and impacts that might be revealed by different sorts of experiment. Some suggested that if EMFs are really important in terms of impacts, they should be evident in all categories of experiments. Others disagreed, referring to the potentially complex nature of the process that might lead to disease.

Some specific types of experiment and individual experimental results were suggested as indicative of the relevance of different categories, including work on electric fields, DNA fragmentation, melatonin, the pineal gland, and blood groups.

3.3 Strengths and weaknesses of laboratory work

Participants were asked to identify the strengths and weaknesses of laboratory work in general. The output from this brainstorm is in Appendix A.

The controllability of laboratory experiments was seen by some as a great strength and the relevance of (for instance) cell studies may sometimes be greater than epidemiological studies because of this. Repeatability can be demonstrated within an experimental programme, and replication by independent research teams enhances the strength and reliability of results. Having said which, participants again noted that when dealing with a phenomenon which might depend on a complex interplay of environmental and other factors, it is not easy completely to replicate an experimental set up in a different laboratory.

The question was posed; does every day and scientific experience of safety at low doses [of other environmental factors] have any relevance to the EMF context? And, does it follow that the effects of low exposure can be ignored while concentrating on mitigating the effects of higher levels of exposure, or does it suggest that people should be concerned at all levels of exposure?

There was discussion of dose/response issues, and their significance in the context of judgments about the strengths and weaknesses of laboratory work and the realism of the experiment - in particular about the potential for different mechanisms and impacts within the 0.4 - 100 microtesla range. Some said they would expect to see evidence of a progressive dose/response relationship whereas others argued that non-linear results are plausible, in which case there would be no progressive dose/response relationship.

The discussion demonstrated the potential significance of the dose/response issue, though there was no specific conclusion. Participants were conscious of the need to remain focused on exposure to low level magnetic fields and their potential role in causing cancer, particularly in children, whilst at the same time being sensitive to the risk that a focus on exposures around the 0.4 microtesla level and the links to Childhood Leukaemia (CL) might result in potential links to other diseases (perhaps with wider impact) being downplayed.

For clarity, further comments made at this point in the workshop about acute/chronic exposure, complexity of causal relationships, and 'realistic' exposures have been collated elsewhere with the record of related discussions.

Factors affecting individual belief

Participants were asked to give examples of the evidence which led them to believe in the health impacts of ELF EMFs or remain sceptical of the existence of such a link.

Many participants perceived the evidence, taken as a whole, to be contradictory, or at least complex and difficult to interpret. Some felt it was broadly balanced and did not convince them either way, others subscribed more definitely to the 'sceptic' or 'believer' or positions.

Those **inclined not to believe** in the effects of EMFs felt that experiments with the following qualities would help them be more disposed to accepting the reality of the effects.

- Same end point by different routes;
- Had predictive power and suggested a plausible mechanism;
- Any single, relevant, experiment might suffice, if were robust, replicated by at least two groups of neutral experts, and involved realistic exposure levels and situations;
- Provided a link to a health impact suggested a possibility for action.

Those **inclined to believe** in the effects of EMFs felt that experiments with the following qualities might weaken their belief:

- A consistent alternative explanation for the effects;
- The experiment would work in different laboratories;
- Credible results, from work with a credible funding source;
- Would have to negate a range of potential causal links (see Section 4 below).

There was some discussion of a publication bias, whereby it is more difficult to publish negative findings. This may bias research groups against continuing with experiments that do not demonstrate any effect. There will inevitably be a suspicion that some groups (whether believers or sceptics) are less enthusiastic about continuing with experiments or publishing results which do not accord with their pre-existing beliefs.

Replication was a vital component in both cases and therefore offered potential as the 'killer experiment' referred to in previous SAGE meetings, at least for testing a postulated causal link. This applies to EMFs or an alternative explanation, but the subsequent discussion generally focused on attempts at replication where EMFs were the agent being tested.

This question prompted more discussion about the conditions for replication. Some points referred back to consideration of the topic earlier in the meeting e.g. the difficulty in reproducing every aspect of an experiment when one is not necessarily sure what factors in the design or implementation are actually driving the effect.

Examples were suggested of meaningful experiments that had failed replication, but where there may well have been good reasons why which were independent of the existence of the effect being tested. In other cases there appeared to have been replication in different laboratories but people had then argued that these had not been undertaken with the required control quality. Therefore, a relevant question was, what criteria did a robust replication have to meet that had not yet been met? There was no consensus here although it might be a fruitful topic for joint working. The reality of replication is much less straightforward that it might at first appear.

Independent replication was important because replication by the original team would always be prone to suspicion of a repeated mistake or a bias of some sort. However, availability of funding (if nothing else) meant that it was only ever going to be attempted for only a small proportion of experiments.

Confirmation through experiment of a predicted effect was a significant test of understanding. There was discussion of the strength of combinations of experiments and procedures that reached the same end point of conclusions through different means. This demonstrates that the process is understood rather than demonstrating the ability to reproduce an experiment.

For clarity, further comments made at this point in the meeting about complexity of causal relationships, and 'realistic' exposures have been included in this report with the record of earlier discussions where the bulk of the comments were made.

There was a short discussion at this point about the relevance of electric fields. It was suggested that the evidence was actually stronger for a link between electric fields and health effects than it was for magnetic fields and research should focus more in this area. Others disagreed with this assertion. Some participants held strong views on one side or the other of this debate; others seemed to feel they were not in a position to come to a conclusion.

Taking a step back, participants discussed the impact on belief of the overall pattern of research results and literature. For many, it was the overall pattern or (depending on one's perspective) lack of any overall pattern that was convincing, not an individual result. It was a complex picture and despite their being there being a very large number of studies, there was no unambiguous conclusion.

It was suggested that if, after 30 years of research, the scientific community could not agree whether there is a deleterious effect from ELF EMFs on human health, then weariness is bound to set in and researchers will tend to concentrate on more fruitful areas. Millions of pounds have been spent yet the answers seemed, at least to some participants, to be just as vague as they were years ago. The counter argument was that in science, 30 years' research before a complex causal link was resolved was not at all uncommon, and in all this time no one has been able to demonstrate that there is not a health issue associated with e.g. overhead power lines and/or that ELF EMFs are not the cause. Depending on one's view, the conclusion may be that there is no 'needle in the haystack' or that the link between cause and effect is complex.

One person from the more sceptical side of the argument said that he at least would be convinced by one robust replication of an experiment demonstrating a biological effect [that might plausibly be linked to a health impact?]. The counter from the other side was that there have been many replicated experiments, and were at least some of them not robust?

It appeared that most participants believed that although the picture might not be resolved, there was clear justification for a precautionary approach - which was indeed the basis of SAGE's remit - especially given the wide range of potential health effects, including (depending on perspective) CL, breast cancer and Alzheimer's disease.

Asked to summarise the three factors that lead to belief or not in the impact of ELF EMFs on human health, the general consensus seemed to be that arriving at the same end point by different routes, success of replication, and consistency and robustness of the literature were the things that strengthened people's belief. Some participants felt that convincing results really needed to cover all four categories of research: epidemiological, laboratory, animal and cellular. Conflicting experimental results and failure in replication tended to weaken confidence in a link between exposure and impact.

Broadly speaking, the main arguments in this session seemed to be [see foot note][1] that:

- 'Sceptics' might doubt the existence of health impacts or they may acknowledge probable impacts but doubt the cause is ELF EMFs.
- 'Believers' acknowledge probable impacts but go further and are confident that at least a contributory cause is ELF EMFs.

[1] Note: because the debate moved back and forth between topics, these six bullet points are offered as the note takers' attempt at a summary of the main arguments made in the discussion.

Therefore:

- If you were a sceptic, to change your mind you required a robust demonstration of the existence of health impacts and/or causal link, typically requiring replication and some insight into a plausible mechanism.
- If you were a believer, to change your mind you again required a robust demonstration of a causal link but, given your prior belief in the existence of the health impacts, in this case relating to some alternative explanation. Again, replication and some insight into a plausible mechanism would be required.
- If there were in fact no significant health impacts, there was obviously no possibility of finding an alternative explanation for them in the laboratory.

3.4 Attributes of an experiment that would change beliefs

As an exercise to help explore the factors that determine participants' beliefs, participants further considered the attributes that such a jointly agreed experiment, if one were to happen, would need to have if it were to convince.

Unsurprisingly, these attributes reflected the discussion through the day on the factors that led people to their position and the strengths and weaknesses of different types of scientific study, including: same end points by different routes; capable of removing large areas of uncertainty; predictive ability; evidence of effect mechanisms; and subsequent consensus among scientists on the validity of the postulated mechanism. Inherent replicability and actual replication were vital, by (it was suggested) at least two independent and neutral groups of scientists or laboratories. Exposures and experimental conditions should be relevant and replicated.

Looking forward to the later discussion on the potential for a jointly-agreed experiment, some participants suggested that a single experiment with these characteristics could potentially be fruitful, whilst others were less convinced that it would necessarily change minds.

It was suggested that the majority of those participants who described themselves as 'non-scientific' were faced with contradictory messages and would not be persuaded of the absence of an effect by one experiment. They, like the believers, would probably need to be convinced of an alternative explanation [of the reported epidemiology results, or potential cause?].

The situation as it stood before starting the detailed discussion on the jointly-agreed experiment was summarised using flipcharts as follows:

Those who tended not to believe that EMFs had an impact were more likely to change their minds on the basis of a single experiment if it was robust and provided the opportunity for replication. The following additional attributes would give credibility to an experiment's conclusions and thus (if it were the outcome) make them inclined to move further towards the 'believe' camp (see Appendix 1 for 'raw' wording):

- If the experiment demonstrated the same end point by different routes;
- Conflicting results and failed replications could be explained;
- Evidence of a dose-response relationship (none exists so far);
- Realistic exposure conditions;
- Links to cancer still uncertain, so if an experiment helps clarify.

Those who had greater belief in the effect of exposure to EMFs required a consistent alternative explanation for any and every lack of effect before their belief would be weakened. Additional factors that would contribute to an experiment's credibility and thus (if it were the outcome) move them towards a more sceptical position were:

- Deals with the complexity of the issue and emerging connections;
- Links to known mechanism.

Related points that explained their starting position included:

- Some groups, while they only publish positive results, could be perfectly justified in doing so because the results are actually all positive: one should not assume bias;
- There is abundant evidence already of impacts;
- There have been successful replications;
- In 30 years, the issue has not gone away;
- There are sufficient suggestions for precautionary measures;
- Differences may reflect partial knowledge;
- The lack of robustness may be the effect of poor communications.

4. JOINTLY-AGREED EXPERIMENT

The previous sessions had explored perceptions of existing laboratory evidence and the sort of laboratory studies that might change participants' positions. In this session, participants now specifically considered whether there was any potential for an experiment to achieve such a shift in position, and if so how it might be commissioned and carried out such that people on all sides of the argument would consider it valid.

Going one stage further, was it possible that such an experiment or series of experiments could be decisive? The ideal in these circumstances would be for both sides to commit in advance to accepting both the result and its implications.

Building on previous discussion, it was suggested that there was already a large body of work that convinced some but not others, and that the starting point should actually be a better understanding of why that should be. It would further the SF's purpose of understanding and potentially resolve different views, and unless SAGE understood in detail why existing original experiments or replications did not convince, it would be unable to design one that did. One point of view was that signing up to new work would arguably be wrong when so many studies remain poorly read and understood.

Some participants expressed doubt that, given the existing volume of studies, any single experiment they could envisage could be paradigm-changing. Science rarely worked like that. Knowledge was accumulated incrementally through work within narrow fields and in complimentary areas. As discussed earlier, for many it was the overall pattern of results that had brought them to their current state of belief, so could a single experiment change it? There may be many false positive and false negative results along the way. Comments emailed in advance made the same point. On the other hand, there were participants – generally those professing to be more sceptical – who reiterated their position that a robust demonstration of an effect *would* change their minds and stimulate new research.

There was discussion about the prospects for designing a 'killer' experiment, given that replication may be difficult because one did not necessarily know what aspects of an experiment were essential to the replication, or what interaction of factors might be necessary to produce an effect. Asking people from whatever side of the argument to commit to changing their views in advance was not going to work, some suggested, because even if the experimental design was shared it was still possible that hindsight or learning from doing the experiment would reveal some flaw in it.

The point was made that even if everyone was equally willing to change their minds, one single negative result was less likely to overturn a body of positive results than one single positive one was to stand clear of previous negative evidence.

Proving negatives was difficult but both sides of the argument were in fact setting similar tests. If you were a sceptic, you required a robust demonstration of the existence of a causal link to EMFs, whereas if you were a believer you similarly required a robust demonstration of a causal link clearly relating to some alternative explanation for each putative health effect.

Also, a demonstration of *any* effect (without defining effect at this point) might convince a sceptic that an effect existed, but if one believed work on a range of potential effects and mechanisms had generated enough evidence (maybe when taken with epidemiology) at least to justify precautionary action, each of these effects and mechanisms might have to be disproved. There was a 'one-to-many' relationship; one experiment opened up the possibility for the sceptics of a range of effects but one experiment could for the believers at best only rule out some effects or mechanisms.

There was a robust exchange of views in which a perceived reluctance of 'believers' to move their position was tested. The outcome was that participants basically agreed that the problem within SAGE was not of members' openness, the issue was one of structural, unavoidable asymmetries. As noted previously, believers and sceptics alike applied similar tests when assessing the evidence for causal links, whether in relation to ELF EMFs or alternative explanations – again recognising that this was predicated on there being a significant health effect to explain.

It was acknowledged that the willingness of Members to change their views might not be matched by those outside the process who were committed to one side or the other. Both sides were said to be good at explaining away results which did not support their views.

Despite the attractions of 'the challenge', there seemed to be consensus that there were now at least two structural asymmetries that had nothing to do with willingness to change one's mind but which made prior commitment only possible - even in theory - for one side of the argument.

Notwithstanding this, most participants thought that there might still be scope for progress. The issue of robust replication had been a theme though the day's discussions and replication of an experiment that one side of the argument believed showed an effect might still an option, even if it wasn't realistic to ask people to commit in advance to changing their views. Or, it may be possible to identify an experiment that would plug a gap in knowledge or at least lead the debate forward and answer *some* questions.

Pete Wilkinson presented his experience of joint fact finding where there was disagreement about 'the truth' amongst protagonists and where neither side trusted the other to conduct or commission objective research. He explained that the primary purpose of joint working is to increase confidence where there is controversy. In some circumstances it may offer a definitive answer but is more generally used to narrow the extremes of uncertainty and clarify key issues. Examples from his experience included investigation of the costs associated with pollution control equipment and the potential impacts from spent nuclear fuel casks being marshalled at a north London suburb. Both issues were resolved successfully through joint working / joint fact finding.

Participants briefly discussed the relevance of Pete's specific examples to the matter at hand. Although there may be limitations, the principle of working together to specify work and commission research was clearly attractive if the context allowed.

Taking these arguments as a whole, it seemed unlikely that most individuals would move from one camp to another on the basis of any single experiment. Nevertheless, whilst there did not seem to be scope for either a single 'killer experiment' or for getting everyone to commit in advance (for structural reasons, even if everybody was otherwise willing), there was real potential value in continuing to work together to consider what sort of experiment might move the debate forward.

This was consistent with the Science Forum's aim of improving mutual understanding, even if there were doubts as to whether taking things forward to the point of an actual experimental programme was within SAGE's remit. Although there were perhaps more reservations than there had been at the start, the balance of comment suggested that the option of jointly-specified work of some kind should be passed through to the next phase of SAGE.

5. INTERNATIONAL POLICY & REGULATION

The final session began with a review of how other countries have translated precaution on the health impacts of EMFs into policy and regulation. Copies of the flip charts from this session are included in Appendix 1. The review was based on tables reproduced from www.emfs.info/related+issues/limits/world/.

The tables illustrated the wide variety of limits applied in different countries and the difficulty in comparing like with like. In some cases, interpretation and targets depended on regional arrangements and conditions. Field strengths were measured in different places (e.g. some US states refer to the edge of the right-of-way). Some exposures were whole-day averages, others referred to different durations (e.g. Poland). Some additionally have precautionary policies (e.g. Sweden), attention values/quality targets (e.g. Italy), investigation levels (e.g. Poland), or 'sanitary norms' (e.g. Russia). Some made reference to the proximity of residential areas, nurseries and schools. Some seemed to focus more on magnetic fields, some on electric fields, and some covered both.

Participants commented on the absence of data and information for African and Arab states. It was suggested that information from Turkey would be interesting, as an example of how an Islamic country with potential for EU membership dealt with the uncertainties of EMFs. John Swanson[2] suggested that the reason we have no information on many countries could simply be that they don't have EMF limits.

Most of the countries discussed took ICNIRP and WHO as their starting point; a sizeable minority then adopted lower national or local limits, sometimes apparently in response to public concerns. The values in the 1999 EU recommendation on public exposure were taken directly from ICNIRP. The information available generally covers only power lines: information on distribution systems, wiring and other means of exposure was not discussed. In many cases, the restrictions were said to apply to power lines only. Where ICNIRP is applied, that applies to all sources.

The ensuing discussion focussed on three main topics:

- The reasons for the wide variation and the fact that the UK appeared to be 'out of step' in its approach compared to some apparently similar countries;
- The distinction between, and relative value of, policy, guidelines and regulations;
- The scope for SAGE gaining useful insight from looking at how different countries used cost/benefit and similar approaches as part of their policy / regulatory frameworks.

Questions posed included: was there evidence of convergence and acceptance of tighter exposure limits; should the UK be heading in the same general direction as those countries that had adopted lower limits and action levels; and, if so, what should the response of the UK and SAGE, as the advisory body to government, be?

[2] John requested that this comment be attributed.

It was reported that at a recent meeting between SAGE members and a Japanese delegation looking at stakeholder engagement in the UK, SAGE members had been told that power lines were not allowed to pass over housing or factories in Japan but this was to protect the power lines from fire and other disasters happening on the ground rather than to protect people from EMFs.

There was a brief exchange on the relative merits of policy-led and regulatory-led approaches. It was suggested that limits without enforcement were meaningless. The rigour with which limits were enforced was said to vary considerably between different countries but participants did not have the information to explore this further.

Participants agreed that a greater knowledge of how other countries approached risk assessment and the methods they used would be valuable. SAGE Members would want to know how science was used to underpin lower limits in those countries that had them: some speculated that they had taken account of more recent research.

In the UK, the Infrastructure Planning Commission (IPC) came into existence in March and power line routes are currently being planned to accommodate proposed new generating plant. It was suggested that the cost/benefit assessment used in determining responses to EMF exposures should be capable of reacting to public concern and support associated decision making on issues such as undergrounding and precautionary measures. CBA was therefore very topical.

Looking to the future, there seemed to be consensus that consideration of the approaches adopted in other countries, the underpinning justifications, and their approach to risk/assessment and CBA should be included in the next phase of SAGE (see also the brainstorm output in Appendix 1). There was still interest in the situation in other non-European countries such as India, South Africa and China, but generally the aim should be to go ‘deeper’ rather than ‘broader’, looking for more in-depth understanding of selected countries. This would be taken forward by the Funders and the Process Group in their planning for the next phase.

6. SAGE 2IA

The final topic was, what from today would participants like to see included in the 2nd Interim Assessment (2IA)?

The day was generally held to have been an important part of SAGE’s ongoing work on science. Consideration of the strengths and weaknesses of different types of evidence, the structural origins of the asymmetry between scepticism and belief, and what could or could not be accomplished through jointly-agreed experiment, all exposed and helped people understand differences.

Most participants wanted to see more rather than less of the day's debate reflected in the 2IA. It was agreed that other countries' approaches to EMFs would be mentioned in the 2IA with a note of SAGE's proposed future activities in this area, but that the details of their different limits etc. would not be included. These recommendations would be fed into next week's drafting meeting.

7. REFLECTIONS ON THE DAY

The exchange of views had been valuable and genuine insights had emerged. Although no 'killer experiment' had been identified and participants were not currently enthusiastic about pushing forward on an experimental programme, there was support for the idea of working together to take matters forward and for continuing to explore the types of evidence that might convince people to shift position. The Funders and Process Group would take account of these conclusions in their deliberations.

All agreed that it had been a very useful day and thanked John for leading it so effectively.

8. SUMMARY OF ACTIONS

There were no specific SF actions from this meeting. Those for the Process Group were taken forward onto the March PG agenda.

9. NEXT MEETING

There are no remaining Science Forum meetings in SAGE 2.

APPENDIX 1

BRAINSTORM OUTPUT

(COPIES OF FLIPCHARTS ARE AVAILABLE ON REQUEST)

Brainstorm output, Categories of research

In decreasing order or relevance.

- Interactions
- Relevance to health
- Predisposition
- 50/60 Hz and harmonics
- Animal experimentation
- Cellular experimentation
- 0.4 microtesla
- Human chronic exposure
- 20/30 microtesla
- Evidence of all effects at cell level
- Cell free work
- Acute human exposure
- More than 100 microtesla exposure – transport, the importance of ‘difference’ and ‘relevance’
- Animal magneto reception
- Navigation per se

Brainstorm output, Strengths of Laboratory Work

In descending order of importance (i.e. from strength to weakness) was:

- Control
- Replication
    - In different laboratories
    - The ability to build on results
- Knowledge about the cause and effect
    - Can control if you know that EMFs are causal (strength)
    - May miss it if you don’t know (weakness)
- Multi-generational
- Effects versus health effects
- So many parameters to consider and get right
- Insufficient time
- Level of difficulty
    - Bias created by ambient field
    - Quality
    - Technique
- Not ‘connected to reality’
- The effect of interactions about which we are unaware

Brainstorm output, Areas of Interest

Some possible areas of interest for experimental investigation.

- DNA fragmentation
- EEG
- Enzymes
- Calcium efflux
- Micronuclei
- Lymphocytes
- Melatonin

Brainstorm output, International Policy & Regulation

Areas of possible future work for consideration.

- Risk assessments in other countries – useful to inform the UK regulatory authorities
- Look at the processes involved in costs and CBA rather than looking at a greater number of countries and how they apply ICRIRP and regulation
- Examination of convergence
- Examination of the possibility that some countries do not have 'limits' but may use policies and actions which are EMF related
- Developed countries may be looking at more recent research and others may have missed recent data
- Divergence issues – ICNIRP?
- 0.4 microtesla adherence
- Gaps identified as: Arab states, India, Africa

What else does the group need to deal with this issue?

- Russia: information from Graham via his contact;
- Electric limit data – e.g. 500 volts per metre in Russia;
- What enforcement measures do countries apply?
- How do countries measure 'economically efficient'?
- Less developed countries have lower limits in some areas such as Costa Rica. Why?
- (Costa Rica has elevated incidence of CL and is undertaking work on pesticides);
- Wiring advice: what happens in homes?
- DH to write letters to countries to ascertain limits employed and why;
- Former eastern bloc nations: a soviet past but what do they do now?
- What body advises each country and what triggers public concern?
- Population density;
- Military bases – EMF exclusions?
- Combinations: any information on toxic/EMF interactions, chemical and environmental;

- Focus on those who differ from ICNIRP and why;
- Most recent information availability;
- Turkey – a good reference country;
- Sweden – [illegible].
- Optimal phasing progress in different countries;
- Anomalies with ICNIRP: 10k for occupational, 5k for public; magnetic 5 x factor. Why?
- Public concern: do they have the same cost of undergrounding and the impact this has on CBA;
- States in the US: Everglades Park levels;
- Not necessarily comparing like with like: e.g. levels and ‘attention’ value.