Mobile Phones, Mobile Phone Masts and Health

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This note describes issues relating to the safety of mobile phones and mobile phone masts. A separate note (SN/SC/1300) deals with planning issues relating to mobile phone masts.

Contents

A. Research on Mobile Phone Effects

Mobile telephones emit radio waves that can penetrate human tissue, producing a heating effect. Safety guidelines produced by the National Radiological Protection Board are based solely on avoiding the known biological consequences of excess heating. The intensity of radiation from mobile phones is too low to produce significant heating; most health concerns surround possible but unproven athermal effects, arising from interference with the body's natural electrical activity for example. The *New Scientist* describes the main issue of disagreement:

> Mobile phones emit such low levels of radiation that they cannot heat tissues by more than a fraction of a degree. So how on earth, ask the sceptics, can they possibly pose a health risk? To try to show that they do, researchers can take two approaches. One is to set up lab studies to show, despite what physicists say, that radio waves really can have effects on animals or cells that heating cannot explain. Alternatively, they

> can do epidemiological studies to find out if, for instance, people who use mobile phones are more likely to get brain cancer than those who don't. Both approaches face some serious stumbling blocks. All studies that have claimed to show any non-thermal effects, for instance, have immediately been dismissed by critics who say that the observed effects could easily have been caused by heating.[1]

The article notes the single exception, de Pomerai's work on nematodes showing a biological effect that produced the exact opposite of what would be expected if heating were actually involved. However, it notes that other groups are finding it hard to reproduce the results. A major World Health Organisation epidemiological study is under way. However, that study is also being criticised. It identifies cancer patients and looks back on their mobile phone use. Some people think that that method might lead to bias. A study is being planned by the UK's Mobile Telecommunications Health Research [MTHR] Programme based on different methodology. The article suggested what might happen next:

> If large-scale studies like [the MHTR] do reveal a clear correlation between mobile phone usage and cancer, the mobile industry could be in trouble. Such results, however, will never explain how cellphones cause these health effects. That will leave researchers back at square one, looking for an elusive mechanism that many scientists are convinced does not exist. If, on the other hand, such studies fail to find any link with cancer, most researchers will come round to [the] view that there really is no association.

An article in the *British Medical Journal* in 2001, reported on studies suggesting that mobile phones did not cause cancer:

> The studies, which together involved more than 1250 patients with brain tumours and an equal number of healthy individuals, found no increased risk of cancers among those who used the devices more frequently. The results are not likely to put the issue of potential harm completely to rest, but they join a growing body of evidence suggesting that the only important risk associated with the handheld devices is a higher likelihood of traffic accidents. "In all of the available scientific literature, there is nothing that indicates any adverse health effects from using cell phones," said Russell Owen, chief of the Food and Drug Administration's radiation biology branch. The two studies leave open the question of whether longer uses of the devices could pose a problem. That issue is being addressed in a still larger European trial now under way, but results are not expected until 2003 at the earliest.[2]

B. The Stewart Report in 2000

One response to uncertainty over possible health effects of mobile phones has been the establishment of an Independent Expert Group on Mobile Phones, chaired by Sir William

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1 "Will we ever know?" *New Scientist*, 13 September 2003

2 S.Gottlieb, "Evidence grows for safety of mobile phones" *BMJ*, 20 January 2001

Stewart, a former Chief Scientific Adviser to the Government. This reported on 11 May 2000, having reviewed the literature and conducted a number of public hearings around the UK.[3] The main conclusions, summarised in an accompanying press release were:

> The use of mobile phones and related technologies will continue to increase for the foreseeable future.
>
> ? The balance of evidence to date does not suggest that emissions from mobile phones and base stations put the health of the UK population at risk.
>
> ? There is now some preliminary scientific evidence that exposures to RF radiation may cause subtle effects on biological functions, including those of the brain. This does not necessarily mean that health is affected but it is not possible to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects.
>
> ? The Expert Group has recommended that a precautionary approach to the use of mobile phone technologies be adopted until more detailed and scientifically robust information becomes available.
>
> ? For base station emissions, exposures of the general population will be to the whole body but normally at levels of intensity many times less than those from handsets.
>
> ? Some people's well-being may be adversely affected by the environmental impact of mobile phone base stations sited next to houses, schools or other buildings, as well as by fear of perceived direct effects.
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> ? For all base stations, including those with masts under 15m, permitted development rights should be revoked and the siting of all new base stations should be subject to the normal planning process.
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> ? The use of mobile phones whilst driving can have a detrimental effect on the quality of driving. Drivers should be discouraged from using mobile phones whilst on the move.
>
> ? The widespread use of mobile phones by children for non-essential calls should be discouraged.

Sir William Stewart amplified his personal concerns about phones (but not masts) to the British Association for the Advancement of Science in September 2001:

> Sir William Stewart...called for the cost of handsets to be increased to restrict their use by children. Sir William…said he would not allow his grandchildren to use a mobile phone...[4]

In 2000, David Blunkett wrote to all schools urging headteachers to restrict the use of mobile phones for pupils younger than those in the sixth form. In addition, all children under the age of 16 are told to use their mobile phones only in emergencies in a new point-of-sale leaflet drawn up by ministers.[5]

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[3] http://www.iegmp.org.uk/

[4] "Mobile telephones in new brain tumour alert", *Daily Telegraph*, 5 September 2001

[5] "Schools warned on mobile phones", *Financial Times*, 25 July 2000

Mobile phone makers started displaying radiation emission levels on handsets following agreement on a European Union-wide harmonised test method. The EU's standards committee adopted an industry-wide testing system to measure specific absorption rates. Since 31 March 2002 all phones have had to display their values.[6]

C. Mobile Phone Masts

The Stewart Report recommended the adoption of the more stringent International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for public exposure. In their response to the report, the Government accepted this.[7] The report also drew attention to the particularly contentious issue of base stations near or within school grounds, recommending that radiation levels be checked for conformity with guidelines. In July 2000, the Government sent advice to local education authorities, with the following passage on base stations and schools:

> **Base Stations on or near schools**
> The [Stewart] report does not suggest that existing base stations should be taken down from schools, or that no new base stations should be erected on school premises. However, under its precautionary approach, the report recommends that the "beam of greatest intensity" from a base station's antenna should not fall on any part of the school grounds or buildings without agreement from the school and parents. Where parents and/or schools wish to know whether the bean of intensity falls on school grounds or buildings, the school should contact the base station's operator. The operators have agreed to provide schools with information on the level of intensity of radio frequency radiation. This should include an explanation of the way in which the intensity of radiation falls off with distance from the antenna. If there is major concern from the school or parents, they could ask the network operator to adjust the antenna.
>
> **Audit of base stations**
> The Government has asked the Radiocommunications Agency to carry out the report's recommendation for an independent random audit of base stations. The Radiocommunications Agency has agreed to audit base stations in and around schools first.[8]

In February 2003, the Radiocommunications Agency published results of the survey of emissions from base stations recommended by the Stewart Report:

> Readings of emissions from mobile phone masts throughout the UK were well below international guidelines, according to the latest figures released today. The

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6 "Mobile Phones to show Radiation Emissions", *Financial Times*,. 24 September 2001

7 Department of Health, *Mobile Phones and Health - Government Response to the report from the Independent Expert Group on Mobile Phones. (Stewart Group)*, 11 May 2000 http://www.doh.gov.uk/mobile.htm

8 DFEE Guidance, *Mobile phones and base stations*, July 2000

> Government study examined mobile phone masts on 109 sites across the UK, looking at 82 school sites and 27 hospitals. The study showed:
> - readings ranged from hundreds to millions of times below international guidelines;
> - the lowest reading in this year's study was taken at Enniskillen Model Primary School at more than 19 million times below the guidelines; and
> - the highest reading, still more than 700 times below the limit, was at Aintree Hospital in Liverpool. The Government also announced it will continue the study of masts in 2003…
>
> Notes for editors
> 1. The mobile phone base station audit is being carried out by the Radiocommunications Agency. It began in December 2000 and tested electromagnetic emissions from 100 mobile base stations located on or near schools. In 2002 the RA tested another 109 sites in schools and hospitals. The findings showed that radiation emission levels ranged between 1/731 and 1/19,907,515 of the international exposure guidelines. The exposure limits are set by the International Commission for Non-Ionizing Radiation Protection (ICNIRP). Further information on the exposure guidelines is available from the National Radiological Protection Board.
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> 2. The Radiocommunications Agency undertook the audit in response to recommendations made by the Independent Expert Group on Mobile Phones, chaired by Sir William Stewart, which reported in April 2000. The Group's report found that evidence did not suggest that mobile phone technologies put the health of the general population at risk. The Group recommended a precautionary approach be adopted and, that as part of this precautionary approach, an audit of base stations be carried out, with base stations near schools and other sensitive sites as a priority.[9]

As the Expert Group notes, the use of mobile phones contributes far more to microwave exposure than the presence of base stations. Despite the absence of a clear health risk in either case, there is clearly a need for further research into the biological effects of microwaves at the frequencies and intensities relevant to mobile phone applications.

1. Microcell and Picocell Base Stations

Microcell and Picocell bases stations provide infill coverage and additional capacity within areas of high mobile phone usage. Smaller than standard 'macrocell' base stations they range in height up to ten meters and have a power output not exceeding five watts. They are generally more accessible to the public than macrocell transmitters, often mounted on street furniture.

In 2004 the NRPB published its study into *Exposure of the General Public to Radio Waves near Microcell and Picocell Base Stations for Mobile Telecommunications*.[10] The study found

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[9] DTI Press Notice P/2003/100, *New results from mobile phone masts study*, 18 February 2003

[10] NHRB, *Exposure of the General Public to Radio Waves near Microcell and Picocell Base Stations for Mobile Telecommunications*, September 2004.

that exposure measured as a percentage of ICNRP guidelines generally ranged between 0.002-2% for the transmitters in the study group. The greatest exposure measured at any of the sites studied was 8.6%. This measurement was taken at a position inaccessible to the public. The NRPB states that any exposure that complies with the ICNIRP guidelines is not considered hazardous.

D. The Mobile Telecommunications and Health Research Programme

One of the key recommendations of the Stewart Report on Mobile Phones and Health was for a programme of new research supported equally by Government and Industry. This recommendation was accepted with an initial £7.4m being allocated for the programme. An international committee of experts, chaired by Sir William Stewart, was set in place to allocate and manage the programme. Fifteen projects have been announced and are under way. A further three projects are jointly funded by the DTI and the Mobile Telecommunications and Health Research Programme. Details are available on the website: http://www.mthr.org.uk/research_projects/funded_projects.htm.

The studies deal almost exclusively with the effects of usage of mobile phones rather than of mobile phone masts, although they would be able to fund projects dealing with the effects of masts. The MTHR Programme Management Committee has given details of research that it would like undertaken in the area of human volunteer studies.

Definition of the Study Samples

Research is needed to define the criteria for inclusion of individuals into volunteer and control groups for a provocation study (see below). The research should include consultation with relevant action and interest groups. In defining the volunteer group, consideration should be given to people who attribute symptoms to their exposure to a variety of electromagnetic emissions, in addition to those whose complaints are limited to exposure exclusively to mobile phone base station emissions. Consideration should also be given to how evidence might be obtained that will help authorities refine their advice on the effect of this technology on children.

Provocation Study

An investigation into the basis of symptoms attributed to base station emissions. The central component of this study should be a double blind, randomised, provocation experiment. The test environment and exposure conditions are described in a separate document…Technical support including assistance if necessary with the provision of appropriate transmitter equipment and test environment, will be provided to the successful applicants to ensure compliance with these technical specifications. The experimental protocol should not result in exposure conditions greater than those found in everyday situations. In addition to subjective ratings by participants, appropriate physiological indices (e.g. heart rate variability) should be recorded in the different exposure conditions. In addition, relevant psychometric data (e.g. measures of state and trait anxiety, depression ratings, etc) should be obtained.

In order to maximise the face validity of the study from the participants' perspective, and to optimise its sensitivity, the double blind study should be preceded by an 'open'

provocation condition, allowing participants explicitly to associate symptoms with the different exposure conditions.[11]

E. The National Radiological Protection Board Report, 2003

The Report, published by the National Radiological Protection Board (NRPB), was written by an independent group on non-ionising radiation, chaired by Professor Swerdlow.[12] It surveyed studies that had been published since the Stewart Report, also known as the report by the Independent Expert Group on Mobile Phones (IEGMP). The report, *Health Effects from Radiofrequency Electromagnetic Fields*, produced the following overall conclusions:

> **Overall summary and conclusions**
> This report examines possible health effects of exposure to radiofrequency (RF) fields, with an emphasis on studies conducted since the review by the Independent Expert Group on Mobile Phones (IEGMP) in 2000. There are many sources of RF fields – at work, at home, and in the environment – but recent emphasis in health-related studies has been on mobile phones and broadcasting masts. Studies reviewed by IEGMP suggested possible cognitive effects of exposure to RF fields from mobile phones, and possible effects of pulse modulated RF fields on calcium efflux from the nervous system. The overall evidence on cognitive effects remains inconclusive, while the suggestions of effects on calcium efflux have not been supported by more recent, better-conducted studies. The biological evidence suggests that RF fields do not cause mutation or initiate or promote tumour formation, and the epidemiological data overall do not suggest causal associations between exposures to RF fields, in particular from mobile phone use, and the risk of cancer. Exposure levels from living near to mobile phone base stations are extremely low, and the overall evidence indicates that they are unlikely to pose a risk to health. Little has been published specifically on childhood exposures to RF fields, and no new substantial studies on this have been published since the IEGMP report.
> In aggregate the research published since the IEGMP report does not give cause for concern. The weight of evidence now available does not suggest that there are adverse health effects from exposures to RF fields below guideline levels, but the published research on RF exposures and health has limitations, and mobile phones have only been in widespread use for a relatively short time. The possibility therefore remains open that there could be health effects from exposure to RF fields below guideline levels; hence continued research is needed.[13]

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[11] http://www.mthr.org.uk/research_projects/third_call_final.htm

[12] NRPB, *Health Effects from Radiofrequency Electromagnetic Fields*, 2003 http://www.nrpb.org/publications/documents_of_nrpb/pdfs/doc_14_2.pdf

[13] http://www.nrpb.org/publications/documents_of_nrpb/abstracts/absd14-2.htm

F. Are third generation phone masts different?

A Dutch study, widely reported in the UK, suggested that those experiencing radiation from a third generation mobile phone mast experienced symptoms including nausea, which were not experienced by those near phone masts from conventional phones.[14] However, the NRPB report rejects the idea that third generation phones are causing the difference:

> In another study (Zwamborn et al, 2003)…blinded experimental exposure to electromagnetic fields similar to those produced by a UMTS base station antenna, with a peak field strength of 1 V m^{-1}, was associated with a significant reduction in "well-being" (assessed by a questionnaire) in 36 individuals who had previously registered symptoms which they attributed to antennas. Moreover, a significant reduction in well-being was also observed in a group of 36 healthy volunteers when similarly exposed. However, there was no significant effect on well-being from exposure of the symptomatic subjects to 900 or 1800 MHz GSM-type fields, as might have been expected had their symptoms genuinely been attributable to a noxious effect of such radiation.[15]

Of course, if other researchers can replicate the results from the Dutch team, then further consideration will have to be given to finding an explanation of the results.

G. The Interphone Study, 2004

A PQ in 2004 described an international study on whether mobile phones cause cancer:

> **Baroness Miller of Chilthorne Domer** asked Her Majesty's Government:
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> Further to the Written Answer by the Baroness Andrews on 12 May 2003 (WA 15–16), whether the Interphone study by the International Agency for Research on Cancer into the use of mobile phones has now reported; and, if not, when they expect it to do so.
>
> **Lord Warner:** The Interphone study, set up by the International Agency for Research on Cancer, to investigate the relationship between cancer risk and mobile phone use is expected to produce its first results at the end of 2004. Information about the study can be found on the website www.iarc.fr/pageroot/UNITS/RCA4.html Copies have also been placed in the Library.[16]

The link gives the following information about the study:

> **The INTERPHONE Study**
> Several recent expert groups have reviewed critically the current evidence concerning the health effects of low-level exposures to radio frequency (RF) electromagnetic fields (WHO 1996, McKinlay et al. 1997, Repacholi, 1998). In view of the current

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[14] http://www.ez.nl/beleid/home_ond/gsm/docs/TNO-FEL_REPORT_03148_Definitief.pdf

[15] NRPB, *Health Effects from Radiofrequency Electromagnetic Fields*, 2003, pp111-2

[16] HL Deb 11 March 2004 c199 WA

state of knowledge concerning the possible adverse health effects of RF exposure, and of the increasingly widespread use of portable telephones in many countries, these groups recommended that research be carried out to determine whether radiotelephones could cause adverse health effects. Priority was given to epidemiological studies of the relationship between use of mobile telephones and the incidence of (a) brain tumours (b) salivary gland tumours, acoustic neurinomas and other head and neck tumours (c) leukaemia and lymphomas be carried out.

As a result of these recommendations, a detailed feasibility study was carried out in 1998 and 1999 in fourteen countries, co-ordinated by the International Agency for Research on Cancer (IARC) in Lyon. Using criteria established in advance, it was concluded that an international study of the relation between mobile telephone use and brain cancer risk is feasible and informative: the past prevalence of mobile telephone use and the expected number of cases are adequate to detect a 1.5 fold increase in risk five to 10 years from beginning of use, if it exists.
A series of multi-national case-control studies has therefore been set-up, co-ordinated by IARC. Separate studies are being carried out for acoustic neurinoma, gliomas and meningiomas and tumours of the parotid gland, the tumours that, if RF are carcinogenic, would be most likely to be related to mobile telephone use. A study of leukaemia risk is also planned, conditional on funding.

The primary objective of these studies is to assess whether RF exposure from mobile telephones is associated with cancer risk. A secondary objective of the studies is to investigate the relationship between these diseases and a number of potential environmental and endogenous risk factors. Possible gene-environment interactions for brain tumours will also be studied as part of a collaboration with the US National Cancer Institute consortium of brain cancer studies. The studies are based on a common "core" protocol, describing common procedures to be followed in all participating countries. National studies, however, may have specific features or a wider scope than the international study.

Participating countries are Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden and the UK. In order to maximise the power of finding a risk if it exists, the studies are mainly focused on tumours in relatively young people (30-59 – who had the highest prevalence of mobile phone use 5 to 10 years ago) and on regions within the participating countries with longest and highest use of mobile phones. It is expected that the studies will include about 6000 cases of gliomas and meningiomas (both benign and malignant), 1000 cases of acoustic neurinoma, 600 cases of parotid gland tumours and close to 10000 controls.

The primary source of information is an in-person computer assisted interview (CAPI) conducted by a trained interviewer. Retrospective and prospective validation studies are being carried out to investigate the accuracy of self-reported use of mobile phones by comparing questionnaire answers to information from records of mobile telephone companies and to information recorded by software modified phones. A subcommittee of experts in exposure assessment is developing, testing and implementing an exposure index based on information from the questionnaire, as well as on technical information on the characteristics of the network and of the telephones used and on the time period. In some countries, samples of blood or buccal cells are being collected to enable future analyses of gene-environment interactions.

Case ascertainment is complete in Finland, Denmark and Sweden and interviews of cases and controls are being completed. Data collection will be completed in most countries by the end of 2003. Data from individual countries will be sent to IARC at the end of 2003. The first results of the study are expected in late 2004.

H. The Karolinska Institute Study

In October 2004 the Karolinska Institute in Stockholm published the findings of its study on mobile phones and ear tumours. Their research showed that using a mobile phone increases the risk of acoustic neuroma by 3.9 times. A BBC report details the study:

> The Karolinska Institute study of 750 people found the risk of acoustic neuroma rose by 3.9 times on the side of the head the phone is used. There was no increase in risk on the other side of the head - giving an overall rise in risk of 1.9 times. Acoustic neuroma is a benign tumour in the auditory nerve, which can cause brain and nerve damage. It affects one in 100,000 people.
> Those who had used mobile phones for less than 10 years were not at a greater risk, the team reported. Out of the 750 people who took part in the study, 150 had acoustic neuroma and of those one in 11 had used a mobile phone for at least a decade. Professor Anders Ahlbom, from the Stockholm-based institute, told BBC News Online he was "surprised" by his team's findings.
> "The results show there is a relatively substantial risk and we are hoping others will follow up our research. We do not know what is causing it but the risk certainly increases over time." He said he would not go as far as warning people not to use mobile phones. But he added: "If people are concerned the simple way to avoid risk is to use a handset. Our researched showed that the risk is only on the side of the head on which the mobile phone is used."
>
> **Risk**
> At the time of the study only analogue mobile phones had been in use for more than 10 years. The majority of people now have digital (GSM) phones, which came on to the market in the mid to late 1990s. Some of the people who took part in the study had used both analogue and digital phones. There was no evidence to suggest solely using digital phones for 10 years increased the risk. Dr Michael Clarke, a spokesman for the National Radiological Protection Board, the UK's advisory group, said it was a "good study from a well respected institute". He said: "It is suggestive rather than conclusive but we will obviously take it into account when we issue guidance in the future."
> And a spokeswoman for the Mobile Operators Association said:
> "The mobile phone industry takes very seriously questions relating to the safety of its products and is committed to addressing public concern in an open and transparent manner." But she added: "Individual studies must be seen in the light of the total research effort into mobile phone safety. There have been other recent studies that have failed to show any link between mobile phones and tumours."
> Three quarters of adults in the UK own or use a mobile phone. The mobile phone industry has always maintained there is no scientific evidence of negative effects from mobile phone use. But over the last few years experts have remained divided

over the question of risk. A study by Finnish scientists in 2002 found electromagnetic radiation, which is emitted from mobile phones, affected human brain tissue. But the UK government-commissioned Stewart report in 2000 concluded there were no risks associated with using mobile phones. However, the report recommended children should only use mobile phones in emergencies.

Further details of the study are available from the Karolinska Institute website:

http://www.imm.ki.se/PDF/Press%20release%20Oct%2013%202004.pdf

I. NRPB Mobile Phones and Health 2004

On 11 January 2005 the NRPB published Mobile Phones and Health 2004. This review updates the 2000 UK Independent Expert Group Report on Mobile Phones and Health (the Stewart Report). The main conclusion of the report is that there is no hard evidence at present that the health of the public is being affected adversely by the use of mobile phone technologies. The report does state that some uncertainties remain and a continued precautionary approach to the use of mobile phones is recommended until the situation is clarified.

It recommends:

- Improvements be made in ensuring ready access by the public to all up to date and relevant information related to the use of mobile phones and of masts.
- The planning process associated with the erection of mobile phone base stations be subject to independent review.
- The legal responsibilities and regulations in relation to the installation of microcells and picocells should be clarified and more information about their deployment be made available.
- Monitoring of potential exposures from 3G base stations be carried out concomitantly with the rollout of the network.
- A formal inspection procedure be set in place to ensure that exclusion zones around base stations are clearly identified.
- Comparative information on the SAR values of different phones be made readily available to better inform consumer choice.
- Particular attention be given to how best to minimise exposure of potentially vulnerable sub-groups such as children and to consider the possibility that there may be other sub-groups who may be particularly sensitive to radiowaves.
- A continuing research programme on the possible health effects of mobile phone technologies be strongly supported.[17]

[17] http://www.nrpb.org/press/press_releases/2005/press_release_02_05.htm

On publication of the report Sir William Stewart, Chairman of the NRPB, said:

> The fact is that the widespread use of mobile phones is a relatively recent phenomenon and it is possible that adverse health effects could emerge after years of prolonged use. The evidence base necessary to allow us to make firm judgements has not yet been accumulated. What we can say is that there is as yet no hard evidence of adverse health effects on the general public, but because of the current uncertainties we recommend a continued precautionary approach to the use of mobile phone technologies. This approach should be adopted by all involved in this area – including government, the mobile phone industry and all who choose to purchase a mobile phone for themselves, or their family, or their children.[18]

1. 3G

On the subject of 3G mobile communications the report concluded that there is no reliable evidence to suggest 3G base stations or handsets are more harmful than the pre-existing 2G system. The Zwambourne study (see above) was cited as suggesting that 3G technology may have some affect on brain function. However the study was limited and the NRPB call for further research in this area.

Measurements of the transmissions from a number of 3G base stations were also examined. The technology required to run a 3G network generally requires that base stations are closer together than for the GSM system. This means that the network can function at a lower power so both base station and handset emissions will be reduced. However it also means that more base stations will be required. Overall the average output from 3G base stations should be less than from GSM, though individual sites may be exceptional and more 3G bases stations will be required. Furthermore the peak output of a 3G handset is less than that of a GSM device. However 3G handsets will constantly emit when in use.

On the subject of 3G the report states:

> **3G MOBILE TELEPHONY**
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> The first 3G mobile phone network was launched in 2003 by the operator Hutchinson 3G. Five-thousand base stations had been built and integrated into the network by December 2003, and over a third of a million customers were attracted in the first year of operation. A further four GSM networks are under construction by the existing GSM network operators and these are beginning to provide 3G services for domestic and business applications. The function of 3G mobile phone networks in Europe is base on the Universal Mobile Telecommunications Standard (UMTS) system. The growth of the networks will depend on the extent to which the new

[18] http://www.nrpb.org/press/press_releases/2005/press_release_02_05.htm

system is adopted but is its predicted by operators that the total number of base stations is likely to increase to from the present 40,000 to around 48,000 by 2007…

…The peak output powers of UMTS (*3G*) handsets are lower than those of GSM handsets; however the transmission of GSM handsets are pulsed whereas UMTS handsets transmit continuously. Consequently, the maximum timed averaged power is the same for UMTS handsets as for GSM handsets operating in the 1800MHz frequency band…

…It is expected that the radiated power of 3G base stations will generally be less than that of 2G (GSM) base stations because 3G cell sizes are generally smaller. Nevertheless, as with 2G base stations powers will be allocated to individual base stations on their particular site circumstances and a range of powers up to the maximum licensed power will be used. Exposures at particular locations will be largely determined by the local power density, which can be measured as has been done with 2G base stations.

On the assumption that the powers of 3G sites are generally no more than those of 2G sites and that mast configurations, antenna heights, antenna beam configurations and the tendency for shielding at public exposure locations due to intervening buildings etc are similar, exposures would be expected to be very much below guideline levels, as with 2G sites. NRPB measurements at a small number of 3G sites are consistent with their expectation.

The maximum licensed powers of individual 3G sites can be obtained from the Sitefinder online database provided by the Office of Communications (Ofcom, www.sitefinder.radio.gov.uk).[19]

[19] NRPB, Mobile Phones and Health 2004, 2004.