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Background

- 1.1 The widespread use of mobile phones is a recent phenomenon. Their use has escalated over the past decade and to many they are now an essential part of business, commerce and society. Over the Christmas 1999 period alone approximately 4 million phones were sold in the UK and at present (April 2000) there are about 25 million mobile phones in circulation. This is equivalent to nearly one phone for every two people (see paragraph 2.16)
- 1.2 The fact that so many people own mobile phones attests to their perceived importance to the general public. The advent of third generation systems will extend the use of most forms of communications technologies, including fax, e-mail and Internet access. **The use of mobile phones and related technologies will continue to increase for the foreseeable future.**
- 1.3 The extensive use of mobile phones has been accompanied by public debate about possible adverse effects on human health. The concerns relate to the emissions of radiofrequency (RF) radiation from the phones (the handsets) and from the base stations that receive and transmit the signals (paragraphs 3.3–3.7). For the general population, the levels of exposure arising from phones held near to the head or other parts of the body are substantially greater than whole-body exposures arising from base stations (paragraphs 4.28–4.36).
- 1.4 There are two direct ways by which health could be affected as a result of exposure to RF radiation. These are by thermal (heating) effects caused mainly by holding mobile phones close to the body, and as a result of possible non-thermal effects from both phones and base stations (paragraphs 5.5–5.26).
- 1.5 There can also be indirect effects. There is evidence that using a mobile phone whilst driving can increase the risk of accidents. Also some people's well-being may be adversely affected by the environmental impact of mobile phone base stations sited near their homes, schools or other buildings, as well as by their fear of perceived direct effects (paragraphs 5.264, 6.44 and 6.45).

Sources of Exposure

- 1.6 Mobile phones and base stations emit RF radiation. In both cases levels of exposure generally reduce with increasing distance from the source. For mobile phones, exposures will be principally to the side of the head for hand-held use, or to the parts of the body closest to the phone during hands-free use.
- 1.7 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 (paragraphs 4.28–4.36). Base stations communicate with mobile phones within a defined area or "cell". These can be of

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three types: *macrocells*, *microcells* and *picocells* depending upon their size and the power output of the antenna (paragraph 4.9).

- 1.8** *Macrocells* provide the main structure for the base station network. The base stations for macrocells have power outputs of tens of watts and communicate with phones up to about 35 kilometres (22 miles) distant. There are at present about 20,000 macrocells covering the country (paragraph 4.9). We believe that this number will continue to increase. Measurements that have been made (see paragraphs 4.30–4.36) indicate that exposures of the general population from these sites are typically many hundreds, or thousands of times lower than existing exposure guidelines. There are concerns, nevertheless, about whether the emissions from all base stations are uniformly low, about whether the emissions could cause unknown health effects, and whether, with the increased use of mobile telecommunications, their output will have to rise.
- 1.9** *Microcells* are used to infill and improve the main network, especially where the volume of calls is high. They are sited in places such as airports, railway stations and shopping malls. Their number is rapidly increasing in line with the growth in demand for mobile phones. The microcell base stations emit less power than those for macrocells and their range is a few hundred metres. We understand that exposures above guidelines do not occur, provided the case surrounding the antenna is kept in place. However, as with some other items of electrical equipment – for example, lasers in CD equipment – there is a possibility of overexposure if the case is removed.
- 1.10** *Picocell* base stations have a lower power output than those of microcells (a few watts) and are generally sited inside buildings. It is likely that the number of picocells within buildings will substantially increase. Although we are satisfied that their emissions should not exceed the guidelines, the system of audits that we propose (paragraph 1.40) will provide an independent check on the output not only from picocell antennas but from all base station types.
- 1.11** As well as mobile phone base stations, there are a large number of other RF emitting sources in our environment, including antennas for radio, television and paging (paragraphs 4.20–4.22). Exposures of individuals to RF radiation from these sources will depend upon their proximity and may be above those from mobile phone base stations, although still well below guidelines.

Current Guidelines on Acceptable Levels of Exposure to Radiofrequency Radiation

- 1.12** Government has in place national guidelines (paragraphs 6.19–6.26, 6.32) established by the National Radiological Protection Board (NRPB) on the maximum levels of exposure to RF radiation emitted from mobile phones, base stations and other sources (“the NRPB guidelines”). These guidelines were established in 1993 when mobile phone technology was in its infancy. The guidelines were based on a comprehensive review of the scientific literature carried out by NRPB, a statutory body, which advises Government on radiological issues related to health.
- 1.13** In 1998 the International Commission on Non-Ionizing Radiation Protection (ICNIRP) published its own guidelines (paragraphs 6.27–6.31) covering exposure to RF radiation. These were based on essentially the same evidence as that used by NRPB, and for workers the limits on exposure are similar. However, under the ICNIRP guidelines, the maximum levels of exposure of the public are about five times less than those recommended for workers. The reason for this approach was the possibility that some members of the general public might be particularly sensitive to RF radiation. However, no detailed scientific evidence to justify this additional safety factor was provided.

Main Conclusions on the Possible Effects of Mobile Phone Technology on Human Health

- 1.14 The ICNIRP guidelines for the public have been incorporated in a European Council Recommendation (1999), which has been agreed in principle by all countries in the European Union (EU), including the UK. In Germany the ICNIRP guidelines have been incorporated into statute (paragraph 6.33).
- 1.15 Both the NRPB and ICNIRP guidelines are based on the need to avoid known adverse health effects. At the time these guidelines were drawn up, the only established adverse effects were those caused by the heating of tissues.

Main Conclusions on the Possible Effects of Mobile Phone Technology on Human Health

- 1.16 Despite public concern about the safety of mobile phones and base stations, rather little research specifically relevant to these emissions has been published in the peer-reviewed scientific literature. This presumably reflects the fact that it is only recently that mobile phones have been widely used by the public (paragraphs 2.1–2.12) and as yet there has been little opportunity for any health effects to become manifest. There is, however, some peer-reviewed literature from human and animal studies, and an extensive non-peer-reviewed information base, relating to potential health effects caused by exposure to RF radiation from mobile phone technology.
- 1.17 **The balance of evidence to date suggests that exposures to RF radiation below NRPB and ICNIRP guidelines do not cause adverse health effects to the general population (Chapter 5, paragraphs 6.33–6.42).**
- 1.18 **There is now scientific evidence, however, which suggests that there may be biological effects occurring at exposures below these guidelines** (paragraphs 5.176–5.194, 6.38). This does not necessarily mean that these effects lead to disease or injury, but it is potentially important information and we consider the implications below.
- 1.19 There are additional factors that need to be taken into account in assessing any possible health effects. Populations as a whole are not genetically homogeneous and people can vary in their susceptibility to environmental hazards. There are well-established examples in the literature of the genetic predisposition of some groups, which could influence sensitivity to disease. There could also be a dependence on age. **We conclude therefore that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects, and that the gaps in knowledge are sufficient to justify a precautionary approach** (Chapter 5, paragraphs 6.35–6.42).
- 1.20 **In the light of the above considerations we recommend that a precautionary approach to the use of mobile phone technologies be adopted until much more detailed and scientifically robust information on any health effects becomes available** (Chapter 5, paragraphs 6.35–6.42).
- 1.21 We note that a precautionary approach, in itself, is not without cost (paragraph 6.16) but we consider it to be an essential approach at this early stage in our understanding of mobile phone technology and its potential to impact on biological systems and on human health.
- 1.22 In addition to these general considerations, there are concerns about the use of mobile phones in vehicles. Their use may offer significant advantages – for example, following accidents when they allow emergency assistance to be rapidly summoned. Nevertheless, the use of mobile phones whilst driving is a major issue of concern and experimental evidence demonstrates that it has a detrimental effect on drivers' responsiveness. Epidemiological evidence indicates that this

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effect translates into a substantially increased risk of an accident. Perhaps surprisingly, current evidence suggests that the negative effects of phone use while driving are similar whether the phone is hand-held or hands-free (paragraph 5.213). **Overall we conclude that the detrimental effects of hands-free operation are sufficiently large that drivers should be dissuaded from using either hand-held or hands-free phones whilst on the move** (paragraphs 5.201–5.214, 5.262–5.263 and 6.93–6.95).

- 1.23** We consider below ways in which a precautionary approach to the use of mobile phone technology might be adopted.

A Precautionary Approach and Related Issues

- 1.24** We recommend that national and local government, industry and the consumer should all become actively involved in addressing concerns about possible health effects of mobile phones (paragraph 6.40).

- 1.25** Our recommendations focus on five areas:

- advice to Government,
- advice to industry,
- research requirements,
- the need for better public information and consumer choice,
- the role of NRPB.

Advice to Government

- 1.26** We recognise that the mobile phone industry impacts on people and business around the world and that the UK is a global leader in telecommunications technology. There are benefits that the development of mobile telecommunications can bring, provided there is no adverse impact on health. It is against this general backcloth that we make our recommendations.

Standards

- 1.27** We recommend that, as a precautionary approach, the ICNIRP guidelines for public exposure be adopted for use in the UK rather than the NRPB guidelines. This would bring the UK into line with other countries in the European Union and accord with the Recommendations of the House of Commons Select Committee on Science and Technology Report on Mobile Phones and Health (1999) (paragraphs 6.19–6.42).
- 1.28** We are not convinced of the need to incorporate the ICNIRP guidelines in statutes. We believe that they are liable to change as more scientific information on possible health effects becomes available (paragraph 6.36).
- 1.29** It would be sensible, in line with the precautionary approach, to set in place a long-term follow-up of workers who are occupationally exposed to RF radiation at relatively high levels. **We recommend that a register of occupationally exposed workers be established and that cancer risks and mortality be examined to determine whether there are any harmful effects. If any**

adverse effects of exposure to RF radiation are identified then the Health and Safety Executive should establish a system of health surveillance (paragraph 5.240).

Planning issues

- 1.30** The siting of base stations in residential areas can cause considerable concern and distress. At all our open meetings and in written evidence we heard concerns about the location of base stations in sensitive sites. These include schools, residential areas and hospitals. This concern relates, in part, to the fact that base stations up to 15 m (48 ft) in height can be installed in residential areas without the need for a full planning application. We consider this to be unacceptable.
- 1.31** We are concerned at the indirect adverse impact which current planning procedures are having on those who have been, or are, subjected to the often insensitive siting of base stations. Adverse impacts on the local environment may adversely impact on the public's well-being as much as any direct health effects.
- 1.32** We recognise that exposures of people in the vicinity of base stations are expected to be well within guidelines yet there is no independent audit to ensure that this is the case (paragraphs 4.30–4.35).
- 1.33** **We conclude that the balance of evidence indicates that there is no general risk to the health of people living near to base stations on the basis that exposures are expected to be small fractions of guidelines. However, there can be indirect adverse effects on their well-being in some cases** (paragraphs 5.264, 6.44 and 6.45).
- 1.34** We perceive a lack of clear protocols to be followed in the public interest prior to base stations being built and operated and note that there is significant variability in the extent to which mobile phone operators consult the public on the siting of base stations. We have heard little specific criticism of most of the network operators, apart from Orange. The Department of the Environment, Transport and the Regions and the National Assembly for Wales (DETR, 1998) produced a *Code of Best Practice: Telecommunications prior approval procedures* as applied to mast/tower development. We understand that consideration is being given to extending this to include health concerns (paragraphs 6.104–6.109). We support this development.
- 1.35** Overall we consider that public concerns about the siting of base stations demand changes in the planning process. Thus:
- 1.36** **We recommend that for all base stations, including those with masts under 15 m, permitted development rights for their erection be revoked and that the siting of all new base stations should be subject to the normal planning process** (paragraphs 6.43–6.46 and 6.55–6.62).
- 1.37** **We recommend that, at national Government level, a template of protocols be developed, in concert with industry and consumers, which can be used to inform the planning process and which must be assiduously and openly followed before permission is given for the siting of a new base station** (paragraphs 6.58–6.62). We consider the protocol should cover the following issues.
- All telecommunications network operators must notify the local authority of the proposed installation of base stations. This should cover installations for macrocells, microcells and picocells.
 - The local authority should maintain an up-to-date list of all such notifications, which should be readily available for public consultation.

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- The operator should provide to the local authority a statement for each site indicating its location, the height of the antenna, the frequency and modulation characteristics, and details of power output.
 - Any change to an existing base station which increases its size, or the overall power radiated, should be subject to the normal planning process as if it were a new development.
- 1.38 We recommend that a robust planning template be set in place within 12 months of the publication of this report. It should incorporate a requirement for public involvement, an input by health authorities/health boards and a clear and open system of documentation which can be readily inspected by the general public (paragraphs 6.55–6.62).**
- 1.39 We recommend that a national database be set up by Government giving details of all base stations and their emissions. This should include the characteristics of the base stations as described in paragraphs 6.47 and 6.48 and should be an essential part of the licence application for the site.**
- 1.40 We recommend that an independent random, ongoing, audit of all base stations be carried out to ensure that exposure guidelines are not exceeded outside the marked exclusion zone and that the base stations comply with their agreed specifications. If base station emissions are found to exceed guideline levels, or if there is significant departure from the stated characteristics, then the base station should be decommissioned until compliance is demonstrated (paragraphs 6.53 and 6.54).**
- 1.41 We recommend that particular attention should be paid initially to the auditing of base stations near to schools and other sensitive sites (paragraphs 6.54 and 6.63–6.68).**
- 1.42 We recommend, in relation to macrocell base stations sited within school grounds, that the beam of greatest intensity (paragraphs 4.32–4.35 and 6.63–6.68) should not fall on any part of the school grounds or buildings without agreement from the school and parents. Similar considerations should apply to macrocell base stations sited near to school grounds.**
- 1.43 We recommend that in making decisions about the siting of base stations, planning authorities should have the power to ensure that the RF fields to which the public will be exposed will be kept to the lowest practical levels that will be commensurate with the telecommunications system operating effectively (paragraphs 6.55–6.62).**

Exclusion zones

- 1.44 We recommend the establishment of clearly defined physical exclusion zones around base station antennas, which delineate areas within which exposure guidelines may be exceeded (paragraphs 6.49–6.52). The incorporation of exclusion zones should be part of the template of planning protocols that we advocate.**
- 1.45 Each exclusion zone should be defined by a physical barrier and a readily identifiable nationally agreed sign with a logo. This should inform the public and workers that inside the exclusion zone there might be RF emissions which exceed national guidelines. We recommend that the design of the logo should be taken forward by the British Standards Institute and implemented within 12 months (paragraphs 6.49–6.52).**
- 1.46 We recommend that warning signs should be incorporated into microcell and picocell transmitters to indicate they should not be opened when in use (paragraph 6.52).**

Use of mobile phones near hospitals

- 1.47** We are concerned about the indiscriminate use of mobile phones in hospitals and other sites where the RF radiation could possibly interfere with sensitive equipment. **We understand that health authorities/health boards issue guidance on the use of mobile phones. They should ensure that all hospitals comply. This guidance should include the placing of visible warning signs at entrances to buildings to indicate that mobile phones should be switched off** (paragraphs 4.6, 6.91 and 6.92).

Devolution in Scotland, Wales and Northern Ireland

- 1.48** Where recommendations (paragraphs 1.30–1.46) impact on the devolved responsibilities of the Scottish Parliament, the Welsh National Assembly and the Northern Ireland Assembly then they should be considered by their appropriate authorities or bodies. We have noted with interest the recent report on planning procedures for telecommunications developments produced by the Transport and the Environment Committee of the Scottish Parliament (2000) (paragraphs 6.112–6.117).

Advice to Industry

- 1.49** We believe that in the global economy of the 21st Century a competitive edge will be generated by developing innovative, technologically advanced and safe products, which can lead the field and win competitive advantage.
- 1.50** We understand from the Mobile Manufacturers Forum that all mobile phones presently marketed in the UK comply with both NRPB and ICNIRP guidelines. A crucial issue in relation to the exposure of people using mobile phones is the specific energy absorption rate (SAR). This determines the amount of energy absorbed in the body of the user. In most circumstances of use this will be the head. The SAR depends upon the power output of the phone and its design (paragraph 4.37). We understand that an internationally agreed standard testing procedure that will allow the SAR from mobile phones to be compared is being developed and will be finalised this year (2000). Such a procedure should benefit consumers and should also be welcomed by industry. We note that in the case of cars, standard testing procedures for fuel consumption have been developed to inform consumer choice, and have resulted in the development of more efficient engines. We see no reason why, in the case of mobile phones, standard testing procedures should not lead to a progressive reduction in exposures from the equipment.
- 1.51** **We recommend that an international standard for the assessment of SAR values from mobile phones should be adopted for use in the UK once it has been demonstrated to be scientifically sound** (paragraphs 6.74–6.79).
- 1.52** **We recommend that information on the SAR values for mobile phones must be readily accessible to consumers** (paragraph 6.77):
- **at the point of sale with information on the box,**
 - **on leaflets available in stores giving comparative information on different phones and with explanatory information,**
 - **as a menu option on the screen of the phone and as a label on the phone,**
 - **on a national web site, which lists the SAR values of different phone types.**

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- 1.53** If there are currently unrecognised adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head (paragraph 4.37), and a longer lifetime of exposure. In line with our precautionary approach, at this time, we believe that the widespread use of mobile phones by children for non-essential calls should be discouraged. We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children (paragraphs 6.89 and 6.90).
- 1.54** We have examined the value of mast sharing and roaming agreements. These can offer advantages in terms of providing a better service in rural areas and limiting environmental intrusion. **We recommend that operators actively pursue a policy of mast sharing and roaming where practicable** (paragraphs 6.69 and 6.70).

Health Related Research

- 1.55** The mobile phone industry has supported a substantial and ongoing programme of research internationally. The recent upsurge in the use of mobile phone technology in the UK has not been matched, in general, by the output of good quality relevant research supported by the public sector. Too many studies have been carried out at exposure levels and frequencies not directly related to the use of mobile phones or base stations.
- 1.56** In relation to present research findings, the following three areas deserve particular comment.
- First, the balance of the evidence available does not suggest that RF radiation from mobile phones or base stations causes cancer or other disease. However, there is now evidence that effects on biological functions, including those of the brain, may be induced by RF radiation at levels comparable to those associated with the use of mobile phones. There is, as yet, no evidence that these biological effects constitute a health hazard but at present only limited data are available. This is one reason why we recommend a precautionary approach.
 - Second, concerns have been expressed that the pulsed nature of the signals from mobile phones and masts may have an impact on brain function. This is an intriguing possibility, which deserves further research, particularly if pulsed signals continue to be used in the third generation of phones and related technologies. Research should concentrate on signal modulations representative of present and future phone technology (paragraphs 5.4, 5.12–5.26 and 5.270).
 - Third, we commend the World Health Organization (WHO) for encouraging the use of standard experimental protocols under realistic exposure conditions relevant to mobile phone technology (paragraph 5.284). This should allow experiments from different laboratories to be readily compared.
- 1.57** On the basis of the current state of knowledge **we recommend that priority be given to a number of areas of research related particularly to signals from handsets** (paragraph 5.270). These should include the following:
- effects on brain function,
 - consequences of exposures to pulsed signals,
 - improvements in dosimetry,
 - the possible impact on health of sub-cellular and cellular changes induced by RF radiation,

- psychological and sociological studies related to the use of mobile phones,
 - epidemiological and human volunteer studies (paragraphs 5.249–5.264), including the study of children, and individuals who might be more susceptible to RF radiation (paragraphs 4.37, 6.29 and 6.30).
- 1.58 We recommend that a substantial research programme should operate under the aegis of a demonstrably independent panel.** The aim should be to develop a programme of research related to health aspects of mobile phones and associated technologies. This should complement work sponsored by the EU and in other countries. In developing a research agenda the peer-reviewed scientific literature, non-peer reviewed papers and anecdotal evidence should be taken into account (paragraphs 5.270–5.272).
- 1.59 We further recommend that this programme be financed by the mobile phone companies and the public sector (industry departments, health departments and the research councils), possibly on a 50 : 50 basis.** The contribution from industry could be made on a voluntary basis or by a continuing levy reviewable every five years (paragraph 5.272).
- 1.60 It will be essential for further research in this area to be kept under review. We recommend that the issue of possible health effects of mobile phone technology should be the subject of a further review in three years time, or earlier if circumstances demand it** (paragraph 5.273).

Public Information and Consumer Choice

- 1.61** We are concerned at the variability and the limited extent of the information made available to consumers on mobile phone products. **We recommend that Government circulates a leaflet to every household in the UK providing clearly understandable information on mobile phone technology and on related health aspects, including the use of mobile phones while driving** (paragraphs 5.201–5.208). **This leaflet should additionally be available at the point of sale. The leaflet should be developed in concert with industry, which has already produced some good leaflets** (paragraphs 3.48 and 3.49).
- 1.62 We recommend that an Ombudsman be appointed to provide a focus for decisions on the siting of base stations when agreement cannot be reached locally, and on other relevant issues** (paragraphs 3.50 and 3.51).
- 1.63** There are various devices that seek to reduce exposure to RF radiation from mobile phones. These include shields and devices that attach to phones. We remain to be convinced of their effectiveness in reducing personal exposure in normal conditions of use of mobile phones.
- 1.64** Hands-free extensions, which allow the phone to be held away from the body, have the potential for reducing exposure, but some recent tests have cast doubt on their general level of effectiveness. For users wishing to reduce their exposure, we advocate the use of hands-free kits of proven effectiveness. A satisfactory design may involve the use of chokes or filters in the connecting lead. A standard testing procedure should be established.
- 1.65** The regulatory position on the use of shielding devices and hands-free kits, which may affect the phone's performance, is unclear. In addition, information available for the public on the use of such devices is limited to that provided by the suppliers of the devices and the mobile phone industry. **We recommend that Government sets in place a national system which enables independent testing of shielding devices and hands-free kits to be carried out, and which enables clear information to be given about the effectiveness of such devices. A kite mark or**

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equivalent should be introduced to demonstrate conformity with the testing standard (paragraphs 6.86–6.88).

National Radiological Protection Board (NRPB)

- 1.66** We believe that NRPB is a valuable UK asset which should be built upon, and that it carries out scientific work which is well-regarded nationally and internationally.
- 1.67** Whilst there is no criticism of its science, **we recommend that NRPB gives greater priority to the execution of a more open approach to issues of public concern such as mobile phone technology and that it is proactive rather than reactive in its approach** (paragraph 3.44).
- 1.68** **We recommend that public concerns about risk be addressed by NRPB in a more sensitive and informative manner** (paragraph 3.45).
- 1.69** **We recommend that NRPB makes more use of specialist time-limited *ad-hoc* committees of experts and lay representatives to bring forward broadly based, well-considered advice** (paragraph 3.42).
- 1.70** **We recommend that in a rapidly emerging field such as mobile phone technology where there is little peer-reviewed evidence on which to base advice, the totality of the information available, including non-peer-reviewed data and anecdotal evidence, be taken into account when advice is proffered** (paragraph 3.46).
- 1.71** We note the paucity of resources available at NRPB for work on non-ionising radiation, including work on mobile phones, and related research on life sciences. **We recommend that work on non-ionising radiation and related life sciences work be strengthened at NRPB** (paragraph 3.47).

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