6

A Precautionary Approach

6.1 Many of those who submitted evidence to the Expert Group, either orally or in writing, urged the application of a precautionary approach to the new technology of mobile phones, and especially to the siting of base stations. Before considering the case for this and the ways in which it might operate, it is helpful to review the general principles of risk assessment and risk management.

Risk Assessment

6.2 Risk assessment is the process whereby the potential adverse consequences (hazards) associated with a technology or development are identified, and the probability (risk) of their occurrence is estimated. The hazards may be to human health or to the environment, or may be economic, but below we focus on hazards to human health. The identification of health hazards and the estimation of associated risks may be based on various sources of information.

6.3 It is often possible to predict the hazards from a new technology on theoretical grounds, especially where it has evolved from other similar technologies already in use. If these hazards are well understood then risk assessment may only require an estimate of the levels of exposure that will occur. For example, the main hazard associated with a new industrial plant might be one of noise-induced deafness in the people who will work on it. The quantitative relation between noise exposure and deafness is well characterised, and an assessment of risk would therefore be possible once the likely levels of workers' exposure to noise had been established.

6.4 Laboratory experiments are another source of information. Experiments may be carried out *in vitro* (eg tests of a chemical's capacity to cause mutations in the genetic material of bacteria), using living animals (eg tests for long-term toxicity when a chemical is regularly inhaled or ingested), or more rarely, using human subjects. Such investigations form the basis for the risk assessment of many new chemicals such as drugs and pesticides.

6.5 Epidemiological studies of people are also important. These involve comparing rates of disease in different groups of people according to their exposure to known or suspected hazards.

6.6 Each source of information has advantages and disadvantages to its use. Background scientific knowledge can be applied relatively cheaply and quickly. Experience indicates that it is usually reliable, although not always. For example, it would have been difficult to predict the hazard of cancer from asbestos on the basis of scientific knowledge at the time the mineral first came into use. Similarly, before the emergence of new-variant CJD, it seemed unlikely that BSE would pose a significant health risk to people.

6.7 Laboratory experiments may take up to several years to complete, but can usually be carried out before any extensive human exposure to a new technology has occurred. There are, however, uncertainties in the extrapolation of findings from animals to people. For example, arsenic is

known to cause skin and lung cancer in people, but attempts to demonstrate the hazard in animals have failed.

6.8 Epidemiological studies provide direct information about risks in people, but by definition elevations of risk can only be demonstrated once disease has started to occur. Ideally, hazards would be prevented or eliminated before any ill-effects in people had resulted. Furthermore, the accuracy with which risks can be estimated from epidemiological studies is limited by the practical and ethical constraints of working with human subjects.

6.9 At each stage in the development of a new technology, risk assessment entails a synthesis of all the relevant information that is available from the sources described. Depending on how much information is available, risk estimates will be more or less certain. Thus, our knowledge about the adverse effects of ionising radiation is such that we can predict risks with relative precision. On the other hand, the risks associated with many industrial chemicals have been much less studied, and while current evidence may not suggest any important risk, we cannot always exclude this possibility with the same confidence.

Risk Management

6.10 Risk management is the process by which the risks and benefits associated with a technology or development are weighed against each other and decisions are made on whether and how to proceed with its implementation. The benefits may be real or potential, and direct (eg an improvement in health from a new drug) or indirect (eg making an industry more competitive and thereby promoting employment). The balancing of risks and benefits should take account of the uncertainties in risk estimates and also the severity of the adverse effects that might result. A small risk of a minor health effect such as transient headache might be acceptable, whereas the same risk of a more serious outcome such as brain cancer would not be acceptable.

6.11 A common approach in risk management is to identify a critical adverse health effect, (usually that which occurs at the lowest level of exposure). The lowest exposure at which this effect has been shown to occur is then multiplied by an “assessment” factor, also known as a “safety” or “uncertainty” factor, to derive an exposure limit or guideline. The aim is that, below this limit, exposures will not cause the adverse effect in any individual. Moreover, because the starting point for the calculation is the adverse health effect that occurs most readily, others, which only occur at higher exposures, should also be prevented. The assessment factor is designed to allow for differences in sensitivity between individuals, and also, if the assessment is based on data from animals, between species. It may be increased if the critical health outcome is particularly serious, eg cancer or congenital malformations. The exact size of assessment factors used, however, is to some extent arbitrary. It should be noted that this derivation of exposure limits or guidelines is based only on observed adverse effects. There may be evidence for other biological effects at lower exposures, but if these are not considered to be adverse, they do not enter the calculation.

6.12 Risk management is not a simple accounting process since, in general, risks cannot be quantified in the same units as benefits. For example, it may be necessary to weigh a risk to health against an economic gain. This is not an impossible task. It is something that all of us do regularly in our day-to-day lives. When we buy a new car, we make a decision – conscious or unconscious – whether to pay extra for additional safety features. When we decide to save money by undertaking a “do-it-yourself” (DIY) task in the home, we accept the risks of accidental injury that may be entailed. Such decisions involve value judgements, and individuals will differ in where they draw the balance between perceived risks and benefits.

6.13 A further complication arises because the people who benefit most from a new development are not necessarily those who will incur the highest risks. A new municipal incinerator may be to the advantage of most people in a community, but may pose an increased risk of road traffic accidents to those who live nearby. In this circumstance, balancing the risks and benefits poses moral and ethical questions and, in a democratic society, is overseen by the elected representatives of the people.

The Precautionary Principle/Approach

6.14 We live in an era in which science and technology are advancing at an ever-increasing rate. This has led to many improvements in health and in the quality of life. Thus in the UK, as in many other developed countries, life expectancy is currently increasing. At the same time, however, many people have anxieties about the pace of change and the potential for major adverse consequences if new developments are not appropriately controlled – if science has greater power to do good, it also has greater power to do harm. They therefore advocate a precautionary approach to new technology where there are uncertainties about the associated risks. In this context it is important to note the recent publication of the European Commission on the precautionary principle (EC, 2000), where guidance is given on approaches that should be used. Most importantly, this document indicates that actions taken under the precautionary principle should be commensurate with anticipated risks of health detriment. This has also been outlined in a World Health Organization (WHO) background publication entitled "Electromagnetic Fields and Public Health: Cautionary Policies" (WHO, 2000).

6.15 Some people propose that new developments should only be permitted when they have been shown to be completely safe, but this is unrealistic. Science can never provide a guarantee of zero risk. It may, however, offer strong reassurance that any risks from a technology are small in comparison with many other risks that we accept in our lives.

6.16 The precautionary approach is not all or none in nature. Rather, it is a matter of degree. In essence, it requires that before accepting a new development we should have positive evidence that any risks from it are acceptably low, and not simply an absence of convincing evidence that risks are unacceptably high. However, individuals will differ in the strength of evidence that they need before concluding that risks are sufficiently small. The implementation of a precautionary approach carries costs, which may be direct, eg for better engineering, or from a delay in the benefits that the new technology will bring. Important indirect costs may also arise if resources are directed away from a more serious risk to deal with another risk that is in fact very minor. The aim, therefore, must be to follow a policy that is acceptable to most people, and which minimises the chance of adverse outcomes without unnecessarily stifling progress.

6.17 The policy by which a precautionary approach is applied to risk management in situations of scientific uncertainty has been termed the precautionary principle. This principle was formally adopted by countries of the European Union in the Treaty of Maastricht (1992), and is evident in a ruling of the European Court of Justice when it upheld the decision of the European Commission to ban beef from the UK with a view to limiting the risk of transmission of BSE. The Court concluded as follows:

> *"In view of the seriousness of the risk and the urgency of the situation, and having regard to the objective of the decision, the Commission did not act in a manifestly inappropriate manner by adopting the decision, on a temporary basis and pending the production of more detailed scientific information.*

> *"Where there is uncertainty as to the existence or extent of risks to human health, the Commission may take protective measures without having to wait until the reality or seriousness of those risks becomes apparent."*

The application of this principle was defined further in an EC Commentary in February 2000 (EC, 2000).

6.18 Against this general background, we now consider how the potential health risks from mobile phone technology should best be managed.

Application of the Precautionary Approach to Mobile Phone Technology

Exposure guidelines for RF radiation

6.19 As described in paragraph 6.11, one approach that is often adopted in risk management is to define exposure limits or guidelines, below which the recognised adverse effects of a hazard would not be expected to occur. In the UK, national guidelines on exposure to RF radiation were drawn up by NRPB (NRPB, 1993a,b), and have been accepted and implemented by Government Departments and Agencies.

6.20 Having reviewed all relevant epidemiological studies, NRPB concluded that the results were inconclusive and did not provide an adequate starting point from which to derive exposure guidelines (NRPB, 1993b,c). Instead, therefore, the guidelines were based on the potential of RF radiation to cause illness or injury through heating of body tissues. While some research had suggested that adverse health effects might occur from exposures lower than those needed to produce significant heating, the evidence for this was not considered sufficiently robust to form a basis for the derivation of exposure guidelines.

6.21 The NRPB exposure guidelines incorporate *basic restrictions* on the specific energy absorption rate (SAR, see paragraph 4.37). For mobile phones, the relevant restrictions are for frequencies between 10 MHz and 10 GHz, and these are given in Table 6.1. To verify that the exposure of an individual is within NRPB guidelines, it is necessary to demonstrate that none of the four basic restrictions is exceeded. The SAR is averaged over an exposure time and a specified mass of tissue, depending on the tissue region. Averaging times are specified because of the time taken for the temperature of tissues to equilibriate when they are exposed to the radiation.

Table 6.1 NRPB basic restrictions on exposure in the frequency range 10 MHz to 10 GHz (NRPB, 1993b)

		Averaging parameters	
Tissue region	SAR limit (W/kg)	Mass (g)	Time (minutes)
Whole body	0.4	–	15
Head, fetus	10	10	6
Neck, trunk	10	100	6
Limbs	20	100	6

6.22 These restrictions apply equally to workers and to members of the general public. NRPB has taken the view that they provide adequate protection against harmful thermal effects for all exposed individuals under all conditions (NRPB, 1999a,b).

6.23 Since SARs cannot easily be measured in living people, the NRPB guidelines also specify *investigation levels* for external electromagnetic field strengths, at or below which the basic restriction on whole-body SAR will not be exceeded. If an investigation level is exceeded, more detailed investigation of the resultant SAR is indicated. For children, additional reductions in investigation levels for the whole body are applied because, over certain RF frequencies, small children absorb more energy from external electromagnetic fields than adults. Table 6.2 shows these investigation levels for the frequency range covered by mobile phones.

Table 6.2 NRPB investigation levels for exposure at mobile telecommunications frequencies (NRPB, 1993b)

Frequency (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (W/m^2)
400 – 800	100	0.26	26
800 – 1550	125*f*	0.33*f*	$41f^2$
1550 – 3000	194	0.52	100

f is the frequency in GHz.

6.24 The three investigation level quantities shown in Table 6.2 are related to each other (the fields are assumed to be in the far-field region – see paragraph 4.24), and it is only necessary to consider one of them. To investigate compliance, measurements are usually made of either electric field strength or magnetic field strength.

6.25 For the current generation of mobile phones and their base stations the investigation levels in the frequency range 800–900 MHz are from 26 to 33 W/m^2 and for the range 1800–1900 MHz the level is 100 W/m^2.

6.26 Since publication of its guidelines, NRPB has continued to monitor and review the published scientific literature relevant to exposure to electromagnetic fields and human health. In this, it is supported by its independent Advisory Group on Non-ionising Radiation chaired by Sir Richard Doll. Its current position is that compliance with its guidelines for exposures to electromagnetic fields will prevent any known adverse effects on human health (NRPB, 1999a,b).

6.27 Guidelines on exposure to RF radiation have also been published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998a,b). Similarly to the NRPB guidelines, these are designed to prevent illness or injury through heating effects. Their starting point is the behavioural changes that have been found when experimental animals were exposed to RF radiation at levels that produced a rise in whole-body temperature in excess of 1°C. An SAR of 1–4 W/kg or higher is needed to cause these changes (1 W/kg when animals are exposed in conditions of adverse temperature, humidity and air movement, and 4 W/kg under normal environmental conditions). ICNIRP considered that there was no firm evidence for any effects that would impair health at lower levels of exposure to RF radiation.

6.28 In contrast to the NRPB guidelines, the ICNIRP guidelines feature a two-tier system with lower limits for exposure of the general public than for occupational exposure. For occupational exposure, the basic restrictions on SAR are the same as those recommended by NRPB (see Table 6.3), except that an averaging time of six minutes and an averaging mass of 10 g apply to the three localised SAR restrictions.

6.29 However, for exposure of the general public, the guidelines are five times lower than for occupational exposure. This difference was intended to allow for the following circumstances.

Table 6.3 ICNIRP basic restrictions on occupational exposure and general public exposure (in brackets) in the frequency range 10 MHz to 10 GHz (ICNIRP, 1998a)

		Averaging parameters	
Tissue region	SAR limit (W/kg)	Mass (g)	Time (minutes)
Whole body	0.4 (0.08)	–	6
Head, trunk	10 (2)	10	6
Limbs	20 (4)	10	6

- *Exposure under extreme environmental conditions – high temperatures, high humidity, low air movement and high activity increase the thermal burden from RF exposure.*
- *Potentially higher thermal sensitivity in certain population groups such as those who are frail or elderly, infants, young children, and people with diseases or taking medications that compromise thermal tolerance.*

6.30 Further arguments in support of the additional reduction factor for public exposure were also given in an earlier publication (INIRC/IRPA, 1988) as follows.

- *Workers are normally healthy adults exposed under controlled conditions, who are trained to be aware of potential risks and to take appropriate precautions to avoid unnecessary exposure. The general public cannot reasonably be expected to take the same precautions.*
- *Workers are exposed only during the working day (usually 8 hours per day). On the other hand, the general public can be exposed for 24 hours per day (this total weekly exposure duration is approximately five times that of workers; hence the derivation of the extra safety factor of five for the general public).*
- *In general, children and babies are normally considered to be more sensitive to exposures to physical, chemical or biological agents. At higher frequencies, children absorb more energy from external electromagnetic fields than adults.*

6.31 The ICNIRP guidelines are presented with *reference levels* analogous to the NRPB *investigation levels*, and these also reflect the factor of five difference between the public and occupational basic restrictions. In general, over the frequency range used by mobile phones, the ICNIRP reference level for the public is lower (in terms of power density) than the NRPB investigation level by a factor of between 6.5 and 11. The ICNIRP public reference levels for the frequencies used by mobile phones are shown in Table 6.4. Reference levels for mobile telecommunications in the frequency range 800–1000 MHz are from 4 to 5 W/m^2 and for 1800–1900 MHz from 9 to 9.5 W/m^2 (ICNIRP, 1998a).

Table 6.4 ICNIRP reference levels for public exposure at mobile telecommunications frequencies (ICNIRP, 1998a)

Frequency (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (W/m^2)
400 – 2000	$1.375f^{½}$	$0.0037f^{½}$	f/200
2000 – 3000	61	0.16	10

f is the frequency in MHz.

6.32 Following a detailed comparison of the NRPB and ICNIRP guidelines and the implications for practical hazard assessment (NRPB, 1999a), the National Radiological Protection Board issued the following Statement:

> *"The Board has concluded that for occupational exposure the basic restrictions in the new ICNIRP guidelines do not differ in any significant way from those previously recommended by NRPB and have no implications for the UK guidelines. For members of the public, ICNIRP has generally included a reduction factor of up to five in setting basic restrictions across the frequency range to 300 GHz. There is, however, a lack of scientific evidence to support the introduction of these additional reduction factors. The Board believes that the existing UK advice by NRPB on limiting exposures for the general public already provides sufficient protection from direct and indirect effects and that any health benefits to be obtained from further reductions in exposure have not been demonstrated. It sees no scientific justification, therefore, for altering the advice previously given by NRPB on exposure guidelines for members of the public. It does, however, accept that other factors may need to be taken into account by government in establishing generally accepted exposure guidelines for the public.*
>
> *"In relation to furthering knowledge on possible health effects of exposure to EMFs, the Board supports the need for further epidemiological and experimental studies."*

The Board also said that the Statement reflected "understanding and evaluation of the current scientific evidence. If and when further relevant information becomes available, the Board will review its advice".

6.33 The ICNIRP guidelines for the public have been adopted in a European Council Recommendation (1999), which has been agreed in principle by all countries in the European Union, including the UK. In Germany the ICNIRP guidelines have been incorporated into statute.

6.34 *From a review of the scientific evidence, we conclude that the prevention of heating effects currently remains the best basis for exposure guidelines. We further conclude that the approach adopted by ICNIRP is preferable to that of NRPB. Within the general public there may be people with illnesses that render them unusually susceptible to the heating effects of RF radiation, and this justifies the use of a higher assessment factor than for occupational exposures.*

6.35 **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).

6.36 **We are not convinced of the need to incorporate ICNIRP guidelines into statutes.** We believe that they are liable to change as more scientific information on possible health effects becomes available.

6.37 **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 (paragraphs 5.267–5.269).**

6.38 **There is now scientific evidence, however, which suggests that there may be biological effects occurring at exposures below these guidelines.** This does not necessarily mean that these effects lead to disease (paragraph 5.266).

6.39 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.**

6.40 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. We further 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.**

6.41 On its own, adoption of the ICNIRP exposure guidelines will not allow fully for the current gaps in scientific knowledge, and particularly the possibility of, as yet, unrecognised thermal or non-thermal adverse effects at lower levels of exposure. One way in which this uncertainty could be taken into account would be to apply a higher assessment factor in the derivation of the exposure guidelines. This would have the merit of simplicity. However, as yet, there is no satisfactory scientific basis on which to set the size of any increase.

6.42 An alternative would be to adopt the exposure guidelines recommended by ICNIRP, and in addition have a policy that requires best engineering practice for equipment and installations that ensures that fields are kept to the lowest levels commensurate with the telecommunications system operating effectively. We believe that this approach is preferable. We next consider how it might be applied in relation to the design and siting of base stations, and the design, marketing and use of mobile phones.

Base Stations

6.43 The location of base stations and the processes by which they are authorised appear to be the aspects of mobile phone technology that generate most public concern (see Chapter 3). Public telecommunications operators have been granted a number of rights similar to those enjoyed by gas, water and electricity companies. These include permitted development rights, which allow them to carry out certain developments, including the erection of masts less than 15 m high, without the need to make a full planning application. (A more detailed description of the current planning situation with respect to telecommunications is given in paragraphs 6.96–6.117.) In assessing the potential impact of a planned base station on health, the current approach in the UK is to determine whether it might cause exposures in excess of NRPB guidelines (NRPB, 1993a,b; 1999). If this can be ruled out satisfactorily, risks to health are not considered further.

6.44 We believe this approach is not optimal since it does not allow adequately for the uncertainties in scientific knowledge. Although it seems highly unlikely that the low levels of RF radiation from base stations would have significant, direct adverse effects on health, the possibility of harm from exposures insufficient to cause important heating of tissues cannot yet be ruled out with confidence. Furthermore, the anxieties that some people feel when this uncertainty is ignored can in themselves affect their well-being.

6.45 Other aspects of the planning process for base stations are also unsatisfactory. Some citizens feel that the siting of base stations, and particularly of masts, can result in a loss of amenity and possibly a reduction in the value of property, and it is clear that, in the face of this threat, many feel excluded and disempowered by the planning system now in operation. The resultant frustration also has negative effects on people's health and well-being.

6.46 *We conclude therefore, that changes to the regulation of base stations are necessary.*

National register of base stations

6.47 A first requirement is for reliable and openly available information about the location and operating characteristics of all base stations. Easy access to such information would help to reduce mistrust among the public. Furthermore, the data would be useful when applications for new base stations were being considered, and might also be of value in epidemiological investigations.

6.48 **We recommend that a national database be set up by Government giving details of all base stations and their emissions.** For each this should list: the name of the operating company; the grid reference; the height of the antenna above ground level; the date that transmission started; the frequency range and signal characteristics of transmission; the transmitter power; and the maximum power output under the Wireless Telegraphy Act. Moreover, this information should be readily accessible by the public, and held in such a form that it would be easy to identify, for example, all base stations within a defined geographical area, and all belonging to a specified operator.

Exclusion zones

6.49 Although exposures to RF radiation from base stations will generally be well below exposure guidelines, the need remains to prevent access by workers or the public to places where the relevant guidelines might be exceeded. Therefore, we endorse the practice of defining clear exclusion zones around base stations.

6.50 **We recommend the establishment of clearly defined physical exclusion zones around base station antennas, which delineate areas within which exposure guidelines may be exceeded. The incorporation of exclusion zones should be part of the template of planning protocols that we advocate (paragraphs 6.54, 6.58 and 6.59).**

6.51 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 that 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.**

6.52 **We recommend that warning signs should be incorporated into microcell and picocell transmitters to indicate that they should not be opened when in use.**

Audit of base stations

6.53 There is a need to ensure that base stations are operating within the parameters specified when they were approved.

6.54 **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 there is significant departure from the stated characteristics, then the base station should be decommissioned until compliance is demonstrated. We recommend that particular attention should be paid initially to the auditing of base stations near to schools and other sensitive sites. The audit should include appropriate checks to ensure that base stations conform to the operational parameters specified when they were approved, and that exclusion zones are properly demarcated and signed.

Planning process

6.55 As described in the annex to this chapter, the erection of base stations for mobile phone networks is not subject to such stringent planning procedures as some other types of construction project. In particular, masts less than 15 m high can be built without the planning permission that would normally be required. The lack of public consultation is a major cause of grievance in people who suffer a loss of amenity when base stations are erected and we consider the current situation to be unacceptable.

6.56 One operator has told us that it now seeks full planning permission for all new masts, even if they will be less than 15 m high, but there appears to be significant variation in the extent to which operators consult the public about the siting of base stations.

6.57 We recommend that for all base stations, including those with masts under 15 m, permitted development rights should be revoked, and that the siting of all new base stations should be subject to the normal planning process. This planning process should also apply when a change to an existing base station will increase its power output.

6.58 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 base station.

6.59 We consider that the protocol should cover the following points.

- 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.
- The operator should provide to the local authority a statement for each site indicating its grid reference, the height of the antenna above ground level, the frequency and signal characteristics, and details of maximum power output.
- Any change to an existing base station that increases its size, or the overall power radiated, should be subject to the normal planning process as if it were a new development.

6.60 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.

6.61 We recommend that in making decisions about the siting of base stations, planning authorities should have 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.

6.62 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 in 2000 (paragraphs 6.112–6.114).

Base stations near schools

6.63 A common concern among members of the public who attended our open meetings was the siting of macrocell base stations on or near school premises. The placement of a base station on a school building may indirectly benefit its pupils through the income generated in rent. The balance of evidence indicates that there is no general risk to the health of people living near to base stations where the exposures are only small fractions of guidelines. However, it was suggested to us that children might be especially vulnerable to any adverse effects of RF radiation. There is evidence that at the frequencies used in mobile phone technology, children will absorb more energy per kilogram of body weight from an external electromagnetic field than adults (see paragraph 4.37). A one year old could absorb around double, and a five year old around 60%, more than an adult. Additionally, since children are being exposed to RF radiation from base stations (and from mobile phones) from a younger age than adults, they will have a longer time in which to accumulate exposure over the course of their lives, and a longer time for any delayed effects of exposure to develop.

6.64 In recognition of this, some countries have prohibited the placement of macrocell base stations on sensitive sites such as schools. Such policies have the merit of being easy to administer, but they may not always produce the desired effect. For example, because of the way in which emissions are beamed, a macrocell base station located near to a school may cause higher exposure to pupils than if it were placed on the roof of the school building.

6.65 We suggest therefore that a better approach would be to require that the beam of greatest RF intensity (see paragraph 4.32) from a macrocell base station sited within the grounds of a school should not be permitted to fall on any part of the school grounds or buildings without agreement from the school and parents. Furthermore, when consent is sought from a school and parents about this question, they should be provided with adequate information to make an informed decision, including an explanation of the way in which the intensity of radiation falls off with distance from the antenna. This may be particularly relevant for schools with large grounds. If, for an existing base station, agreement could not be obtained, its antennas might need to be readjusted.

6.66 We further suggest that similar considerations should apply in relation to a macrocell base station outside the grounds of a school but at a distance from the edge of the grounds comparable to that of a macrocell base station were it to be placed within the school grounds. In this case, if requested by the school or parents, the network operator should be required to inform the school whether the beam of greatest intensity (see paragraph 4.32) falls on the school grounds or buildings. If it does, the operator should tell them where it falls and the nearest distance from the antenna to these points. It should also provide them with adequate information to make an informed consideration of the level of the intensity of RF radiation. This information 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 about the situation from the school and parents, it may be necessary for the network operator to make adjustments to the antennas.

6.67 We suggest that the responsibility for monitoring the requirements of paragraphs 6.65 and 6.66 should be given to local authorities with advice from the agency responsible for maintaining the database. Disputes could be referred to the Ombudsman (see paragraph 3.51).

6.68 **We recommend, in relation to macrocell base stations sited within school grounds, that the beam of greatest RF intensity 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.**

Developments in rural areas

6.69 In urban environments and adjacent to major roads and railways, the need for new base stations will arise principally from growth in the number of phone calls that must be handled at any one time. In rural areas, however, the main drive to expansion of networks at present is the need for wider geographical coverage. In this circumstance, there may be scope to limit the number of masts that are required through agreements between operators on mast sharing and roaming.

6.70 **We recommend that operators should actively pursue a policy of mast sharing and roaming where practical,** and that they should be considered by planning authorities as an alternative option when new masts are proposed.

Mobile Phones

6.71 Use of a mobile phone can expose tissues adjacent to the antenna to levels of RF radiation more than a thousand times higher than people would normally encounter from base stations. We understand from the Mobile Manufacturers Forum that all mobile phones presently marketed in the UK comply with both NRPB and ICNIRP guidelines for RF radiation and on current evidence, it seems unlikely that the exposures experienced by users would have important adverse effects on health. However, direct empirical support for this assessment is limited, and several observations suggest a need for caution.

6.72 As described in Chapter 5, recent experiments in people have suggested that subtle effects on brain function might occur from the use of mobile phones held to the head (Preece *et al*, 1999; Koivisto *et al*, 2000, *in press*; Krause *et al*, 2000), although even if confirmed by further research, these effects on function would not necessarily result in illness. Also of concern is the observation in one study that exposure to pulsed RF radiation may accelerate the development of tumours (Repacholi *et al*, 1997). These findings require independent confirmation. However, the uncertainties that such research raises are a reminder that the current evidence base is not yet so secure that the possibility of harmful effects from the use of mobile phones can be totally discounted.

6.73 These uncertainties are less problematic in so far as people can choose whether or not to use a mobile phone. However, it is important they should be adequately informed when making their choice, and that they be advised of the best way in which to reduce their exposure if that is what they wish to do.

Information for consumers

6.74 To this end, purchasers of mobile phones should have information to allow them to make informed choices about personal exposures resulting from their use. Based on current evidence, the main points to convey would be as follows.

- At present scientific evidence suggests that the RF radiation produced by mobile phones is highly unlikely to be a cause of direct adverse health effects on the general population of the UK.
- There is, however, still some uncertainty about this, and individuals may therefore wish to minimise their exposure to such radiation.
- This can be achieved in several ways including, for example, by making fewer and shorter calls.
- Specific absorption rate (SAR) values are a relevant measure of exposure in this situation and should allow people to make an informed choice.
- Another way of reducing exposure would be by use of an approved, hands-free set (see paragraphs 6.86–6.88).

6.75 We understand that an internationally agreed standard testing protocol for the assessment of SAR values from mobile phones will soon be available. We welcome this development.

6.76 **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.**

6.77 **We recommend that information on SAR values for mobile phones must be readily accessible to consumers:**

- **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**.

6.78 In order that consumers can interpret SAR values it will also be necessary to provide them with an explanation of the measure and its application.

6.79 Such information could be given by mobile phone manufacturers or retailers in addition to that already provided (see paragraphs 3.28 and 3.29). However, we believe that it would carry more weight if it came from Government and were clearly seen to be independent.

Shields

6.80 Shields seek to reduce the RF radiation to which users of mobile phones are exposed, and various types of device have been produced for this purpose. For most of them, eg ceramic absorbing devices, there is no apparent physical basis for their alleged effect, and there are no convincing test results to verify that they reduce exposure.

6.81 One particular type does have a physical basis. This type consists of a case that fits over the handset and has a metallic or metallic-mesh screen within the case and a "guard" for the antenna. Together these partially screen the radiation emitted by the phone.

6.82 Tests by various laboratories, including some that formed the basis of a *Which?* report published in April 2000, have measured the effect of this type of shield on the radiation from a mobile phone when it was set to produce constant power. The shield substantially reduced the radiation by a factor that could be adjusted by the user.

6.83 In most normal use, however, the shield would not reduce the exposure of the user to this extent, since the reduction in radiation produced by the shield would automatically be compensated for by adaptive power control. (This increases or reduces emissions to give an optimal signal at the base station, see paragraph 4.14.) An exception would occur where the mobile phone was already operating at or close to its maximum power, eg because it was a long way from the base station or in a building, but in this situation, the signal at the base station would be weakened by the shield and communication might not be possible.

6.84 Some of the test results have shown that the radiation is reduced more in the direction of the head than in the direction away from it. If so, users could reduce their exposure somewhat by turning the appropriate side of their head towards the base station. However, this could only be done if they could see the base station, which is not the usual situation. For other orientations of the head the tests imply that the reduction in exposure would be very small.

6.85 We conclude that, in practice, there would be very little reduction in the exposure received by most users through use of a shield of this type, and that their reception could be impaired when they were a long way from a base station or in buildings, cars, etc. If the use of shields became widespread there could also be adverse effects on the environment, since more base stations would likely be needed to maintain the quality of communication.

Hands-free kits

6.86 Exposure to RF radiation from a mobile phone can be reduced by increasing the distance of the phone from the body. This could be achieved by using an appropriately designed hands-free kit. Little or no advantage will be gained, however, if the phone is merely moved from the head to, say, the waist since in that case other organs may receive comparable exposure.

6.87 Even if the mobile phone is some distance from the body, reduction in exposure may not be achieved if the wires from the handset to the earpiece can carry radio signals to the ear or themselves radiate significantly. Since the original purpose of hands-free kits was to permit the use of both hands while phoning, they may not all have been designed with exposure in mind. The *Which?* report published in April 2000 showed that the hands-free kits tested could increase the exposure to the user. On the other hand, we are aware of other tests which claim a very substantial reduction. In both cases there is insufficient published information about the measurement methods to form a clear view. We believe, however, that it should be possible to design hands-free kits which would significantly reduce exposure to the user if used correctly (ie with the phone some distance from the body).

6.88 The regulatory position on the use of hands-free kits and shields is unclear and the only information available to the public appears to be that supplied by their manufacturers. **We recommend that the 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 equivalent should be introduced to demonstrate conformity with the testing standard.**

Use by children

6.89 We have already discussed the arguments for minimising the exposure of children in school to RF radiation from base stations (see paragraphs 6.63–6.68). These apply even more to the higher exposures that occur from use of mobile phones. There may be circumstances where the use of a mobile phone by a child can promote safety (eg to ask a parent for a lift rather than walk home alone).

6.90 **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, 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.**

Use near hospitals

6.91 As described in paragraphs 4.5 and 4.6, there is a potential hazard from the indiscriminate use of mobile phones in hospitals and other sites where RF radiation could interfere with sensitive electronic equipment. We support the steps that are already being taken both by mobile phone manufacturers and hospitals to warn people about the dangers of using phones in such sites.

6.92 **We understand that health authorities/boards issue guidance on the use of mobile phones. We recommend that 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.**

Use while driving

6.93 As described in paragraphs 5.201–5.214, there is strong evidence that use of a mobile phone whilst driving significantly increases the risk of accidents. It has been suggested to us that the use of hand-held phones while driving should be banned, and the Department of the Environment, Transport and the Regions (DETR, 2000) considered this issue sufficiently important to warrant a publicity campaign aimed at dissuading drivers from using a mobile phone, especially one which is hand-held, when in control of a vehicle.

6.94 We welcome this initiative, but note that, perhaps surprisingly, current evidence indicates that the negative effects of phone use while driving are broadly similar whether the phone is hand-held or hands-free.

6.95 **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.**

ANNEX (based on material provided to the Expert Group by DETR)

Current Planning Procedures for Telecommunications Development

6.96 All development requires planning permission. In most cases, this will entail a full application to the local planning authority (LPA) for express permission. LPAs are required to determine applications in accordance with the development plan, unless material considerations indicate otherwise. These considerations can include views expressed by local people. LPAs have to publicise all planning applications.

6.97 Relatively minor development does not require express permission. It is granted planning permission under the Town and Country Planning (General Permitted Development) Order 1995 – the "GPDO". These "permitted development rights" are enjoyed by a range of bodies, including householders and statutory undertakers.

Legal position

6.98 Larger developments, such as masts over 15 m high, require a full planning application, which will be considered by the LPA.

6.99 Public telecommunications operators hold licences under Section 7 of the Telecommunications Act 1984 to run telecommunications systems. In order to help them do this, they have been granted Telecommunications Code Powers (contained in Schedule 2 of the Telecommunications Act 1984). These essentially confer on telecommunications operators a number of rights similar to those enjoyed by the gas, water and electricity companies. These Powers enable them to install their systems in the maintainable highway and, with the appropriate consents, on private land. The Code also places a number of obligations on operators.

6.100 Part 24 of the GPDO grants a range of permitted development rights for telecommunications code system operators. These allow operators to carry out specified development, subject to certain conditions and limitations, without the need to make a full planning application to the LPA. This development includes masts of 15 m and below. However, there are special provisions regarding the installation of any mast in designated areas such as National Parks, Areas of Outstanding Natural Beauty, Conservation Areas and Sites of Special Scientific Interest. In these areas the installation of masts of 15 m and below do not enjoy permitted development rights under the GPDO. The installation of all masts in such areas is subject to a full planning application.

6.101 In general, permitted development under the GPDO is subject to various conditions and limitations. For telecommunications permitted development in England and Wales the GPDO includes an important additional control mechanism – the prior approval procedure. Following changes made in 1999 LPAs now have 42 days (rather than the previous 28) in which to determine and notify whether they wish to approve the siting and appearance of ground-based masts. Operators are also now required to post a site notice to publicise the proposed development. These changes were designed to give the public a better opportunity to comment to the LPA on its siting and appearance. There is also a statutory requirement for LPAs to consult the relevant parish council, at the council's request. Where the LPA considers that the proposed development would have a detrimental effect upon local amenity, it is able to refuse approval. However, LPAs are advised to explore the scope for modifying its siting and/or appearance before doing so.

6.102 For a number of other forms of telecommunications development under Part 24 of the GPDO the 28-day prior approval procedure continues to apply. This includes masts installed on a building or structure. Although there is not a statutory requirement for operators (or LPAs) to publicise such proposals, LPAs are encouraged to give proposals publicity so that local people can make their views known.

6.103 It is a condition of the permission granted by the GPDO that apparatus that is no longer required for telecommunications purposes should be removed as soon as reasonably practicable from the land or building on which it is located, and the land restored to its previous condition.

Policy guidance

6.104 In England, Government policy on planning for telecommunications development is set out in "Planning Policy Guidance Note 8" (PPG8), issued in December 1992. In Wales, similar guidance is to be found in "Planning Guidance (Wales): Planning Policy, First Revision" (April 1999), together with Technical Advice Note (Wales) 19, "Telecommunications", August 1998. This guidance should be taken into account by LPAs as they prepare their development plans, and may be material to decisions in individual planning applications and appeals. It is supplemented by DETR Circular 4/99 and Welsh Office Circular 29/99 ("Planning for Telecommunications"), issued in June 1999 in parallel with the GPDO changes outlined in paragraph 6.101 above.

6.105 It is Government policy that the number of telecommunications masts should be kept to a minimum and to encourage mast sharing where appropriate. The licences issued to the four existing network operators require them to take all reasonable steps to investigate using, or replacing, an existing mast or other structure before erecting a new mast. Where a new mast is required, operators are required to investigate co-operating with another operator in erecting a mast for joint use.

6.106 Planning Circulars 4/99 and 29/99 underline the Government's expectation that developers should provide the LPA with clear evidence that they have fully considered the use of existing masts, buildings and other structures before seeking to erect any new mast. If the evidence regarding the consideration of such alternative sites is not considered satisfactory, the LPA may be justified in refusing approval to the installation of the mast.

6.107 However, mast sharing is not always possible. Although an existing mast might be in close proximity to a proposed site, the precise location and height of the existing mast may not be compatible with the operator's network. The size of the mast will also affect the ability to mast share; smaller masts may not be suitable for additional operators either because the structure is inadequate for the additional weight, or because there would be insufficient vertical separation between different sets of antennas to avoid interference. In addition, LPAs may consider the merits of mast sharing on a case-by-case basis. In some locations it may appear that a single large mast would have less impact, whilst in others it may be considered that several smaller masts, even in close proximity, are less visually intrusive.

6.108 The Government is keen to encourage early discussions between the operator and the LPA about proposed telecommunications development. Under a Code of Best Practice, issued by DETR in 1998, for telecommunications prior approval procedures in England and Wales, operators are encouraged to provide information to the LPA on significant installation plans in the LPA area and to undertake informal discussions on these plans. Close consultation between the operator and LPA before an application for consent for telecommunications development is made will allow the two sides to examine locally not only alternative mast locations, including

opportunities for site sharing, but also different design solutions. We understand that consideration is being given to extending this to include health concerns.

6.109 Draft guidance to LPAs in drawing up development plan policies or deciding planning applications for development giving rise to electromagnetic fields, such as telecommunications base stations, is contained in the joint DETR/DH draft circular, "Land-use Planning and Electromagnetic Fields (EMFs)", issued for consultation in December 1998. A similar consultation exercise was carried out in Wales by the then Welsh Office. The circulars will be finalised as soon as practicable. In July 1999 the then Minister for Public Health and the then Minister for Planning jointly wrote to all Members of Parliament for constituencies in England, and to all Council Leaders in England, setting out the Government position about the possibility of adverse health effects associated with telecommunications base stations. In October 1999, a similar letter was issued in Wales by the two Assembly Secretaries with responsibility for health and planning to all Members of Parliament for constituencies in Wales, all Assembly Members and to all Council Leaders in Wales.

Scotland

6.110 In Scotland broadly similar permitted development rights apply to telecommunications development but with a number of significant differences. For example, the restrictions on permitted development rights for masts in certain designated areas currently relate only to masts for "microwave antennas" (as defined in Scottish planning legislation) in National Scenic Areas and conservation areas. There are no prior approval procedures in Scotland for telecommunications permitted development, the system in Scotland relying more upon the obligations contained in the telecommunications code system operator's licence. This is also true in relation to the general condition requiring the removal of redundant telecommunications equipment that has benefited from permitted development rights.

6.111 The Scottish Executive intends to increase the controls on permitted development rights in Scotland to a level approximating that in England and Wales, including the introduction of a prior approval regime. Work on the relevant legislative amendments is in hand and will be considered by the Scottish Parliament in due course. New guidance will also be issued to update that currently contained in the Scottish Executive's Circulars 25/1985 and 5/1992. Similarly, a Code of Best Practice for telecommunications prior approval procedures, in the form of a Planning Advice Note, is also intended. These documents will reflect the policies mentioned at paragraphs 6.104–6.109 above. The Scottish Executive produced its own version of the draft circular on "Land-use Planning and Electro-Magnetic Fields", which will also be finalised as soon as practicable.

6.112 The Scottish Parliament's Transport and the Environment Committee recently produced a report entitled "Planning Procedures for Telecommunications Development" (Scottish Parliament, 2000). This was prompted by public concern about mobile phone masts and the Scottish Executive's proposals to increase controls on permitted development rights (see paragraph 6.111). The Committee concluded that the existing system was inadequate and that change was required. It expressed significant concern about the prior approvals process and recommended the introduction of full planning controls. In addition, the Committee identified three key factors that should inform policy in this area: amenity, health, and a precautionary approach.

6.113 In relation to amenity, the Transport and Environment Committee concluded that environmental impact could be minimised through early discussion of strategic network requirements, site sharing, mast sharing, design and disguise, and the introduction of national roaming. Although guidance was required to minimise the impact of development on environmentally sensitive

areas, this should allow for local flexibility. In relation to health the Committee decided that whilst there was no conclusive scientific evidence for non-thermal effects, there was reasonable doubt about health risks, and it therefore recommended that health should be a material planning consideration. It also recommended adopting a precautionary approach, and urged planning authorities to consider a hierarchy of preferred locations that would favour development in sparsely populated areas, such as industrial sites. However, the Committee concluded that there was insufficient evidence to justify a *cordon sanitaire*.

6.114 The Committee recommended the development of a national policy framework in consultation with interested bodies, including telecommunications developers and operators. Within this framework the Committee identified a need for clear guidance based on a precautionary approach.

Northern Ireland

6.115 In Northern Ireland planning decisions are the responsibility of the Planning Service, a Next Steps Agency of the Department of the Environment. This Agency has six divisional offices and two subdivisional offices, each covering a number of district council areas.

6.116 As in England and Wales, larger developments, such as masts over 15 m high, require full planning permission. However, telecommunications code system operators enjoy permitted development rights for a range of developments under the Planning (General Development) Order (Northern Ireland) 1993, as amended by the Planning (General Development) (Amendment) Order (Northern Ireland) 1998. These rights are subject to limitations and conditions to protect amenity and the environment, and essentially mirror those in England and Wales.

6.117 Some permitted developments, such as erection of masts up to 15 m high, are conditional upon prior approval by the Planning Service. Under this procedure, the Planning Service has 28 days in which to whether to approve the site and appearance of the installation. Where it considers that the development would pose a threat to amenity, the Planning Service may refuse approval. In England and Wales the prior approvals process was modified by the Town and Country Planning (General Permitted Development) (Amendment) Order 1999, and similar changes are currently being introduced in Northern Ireland. It is expected that these changes will be implemented in 2000, and will extend to 42 days the period allowed for notification that prior approval is required, and the decision on whether to approve the siting and appearance of the installation.