TRANSPORT AND THE ENVIRONMENT COMMITTEE

Wednesday 17 November 1999
(*Morning*)

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TRANSPORT AND THE ENVIRONMENT COMMITTEE
7th Meeting

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*Nora Radcliffe (Gordon) LD)
*Tavish Scott (Shetland) (LD)
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Dr Helene Irvine (Greater Glasgow Health Board)
Dr Alastair McKinlay (National Radiological Protection Board)
Dr Colin Ramsay (Scottish Centre for Infection and Environmental Health)
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Lynn Tullis

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Scottish Parliament

Transport and the Environment Committee

Wednesday 17 November 1999

(*Morning*)

[THE CONVENER *opened the public meeting at 09:54*]

The Convener (Mr Andy Kerr): I begin by welcoming everyone to this meeting of the Transport and the Environment Committee. My name is Andy Kerr, and I am the committee's convener. I welcome members of the press and public, visitors and those from whom we will be taking evidence. Sprinkled around the table are MSPs, members of the official report and officers of the Parliament. They all have their names in front of them, so I do not intend to introduce them individually.

The Signet library is not normally the venue for our committee meetings. It is very prestigious but, I understand, fairly cold. That is a problem that we may have to try to solve during the meeting, but I hope that everyone here will manage to survive. We may break in the middle for some vigorous exercise to heat ourselves up.

Telecommunications

The Convener: This meeting forms part of our investigation into planning in the telecommunications industry. It is our most crucial meeting, because it involves those organisations and bodies that have views on the health aspects of this issue. Before we proceed to questioning, I should say that I have received apologies from Kenny MacAskill MSP and Des McNulty MSP, who are unable to attend today's meeting.

We will take evidence this morning from the Scottish Centre for Infection and Environmental Health, from Greater Glasgow Health Board and from the National Radiological Protection Board. I invite Dr Colin Ramsay to come before the committee. I appreciate that this looks like a fairly formal arrangement, but we will try to keep things as informal as possible. Thank you, Dr Ramsay, for taking the time to come to speak to the committee. We are interested in your submission and in what you have to say to us this morning. After you have taken a couple of minutes to make some introductory remarks, I will invite members of the committee to ask questions.

Dr Colin Ramsay (Scottish Centre for Infection and Environmental Health): Thank you for this invitation to speak to the committee. I thought that it might be helpful to give a brief introduction to my perspective on the subject. I am a consultant epidemiologist at the Scottish Centre for Infection and Environmental Health. I trained in medicine and qualified in 1980. I then trained in public health and epidemiology. I worked as a consultant in public health for communicable diseases and environmental health with Lothian Health for nine years before moving to SCIEH.

SCIEH is part of the health service in Scotland. It is a division of the common services agency. The organisation was set up to provide advice and support to health boards, local authorities and the Scottish Executive health department. I became involved in the mobile phone masts issue when I was asked for advice by health board public health consultants. I therefore had to research the issue and come to some conclusion about the health aspects of the problem.

I know that a lot of evidence, both oral and written, has been submitted to the committee. Committee members will already have heard about what are known as the thermal effects of electromagnetic radiation. It will have been explained to members that those are effects induced by the absorption of energy, resulting in an increase in temperature in tissues. The health consequences can be extreme; for example, development of cataracts. One would not expect such effects to be associated with mobile phone base stations.

The other effects, which are somewhat more contentious, are what are known as non-thermal effects, because no increase in temperature is detected. Some people say that such effects are inexplicable and therefore do not count. The NRPB tends to take that view. However, many other scientific authorities say that the effects are real and should be considered.

Experimental evidence shows non-thermal effects to be wide-ranging, from effects on calcium-ion transport in tissues and cells to effects on enzymes and the production of hormones such as melatonin. Some studies have also shown effects on laboratory animals, such as changes in behaviour, which could be interpreted as a stress reaction, and there is evidence that suggests that memory deficit could be a consequence of exposure.

The significance of those findings, if correct, is that, although they may be small and occur at low energy levels, a large number of people are being exposed over a long period of time. From that point of view, it is a public health concern.

I want to consider also the health impact assessment aspect. People have focused too

much on trying to assess damage to tissues and to people. My concept of health—the public health view—is that health is about more than the absence of disease; it is all about well-being. We must acknowledge the fact that this debate induces anxiety and stress. It causes an enormous amount of concern among parents if base stations are sited in schools or close to their back gardens. In the widest sense, we must consider that a health impact, which must be taken into account.

10:00

I move on to consider the matter from an environmental health perspective, taking into account other environmental aspects. We are trying to minimise exposure to air pollution, we have set about having lead-free petrol and we are about to introduce a new set of water quality guidelines that reduce the exposure to lead. The only area in which we seem to be quite happy to allow an increase in pollution is in electromagnetic radiation.

Studies in the United States have shown that, over the past decades, there has been a progressive increase in the levels of background electromagnetic radiation. That must be a concern in itself, and another reason why we must adopt a rather more precautionary approach to this whole question. What is being conducted, in effect, is an enormous natural experiment. We will not know the answer to whether there are really health effects for many years, even decades. By then, it may be too late.

Finally, I want to touch on the current guidelines that are in operation in the United Kingdom. You may have heard already that the NRPB guidelines are based on the accepted thermal effects and do not take into account the possible biological or non-thermal effects, because the NRPB does not view them as legitimate in the setting of guidelines. It must be acknowledged that the NRPB guidelines are the least strict guidelines in the whole of Europe and most of the developed world. They do not match the guidelines that are advocated by the International Committee on Non-Ionizing Radiation Protection, or ICNIRP.

You might also be interested to know that a microchip embedded in a piece of sensitive electronic equipment would be expected to sustain only about a fortieth of the energy levels that a human is supposed to be able to sustain without apparent damage. To me, that is an interesting anomaly. There is a whole host of reasons why this topic is a legitimate one for public health concern, and one in relation to which I would like the planning process to be used to good effect.

The Convener: Thanks very much, Dr Ramsay. That was most interesting.

Nora Radcliffe (Gordon) (LD): I want to ask a few questions to ensure that committee members are clear about the role and status of the Scottish Centre for Infection and Environmental Health. How does that relate to health boards, local authorities and planning authorities in Scotland? What is your relationship with those other public bodies?

Dr Ramsay: We are funded by the national health service. The Scottish Centre for Infection and Environmental Health is the amalgamation of two units. One of those was the Communicable Diseases Scotland Unit, which was set up in the 1960s following the Aberdeen typhoid outbreak and which provided a national centre in the field of communicable disease. A similar centre was established in the early 1990s for environmental health. Those centres were amalgamated in the 1990s, which is how SCIEH came into existence.

The centre employs a wide range of people who have expertise in communicable disease and environmental health, who are there to provide support and advice when health boards and local authorities, or indeed the Scottish Executive, have issues that need to be researched, which are beyond the capabilities of the ordinary individual. Our purpose is to evaluate scientific evidence, arrive at conclusions and give advice. That is the way in which we operate.

Nora Radcliffe: How do you come to conclusions about issues such as this? Does one person research them, or do you have a board that examines evidence? How do you arrive at your conclusions?

Dr Ramsay: The topic is a complex one, as I am sure you appreciate. There is an enormous wealth of literature on the subject, volumes of material. It would be difficult for one individual to research every paper that has ever been written on the subject. We need to examine reviews that have been conducted by leading authorities on the subject, who are experts and who have an unbiased viewpoint. For example, a very good review of this subject, which was conducted by the Royal Society of Canada, was published in March. That organisation researched all the papers that relate to the subject and concluded that biological effects exist and should be taken into account. That is the kind of material that I would refer to before coming to my conclusions on the matter.

There are clearly an awful lot of scientific and technical issues behind the subject. I do not have a background in physics that would enable me to assess those aspects, so I must rely, to some extent, on the abilities of expert reviewers who publish work in peer review journals.

Nora Radcliffe: Are you bringing your expertise in epidemiology and public health to what you

perceive as a problem?

Dr Ramsay: We are trying to interpret it from a public health perspective and trying to make a judgment on the basis of the scientific evidence. There are differing perspectives on where guidelines should be set. Some people say that they should be set on the basis of hard-and-fast scientific evidence; others who adopt a more wide-ranging view of health may consider that other aspects should be taken into account in setting guidelines. That brings a public health perspective into consideration, as opposed to a purely scientific perspective.

The Convener: What level of interest has been expressed by the people with whom you work? Are they coming to you for information, and is there a lot of interest and concern out there in the scientific community?

Dr Ramsay: We have had a lot of inquiries from a variety of health boards and local authorities, because questions have arisen as a result of planning applications, for example. They tend to refer to us for advice on the subject. That is why a piece was written in the SCIEH weekly report in an attempt to synthesise some of the evidence. It was a short piece and by no means comprehensive, but there is anxiety in health boards and local authorities about the whole question of how to apply the precautionary approach.

Helen Eadie (Dunfermline East) (Lab): Could you explain how emissions are transmitted—for example, the directional effect of masts and the combined effect of a number of masts and transmitters?

Dr Ramsay: I am not a technical expert on transmission, and that question would be better directed at a technical expert. However, my lay understanding is that the outputs that are emitted by mobile phone masts are directional. That is another reason that is cited for their relative safety. The question about cumulative emissions is, again, rather technical, and I do not feel that I am able to answer it.

Helen Eadie: What would be the geographic effect of change in recommended emission levels as recommended by the House of Commons Science and Technology Select Committee?

Dr Ramsay: I understand that the House of Commons select committee advocated the adoption of ICNIRP levels. The difference between the ICNIRP level and the NRPB level is that the NRPB level applies to both occupational exposure and the general public. The NRPB did not accept the idea that there should be a further safety factor reduction for the general public, because it did not accept the fact that there were vulnerable groups in the community such as children.

There is scientific debate as to whether certain groups in the population are more vulnerable. The thermoregulatory mechanisms of children and the elderly are less effective than those of the average fit and healthy adult. If there were to be a thermal effect, those groups may have less ability to cope with that than an adult would. That is one reason why the House of Commons committee favoured the ICNIRP guidelines. They introduce another safety factor of about five in terms of reducing the level below what the NRPB advocates. That introduces a further safety margin.

Helen Eadie: How are electromagnetic field strengths and exposure levels currently monitored and measured, what are the key issues in the current approach to monitoring and measurement and what are the availability and cost of equipment?

Dr Ramsay: Those are interesting questions. It seems that not much in the way of mandatory regulation of monitoring is required once masts are erected. That situation must be examined. Surveys have been conducted on a rather ad hoc basis by some local authorities, but there are question marks about whether some of the equipment that they have used is sensitive enough to detect the levels that people are interested in.

The whole question of monitoring has not been sufficiently explored in terms of routine use. More should be done to prove that masts meet adequate criteria rather than accepting that they have been set up to meet technical criteria.

Helen Eadie: Are you concerned about the expertise of those who are using the monitoring equipment?

Dr Ramsay: It is a very technical field. Measuring very low-level emissions from telephone masts may be beyond the normal means of the average local authority.

Janis Hughes (Glasgow Rutherglen) (Lab): Will you explain the biological effects of emissions from land-based telecommunications equipment? What does “chronic” mean in relation to exposure to electromagnetic fields?

Dr Ramsay: Chronic exposure simply means that it is long-term. On the whole question of mobile phones and telecommunications, we are in a new era. The population has been exposed to these emissions for only a few years so far, but will obviously be exposed for decades, given current trends. That is when it will become chronic. It is rather like the exposure to lead in water; that is chronic exposure because it happens every day of the week.

Some people regard the biological effects as contentious because no one has been able to explain how they occur. A wide range of effects

has been cited in a variety of scientific studies. Those effects are difficult to explain, but reviewers have concluded that there is sufficient evidence—albeit very diverse—to suggest that they should be considered.

There are effects on the transport of calcium ions across cell membranes and on the production of enzymes, which are necessary for energy production. There are examples of effects on the output of melatonin, which is a brain hormone. Studies on laboratory animals exposed to very low levels of radiation found that the animals reacted in ways that suggested that they were suffering stress. Other experiments appeared to show that memory deficit resulted from exposure to low-level radiation.

Those are termed biological effects. They are apparently not induced by increases in temperature; nobody has been able to detect a temperature rise, although some people think that not being able to detect very small temperature rises may be a problem. However, in the main, those biological effects are characterised by unexplained mechanisms. There is a whole question about uncertainty. Because the effects are biological, one has to question at what point they could become health effects, and finding that boundary is very difficult. Traditionally, people have stuck to saying that thermal effects are defined, can be seen and demonstrated, and that they are therefore the cut-off point as far as health is concerned. My view is that the consideration of health effects should be much wider.

Janis Hughes: What health effects could be the consequence of long-term exposure?

Dr Ramsay: That is difficult to predict. Attempts have been made to consider the whole question from the point of view of epidemiology—studying the distribution of diseases associated with exposure. The problem with that is that we have not had long enough to do good epidemiological studies. It is also extremely difficult for studies to measure the exposure for an individual, because that changes so much over time. Some studies have indicated increases in lymphomas and the possibility of cancer promotion caused by low-level radiation. That may seem to affect only a small number of people, but it could become significant if large numbers of people are exposed over a long period.

Janis Hughes: How do pulsed signals differ from non-pulsed signals?

Dr Ramsay: That is a very technical question and I may not be the best person to answer it. However, many scientific workers have pointed out that a lot of the studies that attempt to reassure people have been based on non-pulsed radiation. Pulsed radiation has a different physiological impact. Consideration of the frequency at which the pulses reverberate and oscillate must be added to consideration of the frequency of the radio waves. There is a term known as resonance, whereby the body resonates at certain natural frequencies. If the frequency of pulsing were to match the frequency of natural resonance, there would be an additive effect. That could potentiate any existing biological effect. The mere fact that the radiation is pulsing is another new phenomenon in human exposure, and therefore another potential cause of concern that we have to take into account.

Nora Radcliffe: At what point do levels of oscillation become biologically dangerous? Are the human body's natural resonances known and mapped?

Dr Ramsay: They are known, but do not ask me to quote the figures. Studies on a range of different oscillating frequencies have shown that different frequencies have different effects. There has also been evidence of thermal effects. It has been pointed out that altering the base level frequency at which radio waves have been pitched can cause different changes.

10:15

Nora Radcliffe: Does that mean that we can tailor matters so that they are not detrimental to health?

Dr Ramsay: That is a possibility. However, that is a very technical issue.

Janis Hughes: You mentioned that the difference between thermal and non-thermal effects of radiation is that there is no increase in temperature with non-thermal effects. Is there a level beneath which there is no thermal effect?

Dr Ramsay: The current guidelines set levels at which thermal effects should not occur. Using experimental techniques, it is possible to measure the temperature rise for a given amount of energy. People experience changes in temperature. For example, it is pretty cold outside this room, as those of us waiting outside discovered. When we exercise, we generate heat in the body and the brain temperature goes up. That is not harmful, because the body is designed to cope with a range of temperature variation. Damage starts to occur when the body gets beyond its compensating ability and the cooking phenomenon begins to happen at a very, very low level, although I do not want to overdramatise that. When the body can no longer regulate temperature, tissue damage occurs. The thermal guidelines mean that the body maintains any temperature rise within its ability to regulate its own temperature.

The Convener: Would you make any distinction between the energy levels from mobile phone handsets and from masts, or is the effect that you describe a general one?

Dr Ramsay: That raises a difficult aspect. The energy levels from mobile phones are greater than the levels that we might receive from passing a mobile phone base station, because we hold handsets right next to our heads.

Concerns about and guidelines on the appropriate levels for mobile phones are a slightly different issue. That debate is analogous to the debate about passive and active smoking. People who decide to use mobile phones need to be aware of the risks and to know how to minimise exposure by, for example, using remote handsets and earpieces and not keeping the aerial next to the brain. The industry is working on measures to minimise risks; the energy levels of phones are being reduced all the time.

The question about mobile phone masts is slightly different, because we cannot limit our exposure to energy levels, apart from walking away from them. That is the point at which the issue becomes emotive for parents, who cannot influence where the station is being sited. They can decide whether to let their children use phones, but not whether their children can go to a school without a mast on the roof.

Robin Harper (Lothians) (Green): What status do you attach to the NRPB's guidance on emissions and their impact on biological and epidemiological matters?

Dr Ramsay: The NRPB is a well-respected organisation that specifically provides scientific advice to the Government. The levels that the NRPB quotes are guidance levels and have no statutory authority; they are based on its assessment of the scientific evidence. It has stated quite clearly that the thermal aspect provides the basis of its scientific assessment. It also says explicitly that it does not take biological effects into account and that it does not see any necessity for doing so—it does not regard that as being the basis on which to make recommendations on health effects. Many other scientists in this field, particularly in other parts of the world, do not share that view.

Robin Harper: You have answered the question on whether the NRPB's position fits in with current scientific advice—it does not.

Dr Ramsay: As I said, the NRPB's attitude towards the required safety margin was the principal difference between the NRPB and the ICNIRP, in terms of the recommendations.

However, Italy, for example, has accepted the basis of non-thermal biological effects. The Italian threshold level is leagues below anything that is regarded as normal in this country. There is an enormous divergence of opinion on where guidelines should be set. It boils down to the question of what criterion is being used—the NRPB is quite open about its criteria. Others would like the UK to move towards a more precautionary level.

Robin Harper: What specific guidance do you think the NRPB should issue in order to take a sufficiently precautionary approach?

Dr Ramsay: That is a very difficult question. If one were to pitch the level at any point below what the NRPB currently suggests, one would be open to the argument that the system was arbitrary. It has been argued that we should use the level that has been cited for electronic equipment. It is something of an anomaly that we are prepared to protect sensitive electronic equipment by setting a guideline of about 0.027 W/sq m, whereas we are prepared to allow around 3,300 W/sq m for human exposure. There is an enormous difference between what we accept as being apparently damaging to electronic equipment and what we are prepared to accept as being damaging to human beings.

It is interesting, technically, that people say, "Oh well, the levels we set are actually way above what these base stations emit anyway, so you don't need to worry." However, if that is the situation, why are we setting such high guidelines? It is rather like having a speed limit of 500 mph on a motorway and saying, "Well, nobody's going to reach it anyway, so nobody's going to come to any harm. Why worry?" That is not the point of the guidelines. They should take into account the need to reassure people that their best interests and health—their well-being—have been considered, not just the fact that we are not going to cook them.

Linda Fabiani (Central Scotland) (SNP): Dr Ramsay, you mentioned the precautionary approach, which I am particularly interested in. One of the problems is the conflict between the NRPB's medical evidence and your evidence. Can you estimate the likely time scale for achieving conclusive evidence on the health implications?

Dr Ramsay: I have to be honest and say that we may never get conclusive evidence; that is a persistent problem with many environmental health matters. We are dealing with extremely complex and difficult situations and because of that complexity, even the best epidemiological studies will be flawed in their ability to show an effect. It is extremely difficult to differentiate the exposure from mobile phone base masts from all the other electromagnetic radiation to which people are exposed. One would have to tease out from the evidence that someone's leukaemia, or

whatever, is definitely due to the fact that he or she has been exposed to the base station for the past five years. It would be incredibly difficult to do that, so we may never reach the holy grail of the answer to the question.

We have to go back, therefore, to proxy measures and the other indicators of potential biological effects that could cause damage and that we must consider to be real. We must make a pragmatic judgment about the level of evidence that we are prepared to accept as being adequate. It would not be realistic for me to say that we will know the answer to that question in five years' time, as I do not necessarily think that we will.

Linda Fabiani: You explained earlier why elderly people and children were likely to be most at risk.

Dr Ramsay: Again, that boils down to physiological mechanisms; that approach is contested by some people who ask, "Well, where's your evidence that this is really true?" It is based on an understanding of the physiology of children that their biological mechanisms for coping with heat and excessive cold are less well developed. For example, children are much more prone to getting very hot or cold—they do not have mature mechanisms to cope. The physiological ability to cope also decreases as people grow older, so there is reason to suspect that elderly people are more vulnerable, but it might be difficult to provide hard and fast evidence of that.

Linda Fabiani: Should schools and residential areas be treated differently? Some people say that masts should be kept away from schools. Should we be more cautious than that, as children are in residential areas, too?

Dr Ramsay: It is difficult not to adopt an arbitrary approach. I want the concept of minimising exposure to be accepted. Clearly, minimising the exposure of children is a reasonable way forward, as they will be exposed to radiation for a much longer time and it is the cumulative effect of radiation that is, perhaps, the cause for concern.

There are two ways to go on this—

Linda Fabiani: You are answering my next question, but carry on.

Dr Ramsay: There are two ways in which to adopt the precautionary approach. One can set a relatively arbitrary physical limit of, say, 100 m, and say that there should not be a base station within that distance of the boundaries of a school, on the basis that that will minimise exposure. However, although children may be in school for seven hours a day, five days a week, what about the rest of the time? Children are in their homes and their local environments. How does one set guidelines? Perhaps that is not the best way to go, although it might be a pragmatic approach. It would reassure parents, and others, that something was being done to minimise exposure.

The second approach might be to consider the energy levels impinging on particular sites. That would demand a much more robust mechanism for measuring the output from transmitters, and measuring levels at places such as schools.

The second option would probably be much more expensive and technically difficult. It would be easier and more pragmatic, but relatively arbitrary, to set a limit of 100 m, for example. That approach has been adopted in a number of countries.

Linda Fabiani: You have answered my next question as well.

The Convener: We talked about the directional effects of antennae and masts. I asked a previous witness about that. There is an argument that, because the signal from an antenna that is on top of a high-rise block of flats goes out the way, people living in the flats below are relatively unaffected. How does that view of directional effects influence what we are saying about playgrounds and other sensitive areas?

Dr Ramsay: Technical people will tell you that if measurements are taken several floors below where a mast is sited, extremely low levels will be detected. That may be technically correct, but one has to balance the reassurance aspects of a health impact assessment with those physical measurements. One might agree that, strictly, a mast meets the technical requirements, but its physical presence still results in anxiety and stress. That has to be considered in determining the impact on health, as there is more to this than technical factors.

The Convener: I appreciate that.

Linda Fabiani: What is the best international practice of which you are aware?

Dr Ramsay: The strictest criteria of which I am aware apply in Italy. In effect, Italy has gone for a level that is about equivalent to that applying to sensitive electronic equipment.

Helen Eadie: What information on telecommunications developments should be given to the public? From whom should that information come?

Dr Ramsay: Often, it seems that the first that people learn about the siting of telephone base stations is when they pop up at the bottom of their gardens. I am not an expert on planning regulations, but I understand that, if the height of a mast is less than 15 m, companies do not need to seek planning permission and can plonk it more or

less where they like.

A situation that engenders such public anxiety has to be examined carefully. The public must be given an opportunity to find out about the situation. The companies should adopt a more open approach. They should demonstrate that they have a compelling reason to have a mast in a particular location and that it is not just for the sake of convenience. They have to reassure people that they are meeting whatever guidelines are set. At the moment, I do not think that that is being done.

10:30

Nora Radcliffe: I know that you come from a medical background rather than an environmental health background, but could you tell me what equipment is available to measure the output of the masts? Do our local authorities have the equipment?

Dr Ramsay: That is a technical matter. I think that local authorities use hand-held meters to determine the energy levels, but there are doubts about the sensitivity of the meters. They are probably good enough to determine if the mast conforms to current National Radiological Protection Board guidelines, but more sophisticated equipment would be required to test for lower levels. The authorities would have to buy such equipment and people would have to be specially trained. If the environmental health department cannot do the work, another mechanism will be needed to reassure people.

Linda Fabiani: It seems clear that your agency would like the matter to be brought under planning legislation.

Dr Ramsay: Yes. I understand why things were set up as they were—to allow the industry to expand—but we have to question whether it is reasonable to continue in that way. I believe that the public needs to have a greater say.

Linda Fabiani: At the moment, people cannot object to the siting of a mast on health grounds. Would you like the planning regulations to be expanded?

Dr Ramsay: Yes. I would like a much wider understanding of health impacts, not just of the thermal effects.

Mr Harper: Is there a difference between the views that you have expressed and those of the Scottish health boards?

Dr Ramsay: The Scottish health boards have written to us for advice many times. It is up to them whether they accept our advice, which they might not agree with.

Mr Murray Tosh (South of Scotland) (Con): You mentioned that, in Britain, there had been a loose regime to begin with to allow the industry to establish itself. Was the development of the Italian industry adversely affected by the fact that, as you said, the Italian regime is very tough?

Dr Ramsay: I do not know. I hear that many Italians walk around with mobile phones so I assume that they can use them.

Helen Eadie: The committee has heard a lot of evidence on this subject. Why should we give more weight to the evidence that you give than to that given by the NRPB?

Dr Ramsay: Clearly, I am biased, but I think that the planning system has not taken health into account as a valid reason for objections. Objections on the basis of health must be backed up by rigid scientific evidence. The onus is always on people to prove demonstrable damage, as opposed to psychological damage or damage because of persistent chronic stress—I acknowledge that those are softer areas of health, but they are still valid. The planning system should be more open-minded about taking health into account, even if we have a wide-ranging perception of health and consider it to be about well-being. The planning system should be willing to listen to people's legitimate and serious concerns, even if those concerns are not couched in the best scientific language.

The Convener: If there are no further questions, I want to thank Dr Ramsay. That was an interesting, full and frank discussion. We appreciate your openness.

I have some news about the heating. The boiler is on the blink—to use the technical term. The engineer has been sent for, but we will not be the beneficiaries of his visit. Sadly, we must continue in this rather chilly climate.

I invite Dr Helene Irvine of Greater Glasgow Health Board to join us.

People on the public benches may find that some of the questions that we will ask are similar to those that we asked previously, but we are trying to hear the views of different organisations. The questions are valid. We want to determine the broader picture.

I welcome Dr Irvine. Thank you for your written evidence and for the evidence that we are about to receive—as they say. You are most welcome. Nora Radcliffe will start the questioning.

Nora Radcliffe: What view do you and the Greater Glasgow Health Board take on the issue?

Dr Helene Irvine (Greater Glasgow Health Board): Would you like me to answer that before I give my five-minute presentation?

The Convener: Sorry. I should have given you

the opportunity to make a short statement. I apologise. I thought that you might work your statement into your answer to Nora Radcliffe's question, but you are very welcome to make an opening statement.

Nora Radcliffe: I am sorry. Your statement will no doubt answer my question.

Dr Irvine: Good morning committee members. My name is Helene Irvine. I am a consultant in public health medicine, responsible for communicable diseases and environmental health with the department of public health at Greater Glasgow Health Board. I am concerned about the potential for ill health caused by cellphones and transmitter masts. As members will know, in my written submission I argued in favour of adopting a precautionary approach enshrined in some form of enforceable legislation.

In February this year, the head of environmental protection and public health at Glasgow City Council wrote to me. He asked me, as the designated medical officer for Greater Glasgow Health Board and a consultant in public health with responsibility for environmental health, for my views on the health implications of cellphone masts. Since February, I have reviewed existing scientific and circumstantial evidence. I have communicated with a number of scientists working in the field from around the world and have attended two key conferences.

My work has led me to conclude that there is enough evidence to merit the adoption of a precautionary approach to the siting of masts. In early June, I advised senior officers from the six local councils covered by GGHB to that effect. That is not to say that I know that such masts are hazardous. It means simply that I concluded that there was a sufficient question mark over the long-term safety of masts to advise caution.

Specifically, I advised that no more masts be erected in residential areas and schools, at least until the various expert groups reported. I advised that it was likely that that approach should continue, given that we would not know for many years the long-term effects of low intensities of radiation and on the ground that children would be more susceptible to the effects of such radiation. I suggested that, although we were not experts on the subject, it was reasonable to err on the side of caution, assume that such radiation could have an effect and introduce a band of safety around each mast. I suggested that, as an interim measure, it was reasonable unilaterally to introduce an arbitrary safety limit that took into account the possibility of non-thermal effects.

I will summarise some of the key points that need to be considered. We do not know the daily tolerable exposure to microwave radiation. We do not know the long-term consequences of chronic low-level exposure or whether such effects might be cumulative. We know from watching television and from walking down the high street that cellphone technology is everywhere—even many children own cellphones. The technology has been released for use by the general population without the kind of experiments that would enable scientists to confirm that it is entirely safe in the long term.

A substantial body of published, peer-reviewed evidence suggests that this form of radiation is not inert. It has been shown to have a range of biological effects in animal models and human cells in vitro at low intensities in the range that might conceivably be experienced around a transmitter mast. Those effects have included changes in the blood-brain barrier, reductions in fertility and size of offspring, DNA-strand breakages, changes in the behaviour of rats, reductions in eating and drinking in mammals, changes in calcium movement across cell boundaries and so on. All those results were published in peer-reviewed journals; they were all achieved at intensities that could be experienced around a mast.

Many reputable scientists are concerned about the adequacy of the NRPB safety standards, which are many times less stringent than those adopted by most western countries and which do not take into account the possibility of non-thermal effects. Those standards do not ensure that masts are kept at a reasonable distance from individual homes and schools. There are examples in the UK of masts that are located just 5 m from a primary school. I know about those examples, as they have been reported to the health board.

The volume of radio signals that is transmitted by masts is set to increase markedly over the next few years. Measurements that are taken from a limited sample of masts—by City of Edinburgh Council, City of Glasgow Council and Renfrewshire Council, for example—over limited periods and at specific points in time will not necessarily reflect the situation next spring or next year. We are trying to measure a moving target.

Given the long latency period for most cancers, the lack of firm epidemiological evidence to link serious disease in humans with this form of radiation should not be used to dismiss the adoption of a more cautious approach. Even if small clusters of disease were to develop around transmitter masts, we, as public health doctors or consultant epidemiologists, would find it difficult or impossible conclusively to attribute those clusters to the masts. It is not good enough to rely on post-marketing surveillance.

Wireless Technology Research—the research arm of the industry in America—has equated post-

marketing surveillance of disease with protection of the public health. However, post-marketing research is not a reasonable substitute for public health protection, which involves ensuring that radiation levels are kept to an absolute minimum in sensitive areas and that, in using cellphones, people are advised to keep their calls short, to use hands-free sets, not to attach the phone to their waist and so on.

As has been said, even if only a small percentage of the population were to be affected by the masts, the impact on the public health would be substantial because of the sheer number of people who are exposed to radiation.

Local government commitments—in booklets such as Stirling Council's "The Things Children Want"—state that children should be safe from harm in their home, at school and at play, and that they should be listened to when they raise concerns. Those commitments to protect the health of children and to listen to parents should be honoured.

A more precautionary approach should have been adopted during the uncontrolled promotion of tobacco after the war and in the careless use of asbestos in the shipbuilding industry and later by the construction trades. A precautionary approach should also have been adopted during the processing of feedstuffs to nourish beef herds during the recent BSE epidemic. Those three big examples teach us that we should be more careful in future.

In conclusion, a debate is required on whether we, as a society, are prepared to take the risk that these masts may have effects on the health of some of us. That debate should include not only the expert scientists, but, crucially, the rest of society. Ultimately, the public must decide whether they are prepared to have the masts on their schools or near their homes, whether they are prepared to accept sub-optimal signal coverage, and whether they are prepared to pay more for their phones and calls to fund any adjustments that are necessary to reduce the electric field strengths that the masts emit.

Many of the ways in which that can be done have not been sufficiently explored or may have cost implications that the industry has not welcomed. We must have a debate with the industry to determine whether it can afford to absorb the costs of any adjustments. Surely, with all the lessons that have been learned from the past, we are at a stage in our history when we can consciously decide to place a sufficiently high value on public health that we are prepared to debate these issues openly and consider collectively the imposition of restrictions on the placement and emission levels of these masts.

Nora Radcliffe: Will you expand a little on why we should listen to your advice? What is your expertise in this field and what are your professional qualifications?

Dr Irvine: I would not suggest for a second that I am an expert in this field. I have a bachelor of science degree in physiology, a master of science degree in human biology, a medical degree from Canada and a master of public health degree from the University of Glasgow. After five years of training, I am qualified in public health with a postgraduate qualification in public health medicine.

I have been concerned with this subject only since February, so I do not have nearly as many years of experience as some of the scientists of the NRPB. The big thing in my favour is that my only remit is to protect the health of my population at GGHB. I do not have any vested interests. My aim is not to publish a paper to further my career, because I have what I want in life, which is a consultant's job in a health board near where I live. I do not have any connections with the industry or with Government, which, indirectly, has an interest in promoting this technology.

10:45

Nora Radcliffe: That was a very fair round-up. What is your relationship with local authorities, and what sort of advice, about planning and environmental health, do you proffer them or do they seek from you?

Dr Irvine: As I mentioned, I act as one of the two designated medical officers at GGHB for the six councils that we advise. That includes all Glasgow city and parts of five other councils. In that capacity, I am regularly called on to give advice on a range of communicable disease and environmental health issues. For instance, yesterday I was called about whether a child with salmonella should be excluded from a nursery. That is the sort of thing that I would be advised about, after which I can use the law to exclude that child if I think it appropriate. I could be asked about the hazardous effects of a rapeseed field, a chemical spill or an outbreak of E coli 0157, as happened in our area in Lanarkshire.

Most of the time, my advice is, strictly speaking, advice only. People are not required to follow it. Apart from the rare opportunities in which I can use the law—for example, to take somebody under the National Assistance Act 1948 from their home against their will to a place of safety, or to require somebody under the law on tuberculosis to enter hospital for treatment—there are very few instances in which anything that I say must be adhered to. I work in an advisory capacity, and I rely on my knowledge and credibility for that

advice to be followed.

Nora Radcliffe: I gather that you have had a volume of inquiries on telecommunications masts.

Dr Irvine: Yes, and not only from my own patch, but from throughout the United Kingdom.

Janis Hughes: What is your understanding of the biological effects of emissions from land-based telecommunications equipment?

Dr Irvine: I have to say that I am not a biophysicist, I am not a bioengineer and I am not a molecular biologist, so all those questions are difficult for me. However, knowing how complex the human body is—and I have had that drummed into me during my 20 years of education—knowing how subtle the effects of new forms of radiation can be, and understanding the pulsed nature of some forms of digital cellphone radiation, I feel that it is reasonable to say that radiation might interact with living things to turn on or turn off existing cell processes. It is a well-known phenomenon that a flashing light can induce a seizure in an epileptic. It is not the intensity of the light that can trigger the epileptic seizure, but its pulsed, recurring nature and the fact that it is in synchronisation with some of the cells at the site of the trigger in the brain. That sort of mechanism is a possible cause of biological effects.

Janis Hughes: How do pulsed signals differ from non-pulsed signals, and what are their effects on health?

Dr Irvine: I do not know an awful lot about that. However, from looking at the biological evidence from studies on both continuous and pulsed cellphone radiation, I know that they have different thresholds for inducing effects. The pulsed nature apparently causes a more potent effect, but that is about as much as I know.

Janis Hughes: In your research, what did you find out about the health effects of long-term exposure to emissions from land-based telecommunications equipment?

Dr Irvine: On an epidemiological basis, there is very little evidence linking ill health in humans to transmitter masts. Such masts have not been around for long enough and the evidence at the moment is largely anecdotal—people insist that symptoms that they experience are owing to a nearby mast.

For us to be able to attribute to the masts measurable diseases, such as cancers, we would need to wait for the latency period to pass. Most cancers take many years to develop, and the masts have not been around for long enough. We would also need to see a significant number of cancerous tumours developing to gain statistical confidence that they are more frequent than we would expect. People are developing cancer all the time, as they grow old or because of their lifestyle. We would need to tease out all the other contributing factors. That relates to my point about the difficulty of attributing any cancers to the masts. Hence, there is a need for prevention in the first place.

Janis Hughes: You said that if clusters—of leukaemia or other types of cancer—developed around masts, you would not necessarily be able to attribute them to the emissions from masts.

Dr Irvine: At the moment, clusters would not be developing on account of the masts, unless they applied to children, who can develop leukaemia very quickly. Clusters are measured all the time, but is difficult to attribute them to environmental hazards. There is a controversial debate in the UK about the aetiology of the clusters. Some people support the view that people come into contact with viruses when they move into a new area and that that is why there are clusters around nuclear installations and so on.

It is incredibly difficult to attribute ill health to an environmental hazard. My view, which can at times be cynical, is that we never want to pin anything on the environment any more—we say that things are all to do with lifestyle or perhaps with genetic make-up or occupation. One would think that we lived in an environmentally pure world, because we can never pin any ill health on chemical reprocessing plants, nuclear installations, landfill sites and so on. It is difficult to prove a link with something in the environment, perhaps because we have set difficult standards for ourselves.

Janis Hughes: In your opinion, will the continuing research give us more conclusive evidence in due course?

Dr Irvine: If the effects are marked, it will be easier and quicker to obtain such evidence. If the effects are subtle, it will be more difficult and it may never be possible.

The Convener: Do you have a view on the directional effects of masts?

Dr Irvine: The masts are very directional, as has been said. They can be specifically targeted, but there is a risk that we use that feature to claim that masts can be safely located anywhere, and that we can target the beam to avoid residential areas. There may be some truth in that, but the point is that the structures on which the masts sit are not sited in isolation. One may be put on top of a primary school and the beam may be directed away from the children occupying the building underneath, but the chances are that that school will be in a residential area—most schools are situated where people live. We would have to ensure that the beam was not directed at any residential area and that there was no chance that

parents dropping their children off at school in the morning and who looked at the mast were affected.

My worry is about the number of masts. I am told that there are 75 of them in Glasgow—they were erected before I was asked my view on the health implications. I am told that that number will at least double in the next five years. That means that we have to ensure that each mast is emitting the same low level as it was last year; that the direction of the beam is exactly what it was when it was measured; and that, since then, no new buildings have been erected in the path of the beam.

Members can understand the complexity of the situation. Each mast has to be considered individually in terms of the intensity of the power coming from it, the linear gain of the beam, where the beam is headed and its fall-off over distance. Hundreds of masts may have to be monitored in a densely populated area. The manpower implications are obvious.

Robin Harper: I have several quick questions about the NRPB. What status do you attach to the NRPB's guidance on emissions and their biological and epidemiological impact?

Dr Irvine: I am puzzled by the NRPB's stance and concerned by discrepancies between the advice that it is giving and some of its reports. I understand, for instance, that in one report—of which I have a copy—it recommended a more stringent limit for pregnant women and children. However, in its final advice, it abandoned that. I understand that NRPB scientists have requested funding for more research and have investigated the biological effects of radiation in rats and so on. That research has not been reassuring. Dr Zenon Sienkiewicz presented work at the Gothenburg conference showing that the rats that he studied were physiologically stressed at levels of radiation that might be present around a transmitter mast—0.05 W/kg. When the NRPB reveals such results at an international conference but sets a limit that is many times less stringent, that concerns me.

We were invited to a conference organised by the NRPB in Scotland, at which the emphasis was on other issues, such as the risk of lung cancer from radon and the risk of melanoma from being out in the sun and the consequent need to stay indoors for most of the day from March to November. The subject of radiation from cellphones, however, was dealt with glibly in a matter of minutes. We were told that the only effect might be a tiny amount of heating around the temple—that was the sum total of the discussion. Having unearthed the enormous amount of complex literature that underpins this subject, I was surprised that it was dealt with in such a cursory manner at an educational seminar aimed at consultants in public health. People such as I were told that there was nothing to this—we should pass on that message, if anyone asked us. The subject needs more attention than that.

Robin Harper: What is your view on the overall expertise of the NRPB in biological and epidemiological matters?

Dr Irvine: You are asking some very sensitive questions.

Robin Harper: Yes.

Dr Irvine: When I appeared at the NRPB seminar, I was extremely impressed by the articulate, intelligent and informed nature of the lectures. I have heard that things are not that rosy at the NRPB, but I have no insider knowledge.

Robin Harper: I will not press you further on that. How do you think that the NRPB's position fits in with the current state of external scientific advice on these matters?

Dr Irvine: It does not seem to consider all the evidence that I have seen and that has been reviewed by the Royal Society of Canada and by Repacholi. The NRPB does not take those studies seriously, on the ground that they have not been replicated. The notion of replication of studies is a big bone of contention. Dr Repacholi is a respected scientist who heads the World Health Organisation electromagnetic field programme research team. His study of transgenic mice has not been replicated, but it showed a twofold increase in the rate of cancer development in mice that had been made more susceptible to tumours by a gene that had been inserted into their genome. If a reputable scientist such as Dr Repacholi is ready to admit that his research on mice showed an increased risk of cancer after exposure to that kind of radiation, but nobody has replicated his work, does that mean that we should ignore it? Surely we cannot ignore a key piece of work, in a recently published journal, by a key international researcher.

Robin Harper: Given what you have said so far, do you have a view on what interim advice the NRPB should be issuing?

11:00

Dr Irvine: It seems to me that it would be reasonable for the NRPB to have the same approach to its non-thermal figure as it does to its thermal figure. The NRPB arrived at its thermal safety limit—which, I understand, is 10 W per kg for a specific part of the anatomy, and 0.4 W per kg for whole-body exposure—by identifying the level at which thermal radiation definitely has effects and introducing a safety factor of 10. It found that thermal effects are registered at 4 W per kg, then divided that by 10 to introduce a

safety factor and published a limit of 0.4 W per kg as the specific absorption rate maximum, above which there should be an investigation.

The NRPB should examine the biological effects at low intensities and divide those low intensities by 10 to establish a safety limit, which would be orders of magnitude lower. That seems reasonable, because at the moment the NRPB is ignoring all that biological evidence.

Robin Harper: That is helpful. Much of the scientific evidence that you quote focuses on cellphones rather than on masts. What scientific evidence relates to transmitters, base stations and other forms of fixed telecommunications equipment?

Dr Irvine: Very few studies measure biological effects in the communities around masts. That would be logistically difficult, so laboratories are used to reproduce the levels of radiation and pulsed frequencies. The studies might use 900 MHz or 1,800 MHz—the same as is used for the two types of cellphones in the UK. They use the same pulsing frequency and intensities—low intensities—that might exist around a transmitter mast. Rats and so on are exposed to those levels for 45 minutes or longer. A key feature is that rats might be exposed for 45 minutes or two hours when we are exposed to a mast for eight hours if we work near a building with a mast, or 12 hours if we sleep in a house near one.

That is the way in which those experiments are approached generally—they are not carried out by going into the community near the mast. A few studies have measured the effects on children living near radio antennae, but the published studies that concern us—I have looked at eight at least—refer to laboratory conditions where the levels of radiation around a mast have been replicated and the effects measured on various aspects of physiology and behaviour.

Robin Harper: You have answered my next question, so I will move on to my last question.

In your submission, you refer to the evidence given by the British Medical Association to a House of Commons select committee. Will you elaborate on that, especially with regard to the position of the BMA on the possible effects below the thermal threshold and the need for a precautionary approach?

Dr Irvine: I do not have much to elaborate on. I have a photocopy of the letter that was sent by the BMA to that committee. The letter said that we should consider the possibility of non-thermal effects and that we should take a more precautionary approach.

Linda Fabiani: You are advocating a precautionary approach and, in your submission, you refer to sensitive areas. How would you define sensitive areas and groups and what criteria would you apply?

Dr Irvine: That is arbitrary—it is like asking how long a piece of string is. We must take a pragmatic approach. A sensitive area is anywhere where people spend a lot of time, and particularly where children are growing up. Because children tend to grow up with their parents, we must consider nursery schools, primary schools and residential areas generally. That does not mean that we want to ban all masts in residential areas—it means that every mast must be carefully considered and its levels monitored well into the future so that, if radio signal traffic goes up—as we envisage that it will—we know that we have a grip on the situation and that it is not out of control.

I said earlier that if you wanted to put a mast on a school, you would have to persuade parents that when they are driving their children to school and dropping them off they are not in the beam, and that their house a mile away is not in the beam. Schools tend not to be isolated from communities.

Linda Fabiani: When you suggest minimum distances from sensitive areas, for example, as an arbitrary safety standard, what formula could be used?

Dr Irvine: There is a simple formula based on the inverse square law and using pi and so on. I submitted that information in my independent expert group submission, which is why the committee does not know about it. The submission to the committee was limited to six pages, which restricted how much information we could pass on—we could have passed on much more.

The point is that you can plug in the acceptable maximum level if you arbitrarily adopt a more rigid safety standard than the one set by the NRPB. You would plug that value in and take into consideration the power coming off that mast and the linear gain of the beam coming off the mast to predict the minimum distance that would be required to achieve that safety standard.

Linda Fabiani: Are you saying that it could be done?

Dr Irvine: It is a rough and ready formula, which has a limited application, as it applies only when there is a single mast. In cities, in particular, there are masts all over the place, so there might be summative effects. It is naïve to think that we could predict levels in each case. The gold standard would be to measure the level with a spectrum analyser to ensure that the level is as low as possible.

Linda Fabiani: Would that take non-thermal effects into account?

Dr Irvine: A more stringent safety standard

would cover the non-thermal levels—the lower levels—and a spectrum analyser would detect those non-thermal levels.

Linda Fabiani: What about forms of telecommunications equipment other than masts, such as micro-equipment?

Dr Irvine: That is a technical issue, but I have been advised that there is a huge potential to introduce many microcells at ground level, although there would be a cost involved in that. Microcells emit much lower-intensity radiation, but more cells can be set up so that there are better-quality radio signals. That way, more powerful masts that give out much more energy could be avoided.

Linda Fabiani: Would you like us to examine that?

Dr Irvine: There is a whole range of technical issues—roaming, sharing of masts, and so on—that should be addressed by a cellphone engineer.

The Convener: You have given GGHB's position on the precautionary approach; what are the views of other health boards?

Dr Irvine: My impression is that most health boards knew very little about the matter until February. That is why I am peeved with the NRPB for dealing with the subject in such a cursory manner at our educational session. Most consultants in Scotland know little about it and are looking to the Scottish Centre for Infection and Environmental Health or to me for guidance. Some consultants have asked for the report that I have been preparing, and have decided to wait until it is available. I do not blame them, as I would not wish having to start from scratch and looking at all this material on anyone.

The Convener: We have had a flavour of how you feel.

Helen Eadie: What information should be made available to the public on telecommunications developments? From whom, and in what form, should that information come?

Dr Irvine: Do you mean only masts, or do you include cellphones in telecommunications developments?

Helen Eadie: Both.

Dr Irvine: I am glad that you said that, as it is much easier to answer about cellphones. In my view, there is enough evidence to suggest that we should advise caution. Who am I to say that? I am a bit concerned about cellphones, given that the gentleman who headed Wireless Technology Research for six years advises caution. He says that we should suggest to people that they keep their calls short, that they use their cellphones only when they need to make calls, that they use hands-free sets and so on. That kind of advice—which has leaked out from that gentleman at WTR—is fair enough and should be issued in this country as well. Whether that advice should come from the industry, the NRPB or some other body such as the Department of Health, is open to debate, but it is important that the information is evidence based and helpful. It is reasonable to include such information in the packaging of new cellphones.

Helen Eadie: Why should we give your evidence higher priority than that of the NRPB—the Government body that was set up to give advice on electromagnetic fields?

Dr Irvine: I do not have a good answer to that, except to reiterate that I do not have a vested interest. I am not linked to the Government and my remit is strictly to protect the health of my population.

Cathy Jamieson (Carrick, Cumnock and Doon Valley) (Lab): In your submission, you concentrated on anecdotal reports of symptoms from users. You suggest that there is a marked variation in the radiation levels emitted by phones of different prices and so on. Should there be tighter guidelines? Is it a matter for labelling or for giving consumers advice?

Dr Irvine: Both. I understand that there is a huge variation in the levels of radiation that phones emit, and that it is not required that we be told what the levels are. It is wrong that such information, which seems to me to be critical, is not communicated to the purchaser of a mobile phone. The packaging that comes with a new cellphone says only that the level of radiation is within the NRPB standards. It should be a requirement that we are told the specific absorption rate of cellphones when we buy them.

The Convener: I thank you on behalf of the committee. We may wish to follow up for clarification some of the points that you have made—that also applies to Dr Ramsay.

11:10

Meeting suspended.

11:21

On resuming—

The Convener: I welcome John Stather and Dr Alastair McKinlay from the NRPB. As you will be aware, the committee has been conducting this investigation over several weeks. We appreciate the written evidence that you have passed to us and the statements that you have made, which are contained in the appendices. You have the opportunity to make some opening remarks.

Dr John Stather (National Radiological Protection Board): I thank you for this opportunity to speak to the committee. My name is John Stather and I am the deputy director of the National Radiological Protection Board. I am also responsible for the work of one of the divisions that covers ionising and non-ionising radiation effects. I am joined by Dr Alastair McKinlay, who heads the physical dosimetry department, which is concerned principally with measuring exposures to electromagnetic fields covering the whole frequency range, as well as with ultraviolet radiation. He is also the vice-chairman of the International Commission on Non-Ionizing Radiation Protection.

I shall spend a couple of minutes outlining what NRPB is as an organisation. We were set up by the Radiological Protection Act 1970. We are an independent, so-called arm's-length body. We are not civil servants, although our conditions of service are not very different. Our chairman and board members are appointed by health ministers, and our staff are appointed by the board. We are responsible for giving advice on both ionising and non-ionising radiations to Government, local authorities, industry, individuals, the media, and anybody who asks for it. We also carry out research to underpin the advice that we give, and we provide services for which we charge. We have three service-oriented centres: one at Chilton, in Oxfordshire, where we are based, one in Leeds, and NRPB Scotland in Glasgow. We can provide regional services throughout the country.

When we were first set up, our responsibility was to give advice on ionising radiations such as X-rays, gamma rays, beta particles and alpha particles. Our remit was changed, in 1975, to cover non-ionising radiation as well: ultraviolet radiation, lasers, and a whole spectrum of electromagnetic fields from power frequencies and static frequencies to the frequencies that are involved in telecommunications, with which we are concerned today.

The only other aspect that I should mention is funding. Our annual budget is about £13 million, of which about £6 million comes from Government. Most of that comes from the Department of Health, but about £300,000 comes from the Scottish Executive. We earn the rest by providing services. We earn money from the European Commission for carrying out research and we carry out applied research for other organisations throughout the country. We get quite a lot of money from offering radiation protection advice as well as a range of other services. That provides the other £8 million that we need to run the organisation.

Finally, I should point out that we are not a regulatory body, but an advisory body. Other organisations in Government are responsible for providing and enforcing regulations. That is as much as I need to say by way of an introduction.

Cathy Jamieson: You have given us a general introduction to the role of the NRPB, which has been helpful. I would like you now to give a clear indication of the NRPB's specific role in relation to the thermal and non-thermal health effects of electromagnetic fields related to telecoms equipment regulated by planning authorities.

Dr Stather: We have a responsibility to give advice and guidelines on exposure. We do not set limits as such, as there are none. We have given such advice for almost 20 years and it has been updated as more information has become available. The most recent advice was issued in 1993. In the run-up to issuing that, we were anxious to ensure that our advice was underpinned by the range of scientific evidence that was available, including experimental work on animals, cells in culture and epidemiological studies.

The view that we reached in 1993, which really is no different from our view today, was that the only established health effects that could be used as a basis for setting guidelines were the thermal effects due to heating for high-frequency radiation. Concerns have been voiced about other effects that may not be caused by heating, so-called athermal effects, such as the possibility of radio frequencies being involved in the development of cancer in individuals or affecting brain function. However, while I appreciate that some studies suggest those possibilities, others do not. When we set guidelines, we must consider the totality of the evidence.

In 1993, therefore, the view that we took, which was confirmed by our board this year, was that our approach to setting guidelines, which was based on preventing thermal effects, was the right one for the United Kingdom. Other national and international organisations have taken the same view. Alastair McKinlay is the vice-chairman of ICNIRP, which uses the same basis for its advice. There are differences between the ways in which NRPB and ICNIRP give advice, but the basis of the advice is the same for both organisations and for many others.

Dr Alastair McKinlay (National Radiological Protection Board): I must add that the NRPB is not working in isolation on this issue, in case there is an impression that it is. At the scientific level, we are very well tied in with ICNIRP. We are a collaborative centre for the World Health Organisation on non-ionising radiation. We work very closely with others on the international electromagnetic field project. We also work closely with the European Commission on research and developing standards for non-ionising radiation.

We take a broad view of electromagnetic fields, as we do of the whole radiation spectrum. We do not isolate particular frequencies or devices in our advice. Across the spectrum, our advice is consistently based on the biological and epidemiological evidence that is available. We do not deal with mobile phones any differently. They are dealt with properly, taking into account all the scientific evidence.

We are also very involved in international research efforts. That is not an admission that there is a big problem; rather, as others have said, studies have been published that merit replication. There is a clear need for research in this area. The NRPB has consistently called for research, when we have identified areas that require further investigation. As John Stather said, our advice can only be on the basis of what we regard as the established science, taking that science as a whole, and we will continue with that approach. That is not to say that our advice is set in stone; clearly, it is not. We are responsive to scientific literature and to what is published. We are tied into the international research effort and we are aware of what is going on.

11:30

Cathy Jamieson: I am sure that some of my colleagues will come back on some of those points. However, I want to continue to focus on the status of the NRPB's advice and expertise for a couple of minutes. You said that the NRPB is not a regulatory body. In that context, how would you define the status of the NRPB's advice to the Government and other public bodies?

Dr Stather: The Government adopted our advice for application throughout the UK. All Government departments that we are aware of look to the advice that we published in 1993 and that we reinforced this year as advice that industry and other organisations should work to in setting standards of exposure that relate to equipment. It is UK advice that has been adopted by Government.

Cathy Jamieson: Some of the written and oral evidence that has been presented to us mentions the particular case of Tandridge District Council, which I think you will be aware of. The judgment in that case stated:

"In making [a] decision, they (the local authority) would have to take into account the advice of the NRPB".

Do you agree that your advice would be held in the highest regard and that it would underpin decisions that are taken every day in such applications?

Dr Stather: Planning issues are not for the NRPB, as it is not a regulatory body. We provide Government with advice and appropriate guidelines across the frequency spectrum. How those are implemented in planning decisions is not a responsibility for the NRPB; it is a responsibility for others.

Cathy Jamieson: My point is that the judgment accepts that the NRPB has to be referred to. Therefore, the weight of the NRPB's decisions, or the evidence that the organisation submits, informs people in relation to those planning decisions.

Dr Stather: Our advice underpins the Government's response to exposure limits in a range of different situations.

Cathy Jamieson: Do you accept that the NRPB's advice ought to be taken into account by the planning authorities?

Dr Stather: Our advice is the basis of UK advice. We do not give advice on particular installations. Our advice is generic across the frequency spectrum.

Dr McKinlay: I would simply add that our remit is to provide scientifically based advice and information. In making decisions, there are socio-economic and political considerations that are equally important—more important, in a political sense. Therefore, while we hope to provide the best scientific advice that we can, we recognise that Government has to take many other issues into consideration when it forms policy.

Cathy Jamieson: I want to stick with the science point. Given that local authorities probably accept that they have little in the way of such scientific expertise, do you agree that it would be important for the NRPB to state the extent to which emissions impact on health and to give clearer guidance on that?

Dr Stather: We have been asked to examine emissions from different installations, including base stations, and to compare exposures at locations where members of the public might go with our guidelines. We did that across the country, at a range of different locations, as part of the service that we provide. We can talk about the results of those studies, if members wish.

Cathy Jamieson: Do you therefore accept that regular updating in the light of new technology is part of the process?

Dr Stather: We feel that we should have information on exposures from old and new technology.

The Convener: You offered some information and, without betraying the confidence of the organisation that you were working for, are you saying that you were called in to carry out specific monitoring for local authorities?

Dr Stather: Yes, local authorities and schools,

on exposures in playgrounds or in housing estates.

The Convener: Can you give us an idea of the frequency of that, Dr McKinlay?

Dr McKinlay: We have carried out a number of surveys in relation to transmission aerials on top of or adjacent to schools and on public buildings. We have consistently found that the measurements are many times less than the ICNIRP or the NRPB guidelines recommend. There is no reason to believe that the readings would be any different for a mast whose levels we have not measured, but we respond to requests whenever we can and carry out tests when we can.

The transfer of information is important. We run training courses for local authorities. In the UK, we run them in collaboration with the Chartered Institute of Environmental Health. We want environmental health officers and planning officers to come on the courses, which are extensive. We do that to enable the officials to transfer the information to their elected representatives and the public.

Cathy Jamieson: What expertise does the NRPB have in relation to the impact on health of emissions?

Dr Stather: We have a range of expertise in physics, mathematics—because a lot of computation modelling was involved—biology and all the sciences that are needed to tackle the issue. A number of people have taken a specialist interest in the matter during the past 20 years. We also have an independent advisory group, chaired by Sir Richard Doll, on non-ionising radiation that the director set up in 1990. It is made up of influential academics, including experimental biologists and epidemiologists, from around the country who bring outside expertise to the NRPB. The group has considered a range of issues relating to non-ionising radiation—not just electromagnetic fields, but also ultraviolet radiation.

Until recently, the main concern was power lines. The rapid developments in technology have caused the concern to switch to radio frequencies. About nine months ago, we set up a sub-group to examine radio-frequency radiation. There is also the independent expert group on mobile phones that is chaired by Sir William Stewart, which had its first public meeting in Edinburgh last week.

Dr McKinlay: Our biologists, physicists and engineers have been sought by the WHO and ICNIRP to provide input into their standing committee. Obviously, our expertise is recognised by those bodies.

Dr Stather: Most of the surveys and measurements to which Alastair has referred were carried out under contract. We realise that other people might be interested in those measurements so we are putting all that information into a report that we will publish in early January 2000. It will give comprehensive information on exposure levels near a range of different base stations.

Cathy Jamieson: European legislation was approved in the form of a recommendation on 30 July 1999. The legislation states:

"Measures with regard to electromagnetic fields should afford all Community citizens a high level of protection; provisions by Member States in this area should be based on a commonly agreed framework so as to contribute to ensuring consistency of protection throughout the Community".

The recommended limits are five times more stringent than the NRPB's levels. Have you changed your advice in light of that? If you have not, does your view differ from that of the European Union? If you have, what has the EU said that has resulted in you changing your view?

Dr Stather: The EU has adopted the ICNIRP guidelines, which are a two-tier standard. There is one level of guidelines for occupational exposure, and a reduction factor of five for public exposure. When we set our guidelines in 1993, we felt that we already had an adequate margin of safety for both occupational and public exposure, so we had a single-tier standard.

We examined closely what ICNIRP and the EU said, and we see no scientific justification for the factor of five in terms of further reduction in the limit compared with occupational exposure. We think that that could cause practical difficulties for mobile phone use. For example, if one were to use a mobile phone for work, one standard would apply; if one used the same phone to communicate with home, that would be domestic use and a different standard would apply. It is important to ensure that any exposure is governed by a standard that guarantees a sufficient safety margin, and we believe that that is what our guidelines provide.

If the Government chooses to endorse the EU recommendation for other reasons, we have no problem with that, but that endorsement would not be for scientific reasons; it would be because Government felt that it should take on board other issues. That was the view of our board when it produced a report earlier this year on our response to ICNIRP guidelines, both from a scientific point of view and considering other issues.

Cathy Jamieson: Would you say, "These are our guidelines, but EU guidelines are different"?

Dr Stather: We acknowledge the fact that there are differences between our guidelines and the ICNIRP guidelines because of the factor of five

reduction for members of the public. However, we believe that the guidelines that we give for all groups in the population—workers or public—already include a sufficient margin of safety. Dr Alastair McKinlay has been involved in developing the guidelines.

The Convener: In your answer, Alastair, could you also address the issue that we heard earlier about the fact that Italy has guidelines for very low levels of emission? How do we stand compared with the rest of Europe? If we want to fit in with Europe-wide parameters, how do we compare with countries such as Italy?

Dr McKinlay: That is a good question. I do not know how Italy arrived at its guidelines. When we carry out a survey, whether on occupational or public use, we can easily compare the measurements with any set of guidelines; not just the European Commission, but ICNIRP and the CENELEC—European Committee for Electrotechnical Standardisation—guidelines. We are part of Europe and there are international guidelines. The telecommunications industry is global, so the problem of harmonisation of standards is also global. The World Health Organisation is focusing on the globalisation of standards at the moment, and we are part of that discussion. It would be good to have a global harmonisation of standards.

Great emphasis is sometimes put on the difference between a factor of five and a factor of three. In fact, with respect to base stations, that is insignificant in terms of public exposure. That difference would not be relevant to the issues that we would have to address if the guidelines were to be lowered further. It is encouraging that all the standard-setting bodies have developed their guidelines in exactly the same way—by relying on comprehensive reviews of the science and on established biological effects. The guidelines relate to the exposure of people and not to particular devices. I find it comforting that that is the scientific approach to the problem throughout the world.

The numbers issue is not particularly important in terms of the practical implementation with respect either to occupational or to public exposure. There are some minor difficulties for some industries in certain areas, but it is not generally a big issue.

The Convener: Will you clarify what you said about the relevance of the guidelines for base stations? I have read your report a few times and I have still not picked that up.

Dr McKinlay: When I spoke about relevance, I meant in respect of the actual emission levels in places where members of the public might normally be expected to be. The levels are so far below either the NRPB's UK guidelines or the ICNIRP guidelines—the European Commission's recommendation—that the factor of five is insignificant when compared with the large gap between either of those sets of guidelines and the very low levels that we measure and can predict computationally. Non-thermal effects are a separate issue—the effects other than those on which the guidelines are based.

11:45

I am not dismissing the difference between the sets of guidelines; I am just pointing out that, especially for base stations, it is not a major issue. It is a minor problem for occupational exposure, where you are marking out exclusion zones that are very close to masts to give engineers access for maintenance and suchlike.

Dr Stather: In those cases we are talking about people getting to within two or three metres of the mast, and we are deciding whether the exclusion zone should be 2 m, 3 m or 5 m. We are not talking about the 20 m or 30 m zone on the ground well beneath the base station.

Linda Fabiani: Could you give some clarification to someone of a totally non-scientific mind? If the guidelines for levels are set a lot higher than the levels that are happening in practice, that leaves room for levels to rise, until they reach the guidelines. Five years from now, the emissions could be at the level of your guidelines.

Dr McKinlay: Why would that be the case? Why would someone want to do that?

Linda Fabiani: I am not saying that they would want to; I am saying that it is a possibility.

Dr McKinlay: I see—you are asking about the general principle. Yes, they can operate up to the guidelines.

Linda Fabiani: If your guidelines are set at a particular level, they can operate up to the guidelines; so if the guidelines were set at half of that level, they could operate only up to that new level.

Dr Stather: In practice, people are clearly more exposed to radiation from phones than to radiation from base stations. Base stations are some distance away and exposure for the individual is quite small.

Linda Fabiani: The fact that our guidelines are a lot wider than those in other countries means that people here could be faced with higher levels of health damage than in other countries.

Dr McKinlay: We would say not—we would say that our guidelines offer protection for the general public as well as for people who might be exposed

while working. The guidelines are not driven by the technology or what the devices are, they are driven by the scientific, biological, epidemiological and dosimetric evidence. That evidence, if more data came along, is what might change the guidelines, not the worry that somebody—

Linda Fabiani: It is not an argument to say that although the guidelines are set at one level, while in practice the levels of radiation are away down below, everything is okay.

Dr McKinlay: Oh no—I was not suggesting that. I was merely saying that if people are arguing that there is a problem with base stations because the guidelines are three or five times less restrictive, that would be a specious argument. With no other implications, I am just pointing out that the levels are much lower than the guidelines.

Linda Fabiani: So far. At the moment.

Dr McKinlay: At the moment, yes.

Dr Stather: I would like to reinforce the point that Alastair McKinlay made. If evidence became available that suggested that we should change our guidelines, we would change our guidelines. In the case of ionising radiation, at the end of the 1980s, more evidence came to light on the effects of X-rays and gamma rays in terms of how many cancers might be caused by a given radiation dose. We changed our advice as a result of that better scientific information.

Helen Eadie: I can understand where Linda is coming from. I have read that the NRPB's thresholds have reduced over the years. At the same time, we have seen how workers in dockyards have been affected by the dosages that they have been exposed to.

For years, people told us that we should not worry about tobacco. Then they told us that we should not worry about BSE or beef on the bone. Where does the credibility factor come in? If, over the years, your thresholds come down, it leaves lay people such as ourselves very concerned.

Dr Stather: Sir Richard Doll identified a problem with tobacco in the 1950s. He chairs our advisory group on non-ionising radiation and he has taken a particular interest in the possible effects of such radiation. He would be the first to say that there was a problem if he felt that there was one. It has taken a long time for the information about tobacco to percolate down to where it matters. He has been influential in a number of epidemiological fields and he is a very good person to chair our independent advisory group.

The Convener: You say that your guidelines and limits are based on your scientific evidence. Why does Europe set different limits? Is it getting different advice? We have acknowledged that different levels have been set throughout Europe and the world. Why is that?

Dr McKinlay: The United Kingdom is one of the few countries that had the expertise to develop its own guidelines. Many other countries just followed the ICNIRP guidelines when they were published.

The Convener: I am trying to establish what those guidelines are based on.

Dr McKinlay: The ICNIRP guidelines are derived from the same database as the NRPB guidelines. Again, I would emphasise the common approach to this issue. The decision about whether to incorporate an additional safety factor of two, five or whatever is essentially a value judgment. That judgment is taken by a committee or a group of individuals and may not be unanimous. Recently, we published a document that subjected the ICNIRP guidelines to detailed scientific analysis and sought to identify the added health benefit of a reduction by a factor of five. Our answer is clear in that document.

The Convener: And it is?

Dr McKinlay: The answer is that we cannot identify any health benefit. However, we recognise that Government may wish to adopt the guidelines. That is a separate issue.

Dr Stather: I come to this as an outsider, who was not involved in the development of what we might call ICNIRP's two-tier standard or its forerunner—the two-tier standard derives from ICNIRP's predecessor organisation. The people involved in the international non-ionising group 10 or 15 years ago were also concerned with the work of the international group on ionising radiation—the International Commission on Radiological Protection. We have clear evidence from animal studies, cellular studies and human epidemiology that exposure to ionising radiation can cause cancer. We know that it damages DNA directly and can initiate cancer development. While the information on dose response has changed, we have felt for many years that any radiation dose can cause cancer—the greater the dose, the greater the risk.

When ICRP set standards for occupational exposure, it was seeking to establish an acceptable risk. It felt that for people who were occupationally exposed, a higher risk might be more acceptable than for members of the public, because in the one case the risk is voluntary and in the other it is involuntary. There are issues there that we could discuss but probably do not need to.

The scientists involved carried over what they were doing on ionising radiation to non-ionising radiation. The problem is that we do not have dose-response information for non-ionising radiation, which means that the basis for a two-tier standard is nowhere near as solid as it is with

ionising radiation. Those are I believe the circumstances that have led to our having a two-tier standard for non-ionising radiation.

Nora Radcliffe: People talk about the directional effect of masts and so on. With my unscientific mind, I tend to think of the mast standing there and emitting radiation all around it. What is meant by the directional effect of masts?

Dr McKinlay: The masts radiate into sectors. They cover the whole horizon, but they are divided into three sectors, forming a triangle. Radiation is emitted over 120 degrees—imagine a fan-shaped beam, which is normally at a 6-degree angle. The beam will intersect with the ground at 100, 150 or 200 m, depending on the elevation of the mast. That is what is meant by the directional effect. The beam is being directed towards the horizon. If someone is very close to the mast, they may not be in the beam, because there are always small side lobes attendant on the antenna. The main beam is focused outwards to get the maximum coverage for people using mobile phones.

Nora Radcliffe: Do the beams tend to intersect? Can there be effects from more than one pulse?

Dr McKinlay: The network is set up in a cellular structure. As people pass from one cell to another, they switch to a different transmitter to retain the optimum signal. I understand from the industry that the power should be minimised to prevent interference with other channels as much as possible. The transmitters are located at the centres of the cellular network so that coverage is as even as possible.

Dr Stather: I have been interested in the measurements that we have obtained over the past year or more, examining exposure in schools, housing estates and so on. If a housing estate is close to a certain base station, that is the base station that people will worry about, but there might be another one slightly further away.

As Alastair McKinlay said, the base stations tend to point to the horizon rather than down, so if we measure exposure in the housing estate or school playground concerned, the exposure from the further base station might be greater than that from the nearer one. We might also find that, if there is a television transmitter some distance away, the exposure from it could be greater than from either of the base stations. Anybody anywhere could be exposed to radiation from a variety of sources—not necessarily the one that is visible nearby.

Despite all that, the exposure at the given school or housing estate will be a thousandth, ten-thousandth or hundred-thousandth of what our guidelines permit, so, in all situations that we have measured, exposure at areas where members of the public may go will be very small. That is the sort of information that will be going in the report that we will publish.

Linda Fabiani: Everybody is trying to get their heads round everything being okay because the guidelines are much higher than the levels that people are suffering. I find that a difficult concept—we can perhaps return to it.

The Convener: We can perhaps revisit that. I would like to make some progress and let Tavish in.

Nora Radcliffe: Could I mention something related to what I was asking about? We are saying that the beams we get from masts are not dangerous and that mobile phone handsets are of more concern to health. As far as I can gather, the idea is that we make the emission from the handset less powerful. Does that mean that we make the mast more powerful? Where does the balance of potential harm shift?

Dr McKinlay: You used the right word: balance. The relationship between the handset and the base station depends on balancing the system so that the minimum amount of power is being used. As members probably know, the handsets respond to signals from the masts to reduce power or down-power when less is required, and to increase power when more is required. That utilises the handset efficiently and the whole system efficiently. It also minimises battery usage, which is important for the viability of the handset.

If someone goes into a building, where there is more shielding, the handset might have a problem communicating with the base station, and the base station will up the power to the handset, using the adaptive power control facility.

Nora Radcliffe: It may become more critical to worry about where masts are. The industry might react to people's concerns about handsets by making masts transmit more strongly, so that the handsets are weaker—sorry, that was a stumbling explanation.

Dr McKinlay: That is a question to address to the industry. The technology as far as the impact of one device on another is concerned is quite amazing but, in general, the situation is as I outlined.

Dr Stather: It is important that the NRPB keeps in touch with developments in telecommunications. We try to do that when considering the new generation of technology.

Nora Radcliffe: We have to be aware of what might be about to happen in future.

Dr Stather: Of course.

Tavish Scott (Shetland) (LD): I want to go back to something you said in your introductory remarks, Mr Stather, about the NRPB's finances. I

think you mentioned the £13 million budget, of which £6 million comes from Government and the rest from outside. Have you done work for telecommunications companies?

Dr Stather: A very small amount.

Tavish Scott: You have done some work for them?

Dr Stather: We had a parliamentary question in the spring: we had to look at the extent of funding from mobile phone companies. It was less than £20,000 over the previous three years, out of a budget of £13 million.

Tavish Scott: But, by definition, you do regular work for telecommunications companies.

Dr Stather: A small amount of work.

Tavish Scott: But regular, nonetheless.

Dr McKinlay: The work is not regular; it addresses technical issues of design criteria.

Dr Stather: If we do not keep in contact with developments, we will not be able to give advice to Government or others of the consequences of those developments.

Tavish Scott: Some less charitable members—not us—will point out that you are taking money from telecommunications companies. Perhaps that is not the best way to keep up with technical developments in the industry and still be seen as impartial.

12:00

I want to ask two daft-laddie questions about definitions. First, what is the difference between head heating and whole-body heating?

Dr Stather: Local exposure happens when one holds a mobile phone next to one's ear. There are guidelines for that. Different standards apply to whole-body exposure, which can be caused by, for example, a base station some distance away. The body can cope more with heat from partial-body exposure than from whole-body exposure.

Tavish Scott: What is the difference between thermal and athermal effects? We have also had the term non-thermal, which I presume is the same as athermal.

Dr Stather: Thermal effects refer to damage caused by heating, which our guidelines should ensure do not happen. People have expressed concern about athermal effects and about whether mobile phone radiation could have some implication for cancer-development, or affect brain function. We do not believe that there are any established effects that could be used to set standards.

We have said that we support the need for research, however. Alastair McKinlay chaired an expert group set up by the European Community in 1996 to find out what research needs to be done on epidemiology, experimental studies and cellular studies to improve the basis on which standards are set. Although it takes time for research ideas to be included in European framework for research programmes, we believe that the EC work will produce some worthwhile research.

Tavish Scott: What limits has your organisation advised for thermal and non-thermal effects? What is the practical impact of those limits on, for example, specific equipment?

Dr McKinlay: We have said that our standards are based on established thermal effects of radio-frequency radiation. However, it is not true to say that the standards do not address athermal effects. Although those effects might not be addressed quantitatively and specifically, they are addressed through a comprehensive review of the scientific studies on all athermal effects. Those studies have been examined by international commissions, the World Health Organisation, the NRPB and other national agencies, which agree that standards for radio frequency can be set only on thermal effects. Although the standards implicitly address athermal effects, figures can be derived only from thermal effects.

The Convener: What can science do if we cannot examine athermal effects?

Dr McKinlay: When scientists talk about established effects, they mean a body of consistent biological evidence that is supported by an understanding of mechanisms. That evidence is derived from studies that have been replicated from other studies conducted with excellent laboratory practice. When all that evidence is brought together, we clearly end up with expert scientists' value judgments about how the data fit in to the overall picture.

The situation is analogous to a jigsaw—we have individual pieces but we need the whole picture. The bodies that set standards demand scientific rigour because they provide scientific evidence. However, that should not degrade individual studies. We have encouraged the replication of studies.

The Repacholi study has been mentioned. That study is now being replicated. There are two replications that I know of: one is in Australia and another is part of the fifth framework programme in Europe. Those scientific studies are not ignored. Indeed, John Stather mentioned the European Commission's expert group, which I chaired in 1996. We put forward a raft of good proposals for research in this area, which are now being picked up under the fifth framework programme, at least

in part. We are not ignoring individual studies and athermal effects—not at all.

The same can be said for reported effects from members of the public—so-called anecdotal effects. We should not ignore anecdotal effects. We never ignore anecdotal effects, as they act as a stimulus that leads us to ask, "Should we be examining this? What research should we recommend?" They all have an important part to play. However, when it comes to advising on standards, we have a scientific basis that we must adhere to.

The Convener: When is the scientific fraternity going to reach that critical mass of athermal evidence?

Dr McKinlay: It will come only out of good research. I am hopeful that the EC fifth framework programme and the other studies will produce the evidence that we are looking for. The problem is that one negative study does not prove that the hazard does not exist. It is scientifically impossible to prove the absence of a health hazard. However, a series of studies—so-called negative studies, which produce no positive result—builds confidence in particular areas. That is what it is about. Similarly, one positive study does not prove the presence of a hazard; again, replication and scientific rigour is needed. That is the nature of the scientific process—peer review and journal publication.

Tavish Scott: Some of your written evidence suggests that you are considering research into athermal effects. Is that going on at the moment? Have you started that?

Dr Stather: Yes. We are one of many organisations that are carrying out such research. The behavioural studies that Z J Sienkiewicz has been involved in are examining athermal effects.

Tavish Scott: Can you clarify for me the timing of all this? Are the 1993 guidelines the ones that you still apply?

Dr Stather: Yes.

Tavish Scott: When were the European guidelines introduced and when did you start your research into these athermal concerns that are being expressed?

Dr Stather: We have carried out research into the effects of non-ionising radiation, in terms of heating effects, since 1975. In the early 1990s we were more concerned about power frequencies. We became involved in epidemiological studies that were being conducted throughout the country. I suspect that most of the biological research on radio-frequency radiation has been going on for three to four years.

Tavish Scott: When did the European element of that come in? Linda Fabiani made a point about the European regulations, and you used a phrase that I missed.

Dr Stather: EU recommendations were agreed to this year and the ICNIRP guidelines were published in 1998.

Tavish Scott: And you have not felt it necessary to review NRPB guidelines? 1993 is quite a long time ago.

Dr Stather: We were aware of what ICNIRP was doing. We put in place a review of the ICNIRP guidelines and we published our response to them. I can leave a copy of the document with you. Our board took a view on the science. It may be worth reading the final two sentences of the board's statement, in which the two-tier standard, which we talked about, was compared with the single-tier standard that was advised by the NRPB. The board said:

> "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."

The science to support a two-tier standard did not exist. On the other hand, that is in the EU recommendation. The Government needs to address that issue.

Tavish Scott: The Government, the committees and all the other bodies have to come to a wider judgment, as that is part of their job. Are you aware of much wider scientific research into this? Do you contribute to it?

Dr Stather: We hope that we have stimulated wider scientific research through Alastair McKinlay's chairmanship of the European Commission expert group that met from the end of 1995 to 1996.

We have kept closely in touch with the work that is being done in the United States. We go to Washington every other year to visit the agencies that fund research, so we know what is happening there. Because of our international involvement in various organisations, committees and groups, and our attendance at scientific meetings, we have a pretty good idea of what is happening on the subject around the world, and have done for some time.

Dr McKinlay: Our biologists are very much a part of the international scientific groups addressing those issues, through the WHO working groups and the ICNIRP standing committee on biology. That is very important.

We facilitate and encourage research, much of which—in particular, animal studies—requires specialist expertise and large laboratories. Much

research is stimulated in academic institutions, as it rightly should be. We should not expect one institute or organisation to provide the answer. This is a global research effort, which has to be co-ordinated. Rightly, the WHO is co-ordinating that effort through its EMF programme.

Tavish Scott: We have been given examples today of two or three international research projects. Have other research projects been undertaken? It was suggested that the NRPB had, in effect, ignored that evidence. How much work has been done?

Dr Stather: There are two major international programmes. In the United States, the Wireless Technology Research programme, which was headed by George Carlo, closed this year. Not much has been published from that programme; we have heard a lot of anecdotal information but seen very few published papers to justify what George Carlo has said in the media in the past few months. We are in contact with him to find out to which papers he is referring and what is in the press.

There is also the European Union work, which is bringing together a research platform. Many countries have their own research programmes. We are in contact with most current programmes, and know pretty well the totality of the research. There will always be some work going on in some university somewhere of which we are not aware, but we attend the conferences where such work is presented, so we should be familiar with it.

It is important to note that we are involved in research. We cannot be involved in everything, but if we are to understand other people's work and comment on it sensibly, we need to be involved in some research.

Mr Tosh: Much of what I wanted to ask about has been skirted around already, so I apologise if this seems repetitive, but I want to be clear about a number of things.

In paragraph 15 of your submission, you quote the conclusion of your advisory group on non-ionising radiation at its meeting in May 1999

"that there is no human evidence of a risk of cancer resulting from exposure to radiations that arise from mobile phones".

Is your judgment as robust for the influence that such radiation might have on the rate of progression or development of cancer as it is for the effect on the initiation of cancer? Is the conclusion clear in both cases?

Dr Stather: That conclusion is based on the input of the epidemiologists on that group, who had considered the totality of the information that was available. The evidence is that there is not enough energy in the radiations to damage DNA, so they are unlikely to initiate cancer. The only proposition has been that they might promote cancer—they might speed up its development.

Mr Tosh: That is quite a throwaway line.

Dr Stather: No. It is the view of most scientists who have considered the matter that there is not enough energy to damage DNA directly.

Mr Tosh: But you concede that there is a possibility that the progression of a cancer will be influenced?

Dr Stather: Studies, such as that published by Mike Repacholi, have tried to find evidence of that. Mike Repacholi is examining how radiation might affect the way in which cancer develops in animals.

Mr Tosh: Do you believe that there is a risk that radiation may very well have that effect?

Dr Stather: It is something that should be looked at.

Mr Tosh: Were you impressed by the evidence of Dr Ramsay and Dr Irvine, who indicated that there were links between mobile phone radiation and lymphomas and melanomas?

Dr Stather: The lymphoma study to which you refer is probably the Repacholi study, which is being replicated in two other laboratories, one in Australia and one in Europe. The study used a unique strain of mouse, which had been genetically manipulated to make it particularly sensitive to the development of lymphoma. Even Mike Repacholi would say that the implications for humans are not understood. On the other hand, there is something there that needs to be examined to discover, in the first instance, whether the study can be replicated and then to understand the mechanism involved.

Mr Tosh: You are not saying, therefore, that there is no risk, simply that there is no evidence of a risk. You have not come to a firm conclusion. You are saying that—on the basis of the research that has been done and in the absence of high-quality studies—it cannot be demonstrated that a risk exists.

12:15

Dr Stather: That is right. We see a need for more research; we have said that for a number of years.

Mr Tosh: You have said that the lack of evidence does not prove the absence of a risk and that more specific research is warranted.

Dr Stather: Absolutely.

Mr Tosh: I understand.

In a sense, the convener asked my next

question a few minutes ago. Will you be quite clear about the evidence that you would need to be able to advise categorically that there is no health risk? Given the knowledge that you said you have of the on-going research, what is the time scale for such certainty to arise? Will we ever really know? It was pointed out earlier that it is impossible to prove negatives.

Dr Stather: I would say the same thing. However, we can contrast the research on radio-frequency radiation with that on ionising radiation. We understand the mechanisms of DNA damage by ionising radiation. We know that cellular studies can result in the transformation of cells into a type of cell that might be malignant if it were present in a person. We know from animal studies that ionising radiation can cause cancer and that tumours have been seen in animals. There are many epidemiological studies on humans—human health studies—that show that exposure to whole or partial body radiation can cause cancer. We have no such evidence for exposure to radio frequencies.

It could be argued that such research is lagging behind and that studies have not been done to the same extent, but some information is available on people who have been exposed to high-frequency radar, for example, that does not suggest that exposure to radio frequencies can cause cancer. Nevertheless, there is a need to examine radiation from those specific technologies in well-controlled epidemiological and animal studies to discover whether there are implications that we do not believe exist at present.

Mr Tosh: You acknowledge, therefore—perhaps intuitively, rather than scientifically—that there may be a risk. Is that the basis for saying that there should be more research to identify and eliminate such a risk?

Dr Stather: I am saying that we should examine the issue to see whether there is a risk.

Mr Tosh: Given the concerns and uncertainty that exist on the subject, is not there a compelling argument for adopting a precautionary approach? I find it difficult to accept the argument in your submission that there is no scientific basis for what you call the prudent avoidance theory. The implication is that this is a matter not for you, but for the Government. I would have thought that you would consider it important to adopt such a principle. I understand that, philosophically, you cannot prove a negative, but there must be a fairly heavy case for presuming that if concern and anxiety exist, the matter should be examined closely and we should be as careful as possible.

Dr Stather: We certainly examine the matter closely and carefully, but we are a scientific organisation. Our advice must be based on our best interpretation of the totality of the available scientific evidence. That is what we continue to do. The Government might want to take account of other issues, but as a scientific organisation considering the scientific literature and developing scientific advice and guidelines, we can go only so far.

Mr Tosh: Should not you advise the Government to take those other factors into account?

Dr Stather: Our board has told the Government that there might be other factors that it would want to take on board.

Dr McKinlay: If we do not base our guidelines on the scientific data on the established health effects, as all other international organisations do, what level do we set? On which data would we base such a level? That is an open question. Data for study A, study B and study C, which examine different biological end points, might produce a plethora of results for each study. A scientist would then have to ask how one made scientific sense out of those results. The issue is purely scientific; it is not related to the socio-economic and political factors of which we are well aware, as they are a matter for the Government. We would be left with the difficulty of choosing a number.

Dr Stather: We stress again that we give advice across the electromagnetic spectrum. Our advice is not just about emissions from mobile phones or base stations—we are concerned about the whole spectrum. Our advice is generic—in this case, it relates specifically to particular items of instrumentation. However, our advice is not about the instrument, but about exposure to a range of radio and other frequencies.

Mr Tosh: I am quite happy with that. I think that we have established that there is a purist approach on the basis of science, but a widespread recognition that there are other characteristics and influences that will be relevant for the committee to take into account, just as they would be for the Government. So long as we understand that differentiation and no one is saying that we should not examine those other issues, we should be quite happy with that evidence.

Linda Fabiani: My first question goes back to the acceptable standard or level. There is a two-tier standard in Europe—occupational and public. Can I ask where the UK level fits into that?

Dr Stather: The UK level is consistent with the occupational guideline.

Linda Fabiani: So our general level is consistent with Europe's occupational level?

Dr Stather: Yes.

Linda Fabiani: Do you know what the American standard is and where it fits in?

Dr McKinlay: There is an American standard—the Institute of Electrical and Electronic Engineers standard. The Americans have only a radio frequency standard, which extends from 3 kHz up to 300 GHz and therefore the frequency range is the same. Their standard for mobile phone frequencies is similar to, but not exactly the same as, the European, ICNIRP standard.

Linda Fabiani: The higher of the ICNIRP standards?

Dr McKinlay: No. The Americans have a two-tier standard, but it is not based on occupational and public exposure. There is another dimension—their standard is based on controlled and uncontrolled exposure, in terms of the control that one has over the devices or the exposure conditions. Their two-tier standard is similar to the ICNIRP standard, although not in all respects.

Linda Fabiani: So our standard fits in the middle of the American standard?

Dr McKinlay: Our standard is approximately the same as the American occupational standard in the same way that our standard is the same as the ICNIRP occupational standard. There are additional differences that we have not touched upon. The difference between basic restrictions and field levels has important philosophical and practical implications. Some of our field levels would be less than the ICNIRP levels under certain circumstances, one of which relates to the exposure of small children. We recognise from the physical interaction of radio waves with the body that body size is important in terms of the frequency at which it is most efficient at absorbing waves—the smaller the body, the higher the frequency at which the body is efficient. We take that into consideration. However, that is a dosimetric problem that does not relate to biology or to the basic restrictions.

Linda Fabiani: You said that a value judgment has to be made. Can you clarify who in the NRPB makes the value judgment? Is it the board? In what way is the board qualified to make such judgments? Is the board made up of medical people and scientists?

Dr Stather: We have a mix of board members.

The Convener: You could supply us with a list of the NRPB's board members.

Dr Stather: I will do that. The board comprises a mixture of medical people, experimental biologists, scientists—the chairman is Sir Walter Bodmer, Principal of Hertford College, Oxford.

Linda Fabiani: That is the sort of information that I wanted—the board collectively arrives at a value judgment that it would then recommend.

Dr Stather: I will supply a list of board members. I will also supply a list of the members of our advisory group on non-ionising radiation, which makes an important input to our advice.

Linda Fabiani: Will you let all members have a copy of those lists?

Dr Stather: I will leave one copy; I am sure that the clerks can photocopy it.

The Convener: Could I ask one question to satisfy myself about your earlier comments on the way in which masts work in terms of the focus? Why we do talk about areas around the mast of 2 m to 5 m, if, as you say, the signal has already gone out?

Dr McKinlay: I was referring to those areas specifically in relation to possible occupational exposure for the people who make repairs or structural changes to the masts. An area inside which guidelines would be exceeded should be marked on the ground. That would create an exclusion area or, if someone needed to get closer, would require the mast to be shut down. That was my point. We would not expect the general public to have access to such an area, but that is another point about the limitation of access.

The Convener: Are you saying that the ceiling and roof of a flat would provide enough protection?

Dr McKinlay: That would not intercept the beam.

The Convener: It would be going out the way?

Dr McKinlay: Yes. In our experience, when masts have been placed on school roofs, for example, the level of exposure inside classrooms has been very small.

The Convener: Thank you for putting up with our lack of scientific knowledge and our doggedness in finding answers to our questions. We appreciate your presence today.

Dr Stather: Thank you for giving us the opportunity to speak to the committee.

Petitions

The Convener: The Public Petitions Committee met on 2 November to consider petitions received by the Parliament. At that meeting, five petitions were referred to the Transport and the Environment Committee. Petition PE16 was also referred to the Rural Affairs Committee.

Petition PE16, from Jimmy Oswald, is on action to reverse the decline of the capercaillie in Scotland. Members will have read the petition and

we may want to ask the Scottish Executive and Scottish National Heritage to provide details of the approach to the protection of the capercaillie: the practical effects of the listing of the bird under schedule 2 as opposed to schedule 1 in the Wildlife and Countryside Act 1981; current and predicted future levels of capercaillie; and measures that are in place at present to protect the capercaillie, together with the adequacy of those measures. We might also want to ask the petitioner to confirm the basis of the research that relates to the predicted decline in numbers of capercaillie. Do any members want to add anything to that list of actions that the committee might want to take? Are those actions agreed?

Members *indicated agreement.*

The Convener: We are considering petition PE17, on Skye Bridge tolls discounting options for Western Isles residents, and petition PE27, on toll concessions for the transport of livestock, feedstuffs and other haulage across the Skye bridge, together because they deal with similar issues. I suggest that we note the concerns of the petitioners and refer the petitions to the Scottish Executive for further consideration.

Mr Tosh: We are asked to support specific concessions, and I think that the approach that we took to the capercaillie petition would be more appropriate. We should investigate further. I am sure that we would get information from the Executive, but I do not want simply to refer the petitions to the Executive.

It would be appropriate to ask for the basis on which the discounts were granted to normal users from Skye, and to probe the reasons why those discounts were not granted to people from the Western Isles. We should ask what the implications would be for the agreement with the bridge operating company and repayments if the concession were granted.

On the livestock issue, the comparator is the ferry service. It would be appropriate to ask for the reasons why those concessions were granted and what would be the implications of agreeing such a concession on the bridge. If we have that information, we will be in a position to pass a judgment on the petition and to say whether we think that it is reasonable for the Executive to give it favourable consideration. It is a slightly more convoluted approach, but, in this case, it is not just a matter for the Executive. We should give an opinion on the petition. I can imagine that I might agree with some or all of the petition if I had the whole picture.

12:30

The Convener: That is very useful, Murray. Thank you. Are there any other comments? We can add in those made by Murray.

Petition PE21 is from Penicuik and District Community Council on the need for a concessionary bus fare scheme to be operated nationally by the Scottish Executive. We wish to note the concerns of the petitioner. It is one of the areas of early action that we agreed to at our meeting during the recess—it seems a long time ago. We will advise the petitioner of the interest in concessionary fares expressed by the committee and our intention to consider further action on the matter. It would be useful if we passed the petition on to the Executive, so that it knows that there is a concern out there. Is that agreed to by the committee?

Members *indicated agreement.*

The Convener: Petition PE22 from the Island of Cumbrae Tourist Association concerns the fare structure of Caledonian MacBrayne for the ferry to Cumbrae island and calls for more detailed financial information to be made available. We wish to note the concerns of the petitioner, refer the matter to the Scottish Executive for further consideration and request the information and the details of Caledonian MacBrayne's revenue receipts from the Largs to Cumbrae ferry service.

Linda Fabiani: Having had many years both working and living experience of the Clyde ferries, I think that the issue may not just be about the revenue receipts, but about the cost of running specific ferries. Tavish Scott would probably agree with me. It concerns the wider scrutiny of Caledonian MacBrayne and ferry services in general. I would like to give some assurance to the petitioner that we are asking for a wider investigation than that of the revenue receipts alone.

Tavish Scott: I support the principle of what Linda is saying. We need to deal not only with the individual petition, but with the wider question of sea transport. I hope that we will find some time in our busy work programme for that area.

The Convener: I am happy to accept those additions to the remit. With those additions added in, are we agreed? We are.

We will follow up each petition with a letter from the clerk advising the petitioners of our actions.

Work Programme

The Convener: In regard to the work programme to December 1999, two meetings are scheduled for the period prior to the Christmas recess. It would therefore be useful to confirm what activities we wish to undertake between now and December. At our next meeting we will take evidence from local authorities and from the

Convention of Scottish Local Authorities on the telecoms inquiry in which we are involved. In addition, we are expecting some statutory instruments to be referred to us.

I suggest the following action and I am happy to receive any comments or additions from members. In the committee's scheduled time prior to Christmas, it will be necessary to consider the statutory instruments that will come our way. There will be scheduled time in private at our meeting on 15 December to consider the forward approach to the telecoms inquiry. The private discussion will concern our current position on that matter and where we expect to go with it. The committee can carry forward further discussion on concessionary fares to our meetings between January and July 2000. In other words, we realise that that is an area of work with which we wish to proceed and that we should schedule time in the 15 December meeting to receive petitions.

We are advised that one area that could come our way in time for that meeting is the national waste strategy. As members will recollect, we have discussed that as an area of interest on a number of occasions. If it is compatible with our schedule and if the document has been published, it might be possible to have the Minister for Transport and the Environment along to discuss the strategy. That would be a good starting point for a discussion on that area. At that meeting, we would request the clerk to put together a detailed work programme to take us from January to July 2000. Given that we have only two meetings left this year, we know how effectively we can fill them. Is that agreed by the committee?

Tavish Scott: I want to make a couple of points. First, the telecommunications inquiry has been a learning curve for us, because we have conducted it in considerable depth. That gives us some indication of how long it takes to do something properly and of the need both to be thorough and not to get totally bogged down in an issue. It is important to strike a balance, as we need to keep our work topical and moving forward.

I know that Murray Tosh has raised concerns about the current state of the water industry, which most members share. There are real concerns about charging. Some areas of Scotland may have the highest prices in the United Kingdom. We need to structure our programme in a way that allows us to find time to consider issues of that sort, although I will take your advice on that, convener.

The Convener: I sympathise with Tavish Scott's view. As committee members are aware, we are expecting further briefing on the water industry. When that information is available, I will try to incorporate it into our work programme.

Tavish Scott: That would be good.

The Convener: There is also the issue of our work load. If we need to schedule further meetings, I will discuss that with the committee before proceeding.

Mr Tosh: You flagged up in the report that we might consider the strategic roads review. I do not think that it is particularly important that we do that before Christmas, but there is a great deal of work that the committee could be getting on with in that area. We would not want to revisit the politics of the decisions that have been made, because we have already had a debate in the Parliament about that. However, it would be useful for us to have an opportunity to discuss with the minister where the review goes from here.

How do the local authority initiatives progress? How do the deferred schemes get reconsidered, if at any stage they do? How do additional projects that might be considered important in the long term fit in? What about the multimodal travel studies to which the minister referred in her statement? After the debate, we received the big booklet containing the detailed information. We should have time to reflect on that and, in a calm and structured way, to explore its implications and how the Executive sees the situation evolving over the next decade.

The Convener: That would be another useful way of keeping our business topical. We will try to schedule it in.

Robin Harper: There are three other—

The Convener: Just the three?

Robin Harper: I am sorry, but these are topical and important issues that the committee may want to consider, if the Parliament does not find time for them. All impact on the Scottish environment.

The first is the possible extension of genetically modified crop trials. The second is the fluoridation of water in Scotland, which will be considered initially by the Health and Community Care Committee. We may want to discuss the environmental aspects of that. The third is the setting of organic targets, something which has already been discussed by the Westminster Parliament. The Rural Affairs Committee may want to consider that first, but in view of how such targets could impact positively on the water environment of Scotland, we may want to do so too.

The Convener: As you point out, Robin, other committees may be planning to work in those areas. It would be worth discussing with the Health and Community Care Committee and the Rural Affairs Committee what they have already done. We will include all the issues that have been mentioned in the programme for our meeting in

early January. It will be for committee members to decide which of them they want to pursue. We have time available, and it will be filled effectively.

Linda Fabiani: If we are bidding for things that we want to be included in our programme—

The Convener: Not quite yet. I will let you make your bid, none the less.

Linda Fabiani: We do not want to fall behind other countries in our use of renewable energy, so we should ensure that that issue is discussed. Railtrack and airports are other topical matters.

The Convener: We have decided what we will do at our next two meetings. Lynn Tullis will speak to all of you individually about areas of interest, as we could go round the table several times discussing those. At our January meeting, we will have a much more comprehensive overview of the way in which we want our areas of priority to develop. Was that what you wanted to talk about, Helen?

Helen Eadie: The railways are a big priority for me and the part of the country that I represent.

Tavish Scott: I know that other committees have split into sub-groups or have used a rapporteur system. Perhaps the clerk could think about that.

The Convener: Smashing. Are we agreed about what we are doing for the next two meetings?

Members *indicated agreement.*

The Convener: I want to notify the committee that the Convention of Scottish Local Authorities conference on 24 November is on the issue of telecommunications.

Our next meeting is on 1 December. I thank members of the public for their attendance and apologise for the fact that it is very cold in this room. I hope that the heating is fixed for the next time there is a meeting here.

Meeting closed at 12:40.

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