States of Jersey

The States of Jersey Department for
Health & Social Services

Health Protection
Public Health Services

Report on Mobile Phones and Health
Mobile Phone Base Stations

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Mobile Phones and Health

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Introduction

The States of Jersey have recently opened up the mobile telephony market to competition and as a consequence a number of network suppliers have been provided with licenses to set up their networks across the island. As part of that process the suppliers have been required to make application to the Planning and Environment Department for the positioning of base stations critical for the effective operation of their systems.

A number of concerns have been voiced from residents because of the uncertainty surrounding the safety of the equipment involved, and the potential siting of this equipment close to sensitive receptors. Complaints have focussed on the 'health impacts' of such a system and that on the basis of this uncertainty the further expansion of the mobile telephony system should be curtailed. However, this would appear to be at odds with the general principle of risk management and is certainly at variance with the view of the international community with regards to the use of mobile networks. This view would also throw into doubt the continued use of the existing mobile phone network on the island.

If one considers the risks to human health posed by this technology in comparison to other personal behaviours such as smoking, diet and sexual health that have been shown to result in premature death, such a stance does not compare. In other activities, society puts in place controls and does not deny activity by ensuring adequate safeguards. A case in point is that of the use of motor vehicles, there are significant similarities between mobile phones and the motor vehicle, both provide a discrete level of individual ownership, operation and control; they provide a rapid means of communication or travel respectively far in excess of alternatives; they require a network of facilities in order to operate; those network facilities have the potential to impact both on the user and on the premises they neighbour. Both provide a measure of perceived security to their owner.

Background

In the last 6 years the UK has seen the release of two major pieces of work with regard to the health effects of mobile phones and their base stations. This work has been similarly mirrored internationally as governments have sought to ensure the safety of the technology on the back of public disquiet. In 1999 the Independent Expert Group on Mobile Phones (IEGMP) was set up by the UK Government the culmination of which was the Stewart Report (2000), followed in 2004 by the Mobile Phones and Health: Report by the Board of National Radiological Protection Board (NRPB) (now the Health Protection Agency Radiological Protection Division, HPARPD).

The IEGMP concluded the balance of evidence to date suggests that exposure to Radio frequency radiation below NRPB and International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines do not cause adverse health effects to the general population. The expert group went on to conclude 'that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects, and that the gaps in knowledge are sufficient to justify a precautionary approach'

That advice continued in the NRPB report of 2004.

In 1998 the International Commission on Non-Ionizing Radiation Protection (ICNIRP) produced guidelines with basic restrictions on exposure that are set to avoid adverse effects of exposure on health. The Commission continuously monitors and periodically carries out critical reviews of the

scientific literature concerned with the physical characteristics and sources of NIR and possible biological and adverse health effects.

The recent census in Jersey estimated that there are in excess of 90, 000 handsets available in the island more than one per person, a very rapid expansion in the use of this equipment in the last few years and a significantly different level amongst the population to that in the UK where in the year 2000 there was nearly one phone to every two people in the UK.

An opening statement of the Stewart report mentioned later said, "The fact that so many people own mobile phones attests to their perceived importance to the general public. The advent of third generation systems will extend the use of most forms of communications technologies, including fax, e-mail and Internet access. The use of mobile phones and related technologies will continue to increase for the foreseeable future."

In order for the network to function efficiently and effectively the system must have sufficient and suitably sited base stations capable of meeting the peak demand of users. Failure to provide this capability may lead to a reduction in the level of service or no service in certain instances. One of the perceived benefits to the public is the increased level of security which having a mobile phone offers to people on the move, and the extent of the use by the business community.

This concept was recognised and formed the basis of the document produced by the Office of the Deputy Prime Minister in the UK when in 2002 it released the Code of Best Practice on Mobile Phone Network Development. The infrastructure must be developed in a strategic way that minimises the impact on the environment and seeks to take into account the public's views and requires mobile phone operators, local communities and in our case the government to work together in partnership.

It is clear that in the case of the existing provider and now with the current applicant that the level of consultation with the public has been missing and that there does not appear to be any clear standards and procedures in place to deliver consultation with local communities.

What is clear however, is that there was little if any consultation by the current provider Jersey Telecom with the community in establishing their current base station sites around the island. Although planning permission was not strictly required for the base stations prior to 2002 – with Jersey Telecom then a States body benefiting from planning exemptions – applications were made. These were assessed in terms of their visual impact on the environment. Health issues were not considered to be material to the Planning process as, reflecting UK advice, these were more appropriately controlled through other regulatory bodies.

Base Stations

Mobile phone base stations are radio transmitters with antennas mounted on either free-standing masts or on buildings. Radio signals are fed through cables to the antennas and then launched as radio waves into the area, or cell, around the base station. A typical larger base station installation would consist of a plant room containing the electronic equipment as well as the mast with the antennas.

Depending on the location of the base station and the level of mobile phone usage to be handled, base stations may be anything from only a few hundred metres apart in major cities, to several kilometres apart in the countryside. A key feature of mobile phone technology is that a mobile phone does not operate with a fixed output power level when a call is made. The maximum power output from a GSM (second generation) mobile phone is around 2 W peak, but this can reduce in a sequence of 15 steps down to around 2 mW during calls, a power reduction factor of 1000.

The power level that a mobile phone operates at during a call depends on the quality of the radio link to the base station. If the link is good, a low output power level will be used, whereas if the link is poor, a higher output level will be used. A typical situation where a good link to a base station would occur is outdoors at a location where there is a clear view of the base station antennas. Poorer links would be obtained if a mobile phone is used indoors, or at a location where there are physical obstructions such as buildings or hills between the phone and the base station. It is therefore advantageous to have a base station which is close and accessible to limit the output power of the mobile handset and therefore the impact on the user.

The power of each base station transmitter is set to a level that allows a mobile phone to be used within the area for which the base station is designed to provide coverage, but not outside the coverage area. Higher powers are needed to cover larger cells and also to cover cells with difficult ground terrain. Typical maximum powers for individual macro-cellular base station transmitters are around 5-10 W, with the number of transmitters being dictated by the number of users in a particular area.

With larger capacity base stations having multiple transmitters, the output power can vary over time and with the number of calls being handled. One of the transmitters will transmit continuously at full power, whereas the other transmitters will operate intermittently and with varying power levels up to the maximum. As an example, the power output of a macrocellular base station with ten 10 W transmitters could vary between a minimum of 10 W and a maximum of 100 W over time. Microcellular base stations tend to operate at lower power levels around 1-2 W and have fewer transmitters because of their smaller coverage areas.

Typically transmitters are angled to provide grounding of the signal at a distance of between 50 and 300 metres from the antennae although weaker signals are received closer than this.

Close to some base station antennas, the power density can exceed guideline levels. Operators calculate compliance distances in various directions from their antennas in order to define a boundary outside which the guidelines can never be exceeded.

Preventative measures such as administrative procedures or physical barriers are implemented to ensure that people do not accidentally enter regions defined as exclusion zones. The design of sites would normally be such that the general public would not be able to stray into regions designed as exclusion zones.

For large macrocellular base stations radiating up to 100 watts or more, exclusion zones in the range 10-15 m may be required in front of the antennas to ensure exposures remain within the ICNIRP guidelines for public exposure. In other directions such as below and behind the antennas, the exclusion zones would extend for lesser distances.

Low power microcellular base stations radiating around 1-2 W would require much smaller exclusion zones than macrocells and it may be possible to fully encompass all regions where exposure could exceed guidelines within the plastic cover of the antenna.

The general public cannot normally approach regions designated as exclusion zones around base station antennas because the antennas tend to be mounted at the top of masts or on rooftops with controlled access. Typical locations where the public is exposed are at ground level, in buildings beneath antennas and in buildings facing antennas mounted on masts or other buildings. The recent proposal to use many of the Martello Towers around the island for tourist accommodation has meant that a proposal to use the Tower at Anneport as the site of a base station has been withdrawn.

HPARPD has made many measurements of exposure levels at publicly accessible locations around macrocell base stations with measurements taken at 118 locations from 17 different base station

sites. Average exposures were found to be 0.002% of the ICNIRP public exposure guidelines and at no location was exposure found to exceed 0.2% of the guidelines.

HPARPD have also made measurements over a broad frequency range of the radio spectrum in order examine the strength of the radio signals from transmitters other than mobile phone base stations, for example, those used for broadcast radio and television. The measurements also showed that signals from these less obvious, and more distant, transmitters can often exceed exposures produced by a visually more prominent transmitter such as a mobile phone base station.

In short base stations;

- Radiate powers up to around 100 watts
- Antennas are typically tens of metres away from the general public.
- Typical exposures at locations accessible to the public are thousands of times lower than guidelines.
- Exposure is more even over the body but at a very much lower level than with a phone.

In addition to their obligations under UK safety law, the UK Network operators have voluntarily agreed to comply with levels lower than international guidelines.

Investigations into Health Effects

The radio waves that are directed towards the head of the phone user penetrate into the body tissues for a few cm and tend to be absorbed. In being absorbed, they give up their energy to the body tissues and this adds to the energy being produced by the body's metabolism.

Up to a point, the body is able to accommodate extra energy being absorbed in its tissues, but beyond this point, temperature rises or thermoregulatory responses can occur. Protection guidelines advise restrictions on energy absorption in tissues designed to ensure that such effects are small enough not to pose a hazard.

Calculations have shown that the maximum temperature rise produced in the head due to absorption of energy in the radio waves from a mobile phone is around 0.1ºC. Although the IEGMP did not identify any adverse effects on health at this level of exposure, there is no comparable situation where large numbers of people are exposed. It is for this reason that research related to exposure to RF from mobile phones is continuing to be carried out.

There is a large body of scientific evidence relating to exposure to radio waves and there are thousands of published scientific papers covering studies of exposed tissue samples (e.g. cells), animals and people. It is not difficult to find contradictory results in the literature, and an important role of the UK Health Protection Agency Radiological Protection Division (HPARPD) has been to develop judgements on the totality of the evidence in controversial areas of the science. Prior to the Stewart Report the NRPB guidelines were used in the UK as a basis for limiting exposure to Non-ionizing Radiation (NIR) but following the Report the UK moved to the ICNIRP standard as this had a level of exposure for the general population 5 times lower than the UK standard at that time and was preferred because within the general public 'there may be people with illnesses that render them unusually susceptible to the heating effects of radio waves'. IEGMP supported the position of NRPB and ICNIRP in concluding that heating remains the best basis for setting exposure limits.

The ICNIRP is an independent group of experts established to evaluate the state of knowledge about the effects of Non Ionizing Radiation on human health and well being, and, where appropriate, to provide scientifically based advice on non-ionizing radiation protection including the provision of guidelines on limiting exposure. ICNIRP is the formally recognized nongovernmental organization in Non-Ionizing Radiation protection for the World Health Organization (WHO), the International Labour Organization (ILO), and the European Union (EU). It maintains a close liaison and working

relationship with other scientific and technical bodies.

The latest set of ICNIRP guidelines were published in 1998 and ICNIRP intends that they should be used as an input to the development of national standards.The guidelines **contain basic restrictions on exposure that are set to avoid adverse effects of exposure on health**. The basic restrictions are specified in terms of fundamental dose quantities that occur inside the body; consequently, they are not easy to measure. Reference levels are therefore given also in terms of measurable quantities outside the body such as field strength and power density.

According to ICNIRP 'exposure to NIR may cause different biological effects, with a variety of consequences for a human being. Biological effects may be without any known adverse or beneficial consequences, other effects may result in pathological conditions (diseases), while still other biological effects have beneficial consequences for a person. Annoyance or discomfort may not be pathological per se but, if substantiated, can affect the physical and mental well being of a person and the resultant effect should be considered as a potential health hazard'.

When considering exposure in the context of the ICNIRP guidelines, it is important to recognise that the guidelines are intended to limit total exposure to radio waves from all sources and not just that part of exposure arising from a particular base station. Included in the measurement will be that radiation resulting from Broadcast TV and Broadcast VHF radio and any other base stations that may overlap in their coverage.

Both the NRPB and ICNIRP guidelines are based on the need to avoid known adverse health effects. At the time these guidelines were drawn up, the only established adverse effects were those caused by the heating of tissues. The subject is under regular review and it is likely that a further report from the UK HPA will be produced in early 2008.

The European Union Council published a Recommendation on limiting exposure of the general public to electromagnetic fields on 12 July 1999 and the UK Government accepted this. The Recommendation incorporates the restrictions on exposure of the general public advised by ICNIRP in its 1998 guidelines. It also includes policy guidance for the application of the Recommendation. The Recommendation bears on Governments in the EU Member States, including that of the UK and requires compliance by 2008. An implementation report describing progress was published in Spring 2002.

In terms of the health effects it should be understood that there is a far higher potential impact on an individual from the use of a mobile phone handset than there is from exposure to the emission from a mobile phone base station.

Current Network Installations

Jersey currently has a mobile phone network in place operated by Jersey Telecom (JT) with in excess of 100 base stations around the island. There are areas of the island poorly served by the network and it is not uncommon for calls from mobile phones in the vicinity of the east and north coasts to be directed through French operators.

Those base station sites have not been subject to any scrutiny process from a health perspective in comparison with internationally recognised standards as mentioned above. It is likely however, that the hardware will be compliant with the standards as it is understood to be a condition of their Operator's Licence that the equipment and their operations must be within ICNIRP guidelines and the equipment will be internationally available units not just specific for use by Jersey Telecom. Several European Directives refer to radiation safety, and this is taken to include the non-ionising radiation that constitutes the radio waves used with mobile telephony. The practical implication of

these European Directives is that manufacturers wishing to place equipment on the market or put it into service in the UK are required to declare that radiation from the equipment does not pose a hazard when the equipment is used as specified.

A number of the new masts being requested by the current applicant Cable and Wireless are to be sited at the same premises as those already in use by JT. Although it is recommended that where possible 'existing facilities are shared by operators' there may well be a logistical problem over the capacity of existing masts to accommodate further equipment and a reluctance for co-operation due to the extent of commercial self-interest.

Conclusions

There is consensus amongst all of the expert groups who have looked at the potential for adverse health effects that the balance of evidence to date suggests that 'exposure to Radio frequency radiation below NRPB and ICNIRP guidelines do not cause adverse health effects to the general population'. To that end it is incumbent upon the States to ensure that any operator fully complies with those international standards, and openly shows compliance. The most appropriate way of ensuring this would be through the planning application process, which is subject to public scrutiny.

Currently there is little information available to the public, and the government about the siting of base stations and their potential to affect the health of residents; this leads to suspicion and mistrust. There needs to be a central database of information available covering the siting, number of transmitters and power outputs of the equipment.

In the case of the Cable and Wireless network, the information put forward in support of the planning applications indicates that in line with the agreement held with the expert groups, the level of emission from the hardware should be an order of magnitude of 1000 times less than the guidelines. There will however, need to be measurement of the actual levels following commissioning to show compliance.

There is also a need to ensure that the current operator JT, who has not had any scrutiny of past installations, is also required to show compliance with the guidelines even though it may be recognised that part of that compliance the equipment in use is likely to be of an equal standard internationally to proposed installations.

Recommendations

The States of Jersey should ensure that:

- All base stations are to be subject to the scrutiny of the planning applications process to ensure compliance with internationally agreed standards,
- There should be improved consultation by the network operator with the community prior to the selection of a site for a base station,
- Emissions from base stations must as a minimum meet the ICNIRP guidelines for public exposure, as expressed in the EU Council Recommendation. However, the States should seek to ensure that Network operators voluntarily agree to comply with levels lower than international guidelines,
- Measurement of the actual levels of radiation from base stations must be undertaken following commissioning to show compliance and be a condition of the planning permit,
- Mobile Phone network operators deliver with the States of Jersey a database of information available to the public on radio base stations,
- There is cross industry agreement on the sharing of sites and masts for radio base stations wherever possible.

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