

Afsse Opinion on Mobile Telephony

Maisons-Alfort, 18 May 2005

A- The context of the Afsse Opinion and underlying principles

The Act of Parliament of 9 May 2001 which created the Agence française de sécurité sanitaire environnementale (Afsse – the French agency for environmental health safety) stipulates that ‘... with the purpose of ensuring the protection of human health, the Agency's mission is to contribute to the safety of environmental health and to assess health risks relating to the environment’ (Art. L. 1335-3-1).

This Afsse Opinion arose from a dual context:

- First, a joint letter of referral of 3 February 2004 from the General Director for Health (Ministère de la santé, de la famille et des personnes âgées – ministry for health, the family and the elderly) and from the Director of Economic and Environmental Assessment (D4E, Ministère de l'écologie et du développement durable – ministry of ecology and sustainable development) requiring the Afsse to assess the feasibility and relevance of studies intended to duplicate the study conducted by the Dutch technological research institute TNO on certain possible effects of mobile telephone base stations, especially UMTS base stations of the so-called ‘third generation’.
- Second, the French public authorities' Plan of Action on Mobile Telephony, announced on 12 December 2003 and updated regularly. This makes the Afsse responsible for permanent monitoring of mobile telephony and requires the Agency to update the state of knowledge regularly.

The Opinion is in two parts:

- A presentation of the background to the Afsse's work establishing the current state of knowledge of the biological and health effects of mobile telephony, and giving a reminder of the general principles that underlie this Opinion.
- The actual Opinion, which brings together the Afsse's stipulations for the public authorities and other players involved in mobile telephony, based on the main points of information from the scientific data collected by an expert group.

There are also three annexes:

- Annex 1: short glossary
- Annex 2: legislative and regulatory texts published since the Agency's previous Opinion
- Annex 3: other national and international risk management tools.

In assessing environmental health risks, the Agency is assisted by Specialist Expert Committees (SEC), established under Decree no. 2002-299 of 1 March 2002. Pending

publication of the Order appointing the members of the 'Risk Assessment for Physical Agents, New Technologies and Major Developments' SEC, competent in the area of electromagnetic fields, a Specialist Expert Group was set up, after authorisation by the Afsse's Scientific Council, on 27 May 2004. This Expert Group is made up of scientists of recognised competence who have, in varied and complementary fields, met the same selection criteria as members of the Agency's SECs.

The Mission Order from the Afsse's General Director, of 27 August 2004, requests the Expert Group to make an inventory of and assess scientific work published since the Agency's previous Opinion on the biological and health effects of radiofrequency electromagnetic fields associated with radio telephones, with a focus on technologies being deployed or under development. In their report, the experts give concrete answers to questions raised in the referral and mission order letters and provide a wide-ranging review of scientific knowledge; they also shed new light on technologies that are being introduced (UMTS, WiFi, Bluetooth, etc.) or are under development ('fourth generation' systems).

The Agency's Opinion is based on the conclusions of this report, submitted to it on 18 February 2005¹ and on:

- The legislative and regulatory texts published since the Agency's previous Opinion (see Annex 2).
- Social and technological developments that significantly alter the conditions of exposure of people to electromagnetic fields arising from mobile telephony. On the one hand, the considerable expansion of short message services (SMS) and the introduction of third generation mobile telephony are tending to reduce the time for which telephones are held immediately against the skull. On the other hand, intensive use of mobile telephones by adolescents and people in certain professions is currently being observed, as well as the appearance on the market of telephones designed specifically for children, including young children.
- Expressions of concern from civil society, expressed especially in questions addressed to the Agency.

In drafting this Opinion the Afsse, as in 2003, paid particular attention to respect for the general principles of management of environmental health risks (principles of attention, prevention and precaution, and vulnerability criteria).

Once again, a distinction must be made between mobile terminals (telephones) and base stations, as the conditions and levels of exposure are significantly different. For terminals, exposure is of short duration, localised, near field and high level with, in addition to the radiofrequency radiation, a very weak non-sinusoidal, low-frequency (217 Hz) magnetic field due to the battery current. Exposure from base stations is permanent, far field, very low level and without an additional low-frequency magnetic field. Base station power varies over time with communication traffic levels, with random modulation as a function of the traffic, except in the special case of single channel stations (usually pico and micro cells) which have a constant power level. For terminals, exposure can be partially controlled by the user whereas for a base station, exposure cannot be controlled by members of the public.

The main points to have emerged since 2003 are:

¹ The Expert Group report is available on the Afsse's website (www.afsse.fr)

- Publication of initial results of epidemiological studies from the international 'Interphone' programme of the World Health Organisation (WHO). One result entertains the possibility of an increased risk of acoustic nerve neurinoma (benign tumour) amongst those using previous generation mobile telephones.
- A general improvement in objective knowledge of exposure, and identification of points remaining to be improved in this area.
- Initial development of UMTS networks and wide-spread development of new short-range radio communications networks.

B- The Afsses's Opinion based on main points of information from the Expert Group report

1. Regarding possible replication of the TNO study

Regarding the ministerial referral of 3 February 2004 relative to the TNO study, the Agency concurs with the Expert Group's conclusions expressing reservations as to the conclusions that can be drawn, given certain methodological limitations. These limitations are being addressed in a replication study currently under way in Switzerland; another is due to start in Great Britain. The Expert Group was therefore of the opinion that there was no need for further replication studies of this type in France. The question could be raised again, however, depending on the results of the current studies and the possible requirement for further investigation of the methodology of this work.

2. Regarding mobile telephones

2.1. Main points of information from the Expert Group report

Epidemiological work, and especially the recent work on the effects of exposure to the waves emitted by mobile telephone (terminal) antennas does not lead to the conclusion that they are harmful, in the light of present knowledge. However, vigilance must be maintained and the subject requires scientific work to be pursued.

- Where the risk of cancer is concerned, recent work confirms that, at the levels of power used in mobile telephony, the radiation is not genotoxic (see Report § 5.4.1) However, although most of the epidemiological studies published to date tend to refute the existence of a risk of brain cancer or other forms of cancer in humans, sufficient time has not elapsed to allow this hypothesis to be discounted. Globally, the results of the international epidemiological study (Interphone) coordinated by the International Agency for Research on Cancer are expected by the end of 2005; they should throw new light on the subject.
- A recent Swedish epidemiological study, forming part of this international programme, may indicate an increase in the risk of benign tumours of the acoustic nerve in the ears of long-term users of mobile telephones, especially the older analogue telephones used in Sweden and which generate exposure levels 100 times higher than present-day telephones. Given the differences in the equipment used, transposability of these results to France or other countries remains to be confirmed, by the results of the Interphone programme in particular. A comparable study from

Denmark has produced different results, but this does constitute a signal (see Report § 5.8 and 14.1.1).

- Regarding other illnesses or symptoms, the results of work are divided: on the one hand, studies on volunteers show no connection between symptoms experienced (headache, fatigue, sensation of heat) and exposure to radiation from telephony. On the other hand, a 2003 publication (on rats) suggests that such radiation could alter the permeability of the barrier protecting the brain against passive penetration of substances present in the blood². In its 2003 Opinion, based on previous work, the Afsse indicated that if these results were to prove transposable to humans, it could indicate that migraine³ sufferers may experience greater pain and/or intensity. Other international work on the same subject is underway and it is still too soon to consider this effect as being an established fact. It should be borne in mind that, out of 40 studies published to date, less than 10 report an effect on the blood-brain barrier. However, this also constitutes a signal.
- Some biological or physiological effects associated with exposure to mobile telephone waves have been established (alteration of profile of electroencephalogram, reduced reaction times in some tests, etc.) (see Report § 5.2), but these effects are moderate, transitory and, even in conditions of maximum exposure to radiation emitted by mobile telephones, cannot be considered as harmful, in the current state of knowledge.
- To date, the available scientific data do not indicate any particular sensitivity of children to radiation from mobile telephones, in comparison with adults, nor any different levels of absorption of radiation (see Report § 5.7). This is currently the subject of modelling work, as experimental work on children raises obvious ethical questions. The results of this work do not allow firm conclusions to be drawn. It is worth noting that young people tend to adopt practices more quickly than adults, such as the use of SMS leading to lower cranial exposure, and that such uses are developing with the spread of audiovisual applications of mobile telephony. This development could be further encouraged by the systematic use of earphones, whether connected to the terminal unit by wire or not.
- The risk of a road accident when using the mobile telephone when driving is a proven risk. The epidemiological studies published, and experimental studies on volunteer subjects, show an increased risk of accident, essentially due to loss of attention during the telephone conversation. Loss of attention is identical when drivers use sets that allow them to have their hands free.
- For people using mobile telephones in their jobs, difficulties arising from their increased availability are observed (stress, failure to respect safety rules when driving).

2.2. The Afsse Opinion

As in 2003, the Afsse takes account of the persistent serious doubts as to the possibility of health effects associated with the direct exposure of the skull to the fields emitted by mobile telephones. The epidemiological work reporting an increase in the frequency of benign

² Known as the 'blood-brain barrier' because it is specific to the cerebral and meningeal blood vessels.

³ This condition is characterised by inflammation of the dura-mater which lines the meninges, and is associated with permeabilisation of the blood vessels.

tumours of the acoustic nerve in users of previous (analogue) generations of mobile phones and experiments on rats relative to the permeability of the blood-brain barrier are of significance in this respect. For this reason, the Afsse recommends application of the precautionary principle, as follows:

Communication and information:

- Reinforcement of information to consumers by display, on all sets put onto the market, of the estimated average power generated by the telephone during the last call (as a percentage of maximum power) in accordance with standardised and internationally recognised calculation methods. It would therefore be necessary to develop the international standards, an initiative which could be taken by France within the European Union.
- Ensuring enforcement of regulations on featuring SAR in mobile telephone instructions, and request for display of SARs at points of sale.
- Relaunch of a public information campaign to limit avoidable exposure from mobile phones, especially by encouraging use of hands-free kits, through the dissemination of documents easily accessible to everyone.
- Invitation to parents of adolescents using mobile phones to inform them of conditions of use that reduce exposure. Instructions for use of mobile phones should be adapted for this purpose.
- Raising of public awareness, especially amongst adolescents, of the dangers of using the telephone when driving any kind of vehicle, with or without a hands-free kit; this also applies to work-related situations.

Dosimetry:

- Improvement in the conditions of measurement of SAR for mobile telephones by completing the measurement standard, in an international context, in order to incorporate the notion of electromagnetic efficiency of the sets on sale and to allow ease of comparison of true levels of user exposure.
- Research into measurement of local SAR when sets are positioned away from the head (heart, waist, etc.).
- Taking account of the position of hands in protocols for measurement of user exposure.
- Development of suitable measurement protocols and systematisation of evaluation of the SAR measurement associated with the mobile phone–hands-free kit combination, including use of cordless phones (Bluetooth, etc.). This information could, henceforward, be provided to consumers (in instructions and by display at points of sale).

Regarding behaviour of operators, distributors, manufacturers and consumers

- Making the provision of a hands-free kit optimised for the mobile telephone sold systematic regardless of vendor; the information on the SAR associated with the mobile telephone and hands-free kit taken together could henceforth be given systematically to consumers (instructions and display at point of sale).
- Requesting mobile telephony operators, manufacturers and distributors not to target children in their advertising campaigns.
- Requesting mobile telephone manufacturers and distributors, in the light of current uncertainty, to temporarily forego the manufacture and distribution of sets for young children until more ample knowledge is acquired of the possible effects of radiation from telephones on children.
- Advising parents deciding to give mobile phones to their young children to ensure *minimum* use of the set by, for example, taking a subscription with a restricted call list.

3. Regarding base stations

3.1. Main points of information from the Expert Group report

A distinction is made here between the large number of antennas already in the field and the new antennas being installed.

3.1.1. Antennas already in the field

The 2001 and 2003 Expert Group reports concluded on an absence of health effects due to waves emitted from base stations. More recent scientific data do not cause this conclusion to be called into question (see Report § 6.5).

Moreover, the increased density of base stations in conglomerations does not increase the level of electromagnetic fields, rather the contrary. The greater the number of stations, the lower the power emitted by base stations and telephones, due to automatic power regulation.

Numerous pico and micro cell stations have been installed in order to increase the density of networks and improve coverage in some enclosed spaces where there are high concentrations of users (stations, shopping malls, etc.). These are very low power emitters (less than 1 watt to a few watts) and with safety perimeters much smaller than the macro cells. Given their low power, some of these do not even have to be declared (at less than 1 watt equivalent isotropic radiated power (EIRP) no declaration is necessary and between 1 and 5 watts EIRP the emitter is declared to the Agence Nationale des Fréquences (ANFR – national agency for frequency allocations); above 5 watts the emitter is covered by the administrative authorities). Emitters of less than 1 watt are therefore not listed and little is therefore known about the exposure of the population to them.

This lack of knowledge of low-power fixed installations can also extend to private installations such as paging systems, internal radiotelephone networks or data transmissions (Dect, WiFi).

3.1.2. New generation antennas

UMTS base stations

There are no elements allowing identification of health effects specific to the new UMTS signals, all the more so because:

- as the carrier frequency (2000 MHz) is higher than that of GSM, absorption of radiofrequencies by the human body will be lower than for GSM;
- the maximum power of UMTS base stations is very close to that of GSM stations. In addition, as power control for UMTS is more effective, the measured average field level will probably be less than for GSM.

WiFi networks

WiFi networks are local area networks with a central base connected to the network; they have a range of around 100 metres. At present, the carrier frequency is 2450 MHz and power around 100 mW. As the emission power is low, the levels of WiFi fields are very much lower than the limit values, as has been confirmed by measurements in real environments. Values measured for maximum data transmissions are around 0.03 W/m² at 50 cm, i.e. three ten-

thousandths of the exposure limit values; beyond 2 metres, the measurable power density is close to zero.

3.2. The Afsse Opinion

The Afsse observes that no new scientific data published since its previous expert report reveal a health risk relating to radiation from mobile telephone base stations. This being the case, the recommendations made in 2003 remain valid and comply with the *attentiveness principle* intended to take account of public concerns, as follows:

Communication and information:

- Systematise consultative approaches when setting up stations and give importance to their integration into the landscape.
- Organise and disseminate information suitable for the general public about exposure to radiofrequency electromagnetic fields and scientific knowledge of their biological effects.

Where exposure is concerned, the overall objective is to seek to reduce the average exposure of the population while maintaining satisfactory coverage and quality of service. To this end, the Afsse recommends:

- Development of individual dosimetry allowing documentation of information to the public about exposure to radiofrequency electromagnetic fields.
- Description of average levels of exposure to radiofrequency electromagnetic fields and their development, taking account of the evolution of UMTS technology, digital terrestrial channel TV and short-range networks, by development of an appropriate monitoring strategy.
- Continued work on simulation of electromagnetic fields close to radio transmitters.
- Implementation of a global sampled measurement plan (all frequencies, all configurations, especially in the vicinity of micro and pico cell installations).
- Reinforcement of compliance with safety distances around micro and pico cells, especially in places of employment.
- Ensuring that radiofrequency transmitters are shut down when maintenance or other categories of personnel likely to work close by are working.

Regulations and standards

- Obligatory application of the conditions of the circular of 16 October 2001 and future developments (in the form, for example, of a technical guide made compulsory by an official Order), covering all radioelectrical stations including new technologies and especially lower power radioelectrical stations. Implementation of such a change in

regulations, affecting the general rules for the location of antennas, the way consultation is organised and also the rules for establishing safety perimeters around antennas (within which exposure limit values may be exceeded) is the responsibility of the ministers for health, the environment, urban planning and industry.

4. Regarding the need for research

The Afsse supports the research priorities announced by the Expert Group and emphasises that it would be particularly advisable to:

- Pursue research into the effects of exposure during early life, especially by means of dose measurement and animal experiments, including exposure in the womb.
- Give special importance to the possibility of a particular risk to children and adolescents, especially by study in animals, of the development of biological signs likely to constitute markers of the existence of risk at different ages.
- Pursue research into the biological and health effects of mobile telephony with GSM 1800 signals and new signals in use (essentially, UMTS and WiFi).
- Study the possible importance of the intermittent nature of exposure to mobile telephones.
- Carry out research into intensive occupational use of mobile telephones to study possible consequences of such exposure and the psychological effects of constant availability.
- Organise monitoring of occupational exposure of people working close to relay stations, in order to carry out an epidemiological study.
- More generally, participate in international studies undertaken, especially epidemiological.
- Participate in the European Commission's initiative to create a database to facilitate access to knowledge about mobile telephony.

ANNEX 1: Short Glossary

DECT: Digital Enhanced Cordless Telephone

EEG: Electroencephalogram

EIRP (Equivalent Isotropic Radiated Power): this is the theoretical power that would have to be supplied to an isotropic antenna (i.e. an antenna radiating equally in all directions) located at the place of the real antenna to obtain the same power flux at a given point of reception.

ELF: Extremely Low Frequency

FM: Frequency modulation

GSM: Global System for Mobile (Phones)

Hz, kHz, MHz, GHz: hertz, kilohertz, megahertz, gigahertz

Initiator: an agent (chemical or physical) is referred to as a cancer ‘initiator’ when exposure to the agent increases the frequency of cancers

Macro, micro or pico cell antennas: a macro cell antenna (range 300 metres to 10 kilometres depending on terrain) provides mobile telephone coverage. A micro cell antenna (range 20 to 200 metres) covers a part of the cell not adequately covered by the macro cell antenna, usually because of obstacles to propagation. A pico cell antenna (range 10 to 30 metres) will usually cover the inside of a building.

Promoter: an agent (chemical or physical) is referred to as a cancer ‘promoter’ when it tends to favour the onset of cancer after exposure to known carcinogens.

SAR: specific absorption rate, the conventional measure of the amount of electromagnetic energy absorbed by living matter per unit of time, expressed in watts per kilogram (W/kg)

UMTS: Universal Mobile Telecommunication System, third generation mobile telephony

WHO: World Health Organisation

WiFi: Wireless Fidelity Cooperation in Science and Technology, short-range communication system

W/kg: watts per kilogram, the conventional international unit of measurement for the power received by unit of mass (or SAR). The energy received per unit of mass (or SA) is expressed in joules per kilogram (J/kg) and therefore corresponds to SAR multiplied by time.

ANNEX 2: Legislative and regulatory texts published since last Agency Opinion

- **Decree no. 2003-293 of 31 March 2003** relative to road safety and modifying the penal procedure and highway code
- **Decree no. 2003-961 of 8 October 2003** relative to assessment of compliance of telecommunications and radioelectrical terminal equipment and to the conditions of its putting into service and use, and modifying the post and telecommunications code. This transposes European Directive 1999/5 EC into French law
- **Order of 8 October 2003** establishing the specifications for radioelectrical terminal equipment
- **Order of 8 October 2003** relative to consumer information about radioelectrical terminal equipment, in application of Article R.20-10 of the post and telecommunications code.
- **Order of 3 November 2003** relative to the measurement protocols in place aiming to verify for fixed emitting stations the respect of limitations, in terms of reference levels for exposure of members of the public to electromagnetic fields, covered by Decree no. 2002-775 of 3 May 2002
- **Law no. 2004-669 of 9 July 2004** relative to electronic communications and audiovisual communications services, introducing health protection into the legislation on telecommunications.
- **Law no. 2004-806 of 9 August 2004** relative to public health policy, article 80 (article 13333-21 of the public health code) allowing Prefects to order measurement of radiofrequency fields.
- **Decree of 10 January 2005** on recognition of a foundation as being in the public interest (Fondation santé et radiofréquences – health and radiofrequencies foundation)

ANNEX 3: Other national and international risk management tools

The government action plan was prepared by an interministerial working group on radiofrequencies, updated on 14 January 2005. It was intended to implement the recommendations formulated in the Afsse Opinion of April 2003 and the proposals of the Office parlementaire d'évaluation des choix scientifiques et technologiques (OPECST – parliamentary office for assessment of scientific and technological choices) (November 2002). Some actions have been completed to date, others are in progress. The plan includes actions to:

- Reinforce research into the biological and health effects of exposure to radiofrequencies (Comobio programme and setting up of a health and radiofrequencies foundation, amongst other things).
- Ensure periodic review of scientific knowledge (mission entrusted to Afsse).
- Reduce exposure of the public to electromagnetic fields and levels of exposure when using mobile telephones.
- Monitor the levels of exposure of the public, including the development of a national database managed by the ANFR, which also establishes measurement procedures at national level.
- Better protect workers, in particular by establishing limit values for exposure and requiring shutdown of base stations when maintenance personnel are working on them.
- Systematise and lead Departmental consultative bodies.
- Make obligatory or encourage signing of information and consultation charters between operators and public authorities (see below).
- Foster transparency and information to the public and elected representatives regarding base station installation procedures.
- Inform drivers and reinforce the highway code and the enforcement of laws on use of telephones while driving.
- Provide information on risks and their social representation linked to the development of wireless communications, especially by dissemination of information to the general public on the use of mobile telephones, with a view to encouraging users to adopt a cautious approach to telephone use.

Le guide de bonnes pratiques (the Good Practice guide), made public on 2 April 2004 and signed by the Association des Maires de France (AMF – association of mayors of France) and the Association Française des Opérateurs Mobiles (AFOM – association of French mobile telephone operators), focuses on establishing prior consultation with the mayor before any new project for installation or major modification of a relay antenna. The aim is to create a dialogue between mayors and operators and to provide transparent information to the population.

The European Commission (Joint Research Centre, on request from DG SANCO – Public Health and Consumer Protection) is in the process of setting up an information system, harmonised throughout Europe, on electromagnetic fields. One of the aims is to develop

scientifically validated communication tools based on representative data on exposure of the population to electromagnetic fields in each EU member state.

The first stage consists of setting up a database describing all of the measurement results for fields close to mobile telephone base stations and in assessing their accessibility to members of the public, as well as the quality of measurement. These data will be the subject of a report which is being prepared for publication. The report will also review the various national regulations on exposure of the public to electromagnetic fields. The information available so far indicates the existence of significant differences between methodologies for measurement from one state to another. The consequence of these differences is that, in spite of the considerable resources mobilised, valid comparison cannot be made between values measured in different states, nor even between regulations, which are applied in different ways. Work should be pursued on a policy of European harmonisation in this area.

The World Health Organisation, using the recommendations of the International Commission on Non-Ionising Radiation Protection (ICNIRP) and other expert scientific institutions as its basis, planned to update its recommendations on research and establishment of exposure limit values in 2004, as part of its Electromagnetic Fields programme. This date was moved to the end of 2005 or 2006, pending publication of the results of the Interphone study.