

## **AFSSE statement on mobile phones and health**

**Ref. 1/2002**  
16 April 2003

### **Summary**

The law of 9 May 2001 creating a French Environmental Health and Safety Agency (AFSSE) provides that "in order to protect human health, the mission of the agency is to contribute to ensuring health safety with regard to the environment, and to evaluate health risks linked to the environment." (Art. L.1335-3-1 of the Public Health Code).

Mobile telephones are a recent technological development and have already been the subject of considerable research and numerous publications across the world. The equipment required for the mobile phone network to function - base station antennas and handsets - have caused and are continuing to cause concern amongst the general public.

The AFSSE - called upon by both the Parliament in 2001 and by the relevant ministers Ms Roselyne Bachelot-Narquin, Minister for the Environment and Sustainable Development and Mr Jean-François Mattei, Minister for Health in 2002 - has reviewed scientific knowledge and in this opinion puts forward a number of precautionary measures to be brought to the attention of operators, manufacturers and all parties concerned. It also calls for researchers to continue their work, especially with regard to the effects of mobile phones.

### **A- The context of the AFSSE opinion and its principles**

The law of 9 May 2001 creating a French Environmental Health and Safety Agency (AFSSE) provides that "in order to protect human health, the mission of the agency is to contribute to ensuring health safety with regard to the environment and to evaluate health risks linked to the environment." (Art. L.1335-3-1 of the Public Health Code).

In Article 19 of the law of 17 July 2001 containing various social, educational and cultural provisions, the French Environmental Health and Security Agency (AFSSE) was charged with submitting a report on the risks of exposure to radiation from terminal equipment and telecommunications radio installations<sup>1</sup> to the government and parliamentary assemblies.

In the joint letter of referral dated 12 November 2002, the Director General of Health (DGS, Ministry of Health, the Family and the Disabled) and the Director of Economic Studies and Environmental Evaluation (D4E, Ministry of Environment and Sustainable Development) requested that the Agency convene a group of experts to carry out a full and detailed analysis of the data in the scientific literature in order to update the report on "mobile telephones, their base stations and health" published on 7 February 2001. This group of seven experts was set up on 21 November 2002.

The opinion submitted by the AFSSE is based, in particular, on the conclusions of this group of experts whose work was carried out completely independently. The report on mobile telephones and health clearly illustrates the distinctive roles of the groups of experts - to which the AFSSE will refer to on a regular basis - and the Agency itself. Here, the questions asked of the experts generally stem from facts and hypotheses

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<sup>1</sup> For the text of the law visit <http://www.admi.net/jo/20010718MESX0100056L.html>

associated with electromagnetic science and life and health sciences. The Agency also has to take into account other aspects that are useful for informed decision-making ('risk management') and, in particular, social data on the risk, which the AFSSE analyses in reference to other scientific fields covered by human sciences.

To prepare this opinion, the Director General, assisted by the Agency's scientific team, took into consideration the following information:

- the report by the group of experts, submitted on 21 March 2003 and available on the AFSSE website ([www.afsse.fr](http://www.afsse.fr));
- the OPECST (*Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques* (Parliamentary Office for the Evaluation of Scientific and Technological Choices)) report drafted by Senators Jean-Louis Lorrain and Daniel Raoul (available on the Senate's website [www.senat.fr](http://www.senat.fr); OPECST report no. 346 of the *Assemblée Nationale* and no. 52 of the Senate);
- recent work by Pierre Aubineau, research director at the CNRS and member of the 2001 group of experts (this hearing took place on 21 March and the minutes are available on the AFSSE website);
- the requests and proposals set out during the hearing, firstly by representatives of the two associations active in this matter (Agir pour l'Environnement and Priartem) and secondly by officials from the National Institute of Consumption (this session was held on 13 March and the minutes are available on the AFSSE website);
- responses by representatives of the three mobile phone operators in France and the association which represents them (AFOM) to the questions asked by the AFSSE; this hearing was held on 13 March 2003 (minutes are available on the AFSSE website);
- the minutes of the hearing held by the group of experts with these operators on 10 January 2003 (available on the AFSSE website);
- information gathered during meetings with Professors Marcel Rufo (Professor of Child Psychiatry at the University Hospital Centre in Marseilles) and Jean-Louis San Marco (Professor of Public Health at the University Hospital Centre in Marseilles and chairman of the board of management of the INPES (National Institute for Prevention and Health Education) on the role of mobile telephones in parent/child relations, and with Jean-Pierre Loisel, director of the consumption department of CREDOC (Centre for Research and Studies on Living Conditions) on the impact of spending associated with mobile phones on household consumption and, more specifically, on low-income households;
- information gathered during meetings with the delegation of mobile phone manufacturers (1 April 2003) and during a meeting with the National Frequency Agency (ANFr) (2 April 2003);
- the progress report on the investigation into cases of childhood cancer diagnosed in the municipality of Saint Cyr l'Ecole (Yvelines), research carried out by the Ile de France *Cellule Inter-Régionale d'Epidémiologie et d'Intervention* (interregional epidemiology and intervention unit), by the Yvelines DDASS and by the Institut de Veille Sanitaire (document dated 25 February 2003), and the press articles highlighting public concern;
- the letter sent by Professor Roger Salamon, director of unit 330 of the INSERM in Bordeaux, rejecting (giving clear reasons) the DGS request to carry out a feasibility study on an epidemiological study into the health consequences of mobile phone base stations (a facsimile of this letter can be consulted on the AFSSE website, with the author's permission);
- all the measures (listed below) implemented by public authorities following the recommendations made by the 2001 group of experts.

In writing this opinion, the AFSSE was particularly careful to comply with the following principles and procedures:

- the scientific data on which the AFSSE has based its opinion should **meet the quality criteria recognised by the scientific community** and should also be as comprehensive as possible; they should be analysed and synthesised in as relevant a way as possible using collective expertise and taking into account all the data available. To this end, the group of experts was chosen in such a way that it comprises scientists belonging to the main disciplines affected by the subject and whose past and present scientific publications bear witness to their top-level skills (the list of members of the group of experts and their positions and activities in the research area are presented in an annex to their report). This group of experts has worked completely independently, which is a prerequisite for a high-quality evaluation;
- should a danger be identified, care should be taken to ensure that the measures implemented enable the most vulnerable people to be protected as a priority (**prevention principle** and **vulnerability principle**);
- if analysis of the available scientific data concludes that there is a serious concern about the possibility of serious and irreversible effects, arrangements would need to be made with a view to reducing this potential risk, even if the scientific facts are not fully established (**precautionary principle**);
- in certain situations, while there is no scientific argument which justifies health concerns, it is a fact that some people feel their health is under threat; when this phenomenon affects a significant number of people, this becomes a real public health issue which requires suitable remedial measures. In particular, these measures should involve listening to people's suffering and fears and responding where possible (**principle of responsiveness**).

## **B- The main lessons learned by the AFSSE from this collection of information.**

First of all, **a clear differentiation should be made between mobile terminals and base stations**. They involve very different exposure levels and conditions. In the case of handsets (also called mobile terminals), what generally occurs is 'near field' short-term exposure which affects the head alone at a relatively high level with, in addition to radio frequency radiation, a weak low-frequency (217 Hz) magnetic field due to battery current.

In the case of base stations, permanent 'far field' exposure is involved at a very low level with no added low frequency magnetic field. In the case of handsets, exposure is of a voluntary nature and can in part be controlled by the user whereas in the case of the base station, this exposure cannot be controlled by the public. Furthermore, the level of exposure those individuals near the base station depends on traffic. In measuring the level of the field of a base station, the result given always corresponds to the maximum strength to take this variation in traffic into account.

These differences in exposure characteristics lead to significant differences in the methods used for measuring exposure levels. In the case of handsets, the exposure level is evaluated using the Specific Absorption Rate (SAR<sup>2</sup>), which is a direct measurement of the absorption of the radio frequency field on a 'dummy' (device in the

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<sup>2</sup> See definitions in the glossary.

form of a skull which reproduces the phenomena of penetration and absorption of the electromagnetic field)<sup>3</sup>. In the case of base stations, the measurement is made directly on-site and looks at the electric field. The difficulties involved in measuring exposure should be emphasised, both with SAR measurements and even more so with the levels of radio frequency fields on-site. In the two cases, the measurement requires perfectly suited equipment, demands compliance with a strict measurement protocol and requires considerable technical skill. Despite all the precautions taken during measurements, these are tainted with **an uncertainty of at least 30%** and up to 100%.

If methods used for taking measurements are non-standardised and non-selective in terms of frequency, the uncertainty can be even greater. In France, an on-site measurement protocol has been developed by the ANFr so that a reference method is available. In applying the provisions of Decree no. 2002-775 of 3 May 2002<sup>4</sup>, the technical inspection laboratories should respect this protocol, thereby making results easier to compare. Work on standardising field measurement procedures is currently under way at European level based on this French protocol and should lead to a harmonised procedure, probably in 2004.

### **1- Mobile telephones (handsets)**

Epidemiological research and, above all, recent experimental work on the effects of exposure to the waves emitted by handset antennas ('terminals') does not enable a conclusion to be made concerning their harmfulness given the current level of knowledge. However, **vigilance should be maintained and this subject requires continued scientific work.**

- With regard to the risk of cancer, we can accept that with the levels of power used in mobile telephony, radiation does not have an effect on our cells' genes (**it is not 'genotoxic'**). Work carried out on animals using long-term exposure does not indicate a risk of cancer; it shows neither an actual 'initiator'<sup>5</sup> effect nor a 'promoter'<sup>5</sup> effect for cancers caused by carcinogenic agents. However, although epidemiological studies already published mostly tend to refute the existence of a risk of brain tumours or other forms of cancer in human beings, we do not yet have enough hindsight to rule this hypothesis out. The results of the international epidemiological study coordinated by the International Agency for Research on Cancer ('Interphone' project) are expected beginning in late of 2004 and should shed new light on this subject.

- With regard to other illnesses, **the research findings are mixed** : on the one hand, studies using volunteers as subjects show no link between the symptoms experienced (headaches, fatigue, feeling of being warm) and exposure to radiation from telephones

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<sup>3</sup> The SAR level is always measured at the telephone's maximum power; in practice, with good reception conditions, the telephone may reduce its power by a factor of 100 or greater in relation to this maximum power.

<sup>4</sup> Decree implementing paragraph 12 of Article L. 32 of the post and telecommunications code and concerning the limit values of exposure of the public to the electromagnetic fields emitted by the equipment used in telecommunication networks or by radio installations.

<sup>5</sup> See the definitions in the glossary.

(in comparison to control subjects placed in comparable conditions of false exposure), including in subjects who claim to be “hypersensitive to electromagnetic fields”. On the other hand, recent work with animals, which needs to be confirmed – in fact, some recent French research still to be published in international scientific reviews – suggests that in rats this radiation might modify the permeability of the ‘barrier’ which protects the brain against the passive penetration of substances present in the blood<sup>6</sup> for low SAR levels of 0.2 to 0.75 W/kg. If these results are confirmed by work carried out independently under the same experimental conditions and if results are shown to be transferable to humans, this may indicate that people suffering from migraines<sup>7</sup> would be at risk of having their pain increased in frequency and/or intensity. No such effect has been demonstrated to date, and other international research on the same subject has led to opposite conclusions (of around 40 studies published, less than 10 report an effect on the blood-brain barrier.)

- **Various biological or physiological effects** (modification of the electroencephalogram profile, shorter reaction time to certain tests, etc.) associated with exposure to mobile phone waves have indeed been recognised. However these effects, which are moderate and temporary even in conditions of maximum exposure to radiation emitted by mobile phones, cannot be considered harmful given the current level of knowledge. Particular mention should be made of a biological effect which appears to have been confirmed in recent work : an increase - for SAR levels not creating a heating effect (known as the ‘thermal effect’) – in the intra-cellular activity of ‘heat shock proteins’, which are well known cellular stress indicators (whether due to a physical agent – such as temperature<sup>8</sup> – or a chemical agent). The significance of this reaction of cells to radiation received is still uncertain, especially with regard to its long-term development.

- At present, the scientific data available **does not indicate that children are particularly susceptible** to radiation caused by telephones **nor do they have a higher exposure** in comparison to adults. However, this topic should be covered in new research. On this issue, it is noted that young people tend to be quicker to adopt uses of mobile phones which lead to lower exposure of the skull (text messaging) than adults. This trend will increase with technological developments which facilitate visual applications of mobile communication (GPRS and UMTS systems allowing the high-data-rate transfer and multimedia applications). These developments are supported by the systematic use of ear pieces which may be cordless or attached to the terminal.

- **The psycho-affective and social consequences** of mobile phone use during childhood and adolescence appears to vary greatly according to the age : when parents use mobile phones to transfer their parental worries by using the phone to maintain a permanent link between them and their young children (school age attending nursery or primary), this may be detrimental to their need for independence and for socialising; in contrast, adolescents may use mobile phones as a way of affirming their independence and building relationships with their peers, which are positive factors boosting self-

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<sup>6</sup> It is called the ‘blood-brain barrier’ because it is specific to the cerebral and meningeal blood vessels.

<sup>7</sup> This ailment is characterised by inflammation of the dura mater which lines the meninges and is associated with permeabilisation of the blood vessels.

<sup>8</sup> From which this family of intra-cellular proteins takes its name.

confidence. Such hypotheses should be the subject of scientific research. For these reasons, using children in mobile phone advertisements should not be encouraged.

- **The risk of a road traffic accident** when the driver is using a mobile phone is, however, a risk which has been fully recognised. Published epidemiological studies and experiments on volunteers show an increase in the risk of a road traffic accident mainly linked to a loss of concentration during the phone conversation. The loss of concentration is exactly the same whether the driver has a device giving free use of his or her hands (hands-free kit); such a device in no way increases safety.

## 2- Base stations

The report issued by the 2001 group of experts concluded that there were **no health effects** caused by the waves emitted by base stations. The most recent scientific data does not put this conclusion in doubt. Several arguments support this claim.

- The strength of radiation received from base stations beyond a few metres from the base stations is considerably **lower than the strength of radiation from radio and television transmitters**, which have close frequency ranges. The levels of exposure found during a measurement campaign carried out by the ANFr (French Frequency Agency) show an average exposure level of around 8% of the public exposure limit values defined by the European Union recommendation of July 1999 and reiterated in French law by the decree of 3 May 2002 (already cited) for FM radio (for frequencies around 100 MHz) and for television a level of around 2% (for frequencies of 50 to 800 MHz). The average levels of radiation from base stations (with frequencies used ranging from 900 to 1800 MHz in France) does not exceed 1% of these limit values<sup>9</sup>. Moreover, the relationship between average exposure levels (expressed in watts/cm<sup>2</sup>, terms of power density<sup>10</sup>) for mobile telephone waves and for the FM band is around 1/50 to 1/60. The ANFr database currently includes the results of more than 800 measurements carried out according to a standardised protocol. With the current level of scientific knowledge, no health effect has been shown in connection with radiation linked to radio and television transmissions to which we have been continually exposed for decades and which, however, have a much greater biological tissue penetration power than mobile phones.

- In addition, in contrast to what is sometimes claimed, the measurements made confirm that mobile phone base stations **emit no electromagnetic field** other than that which they were designed to emit and, in particular, emit no 'extremely low frequency' field (217 Hz or otherwise)<sup>11</sup>.

- The studies published on the long-term effects of 'full body' exposure of animals to mobile phone signals constitutes a useful reference point for evaluating the possible effects linked to base station waves. All the data currently available, using non-thermal levels of SARs but close to limit values (1.5-2.3 W/kg), appears to show that no serious

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<sup>9</sup> Even the highest field values measured (10% of the highest values) are only around 5% of these limit values.

<sup>10</sup> This is the power received per surface unit of the body of an exposed subject.

<sup>11</sup> It can therefore be seen that this extremely low frequency radiation is produced by handsets –very low strength radiation – but is not produced by base stations.

pathologies can be expected to develop in animals at these levels of SARs. This conclusion applies *a fortiori* to the extremely low field levels emitted by base stations.

- No known mechanism has given a credible scientific explanation for the biological effects of power levels as low as these.
- The symptoms reported in the proximity of base stations are most often symptoms which are common complaints in general medicine, whether or not a base station is present; these symptoms are felt and cited more frequently when people are preoccupied and anxious, whether about their personal physical health or their social environment.

However, it can be observed that **many people claim to suffer due to the presence of mobile phone base stations close to their homes**. It has also been seen that collective protest actions develop against siting new stations near residential areas and in favour of removing antennas placed on or near buildings used by children. Through repetition and a strong vocal presence, these movements **constitute a real public health issue** and a factor in social confusion. This situation can be largely explained by the speed with which the country has been covered with base stations (in the space of just a few years, whereas it took decades to create the network of base stations for television, radio and emergency and public safety services), the fact that the base station is often not installed due to an express and individual request from consumers in contrast to most of the other antennas, and also the lack of transparency in the policy pursued by operators. It is also true that until very recently these demonstrations have found no outlet for expression or dialogue with public authorities, local authorities or operators. This lack of consultation has most certainly helped to amplify movements and some of these have taken radical steps to make their voices heard.

### **3- With regard to public authorities implementing measures since 2001**

Following the expert report of February 2001, the public authorities developed an action plan designed to implement the recommendations made.

- These recommendations concerned the transposition into French law of the recommendation of the Council of the European Union of 12 July 1999. This recommendation was transposed via decree no. 2002-775 of 3 May 2002 and the circular of 16 October 2001.
- With regard to developing research, which was strongly encouraged by the group of experts, the COMOBIO programme finished in December 2001 and no follow-up public financing has been granted. At the symposium organised by the mobile phone operators on 19 March 2003, Claudie Haigneré, minister for research and new technologies, announced the launch of a new research programme into the biological and health effects of radio waves used in mobile telephony.
- Indicating the SAR value on operating instructions and at points sale for handsets has still not been made mandatory, since the decree setting out regulations for evaluating the conformity of terminals and the relevant implementing decrees are still to be published.
- The ANFr carried out a measurement campaign measuring more than 100 electromagnetic fields in sites deemed representative of the exposure of the public outside and inside buildings in 16 metropolitan areas. It published the findings on 19 December 2001.

- With regard to measuring radio frequencies emitted by base stations, while the ANFr has published a measurement reference protocol, this agency does not currently have legislative or regulatory legitimacy in the area of monitoring exposure levels nor has it been certified by technical inspection bodies. This gap should be bridged thanks to the law on electronic communication currently under discussion in parliament, which will give it powers for ensuring compliance with public exposure limits.
- Only 100,000 copies of a public information document on the use of mobile phones were produced in March 2002, but the document is also available on the website of the Ministry of Health as well as on other websites.
- As far as raising awareness amongst car drivers is concerned, the scope of information campaigns has remained limited. Decree 2003-293 of 31 March 2003<sup>12</sup> (published in the Official Gazette on 1 April 2003) meets the requests made by the group of experts in part by making punishable the use of a telephone whilst driving a car but this applies only to the use of a handheld phone.

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<sup>12</sup> This decree modified the Highway Code and introduced an article R.412-6-1. Under this article, drivers of a vehicle in motion may not use a handheld phone. The infringement is punishable by a second-class fine together with two points on the driving licence.

## The opinion of the AFSSE

Consequently, the AFSSE has formulated the following recommendations:

### 1- With regard to handsets

The AFSSE has taken into consideration the possibility of insufficiently understood health effects linked to exposure to mobile phone fields. For this reason, it **recommends applying the precautionary principle**.

*a- Continue to reduce the energy levels supplied to the users of mobile phones when making calls and informing consumers of the exposure levels to which they are subject in order to allow them to adopt a responsible attitude in full knowledge of the facts.*

To this end, the following is proposed:

- The decree under which it is mandatory to display the maximum SAR of the handset should be published as soon as possible and applied quickly (this had already been proposed in the 2001 report);
- Conditions for measuring the SAR of a handset should be improved. The convention is to measure the maximum SAR level. Providing nothing more than this information does not give the consumer a true picture of actual exposure. The SAR measurement does not take into account the **efficiency** of the handset. An efficient handset has a much lower emission level in good reception conditions. A less efficient handset will reduce its emission level less. This means that even if it has a low maximum SAR, the average real exposure level may be higher than with a better handset. The SAR standard measurement therefore needs to be adjusted to include this notion of the electromagnetic efficiency of handsets sold commercially which will enable proper comparison of the real exposure levels of users. This standardisation should take place at no lower than European level. France should take initiatives to make this happen. This should allow consumers to choose the phone which gives least exposure;
- Supplying an over-the-ear headset should be made mandatory for all mobile phone sellers on the French market (currently only mobile phone operators systematically provide an over-the-ear headset in their packages). This simple solution (which had already been recommended) increases the distance between the handset and the head;
- All handsets sold on the market should display the estimated average emission level during the last call, using standardised calculation procedures expressed as a % of the limit value of the SAR; (this recommendation had been made by the 2001 group of experts). This standardisation should also be effected at European level;
- A public information campaign should be relaunched on using mobile phones in a way that avoids unnecessary exposure. Various methods should be used to inform the public, including the leaflet published by the DGS, which should be widely distributed to the public, local authorities and associations<sup>13</sup>.

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<sup>13</sup> To read or download this leaflet, consult the FAQ section of the AFSSE Internet site.

*b- Run a national campaign designed to reduce the use of mobile phones while driving a car. Bolster the Highway Code and call on drivers to act responsibly so that there is an effective preventive and repressive device.*

To this end, the following is proposed:

- National and local awareness-raising campaigns should be boosted in terms of strength and numbers with a view to preventing the use of mobile phones whilst driving;
- The new repressive provisions provided for under Decree 2003-293 of 31 March 2003 on road safety (already cited) should be strictly enforced. This provision is a step forward; it was requested in the 2001 report. Its scope should be evaluated, but it is insufficient because it does not take into account the risk linked to using hands-free kits, which pose just as great a risk of accident as a handheld phone;
- Provisions should be enacted making it possible to ban the use by drivers of mobile phones and other onboard telecommunication systems which are increasingly being offered by carmakers. Carmakers should take steps (positioning and sensitivity of the microphone, etc.) to ensure that such systems can only be used whilst the vehicle is stationary.

## **2- Base stations**

The AFSSE notes that the general analysis of current scientific data on exposure to base station waves **shows no health risk linked to mobile phone base stations.** Given this, **the recommendations made are based on the principle of responsiveness** in order to take into account the public worries about the siting of macro-cellular base stations<sup>14</sup>.

To this end, the following is proposed:

- A national debate should be launched on the risks and social repercussions linked to the development of wireless communication. This national debate, which requires specific resources, could take the form of **a citizens' conference** which the AFSSE is offering to organise for 2004;
- **The departmental advisory bodies**, introduced by the circular of 16 October 2001, should be systematically implemented and given real life, and steps should be taken to ensure the representatives of residents in the local area or municipality where there are plans to site a new base station are invited to attend the meetings which affect them;
- The signature of **information and consultation charters** between mobile phone operators and public authorities should be made mandatory within a maximum of three years in all municipalities, communities and other regional authorities which will be defined by the competent public authorities. These charters will set the objectives for improving regional coverage, conditions for informing local authorities in advance before any base station is installed, conditions for informing local residents in the area around

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<sup>14</sup> See the definition in the glossary.

these base stations and the policy of operators for guaranteeing the more harmonious integration of base stations into the cityscape;

- **Campaigns to measure electromagnetic fields** in the mobile phone frequency ranges should be carried out and published each year, with the cost borne by the mobile phone operators. There should be one measurement point per 5,000 subscribers and there must be a measurement point in any municipality that has at least one antenna. The measurement sites will be defined in consultation with the mayors<sup>15</sup> (and these measurements should be carried out by approved companies on the basis of the protocol set by the ANFr). All the results of these measurements will be sent to the departmental advisory committees and forwarded to the ANFr in order to build up the national database which is accessible online. It is emphasised that such measurements need to be carried out with great care and require a high level of technical skill and high-tech equipment. Consequently, it is not possible for such measurements to quickly become widely available. This means the continued development of high-performance modelling techniques to precisely predict field levels would be useful. Such models already exist but these need to be validated by comparison with on-site measurements. This validation work is the responsibility of the ANFr and should be carried out as soon as possible;

- Formal consultation should be launched between 1) primary school boards and representatives of parents of children attending childcare facilities and 2) the **municipal authorities** with a view to deciding on whether or not to keep any base stations located on the roofs of schools and childcare facilities;

- Steps should be taken to ensure that all base stations in towns in the immediate proximity of residential areas are ultimately better integrated into the cityscape. This should apply to all antennas located within a 100-metre radius of primary schools or childcare facilities within a maximum of three years.

### 3- With regard to research needs

The AFSSE notes that certain subjects have not yet been sufficiently explored and that certain biological effects, indicative of possible health effects, have still to be sufficiently included.

It supports the research priorities laid out by the group of experts and notes that the WHO's 'electromagnetic fields' programme should update its own research recommendations in June 2003. After analysing results due to be published in the very near future, other studies may be commenced if necessary.

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<sup>15</sup> In this regard, it should be emphasised that no one-off measurement is valid even if carried out according to the strictest protocols (currently being standardised) due to the extent to which the electromagnetic field can vary according to the position of the sensors and their immediate environment. For this reason, the ANFr adopted the rule of averaging the results of nine measurements carried out in the same location. In addition, the results of measurements carried out using non-standardised equipment and according to a non-standardised protocol cannot be interpreted. This effort to improve the quality and comparability of measurements makes it urgently necessary to launch a campaign to have monitoring bodies accredited by the French Accreditation Committee (COFRAC).

To this end, the following is proposed:

- Emphasis should be placed on the 1800 MHz radio frequencies, on which less research has been done than GSM900, and especially on the new-generation UMTS range (2000 MHz);
- Experimental work should be carried out, as priority, on the impact of the intermittent nature of exposure, the reversibility or long-term nature of possible biological modifications, in particular inflammation of the dura mater and the permeability of the blood-brain barrier;
- Declared symptoms must be investigated according to the rigorous protocols using blind exposure (during the trials, the volunteers should not know whether or not they are being exposed);
- Research should be developed into individual dosimetry resources prior to implementing epidemiological quality studies.

The ANFr is willing to coordinate the management of research programmes in this area if public authorities or foundations decide to dedicate resources to this.

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## **SHORT GLOSSARY**

**SAR:** specific absorption rate. This is the conventional international measurement for electromagnetic energy absorbed by living matter per unit of time. It is expressed in W/kg

**EEG:** electroencephalogram

**ELF:** extremely low frequency

**FM:** frequency modulation

**GSM:** Global System for Mobile Communications

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

**Initiator:** an agent (chemical, physical or biological) is said to act as an 'initiator' in cancer when exposure to this agent increases the incidence of cancers.

**Macro-cellular antenna (micro- to pico-cellular):** a macro-cellular antenna (range of 300 metre to 10 km according to the terrain) provides coverage for a mobile phone cell. A micro-cellular antenna (range 20 to 200 metres) covers a subsection in the cell due to insufficient coverage by a macro-cellular antenna usually because of obstacles to propagation. A pico-cellular antenna (range 10 to 30metres) generally covers the interior of a building.

**Promoter:** an agent (chemical, physical or biological) is said to acts as a 'promoter' of cancer when co-exposure to this agent tends to increase the incidence of cancers after exposure to known carcinogenic.

**UMTS:** Universal Mobile Telecommunication System

**W/kg:** watts per kilogram; this is the international conventional unit of measurement of power received per unit of mass (or SAR). The energy received per unit of mass is expressed in joules per kilogram, which corresponds to the SAR multiplied by the duration of exposure.

## THE LIST OF EXPERTS WHO PREPARED THE REPORT FOR AF SSE

- **Jean Marie ARAN**, Directeur de recherche à l'Inserm, Ingénieur ENSERB et Docteur ès sciences naturelles, a dirigé le Laboratoire de Biologie Cellulaire et Moléculaire de l'Audition à Bordeaux (Unité Inserm) de 1976 à 1992. Il participe actuellement au programme de recherche européen GUARD (Potential Adverse Effects of GSM Cellular Phones on Hearing).

- **Jean Charles BOLOMEY** est Professeur à Supélec et à l'Université Paris-Sud (Orsay). Il est membre de l'IEEE et du Comité Français de Radioélectricité Scientifique (URSI).

- **Pierre BUSER**, Doctorat d'Etat de science, a été Professeur de Neurosciences à l'Université Pierre et Marie Curie de Paris et directeur de l'Institut des Neurosciences du CNRS à l'UPMC. Professeur émérite de cette Université, il est membre de l'Académie des Sciences.

- **Martine HOURS**, médecin épidémiologiste, spécialiste en Santé Publique et en Médecine du Travail et Docteur es Sciences, est chargée de recherche à l'INRETS. Elle est coordinatrice pour la France de l'étude internationale "Interphone" pilotée par l'OMS et membre de la BEMS et de l'EBEA.

- **Isabelle LAGROYE**, Docteur en Pharmacie et Docteur en Sciences de la vie, est Maître de Conférences au laboratoire de bioélectromagnétisme de l'Ecole Pratique des Hautes Etudes, associé au laboratoire PIOM de l'Ecole Nationale Supérieure de Chimie Physique de l'Université Bordeaux I. Membre du Conseil Supérieur d'Hygiène Publique de France (Section milieux de vie), elle est responsable scientifique du programme européen Perform B.

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