

# CHAPTER 1

## INTRODUCTION

### **Reference to the Committee**

1.1 On 8 December 1999, on the motion of Senator Allison, the Senate referred an inquiry into telecommunications and electromagnetic emissions to the Environment, Communications, Information Technology and the Arts References Committee, not to commence before 31 March 2000 and for report on the 31 October 2000. The reporting date was subsequently extended to 4 May 2001. The full terms of reference may be found at page iii.

### **Conduct of the inquiry**

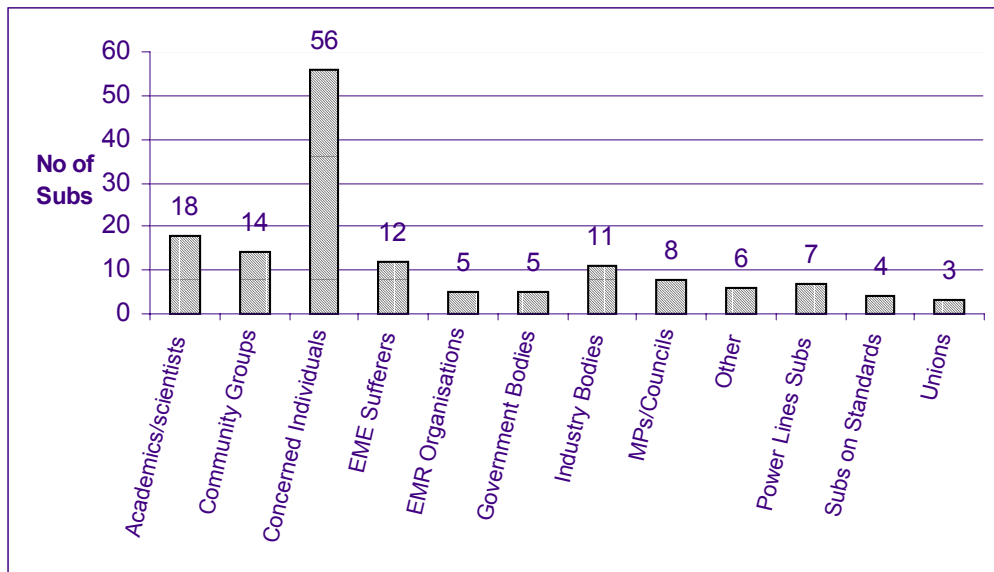
#### *Advertising the inquiry*

1.2 The Committee advertised the inquiry on 15 April 2000 in each state and territory capital city newspaper and *The Weekend Australian*, with the nominated closing date for submissions of 16 June 2000. Details of the inquiry were also placed on the Committee's homepage on the Internet.

#### *Evidence to the inquiry*

1.3 The Committee received 149 written submissions and a number of attachments and supplementary submissions which were published (except for the four whose authors made a request for confidentiality) and are publicly available through the Committee secretariat. The Committee also received follow up material from evidence, details of which are listed at Appendix 1.

Figure 1.1

*Origin of written submissions**Course of the inquiry*

1.4 The Committee conducted six public hearings as part of the inquiry, in: Canberra on 31 August 2000, 8 September 2000, 7 November 2000 and 2 March 2001, in Melbourne on 22 September 2000; and in Sydney on 16 November 2000.

1.5 During the course of the hearings, the Committee took evidence from 13 organisations, 7 Commonwealth Government Agencies and Councils and heard evidence from 16 individual witnesses. Details are listed at Appendix 2.

1.6 Hansard recorded 411 pages of evidence. The transcripts of evidence are available at: <http://www.aph.gov.au/hansard/senate/commtee/comsen.htm>

1.7 During the course of the hearings the Committee also received a number of tabled documents. These are listed at Appendix 3 and available on request from the Committee secretariat.

1.8 Senate Committee procedures provide that where evidence 'adversely reflects' on a person or an organisation (for example, by accusing them of deliberate lies or illegal acts), that person or organisation should have a reasonable right of reply. In a number of cases in this inquiry the Committee pointed out 'adverse' reflections to the affected parties and invited reply. The replies are part of the public evidence of the inquiry (unless the Committee accepted a request for confidentiality) and are noted in Appendix 3.

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## Acknowledgments

1.9 The Committee wishes to thank all those who contributed to the inquiry by preparing written submissions, providing additional information and material where requested and appearing at public hearings.

## Terminology and background

### *Introduction*

1.10 Mobile phone usage has increased rapidly over the past decade with around 8 million Australians owning mobile phones.<sup>1</sup> This figure is part of an increasing global trend, with roughly 25 million mobile phones in circulation in Britain (April 2000),<sup>2</sup> 51.5 million phones in Japan (1999), and the 85.2 million in China (2000) forecast to rise to 240 million by 2005. The rapid adoption of this relatively new technology has also meant there has been some uncertainty about the health implications of the proliferation of mobile phones and the supporting infrastructure. The Committee's terms of reference for this inquiry serve to provide a structure for an inquiry into the health effects and appropriate standards for electromagnetic radiation in the telecommunications sector.

### *What is electromagnetic radiation?*

1.11 Electromagnetic radiation refers to the energy emissions generated from the interaction of an oscillating electric field and a magnetic field. The electromagnetic spectrum (see Figure 1.2) has various divisions based on frequency and wavelength, the main one being between ionising and non-ionising frequencies. Electromagnetic radiation may be regarded as waves in the air that transmit energy but can also be controlled through amplitude, pulsing, etc., to transmit speech, TV images and so forth. Hertz (cycles per second) are used to express the range or spectrum of frequency of the waves. Kilohertz, megahertz and gigahertz ( $10^3$ ,  $10^6$  and  $10^9$  hertz, respectively) are measurements at the higher frequencies. The greater the frequency, the shorter the wavelength and the greater the energy transmitted.<sup>3</sup>

1.12 A significant division in the electromagnetic spectrum is the frequency above  $10^{16}$  hertz, where waves become ionising in nature. This means the waves are capable of knocking electrons out of atoms to form ions. X-rays, ultraviolet rays and gamma rays are examples of ionising radiation. Ionising radiation is known to be carcinogenic. Electromagnetic radiation with longer wavelengths than X-rays do not have sufficient energy to cause ionisation. Areas within this region of the

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1 Australian Mobile Telecommunications Association (AMTA), Submission 19, p 1.

2 Independent Expert Group on Mobile Phones (IEGMP), *Mobile Phones and Health*, 2000, Chiltern, p 1.

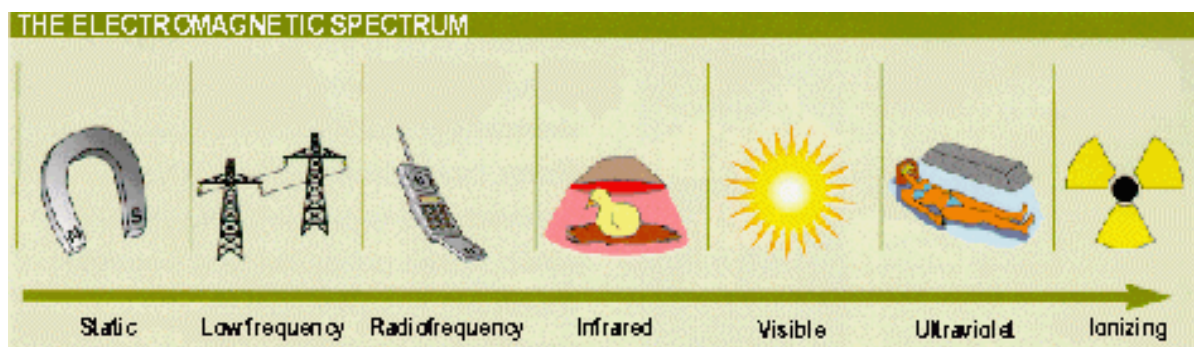
3 R. Panter, 'Electromagnetic Radiation from Mobile Phones, Mobile Phone Towers and TV Towers: Health Aspects' *Australian Parliamentary Library - Current Issues Brief 26 1996-1997*, Canberra, p 2.

electromagnetic radiation spectrum are collectively known as non-ionising forms of radiation.<sup>4</sup>

1.13 The non-ionising range of electromagnetic frequencies can be divided into static electric and magnetic fields, extremely low frequency (ELF) electric and magnetic fields, intermediate frequency fields and radiofrequency fields, which can be further subdivided into radiofrequencies and microwave frequencies. For the purposes of this report, the term electromagnetic radiation (EMR) is used to refer to radiofrequency (RF) radiation and the two terms are used interchangeably.

Figure 1.2

*The Electromagnetic Spectrum<sup>5</sup>*



1.14 Figure 1.2 illustrates some natural and artificial sources of electromagnetic emissions that exist at different frequencies in the electromagnetic spectrum. Whilst there are radio, television, radar, mobile phones and microwaves in the radiofrequency field, the Committee's inquiry has predominantly focused on the telecommunications aspect of RF, ie, mobile phones and mobile phone towers. The Committee received a large number of submissions concerned with other aspects that shall be discussed later in this chapter.

1.15 Figure 1.3 (below) shows the division of the electromagnetic spectrum into four portions:<sup>6</sup>

- The ionising radiation portion, where direct chemical damage can occur (eg X-rays).
- The non-ionising portion of the spectrum, which can be subdivided into:

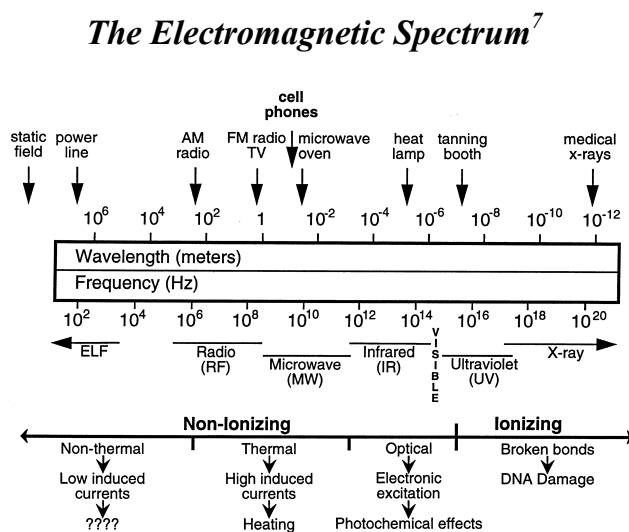
4 ARPANSA, 'The Mobile Phone System and Health Effects' [http://www.health.gov.au/arpansa/mph\\_sys.htm](http://www.health.gov.au/arpansa/mph_sys.htm) (8 June 2000) p 5.

5 WHO Fact Sheet, 'What is electromagnetic radiation?' [http://www.who.int/peh-emf/publications/what\\_is\\_EMF/section1.htm](http://www.who.int/peh-emf/publications/what_is_EMF/section1.htm)

6 Dr Moulder, Submission 60, p 14.

- the optical radiation portion, where electron excitation can occur (eg visible light);
- the portion where the wavelength is smaller than the human body, and heating can occur (eg microwave ovens, mobile phones, broadcast TV, FM radio); and
- the portion where the wavelength is much larger than the human body, and heating seldom occurs (eg AM radio, power-frequency fields, static fields).

Figure 1.3



### *Common terms used for mobile phones*

1.16 Throughout the report a number of terms have been used interchangeably for mobile phones. These include: *cellular phones*, *cell phones*, *radio telephones* and *wireless phones*.

### *Exposure to radiofrequency radiation*

1.17 The use of a mobile phone involves transmission between the phone and a nearby base station, both of which emit RF radiation. In both cases the level of exposure generally declines with increasing distance from the source. When using a handset, exposure will primarily apply to the side of the head against which the mobile phone is being used or the part of the body nearest to the phone during hands-free use.

1.18 A European Commission Report in 1996 referred to emissions from mobile phones as the following:

The electric and magnetic fields surrounding a radiotelephone handset near a person's head are complicated functions of the design and operating

characteristics of the radiotelephone and its antenna, and since the distances involved are less than one wavelength, exposure is in the near-field. In this region, electric and magnetic fields do not have a plane-wave character, but vary considerably from point to point.<sup>8</sup> This means that the charge and current distribution on the antenna and radiotelephone handset are important. This is in contrast to the situation of base stations, where plane-wave approximations can be generally applied, characterised by a locally uniform distribution of electric and magnetic field strengths in planes transverse to the direction of propagation (far-field region).<sup>9</sup>

1.19 For the general population, whole body exposure to mobile phone base station emissions occurs at levels of intensity considerably lower than those from handsets.

1.20 There are different types of *cells* (areas) that exist for base stations to communicate with mobile phones. These cells may be *macrocells*, *microcells* and *picocells*, based on their size and the power output of the antenna. *Macrocells* provide the main basis for the base station network. Base stations for macrocells have power outputs of tens of watts and communicate with phones up to roughly 35 kilometres away. *Microcells* are used to improve the main network through infill, especially where there is a high volume of calls. Places such as airports, railway stations and shopping centres site microcells and they are increasing in number as demand for mobile phones grows. The range of microcells is a few hundred metres and their base stations emit less power than those for macrocells. The third type of cell used is the *picocell*. These base stations are generally situated inside buildings and they have a lower power output than that of microcells (a few watts).<sup>10</sup> Both microcells and picocells are used to supplement reception for macrocells.

1.21 The fact that the radiofrequency fields produced by the base stations at points of public access are less than any national or international radiofrequency exposure standard, has not apparently reduced the concern of many members of the public.<sup>11</sup> Factors such as high visibility, and therefore their effects on views and property values, and the involuntary nature of the exposure to the technology, in contrast to mobile phones, which are operated at the discretion of the user, may be contributors to public concern.

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8 UNEP/WHO/IRPA (1993). 'Electromagnetic fields (300 Hz-300 GHz)'. Geneva: World Health Organization, Environmental Health Criteria, p 137.

9 EC (1996), *Possible health effects related to the use of radiotelephones: Proposals for a research programme by a European Commission Expert Group*, p 16.

10 Independent Expert Group on Mobile Phones (IEGMP), *Mobile Phones and Health*, 2000, Chiltern, pp 1-2.

11 AF McKinlay, ed (1996), *Non-ionizing radiation: sources, exposure and health effects*. Luxembourg: Office for Official Publications of the European Communities. In EC (1996), *Possible health effects related to the use of radiotelephones: Proposals for a research programme by a European Commission Expert Group*, p 16.

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### *Specific Absorption Rate*

1.22 The Specific Absorption Rate (SAR) is the rate of absorption of radiofrequency energy in a unit mass of tissue. It represents the energy actually absorbed and as such is an indicator of the measure of the dose of radiofrequency energy.

### *Biological vs health effects*

1.23 Throughout the evidence received by the Committee there are references to biological and health effects associated with exposure to electromagnetic radiation. Evidence of a ‘biological’ effect may not represent a ‘health’ effect, be it positive or adverse. The Royal Society of Canada report defined ‘biological effects’ as ‘physiological, biochemical or behavioural changes induced in an organism, tissue or cell’, while ‘health effects’ were ‘biological changes induced in an organism that may be detrimental to that organism’.<sup>12</sup>

1.24 When considering the possible health effects of exposure to electromagnetic radiation, the Committee has adopted the approach taken by the Stewart Inquiry, which adopted the World Health Organization’s definition of health as being ‘the state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity’.

### *Thermal, athermal and non-thermal effects*

1.25 While the ‘thermal’ or heating effects of certain electromagnetic energy levels are accepted as having adverse health effects, there is some evidence to suggest biological and health effects are occurring at non-thermal levels. The Royal Society of Canada defines these terms as:

*Thermal effects* often occur when sufficient RF energy is deposited to cause a measurable increase in the temperature of the sample in question (eg more than 0.1°C).

*Athermal effects* are those occurring when sufficient energy is deposited to nominally cause an increase in the temperature of the sample, but no change in temperature is observed due to endogenous [internal] temperature regulation or exogenous [external] temperature control.

*Non-thermal effects* are those occurring when the energy deposited in the sample is less than that associated with normal temperature fluctuations of the biological system being studied.

Terms such as ‘thermal’, ‘non-thermal’, and ‘athermal’, as applied to the biological effects of RF exposure, are relative and it is not possible to identify specific zones of exposure dose at which effects belong in one or

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12 Royal Society of Canada (1999), *A Review of the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunications Devices*, Ottawa, p 15.

another of these categories. The level of energy deposition that would cause a thermal effect varies depending on a number of exposure factors, including: the biological specimen exposed (eg cell culture, small animal, large animal, human), the frequency of the RF field, the polarization of the field, and the control of the ambient temperature around the specimen.<sup>13</sup>

*Additional issues raised in submissions to the inquiry*

1.26 Community concerns about the siting of mobile phone towers and other telecommunications structures are not confined to fears about potential adverse health effects. The Committee notes that a number of submissions referred to the visual impact of the mobile phone facilities,<sup>14</sup> and high voltage powerlines,<sup>15</sup> noise emissions from overhead high voltage powerlines,<sup>16</sup> invasion of privacy,<sup>17</sup> and the effect on property values.<sup>18</sup>

1.27 Submissions also queried the increasing application of switch mode technology in home appliances and the impact on levels of electromagnetic emissions was also an area of concern.<sup>19</sup>

1.28 The Committee received some submissions that raised issues that were not directly relevant to the current terms of reference, including the regulation of MRIs and X-rays,<sup>20</sup> the effect of electromagnetic fields and radiation on the navigational ability of birds and whales,<sup>21</sup> the possible impact of digital radiation on apiculture,<sup>22</sup> labelling for electrical appliances to warn of possible health risks from electromagnetic fields,<sup>23</sup> the environmental impact from the installation of high power lines,<sup>24</sup> and the inclusion of the subject of non-ionising radiation and living systems on the curriculum of major Australian universities.<sup>25</sup>

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- 13 Royal Society of Canada (1999), *A Review of the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunications Devices*, Ottawa, p 15.
- 14 See for example Ms Helen Joyce, Submission 35, p 1; Mr JW Purchase, Submission 46, p 1; Mr Nick McKillop, Submission 63, Attachment 5; Gwenda and Tom Spencer, Submission 82, p 1; Mr John Hyde, Submission 137, p 1
- 15 Mr John Allen, Submission 65, pp 1-2.
- 16 Mr John Allen, Submission 65, pp 1-2.
- 17 Gwenda and Tom Spencer, Submission 82, p 1; Mrs B Humphries, Submission 145, p 2.
- 18 Ms Helen Joyce, Submission 35, p 1; City of Melville, Submission 42, p 1; Ms Sonia Venditti, Submission 76, p 3.
- 19 Ms Gillian Summerbell, Submission 62, p 1
- 20 Mr Stephen O'Rourke, Submission 6, p 1.
- 21 Mr William Lowe and Ms Iris Detenhoff, Submission 47, p 1; Mr Alan K Tunnah, Submission 139, p 2.
- 22 Sunshine Coast Environment Council Inc, Submission 55, p 1. Apiculture is beekeeping.
- 23 Ms Heather Anne Meyer, Submission 123, p 1.
- 24 Karawatha Forest Protection Society Inc, Submission 124, p 1.
- 25 Electromagnetic Awareness Network, Submission 142, p 2.



1.29 Submissions also suggested a moratorium on the placement of new mobile phone towers until further research is conducted,<sup>26</sup> or for the duration of this Committee's inquiry.<sup>27</sup> A moratorium on the use of new mobile phones and related devices for general consumers to enable the health risks to be adequately researched was also recommended.<sup>28</sup>

1.30 Several submissions suggested that government and local councils should take out comprehensive insurance in case of litigation in the event that electromagnetic radiation is proven to cause health effects,<sup>29</sup> while others raised the question as to whether telecommunications companies are required to have insurance in the event that a class action is taken against them in relation to the alleged health effects resulting from exposure to electromagnetic radiation.<sup>30</sup>

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26 Mr Roger M Lilley, Submission 85, p 2; Mr Richard Giles, Submission 112, p 2.

27 Betty Shelley (for the Greenslopes Holland Park Concerned Residents Group), Submission 87(a), p 2.

28 Mr Richard Giles, Submission 112, p 2.

29 Ms Michelle Cossey, Submission 10, p 1; Ms Annie Carn, Submission 15, p 1. See also Mr William Lowe and Ms Iris Detenhoff, Submission 47, p 1; Ms Helen McKillop, Submission 67, p 2; Ms Ruth Parnell, Submission 94, p 2; Telecommunications Officers Association Branch of CEPU, Submission 66(a), p 1.

30 Ms Michelle Cossey, Submission 10, p 1; Ms Annie Carn, Submission 15, p 1. See also Mr William Lowe and Ms Iris Detenhoff, Submission 47, p 1; Ms Helen McKillop, Submission 67, p 2; Ms Ruth Parnell, Submission 94, p 2; Telecommunications Officers Association Branch of CEPU, Submission 66(a), p 1.

