ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE
Telecommunications (Mobile Phone Towers) Bill 2011 12 April 2012

ANSWERS TO QUESTIONS ON NOTICE

HEALTH AND AGEING PORTFOLIO

Question no: 1

OUTCOME 1: Population Health

Topic: International EMF standards comparison

Hansard Page: 29

Chair asked: If you do not think there are, [different international standards] how do we find out. Can you take it on notice and provide us-

Answer:

Please find attached a paper by Rianne Stam of the Bilthoven National Institute for Public Health and the Environment (The Netherlands), titled 'Comparison of international policies on electromagnetic fields (power frequency and radiofrequency fields)'.

Please note that ARPANSA contributed to the document regarding circumstances in Australia but cannot vouch for the accuracy of information relating to other countries.

National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

A. van Leeuwenhoeklaan 9
3721 MA Bilthoven
P.O. Box 1
3720 BA Bilthoven
The Netherlands
www.rivm.nl

CoC Utrecht 30276683

T +31 30 274 91 11
F +31 30 274 29 71
info@rivm.nl

Comparison of international policies on electromagnetic fields (power frequency and radiofrequency fields)

Rianne Stam, Laboratory for Radiation Research, National Institute for Public Health and the Environment, the Netherlands[1]

May 2011

This document was prepared as part of a research project commissioned by the Ministry of Infrastructure and the Environment and the Ministry of Social Affairs and Employment of the Netherlands. The information that forms the basis for this summary was obtained from searches of governmental and scientific websites, scientific publications, policy summaries by other organisations and personal contacts with experts. The information was last updated in April 2011.

Introduction

Power frequency electromagnetic fields (EMF) are generated in the production, transport, distribution and use of electricity. The frequency of alternating current and the resulting EMF is 50 hertz in Africa, most of Asia, Australia, Europe and part of South America and 60 hertz in the remainder of America, the Philippines, Korea, Saudi-Arabia and part of Japan. Radiofrequency EMF are generated, among others, by mobile telecommunication systems, broadcasting transmitters, radar installations, microwave ovens, certain medical applications and equipment for electronic article surveillance and identification.

In 1999, the Council of the European Union published a Recommendation (1999/519/EC, further called 'the Recommendation') on the limitation of exposure of the general public to EMF (0 hertz to 300 gigahertz). It contains basic restrictions for the current density induced in the body by EMF and reference levels for the strength of EMF outside the body (for values at selected frequencies, see Table 1). In 2004, the European Parliament and the Council issued a Directive (2004/40/EC, further called 'the Directive') on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (EMF). It contains exposure limit values for the current density induced in the body by EMF and action values for the strength of EMF outside the body (for values at selected frequencies, see Table 2). The Directive is currently undergoing revision and the deadline for transposition in national legislation of EU member states has been postponed until 2012.

The limits in both the Recommendation and the Directive are derived from the 1998 Guidelines for limiting exposure to time-varying EMF by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP has issued new guidelines for EMF with frequencies between 1 hertz and 100 kilohertz in

[1] **Disclaimer:** The author has taken care to obtain correct and up-to-date information from relevant websites, policy documents and experts in the countries in question. However, no rights can be deduced from any of the information in this document. For further information and corrections, please contact Dr. R. Stam, National Institute for Public Health and the Environment, the Netherlands. E-mail: rianne.stam@rivm.nl

2010, but these have not yet led to changes in EU legislation. ICNIRP has reconfirmed the validity of its 1998 guidelines for EMF with frequencies between 100 kilohertz and 300 gigahertz in a 2009 statement. For the sake of consistency, the terminology of the Recommendation and Directive is also used for equivalent public and occupational exposure limits in national legislation in the present summary, even if these are derived directly from ICNIRP or from other sources.

A. Exposure of the general public

Power frequency electromagnetic fields

European Union

Because the Recommendation is not legally binding, EMF policy in member states can be divided into three different approaches. In the first group of member states the Recommendation has been transposed in binding national legislation. This means that the basic restrictions and reference levels must be applied. Member states in this group are the *Czech Republic, Estonia, Greece, Hungary, Luxembourg, Portugal* and *Romania*. *Luxembourg* also has a ministerial recommendation not to create any new living spaces in the immediate vicinity of overhead power lines (within 20 metres for 65 kilovolt lines and 30 metres for 100 to 220 kilovolt lines). In *France* the limits only apply to new or modified installations. In *Germany* and *Slovakia* the reference levels in the Recommendation are applied as *de facto* exposure limits, without reference to basic restrictions.

In the second group of member states, the national limits based on the European Recommendation or ICNIRP are not binding, there are more lenient limits or there is no regulation. Member states in this group are *Austria, Cyprus, Denmark, Finland, Ireland, Latvia, Malta, Netherlands* and *United Kingdom*. In some of these countries, a precautionary policy has been advised, to which electricity companies and government can voluntarily conform (see below). *Spain* has no federal legislation for exposure of the general public to EMF of 50 hertz, but some regional governments prohibit construction of new power lines near homes, schools and public spaces.

In the third group of member states, there are stricter basic restrictions and/or reference levels based on the precautionary principle or due to public pressure. Reference levels are often applied as a *de facto* exposure limit that may not be exceeded. However, there is a great diversity in particular rules and limits. A brief summary is therefore given per member state:

Belgium: The federal limit on electric field strength since 1987 equals the reference level in the Recommendation. In Flanders, a Decision on indoor environments is in force since 2004 which limits the magnetic flux density in homes and buildings accessible to the public to 10% of the reference level in the Recommendation.

Bulgaria: Minimal distances between homes and power lines or substations are in force depending on voltage. There are no other limits for exposure of the general public to power frequency EMF except for limits on emission by video screens. At a distance of 50 centimetres from video screens, the limit for electric field strength is 0.5% of the reference level in the Recommendation (0.25% for magnetic flux density).

Denmark: The Danish National Board of Health (Sundhetsstyrelsen) recommended in 1993 not to build new homes or children's institutions close to power lines or new power lines close to homes or children's institutions. The exact distance was left to pragmatic considerations. The recommendation was re-

evaluated in 2007 and reaffirmed. The Danish electricity sector and local government have agreed that measures at reasonable cost to reduce the magnetic field must be investigated if the average exposure per year is higher than 0.4 microtesla (0.4% of the reference level in the Recommendation). Like the National Board of Health advice, the agreement applies only to new developments.

Italy: The basic limits for magnetic flux density are identical with the reference levels in the Recommendation. A 10 times lower 'attention value' applies to existing situations with exposure for more than 4 hours in homes, playgrounds and schools. A 'quality goal' of 3% of the reference level applies to new construction of homes, playgrounds or schools near power lines, substations or transformers (or *vice versa*). An even stricter limit for magnetic flux density (0.2% of the reference level) was adopted in three regions before the federal law came into force. This too applies to power lines near homes, schools and other places where people may stay for more than 4 hours per day.

Lithuania: For electric fields of 50 hertz a limit of 10% of the reference level in the Recommendation applies to homes and a limit of 20% of the reference level outside the home.

Netherlands: The Ministry of Infrastructure and the Environment has recommended that local authorities and grid companies avoid creating new situations with long-term stay of children in areas close to overhead high-voltage power lines with annually averaged magnetic flux density greater than 0.4 microtesla (0.4% of the reference level in the Recommendation). This advice was given because of epidemiological studies that found an association between residence near overhead power lines and childhood leukaemia.

Poland: A limit of 20% (electric field) or 75% (magnetic field) of the reference level in the Recommendation applies to areas with homes, hospitals, schools and kindergartens.

Slovenia: A limit of 10% of the reference level in the Recommendation applies for new or modified sources near homes, schools, kindergartens, hospitals, sanatoria, playgrounds, parks, recreational areas, public buildings and buildings with a tourist destination.

Sweden: In conjunction with the Environmental code and legislation of 1998, guidance for policy makers has been published which explains how the precautionary principle is to be applied to electric and magnetic fields of 50 hertz. For existing situations, exposure to a magnetic flux density that differs strongly from natural background (0.1% of the reference level in the Recommendation) must be reduced when possible at reasonable cost and with reasonable consequences. For new situations, an effort has to be made to reduce the exposure when designing and constructing sources.

Other countries

Different approaches to limiting exposure to power frequency EMF also exist outside Europe. Under the Interim Guidelines for EMF of 50 hertz in *Australia*, limits identical to the reference levels in the European Recommendation, but with higher limits for short term exposures, are still in force. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is preparing a standard for low frequency fields up to 3 kilohertz. The draft document includes an increase in the public reference level for magnetic flux density to three times the reference level in the European Recommendation. On the other hand, more attention is paid to precautionary measures such as an obligation to investigate the possibility and cost effectiveness of minimising exposure. The draft standard is still under review.

In *Russia*, general rules for the protection are set in a 1999 framework law. Exposure limits for specific frequency ranges are set in so-called 'Hygienic-epidemiological requirements'. The public exposure limit for electric and magnetic fields of 50 hertz is 10% of the reference level in the European Recommendation. The motivation for this is to prevent biological effects that are not seen as health risks in Western countries.

In *Switzerland*, an Ordinance on Non-Ionising Radiation has been in force since 1999. Exposure limits identical to the reference levels in the European Recommendation apply to all areas accessible to the public. A stricter, precautionary limit on magnetic flux density of 1% of the reference level applies to new installations, unless the owner can prove that the phase order has been optimised and all technically possible and economically viable measures to reduce exposure have been taken. For existing installations, the phase order has to be optimised when the precautionary limit on magnetic flux density is exceeded.

In the *United States*, no federal legislation is in force. In some states (Colorado, Connecticut, Hawaii, Maryland, Ohio), variations on the 'prudent avoidance' principle have been adopted. This means that exposure of the public to EMF of 60 hertz must be limited at reasonable cost. In other states, fixed limits for the electric or magnetic field of power lines are set, varying from 20% to 240% of the reference level in the European Recommendation (Florida, Minnesota, Montana, New Jersey, New York, Oregon).

Radiofrequency electromagnetic fields

European Union
Because the Recommendation is not legally binding, EMF policy in member states can be divided in three different approaches. In the first group of member states the Recommendation has been transposed in binding national legislation. This means that the basic restrictions and reference levels must be applied. Member states in this group are *Cyprus, Czech Republic, Estonia, Finland, France, Hungary, Ireland, Malta, Portugal, Romania* and *Spain*. The Spanish region of Catalonia has stricter regulation than the federal government. In *Germany* and *Slovakia* the reference levels have become *de facto* exposure limits.

In the second group of member states, the national limits based on the Recommendation or ICNIRP are not binding, there are more lenient limits or there is no regulation. Member states in this group are *Austria, Denmark, Latvia, Netherlands, Sweden* and *United Kingdom*. In the United Kingdom telecommunication companies have signed up to a voluntary code to respect the provisions in the Recommendation.

In the third group of member states, there are stricter basic restrictions and/or reference levels based on the precautionary principle or due to public pressure. The limits chosen are sometimes based on the principle 'as low as reasonably achievable without endangering service'. One practical choice can be the lower limit for interference in the European standards for electromagnetic compatibility (for example in Belgium). In other countries the reasons for particular limits are unclear or arbitrary (for example in Greece). In some member states these stricter reference levels are applied as exposure limits that may not be exceeded. Since there is a great diversity in particular rules and limits, a brief summary is given per member state:

Belgium: A national decision on precautionary limits for transmitters between 10 megahertz and 10 gigahertz was declared unconstitutional and regulation left to regional government. Subsequent Flemish legislation limits the electrical field strength per antenna for telecommunication to 7% of the reference level in the Recommendation in places of stay like homes, schools, rest homes and nurseries.

The maximum exposure per location is 50% of the reference level for frequencies between 10 megahertz and 10 gigahertz. The Brussels Region limits total exposure in residences for frequencies between 100 kilohertz and 300 gigahertz to a power density of 0.5% of the reference level in the Recommendation (corresponding with 7% for the electric field strength). For the same frequency range, Wallonia sets a fixed limit for the electrical field strength per antenna in residences which is 7% of the reference level at 900 hertz.

Bulgaria: Fixed limits for electrical field strength and power density are set. Their percentage of the reference levels in the Recommendation decreases with frequency. It is 2% for power density at 900 megahertz and less than 2% for higher frequencies.

Greece: The law on electronic communications sets basic restrictions of 70% of those in the Recommendation and 60% when antenna stations are located closer than 300 metres from the property boundaries of schools, kindergartens, hospitals or eldercare facilities. Installation of mobile phone antenna stations is not allowed within the property boundaries of aforementioned facilities. Reference levels calculated from these two basic restrictions are 84% and 77% of the reference levels in the Recommendation (70% and 60% for power density).

Italy: Under Italian law, reference levels have become *de facto* exposure limits that may not be exceeded. In contrast with the limits in the Recommendation, these are fixed (not frequency dependent) between 3 megahertz and 3 gigahertz. The exposure limit for magnetic field strength at 900 megahertz is 45% of the reference level in the Recommendation (22% for power density). In homes, schools, playgrounds and places where people may stay for longer than 4 hours, an 'attention value' for magnetic field strength applies that is 14% of the reference level in the Recommendation at 900 megahertz (2% for power density). The 'quality goal' for new installations is identical to the attention value.

Lithuania: There are fixed limits for power density at frequencies between 300 megahertz and 300 gigahertz. The limit is 2% of the reference level in the Recommendation at 900 megahertz and less than 2% for higher frequencies.

Luxembourg: Precautionary policy is applied to mobile telephony through a law on classified locations and technical standards. These set a fixed exposure limit for the electrical field strength of 3 volt per metre per antenna which is 7% of the reference level in the Recommendation at 900 hertz. The limit for the total number of antennas in one location equals the reference level in the Recommendation.

Poland: In locations that are accessible to the public, frequency-dependent exposure limits lower than the reference levels in the Recommendation are set for electrical field strength and power density. At 900 megahertz the limit for electrical field strength is 17% of the reference level in the Recommendation (2% for power density).

Slovenia: For frequencies higher than 10 kilohertz, exposure limits for electric and magnetic field strength of 31% of the reference levels in the Recommendation (10% for power density) apply in 'sensitive areas' (homes, schools, hospitals etc.). In all other locations the reference levels in the Recommendation are applied as *de facto* exposure limits that may not be exceeded.

Spain: The Spanish autonomic region of *Catalonia* has exposure limits for electric and magnetic field strength that are 65% of those in the Recommendation (44% for power density) and minimal distances to antennas.

Other countries
Industrialised countries outside the EU also have different ways of limiting exposure of the public to radiofrequency EMF. The mandatory basic restrictions and reference levels in *Australia*'s radiation protection standard are identical to those in the European Recommendation

In *Russia*, general conditions for protection of the population are set in a 1999 framework law. Limits for specific frequency ranges are set in subsequent 'Hygienic-epidemiological requirements'. The exposure limit for power density for EMF with frequencies between 300 megahertz and 300 gigahertz is 2% of the reference levels in the European Recommendation. The reason is to prevent biological effects that are not generally seen as a health risk in Western countries.

In *Switzerland*, an ordinance on non-ionising radiation is in force since 2000. Mandatory exposure limits identical to the reference levels in the Recommendation apply in all areas accessible to the public. A stricter, precautionary limit for the electrical field strength of 10% of the reference level in the Recommendation applies to mobile phone masts. A frequency-dependent exposure limit for electrical field strength of 11% to 3% of the reference level applies to other transmitters and to radar.

The federal legislation for radio transmitters in the *United States* sets basic restrictions identical to that in the Recommendation. The reference levels are higher, because a different model is used to calculate them. At 900 megahertz the difference is 18% for electric and magnetic field strength (33% for power density). In the United States the basic restriction only applies to portable devices close to the body. The reference levels are applied as *de facto* exposure limits for non-portable devices.

B. Occupational exposure

Power frequency electromagnetic fields

European Union
Because the Directive allows member states to set stricter exposure limits and because the deadline for transposition has been postponed, there is still a variety of regulation in place. The exposure limit values and action values of the 2004 Directive have already been transposed in the national legislation of the *Czech Republic, Italy, Latvia, Lithuania, Romania* and *Slovakia*. The Italian law comes into force in 2012.

There is as yet no national legislation with binding limits for EMF of 50 hertz at work in *Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Malta, Netherlands, Portugal, Slovenia, Spain* and *United Kingdom*. Some member states have voluntary recommendations or standards from government, professional associations or insurers, which can be used by the health and safety inspectorate as a measure for adequate control of EMF risks (*Austria, Cyprus, Denmark, France, Hungary, Malta, United Kingdom*). The limits set by professional associations in *Germany* are 2 to 3 times higher than the action values in the Directive, but under strict safety conditions.

In some member states, national legislation is still in force with stricter or more lenient limits than those in the Directive. In *Luxembourg* and *Bulgaria*, the limit for electrical field strength for brief exposures (several minutes) is respectively 2.1 and 2.5 times the action value in the Directive. For longer exposures the limit is half of the action value in the Directive. In *Poland*, the magnetic field limit is one half of the action value in the Directive and there are also time-integrated exposure limits. In *Sweden*, the precautionary principle in the environmental code

and regulation should also be applied to exposure of workers to EMF at 50 hertz. Exposure that clearly diverges from the long-term average for a particular working environment should be avoided when possible at reasonable cost and with reasonable consequences.

Other countries
Under *Australia*'s guidelines exposure limits identical to the action values in the Directive are set for the whole working day. For shorter periods with a maximum of 2 hours, exposure may be higher (three times the action value for electric field strength, ten times for magnetic flux density). In the draft standard for low frequency EMF by ARPANSA, the magnetic flux density reference levels at 50 hertz are higher than the action values in the Directive (3, 6 and 18 times higher for the head, torso and limbs, respectively). The electric field strength reference levels at 50 hertz are identical to the action values in the Directive for normal circumstances but they are doubled under controlled conditions.

Even higher limits are recommended by the American College of General and Industrial Hygiene in the *United States*, but there is no national legislation. In *Switzerland*, the federal law on accident insurance gives general rules to prevent illness caused by physical agents. The national accident insurer has specified that exposure limits identical to the action values in the Directive may not be exceeded. *Russia* has set exposure limits for workers that are stricter than the action values in the Directive. The average magnetic flux density in an 8-hour working day may not exceed a limit of 20% of the action value in the Directive. During shorter periods of time exposure may be higher (up to four times the action value for less than one hour).

Radiofrequency electromagnetic fields

European Union
Because the European Directive allows member states to set stricter exposure limits and because the deadline for transposition has been postponed, there is still a variety of regulation in place. The exposure limit values and action values of the 2004 Directive have already been transposed in the national legislation of *Cyprus, Czech Republic, Italy, Latvia, Lithuania, Romania* and *Slovakia*. The Italian legislation will come into force in 2012. In *Finland*, a decision of the Ministry of Social Affairs and Health from 1991 is still in force which sets exposure limit values and action values identical to those in the Directive.

There is as yet no national legislation with binding limits for radiofrequency EMF at work in *Austria, Belgium, Denmark, France, Germany, Greece, Hungary, Ireland, Malta, Netherlands, Portugal, Slovenia, Spain* and *United Kingdom*. Some member states have voluntary recommendations or standards from government, professional associations or insurers, which can be used by the health and safety inspectorate as a measure for adequate control of EMF risks (*Austria, Denmark, France, Germany, Hungary, Malta, United Kingdom*).

Bulgaria has set a fixed exposure limit for power density at frequencies above 300 megahertz which is lower than the action values in the Directive (44% of the action value at 900 megahertz). *Estonia* has a limit on electric field strength at frequencies above 30 megahertz of roughly 50% of the action value in the Directive (25% for power density). Exposure limits under controlled conditions are comparable to or higher than the action values in the Directive. *Luxembourg* has safety regulations for transmitters with exposure limits equal to the reference levels for the general public in the Recommendation.

Poland has limits for electric and magnetic field strength lower than the action values in the Directive (22% of the action value at 900 megahertz). There are also time-dependent limits as a precaution against possible long-term effects. In

Sweden, legislation with a fixed limit for electrical field strength is still in force (67% of the action value in the Directive at 900 megahertz).

Other countries

Australia's radiation protection standard sets exposure limit values which are virtually identical to those in the Directive. *Russia* sets exposure limits for radiofrequency EMF that are stricter than the action values in the Directive. The relevant 'Hygienic-epidemiological requirements' set a limit for power density at frequencies above 300 megahertz which is 44% of the action value in the Directive at 900 hertz. There is also a time-dependent limit for power density. In *Switzerland*, the federal law on accident insurance gives general rules to prevent illness caused by physical agents. The national accident insurer has specified that exposure limits identical to the action values in the Directive may not be exceeded.

The exposure limit values in the federal legislation for transmitters the *United States* are identical to those in the Directive. The action values for electric and magnetic field strength are 17% higher than those in the Directive (33% for power density), because a different model is used to calculate them. The same exposure limit values and action values are used in the standardisation treaty for protection of military personnel in NATO. The exposure limit values in the United States only apply to portable devices close to the body. The action values are applied as *de facto* exposure limits for non-portable devices.

Table 1: Exposure limits for the general public for electromagnetic fields in inhabited areas in member states of the European Union and selected industrial nations outside the European Union (situation April 2011)

Country:	50 Hz (ELF)		900 MHz (GSM)			1800 MHz (GSM)			2100 MHz (UMTS)		
	electric field strength	magnetic flux density	electric field strength	magnetic flux density	equivalent plain wave power density	electric field strength	magnetic flux density	equivalent plain wave power density	electric field strength	magnetic flux density	equivalent plain wave power density
	(V/m)	(μT)	(V/m)	(μT)	(W/m²)	(V/m)	(μT)	(W/m²)	(V/m)	(μT)	(W/m²)
Recommendation 1999/519/EC	**5000**	**100**	**41**	**0.14**	**4.5**	**58**	**0.20**	**9**	**61**	**0.20**	**10**
Austria	[5000]	[100]	[41]	[0.14]	[4.5]	[58]	[0.20]	[9]	[61]	[0.20]	[10]
Belgium (Flanders)	—	*10*	*21* [1]	—	—	*29* [1]	—	—	*31* [1]	—	—
Bulgaria	– [2]	– [2]	—	—	*0.1*	—	—	*0.1*	—	—	*0.1*
Cyprus	[5000]	[100]	41	0.14	4.5	58	0.20	9	61	0.20	10
Czech Republic	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10
Denmark	– [3]	– [3]	—	—	—	—	—	—	—	—	—
Estonia	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10
Finland	[5000]	[100]	41	0.14	4.5	58	0.20	9	61	0.20	10
France	5000 [4]	100 [4]	41	0.14	4.5	58	0.20	9	61	0.20	10
Germany	*5000*	*100*	*41*	*0.14*	*4.5*	*58*	*0.20*	*9*	*61*	*0.20*	*10*
Greece	5000	100	32 [5]	0.11 [5]	2.7 [5]	45 [5]	0.15 [5]	5.4 [5]	47 [5]	0.16 [5]	6 [5]
Hungary	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10
Ireland	[5000]	[100]	41	0.14	4.5	58	0.20	9	61	0.20	10
Italy	– [6]	*3* [6]	*6* [7]	*0.02* [7]	*0.1* [7]	*6* [7]	*0.02* [7]	*0.1* [7]	*6* [7]	*0.02* [7]	*0.1* [7]
Latvia	—	—	—	—	—	—	—	—	—	—	—
Lithuania	*500* [8]	—	—	—	*0.1*	—	—	*0.1*	—	—	*0.1*
Luxembourg	5000 [9]	100 [9]	41 [10]	0.14	4.5	58 [10]	0.2	9	61 [10]	0.20	10
Malta	[5000]	[100]	41	0.14	4.5	58	0.20	9	61	0.20	10
Netherlands	– [11]	– [11]	—	—	—	—	—	—	—	—	—
Poland	*1000*	*75*	*7*	—	*0.1*	*7*	—	*0.1*	*7*	—	*0.1*
Portugal	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10
Romania	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10
Slovakia	*5000*	*100*	*41*	*0.14*	*4.5*	*58*	*0.20*	*9*	*61*	*0.20*	*10*

Table 1 *(continued)*

Slovenia	*500* [11]	*10* [15]	*13* [12]	*0.04* [12]	*0.45* [12]	*18* [12]	*0.06* [12]	*0.9* [12]	*19* [12]	*0.06* [12]	*1* [12]
Spain	—	—	41	0.14	4.5	58	0.20	9	61	0.20	10
Sweden	— [13]	— [13]	[41]	[0.14]	[4.5]	[58]	[0.20]	[9]	[61]	[0.20]	[10]
United Kingdom	—	—	[41]	[0.14]	[4.5]	[58]	[0.20]	[9]	[61]	[0.20]	[10]
Australia	[5000] [12]	[100] [14]	41	0.14	4.5	58	0.20	9	61	0.20	10
Russia	*500*	*10*	—	—	*0.1*	—	—	*0.1*	—	—	*0.1*
Switzerland	—	*1* [15]	*3* [16]	—	—	*6* [16]	—	—	*6* [16]	—	—
U.S.A.	— [17]	— [17]	—	—	*6*	—	—	*10*	—	—	*10*

All limits are given as root mean square (rms) value. Where necessary magnetic flux density was calculated from magnetic field strength using a magnetic permeability of $4\pi \times 10^{-7}$ H/m. Normal typeface: reference level for the external field in the meaning of Recommendation 1999/519/EC, derived from basic restriction. Application is mandatory unless value is in square brackets. *Italic typeface:* mandatory exposure limit in terms of the external field outside the body.

Notes:
1) Regional regulation; maximum per antenna in Flanders or per site in Brussels: 3.0 V/m at 900 MHz, 4.2 V/m at 1800 MHz, 4.5 V/m at 2100 MHz; maximum per antenna in Wallonia: 3 V/m
2) Minimal distances to power lines and to electrical distribution systems, differentiated by voltage; separate regulation for video display units
3) For new developments: agreement between local government and electricity sector to examine measures to reduce magnetic fields if average yearly exposure above 0.4 µT
4) For new or modified installations, technical conditions for electricity distribution
5) For antenna stations closer than 300 m to "sensitive" locations (schools, kindergartens, hospitals, care homes); elsewhere 35 V/m, 0.11 µT, 3.1 W/m^2 at 900 MHz; 49 V/m, 0.16 µT, 6.3 W/m^2 at 1800 MHz; 51 V/m, 0.17 µT, 7 W/m^2 at 2100 MHz
6) For new installations near homes, schools, playgrounds; 10 µT for existing installations near homes, schools, playgrounds; 1999/519/EC for all other places
7) Near homes and their outdoor annexes, in schools and playgrounds, in places with stay greater than 4 hours; elsewhere 20 V/m, 0.06 µT, 1 W/m^2
8) Limit inside homes; outside homes 1000 V/m; suburban green zone, roads 10000 V/m; uninhabited 15000 V/m
9) Security conditions for electricity lines; there are also voluntary minimal distances to power lines for new developments
10) Limit per antenna 3.0 V/m
11) Recommendation to local government: create no new situations of long-term stay of children in magnetic flux density greater than 0.4 µT around power lines
12) Applies to homes, hospitals, health resorts, public buildings, tourism buildings, schools, nurseries, playgrounds, parks, recreational areas; otherwise limit for external electric and magnetic field strength equal to reference level in 1999/519/EC; for power frequency limits apply to new or reconstructed sources only
13) Reduce exposure radically deviating from natural background when possible at reasonable expense with reasonable consequences
14) For continuous exposure; for few hours per day 10000 V/m and 1 mT; for few minutes per day more than 10000 V/m or 1 mT, provided basic restriction is met
15) For new installations at places of sensitive use (buildings in which persons stay for longer periods, playgrounds); for existing installations limit for external electric field strength and magnetic flux density as reference level in 1999/519/EC, but optimise order of phases at places of sensitive use
16) Limit per location for new and existing antenna installations at places of sensitive use (buildings in which persons stay for longer periods, playgrounds); limit for aggregate exposure from multiple antenna locations equal to reference level in 1999/519/EC
17) No federal regulation; limits are set in some states, other states have prudent avoidance policy (measures to reduce exposure of the population at reasonable cost)

Table 2: Occupational exposure limits for electromagnetic fields in member states of the European Union and selected industrial nations outside the European Union (situation April 2011)

Country:	50 Hz (ELF)		900 MHz (GSM)			1800 MHz (GSM)			2100 MHz (UMTS)		
	electric field strength	magnetic flux density	electric field strength	magnetic flux density	equivalent plain wave power density	electric field strength	magnetic flux density	equivalent plain wave power density	electric field strength	magnetic flux density	equivalent plain wave power density
	(V/m)	(μT)	(V/m)	(μT)	(W/m^2)	(V/m)	(μT)	(W/m^2)	(V/m)	(μT)	(W/m^2)
Directive 2004/40/EC	**10000**	**500**	**90**	**0.30**	**22.5**	**127**	**0.42**	**45**	**137**	**0.45**	**50**
Austria	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Belgium (Flanders)	—	—	—	—	—	—	—	—	—	—	—
Bulgaria	*5000* (1	—	—	—	*10*	—	—	*10*	—	—	*10*
Cyprus	[10000]	[500]	90	0.30	22.5	127	0.42	45	137	0.45	50
Czech Republic	10000	500	90	0.30	22.5	127	0.42	45	137	0.45	50
Denmark	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Estonia	—	—	—	—	*6* (2	—	—	*12* (2	—	—	*14* (2
Finland	—	—	90	0.30	22.5	127	0.42	45	137	0.45	50
France	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Germany	[21320] (4	[1358] (4	[92]	[0.31]	[22.5]	[130]	[0.43]	[45]	[137]	[0.46]	[50]
Greece	—	—	—	—	—	—	—	—	—	—	—
Hungary	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Ireland	—	—	—	—	—	—	—	—	—	—	—
Italy	10000 (5	500 (5	90 (5	0.30 (5	22.5 (5	127 (5	0.42 (5	45 (5	137 (5	0.45 (5	50 (5
Latvia	10000	500	90	0.30	22,5	127	0.42	45	137	0.45	50
Lithuania	10000	500	90	0.30	22.5	127	0.42	45	137	0.45	50
Luxembourg	*5000* (6	*100* (6	41	0.14	4.5	58	0.20	9	61	0.2	10
Malta	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Netherlands	—	—	—	—	—	—	—	—	—	—	—
Poland	*10000* (7	*251* (7	*20* (7	*0.07* (7	—	*20* (7	*0.07* (7	—	*20* (7	*0.07* (7	—
Portugal	—	—	—	—	—	—	—	—	—	—	—

Table 2 *(continued)*

Romania	10000	500	90	0.30	22.5	127	0.42	45	137	0.45	50
Slovakia	10000	500	90	0.30	22.5	127	0.42	45	137	0.45	50
Slovenia	—	—	—	—	—	—	—	—	—	—	—
Spain	—	—	—	—	—	—	—	—	—	—	—
Sweden	– [8]	– [6]	*60*	—	*10*	*60*	—	*10*	*60*	—	*10*
United Kingdom	[10000]	[500]	[90]	[0.30]	[22.5]	[127]	[0.42]	[45]	[137]	[0.45]	[50]
Australia	[10000] [9]	[500] [9]	92	0.31	22.5	130	0.43	45	137	0.46	50
Russia	—	*100* [10]	—	—	*10* [11]	—	—	*10* [11]	—	—	*10* [11]
Switzerland	*10000*	*500*	*90*	*0.30*	*22.5*	*127*	*0.42*	*45*	*137*	*0.45*	*50*
U.S.A.	[25000]	[1000]	—	—	*30*	—	—	*50*	—	—	*50*

All limits are given as root mean square (rms) value. Where necessary magnetic flux density was calculated from magnetic field strength using a magnetic permeability of $4\pi \times 10^{-7}$ H/m. Normal typeface: reference level for the external field in the meaning of Recommendation 1999/519/EC, derived from basic restriction. Application is mandatory unless value is in square brackets. *Italic typeface:* mandatory exposure limit in terms of the external field outside the body.

Notes:
1) Limit for 8-hour working day; limit for brief exposure (several minutes) 25000 V/m
2) Limit in controlled conditions: 30 W/m² at 900 MHz, 60 W/m² at 1800 MHz, 70 W/m² at 2100 MHz
4) Sectoral rules; higher action values apply under controlled conditions (max. 2 hours per day): electric field strength 30000 V/m, magnetic flux density 2546 µT
5) To be applied after the deadline for transposition of Directive 2004/40/EC (30 April 2012)
6) Limit for permanent exposure; limit for brief exposure 21320 V/m
7) There are also frequency-dependent time-integrated exposure limits
8) Reduce exposure radically deviating from long-term average for a particular working environment when possible at reasonable expense with reasonable consequences
9) Applies to whole working day; higher for shorter periods, with a maximum of 30000 V/m and 5000 µT for less than 2 hours
10) Average for 8-hour working day; higher for shorter exposure, up to 2000 µT for less than 1 hour
11) Peak exposure for whole body; peak exposure for limbs 50 W/m²; time-integrated exposure 2 W/m² × h

Colofon
The author thanks the many scientific and policy experts who contributed information and reviewed a draft version of the document.

This document is a publication of:
National Institute for Public Health and the Environment
P.O. Box 1
3720 BA Bilthoven
The Netherlands
www.rivm.nl/en/

ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE
Telecommunications (Mobile Phone Towers) Bill 2011 12 April 2012

ANSWERS TO QUESTIONS ON NOTICE

HEALTH AND AGEING PORTFOLIO

Question no: 2

OUTCOME 1: Population Health

Topic: ARPANS Act review – consultant details

Hansard Page: 29

Senator Bob Brown asked: Dr Larsson, you said that ARPANSA is under potential review by a consultant that has now been identified. Who is that?

Answer:

The Australian Radiation Protection and Nuclear Safety Agency is not under review.

The Australian Radiation Protection and Nuclear Safety Act 1998 is currently under review.

The Department of Health and Ageing has engaged a consultant, Communio Pty Ltd, to carry out the review of the Act.

Contact details for Communio:

Communio Group Corporate Office
Level 3, 221 Miller Street NorthSydney NSW 2060
Postal Address:

PO Box 1796
North Sydney NSW 2059
Phone: + 61 (2) 9922 4666
Facsimile: + 61 (2) 9922 7666

ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE
Telecommunications (Mobile Phone Towers) Bill 2011 12 April 2012

ANSWERS TO QUESTIONS ON NOTICE

HEALTH AND AGEING PORTFOLIO

Question no: 3

OUTCOME 1: Population Health

Topic: Radiation Health Committee agreement on revision of a standard

Hansard Page: 30

Senator Bob Brown asked: Can you give the committee a single case in which there has been an agreement to set a new standard without agreement from all the participants in that committee?

Answer:

No.

This answer is based on the following assumptions:

- that Senator Brown was referring to agreement from 'all jurisdictions' rather than 'all participants'; and
- that Senator Brown intended 'setting a standard' to mean endorsing it at a national level.

Standards are developed and approved by the Radiation Health Committee by a majority vote. Noting that nine of the thirteen members who comprise the Radiation Health Committee represent regulatory authorities from the jurisdictions, it is theoretically possible that ARPANSA could publish a radiation protection standard that has not been agreed to by all jurisdictions; however, it is unlikely that the standard would be endorsed for national adoption.

Radiation Health Committee practice is that a standard intended for national adoption is not approved until all jurisdictional regulatory members have endorsed it. Any objections are usually dealt with during the development process so that the final version is acceptable to all jurisdictions.

For a standard to be endorsed at the national level and be listed in the National Directory for Radiation Protection, approval from the Australian Health Ministers Advisory Council and the Australian Health Ministers' Conference is required. Voting within both groups is by consensus. Theoretically, if they were not able to reach a satisfactory agreement, the standard would be referred back to ARPANSA and the Radiation Health Committee for further development.

ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE
Telecommunications (Mobile Phone Towers) Bill 2011 12 April 2012

ANSWERS TO QUESTIONS ON NOTICE

HEALTH AND AGEING PORTFOLIO

Question no: 4

OUTCOME 1: Population Health

Topic: Technical reasons for Switzerland's decision to have a different standard to that decided by Australia

Hansard Page: 33

Chair asked: I am interested in it. I am not asking you to get involved in the political reasons, but there would have to be a reasoning. We would not send a political expert to get us the reasoning. I am sure ARPANSA would be capable of going over and having a look at the technical reasons and the politics as to why the Swiss came to that decision. If it is not political then it is purely technical. You need to tell us that. That is my view.

Answer:

Switzerland has a Federal Law relating to Protection of the Environment dating from 1983. It is not specific to electromagnetic radiation but aims to protect against nuisances or harmful impacts. In accordance with its precautionary principles, non-ionising radiation must be limited to the lowest level that is technically and operationally possible and economically acceptable, and at least to a level that is neither harmful nor a nuisance to humans or the environment.

To satisfy this requirement, in 1999 Switzerland enacted an ordinance relating to protection from non-ionising radiation that introduces Exposure Limit Values based on the same ICNIRP (1998) Guidelines as were used for the ARPANSA Standard. These limits, assessed against cumulative exposures from all sources, must be respected at all places accessible to the general public.

To address the precautionary requirements of the Protection of the Environment law, the ordinance also includes Installation Limit Values that apply, in 'sensitive locations' to the exposures produced by a single installation, such as a single mobile phone base station, a broadcast transmitter, or electrical infrastructure. These are based on practical experience of what has been achieved previously.

The Installation Limit Values for a single mobile phone base station, or multiple base stations on the same building, are set at about 1% of the Exposure Limit Values (expressed in power units). The Installation Limit Values are assessed on the full power corresponding to maximum speech and data traffic but not on the cumulative exposure from multiple installations. They are assessed only at 'sensitive sites', namely rooms in buildings that are regularly occupied by persons for prolonged periods, designated children's playgrounds and undeveloped sites for which the above uses are permitted.

The explanatory report for the ordinance provides examples of scientific study results that suggest the existence of non-thermal effects below current exposure limits but do not derive the Installation Limit Values from these results. Rather these are based on practical experience of what has been achieved previously.

ENVIRONMENT AND COMMUNICATIONS LEGISLATION COMMITTEE
Telecommunications (Mobile Phone Towers) Bill 2011 12 April 2012

ANSWERS TO QUESTIONS ON NOTICE

HEALTH AND AGEING PORTFOLIO

Question no: 5

OUTCOME 1: Population Health

Topic: Data on regional sites where ARPANSA has measured RF/EME

Hansard Page: 37-38

Senator McKenzie asked: In regional areas in Australia where we are trying to use technology differently to overcome our tyranny of distance, I am just wondering if you can perhaps, on notice, provide some data around regional sites that you have looked at.

Answer:

ARPANSA has conducted or commissioned three surveys of EME exposures from mobile phone base stations, including the currently on-going survey. In the 1999 survey, ARPANSA measured exposures at 14 base stations which used, the then new, GSM technology. These included Bunbury WA, and Nerang Qld, outside capital cities. In the 2003 survey, a further 60 base station sites, mainly in capital cities, were measured.

Since 2007, ARPANSA has been planning and commissioning accredited measurements at a small number of mobile phone base stations each year with financial assistance from the Australian Mobile Telecommunications Association. To date, 23 base stations at 21 locations have been measured. One site at the regional centre of Bathurst, NSW, is included, as well as one at Bli Bli, near Maroochydore, in Queensland. It is intended that one of the next three sites will be in a regional or rural location.

All three surveys have shown that actual exposures from mobile phone base stations are a small fraction of the public exposure limits.