EMF SCIENCE REVIEWS

CONDUCTED BY SCIENTIFIC PANELS, PUBLIC HEALTH ORGANIZATIONS, AND GOVERNMENTAL BODIES

Since 1977, 222 reviews of EMF science have been conducted by governmental bodies, public health organizations, and appointed scientific panels. Those reviews are listed below with some of their key conclusions. Reviews by others, such as interest groups and individuals, are not included. We encourage you to examine the full content of the recent reviews.

#	Agency, Expert Group or Scientific Panel	Year
222	American Conference of Governmental Industrial Hygienists	2024
221	Swedish Radiation Safety Authority	2024
220	European Commission, Scientific Committee on Health, Environmental and Emerging Risks (SCHEER)	2023
219	Radiation Advisory Committee (State of Victoria, Australia)	2023
218	American Conference of Governmental Industrial Hygienists	2023
217	Health Canada	2022
216	US National Institutes of Health, US National Cancer Institute	2022
215	Radiation Advisory Committee (State of Victoria, Australia)	2022
214	New Zealand Ministry of Health	2022
213	Swedish Radiation Safety Authority	2022
212	Health Council of Netherlands (2)	2022
211	Health Council of Netherlands (1)	2022
210	American Conference of Governmental Industrial Hygienists	2022
209	Institution of Engineering and Technology	2021
208	Radiation Advisory Committee (State of Victoria, Australia)	2021
207	Swedish Radiation Safety Authority	2021
206	American Conference of Governmental Industrial Hygienists	2021
205	Radiation Advisory Committee (State of Victoria, Australia)	2020
204	Swedish Radiation Safety Authority	2020
203	American Conference of Governmental Industrial Hygienists	2020
202	Health Canada	2020
201	US National Institutes of Health, US National Cancer Institute	2019
200	Radiation Advisory Committee (State of Victoria, Australia)	2019
199	American Conference of Governmental Industrial Hygienists	2019

198	Swedish Radiation Safety Authority	2019
197	New Zealand Ministry of Health	2018
196	Radiation Advisory Committee (State of Victoria, Australia)	2018
195	American Conference of Governmental Industrial Hygienists	2018
194	Health Council of the Netherlands	2018
193	Swedish Radiation Safety Authority	2018
192	Radiation Advisory Committee (State of Victoria, Australia)	2017
191	American Conference of Governmental Industrial Hygienists	2017
190	Institution of Engineering and Technology	2016
189	Radiation Advisory Committee (State of Victoria, Australia)	2016
188	US National Institutes of Health, US National Cancer Institute	2016
187	Swedish Radiation Safety Authority	2016
186	American Conference of Governmental Industrial Hygienists	2016
185	National Institute for Public Health and the Environment of the Netherlands	2015
184	Australian Radiation Protection and Nuclear Safety Agency	2015
183	American Conference of Governmental Industrial Hygienists	2015
182	Radiation Advisory Committee (State of Victoria, Australia)	2015
181	Swedish Radiation Safety Authority	2015
180	New Zealand Ministry of Health	2015
179	European Commission, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)	2015
178	Radiation Advisory Committee (State of Victoria, Australia)	2014
177	Institution of Engineering and Technology	2014
176	American Conference of Governmental Industrial Hygienists	2014
175	Swedish Radiation Safety Authority	2014
174	Radiation Advisory Committee (State of Victoria, Australia)	2013
173	Institution of Engineering and Technology	2013
172	American Conference of Governmental Industrial Hygienists	2013
171	Swedish Radiation Safety Authority	2013
170	Institution of Engineering and Technology, Biological Effects Policy Advisory Group	2012
169	Health Canada	2012
168	European Health Risk Assessment Network on Electromagnetic Fields Exposure	2012
167	Radiation Advisory Committee (State of Victoria, Australia)	2012
166	German Commission on Radiological Protection	2011
165	Radiation Advisory Committee (State of Victoria, Australia)	2011
164	Canadian Federal-Provincial Territorial Radiation Protection Committee	2011

163	International Commission On Non-Ionizing Radiation Protection (ICNIRP)	2010
162	Swedish Radiation Safety Authority	2010
161	French Agency for Environmental and Occupational Health Safety (AFSSET)	2010
160	Health Canada	2010
159	European Health Risk Assessment Network on Electromagnetic Fields Exposure	2010
158	American Conference of Governmental Industrial Hygienists	2010
157	Radiation Advisory Committee (State of Victoria, Australia)	2010
156	European Health Risk Assessment Network on Electromagnetic Fields Exposure	2010
155	Institution of Engineering and Technology, Biological Effects Policy Advisory Group	2010
154	Australian Radiation Protection and Nuclear Safety Agency	2009
153	British Columbia Centre for Disease Control	2009
152	Health Council of the Netherlands	2009
151	American Conference of Governmental Industrial Hygienists	2009
150	Radiation Advisory Committee (State of Victoria, Australia)	2009
149	European Commission, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)	2009
148	Health Council of the Netherlands	2008
147	American Conference of Governmental Industrial Hygienists	2008
146	Canadian Federal-Provincial-Territorial Radiation Protection Committee	2008
145	Radiation Advisory Committee (State of Victoria, Australia)	2008
144	Health Council of the Netherlands	2008
143	World Health Organization	2007
142	Republic of Ireland, Department of Communications, Marine and Natural Resources Expert Group on Health Effects of Electromagnetic Fields	2007
141	Radiation Advisory Committee (State of Victoria, Australia)	2007
140	European Commission, Scientific Committee on Emerging and Newly Identified Health Risks	2007
139	American Conference of Governmental Industrial Hygienists	2007
138	U.K. Health Protection Agency Advisory Group on Non-Ionizing Radiation	2006
137	Institution of Engineering and Technology, Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields	2006
136	Radiation Advisory Committee (State of Victoria, Australia)	2006
135	Swedish Radiation Protection Institute	2006
134	British Columbia Centre for Disease Control	2005
133	American Conference of Governmental Industrial Hygienists	2005
132	Radiation Advisory Committee (State of Victoria, Australia)	2005
131	Health Council of the Netherlands, Electromagnetic Fields Committee	2005

130	Canadian Federal-Provincial-Territorial Radiation Protection Committee	2005
129	U.K. National Radiological Protection Board	2004
128	Institution of Electrical Engineers, Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields	2004
127	American Conference of Governmental Industrial Hygienists	2004
126	Connecticut Department of Public Health, Division of Environmental Epidemiology & Occupational Health	2004
125	Florida Department of Environmental Protection	2003
124	Australian Radiation Protection and Nuclear Safety Agency	2003
123	International Commission on Non-Ionizing Radiation Protection	2003
122	Health Council of the Netherlands, Electromagnetic Fields Committee	2003
121	American Conference of Governmental Industrial Hygienists	2003
120	Radiation Advisory Committee (State of Victoria, Australia)	2003
119	U.S. National Institute of Environmental Health Sciences	2002
118	Institution of Electrical Engineers, Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields	2002
117	Minnesota State Interagency Working Group on EMF Issues	2002
116	Australian Radiation Protection and Nuclear Safety Agency	2002
115	Italy - Ministries of Environment, Health & Telecommunications, International Evaluation Committee to Investigate the Health Risks of Exposure to Electric, Magnetic, and Electromagnetic Fields	2002
114	American Conference of Governmental Industrial Hygienists	2002
113	California Department of Health Services, California EMF Program	2002
112	Radiation Advisory Committee (State of Victoria, Australia)	2002
111	Florida Department of Environmental Protection	2001
110	World Health Organization	2001
109	International Commission on Non-Ionizing Radiation Protection, Standing Committee on Epidemiology	2001
108	U.K. National Radiological Protection Board Advisory Group on Non-Ionizing Radiation	2001
107	Radiation Advisory Committee (State of Victoria, Australia)	2001
106	European Commission, Directorate-General Health and Consumer Protection Scientific Committee on Toxicity, Ecotoxicity and the Environment	2001
105	German Commission on Radiological Protection	2001
104	International Agency for Research on Cancer, Working Group on the Evaluation of Carcinogenic Risks to Humans	2001
103	American Conference of Governmental Industrial Hygienists	2001
102	Health Council of the Netherlands, Electromagnetic Fields Committee	2001

101	U.K. National Radiological Protection Board, Report of an Advisory Group on Non-Ionising Radiation	2001
100	Swedish Council for Work Life Research	2000
99	Virginia Department of Health, Division of Health Hazards Control	2000
98	Radiation Advisory Committee (State of Victoria, Australia)	2000
97	Health Council of the Netherlands, ELF Electromagnetic Fields Committee	2000
96	American Conference of Governmental Industrial Hygienists	2000
95	U.S. National Institute of Environmental Health Sciences	1999
94	Florida Department of Environmental Protection	1999
93	American Conference of Governmental Industrial Hygienists	1999
92	U.S. National Academy of Sciences, National Research Council	1999
91	World Health Organization	1998
90	Virginia Department of Health, Department of Hazards Control	1998
89	Florida Department of Environmental Protection	1998
88	Canadian Federal-Provincial-Territorial Radiation Protection Committee	1998
87	International Commission on Non-Ionizing Radiation Protection	1998
86	American Conference of Governmental Industrial Hygienists	1998
85	Virginia Department of Health, Department of Hazards Control	1997
84	U.S. National Academy of Sciences, National Research Council	1997
83	Swedish National Board of Occupational Safety and Health, Swedish Board of Housing, Building and Planning, Swedish National Electrical Safety Board, Swedish National Board of Health & Welfare, Swedish Radiation Protection Institute	1996
82	European Commission, Directorate General For Employment, Industrial Relations, and Social Affairs	1996
81	U.K. National Radiological Protection Board	1996
80	Virginia Department of Health	1996
79	U.S. National Institute for Occupational Safety and Health	1996
78	Swedish Criteria Group for Physical Risk Factors	1995
77	Swedish National Board of Health & Welfare	1995
76	Swedish National Board of Health & Welfare	1995
75	Virginia Department of Health	1995
74	Swedish Criteria Group for Physical Risk Factors	1995
73	Swedish National Electrical Safety Board	1995
72	American Physical Society	1995
71	European Committee for Electrotechnical Standardization	1995
70	Australian Department of Health, Radiation Advisory Committee	1995

69	U.S. National Institute of Environmental Health Sciences & U.S. Department of Energy,	1995
68	American Medical Association, Council on Scientific Affairs	1994
67	The Institution of Electrical Engineers	1994
66	Connecticut Department of Environmental Protection and Department of Health Services, Interagency Task Force Studying Electric and Magnetic Fields	1994
65	U.K. National Radiological Protection Board	1994
64	Australian Department of Health and Community Services, Radiation Advisory Committee	1994
63	Swedish National Electrical Safety Board	1994
62	Maryland Department of Natural Resources	1994
61	Virginia Department of Health	1994
60	American Conference of Governmental Industrial Hygienists	1994
59	Danish Ministry of Health, Expert Group on Non-Ionizing Radiation	1994
58	Maryland Department of Natural Resources	1993
57	American Industrial Hygiene Association	1993
56	Connecticut Department of Environmental Protection and Department of Health Services, Interagency Task Force Studying Electric and Magnetic Fields	1993
55	Virginia Department of Health	1993
54	Swedish National Electrical Safety Board	1993
53	Australian Department of Health and Community Services, Radiation Advisory Committee	1993
52	Danish Ministry of Health, SEIIS No. 2 Expert Group on Non-ionizing Radiation	1993
51	Danish Ministry of Health, SEIIS No. 1 Expert Group on Non-ionizing Radiation	1993
50	U.K. National Radiological Protection Board	1993
49	U.S. National Academy of Sciences, Committee on Assessment of the Possible Health Effects of Ground Wave Emergency Network, Board on Radiation Effects Research, Commission on Life Sciences National Research Council	1993
48	French National Institute of Health and Medical Research, Department of the Partnership for Social and Economic Development	1993
47	International Commission On Non-Ionizing Radiation Protection (ICNIRP)	1993
46	U.S. Department of Energy, Bonneville Power Administration	1993
45	Oregon Department of Energy	1993
44	U.S. Environmental Protection Agency	1992
43	Virginia Department of Health	1992
42	Health Council of the Netherlands	1992
41	Victoria Department of Health (Australia), Health and Community Services	1992
40	U.K. National Radiological Protection Board	1992

39	Department of Energy (Ireland)	1992
38	Oak Ridge Associated Universities, Panel for the Committee on Interagency Radiation Research and Policy Coordination	1992
37	Texas Public Utility Commission	1992
36	Maryland Department of Natural Resources	1992
35	Illinois Department of Public Health, Illinois Environmental Protection Agency	1992
34	Connecticut Academy of Science and Engineering, Prepared for the Connecticut Department of Health Services	1992
33	U.S. Environmental Protection Agency, Scientific Advisory Board (SAB), Radiation Advisory Committee, Non-Ionizing Electric and Magnetic Fields Subcommittee	1992
32	American Conference of Governmental Industrial Hygienists	1991
31	Virginia Department of Health	1991
30	U.K. National Radiological Protection Board	1991
29	U.S. Committee on Interagency Radiation Research and Policy Coordination	1991
28	Department de Sante Communautaire du Centre Hospitalier de l'Universite Laval, Quebec, Canada	1991
27	New South Wales Government (Australia)	1991
26	Maryland Department of Natural Resources	1991
25	Virginia Department of Health	1990
24	Swedish National Energy Administration	1990
23	Commonwealth of Pennsylvania, House of Representatives, House Conservation Committee	1990
22	U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Office of Research and Development	1990
21	International Radiation Protection Association, International Non-Ionizing Radiation Commission	1990
20	California Public Utilities Commission, California Department of Health Services	1989
19	U.S. Congress, Office of Technology Assessment	1989
18	U.S. Department of Energy, Bonneville Power Administration	1989
17	Virginia Department of Health	1988
16	Swedish National Energy Administration	1988
15	Department of Energy (Ireland)	1988
14	Virginia Department of Health	1987
13	World Health Organization	1987
12	Royal Swedish Academy of Engineering Sciences, Committee on the Biological Effects of Electromagnetic Fields	1987
11	Ontario Ministry of Health (Canada), Disease Control and Epidemiology Service	1987
10	Swedish National Energy Administration	1987

9	Florida State Department of Environmental Regulation	1987
8	Virginia Department of Health	1986
7	Swedish National Energy Administration	1986
6	Virginia Department of Health	1985
5	American Institute of Biological Sciences	1985
4	Florida Department of Environmental Regulation	1985
3	World Health Organization	1984
2	The Royal Swedish Academy of Engineering Sciences Committee on Biological Effects of Electromagnetic Fields	1983
1	U.S. National Academy of Sciences	1977

222 2024 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 140]

221 2024 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Seventeenth Report from SSM's Scientific Council on Electromagnetic Fields

"No new established causal relationships between EMF exposure and health risk have been identified." [p. i] "The current studies do not resolve whether the consistently observed association between ELF magnetic field (ELF-EMF) exposure and childhood leukemia in epidemiology is causal or not." [p. 33]

220 2023 European Commission Scientific Committee on Health, Environmental and Emerging Risks (SCHEER)

Potential health effects of exposure to electromagnetic fields (EMF): Update with regard to frequencies between 1Hz and 100 kHz

"[O]verall, there is weak evidence concerning the association of ELF-MF exposure with childhood leukaemia. Overall, there is moderate evidence on the association between occupational exposure to ELF-EMF and ALS, weak evidence for the association of occupational ELF-EMF exposure with Alzheimer's disease, and dementia, but only uncertain to weak evidence for residential exposure and these neurodegenerative diseases. No significant association can be established between EMF exposure and Parkinson's or multiple sclerosis disease. No systematic reviews or meta-analyses could be identified on exposure to ELF-EMF and neurophysiological outcomes. Therefore, it is still not possible to draw a definite conclusion on potential effects. The available systematic reviews and meta-analyses have not shown an association between 36 ELF-EMF exposure and reproductive or pregnancy outcomes." [p. 9]

219 2023 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2023

"The Committee's position, based on its scrutiny of the literature, is that evidence is lacking for a consistent and reproducible association between exposure to power frequency electromagnetic fields and adverse health outcomes in humans." [p. 9]

218 2023 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 140]

217 2022 Health Canada

Power lines and electrical products: Extremely low frequency electric and magnetic fields

"The potential health effects of extremely low frequency EMF has been studied extensively. While some people are concerned that long term exposure to extremely low frequency EMF may cause cancer, the scientific evidence does not support such claims. … Extremely low frequency EMF exposures in Canadian homes, schools and offices are far below the limits recommended in the ICNIRP guidelines. You don't need to take precautions to protect yourself from these kinds of exposures."

216 2022 U.S. National Institutes of Health U.S. National Cancer Institute

Electromagnetic Fields and Cancer

"Numerous epidemiologic studies and comprehensive reviews of the scientific literature have evaluated possible associations between exposure to non-ionizing EMFs and risk of cancer in children. (Magnetic fields are the component of non-ionizing EMFs that are usually studied in relation to their possible health effects.) Most of the research has focused on leukemia and brain tumors, the two most common cancers in children. Studies have examined associations of these cancers with living near power lines, with magnetic fields in the home, and with exposure of parents to high levels of magnetic fields in the workplace. No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found. … No

mechanism by which ELF-EMFs or radiofrequency radiation could cause cancer has been identified. … Studies of animals have not provided any indications that exposure to ELF-EMFs is associated with cancer."

215 2022 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2022

"The Committee's position, based on its scrutiny of the literature, is that epidemiological evidence is lacking for a consistent and reproducible association between exposure to power frequency electromagnetic fields and adverse health outcomes in humans." [p. 9]

214 2022 New Zealand Ministry of Health

Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2022

"Overall, the picture is still largely unchanged since the publication of the WHO (2007) review. The possibility that long-term exposures to relatively strong magnetic fields (albeit low in comparison with the recommended exposure limits) somehow increases the risk of developing childhood leukaemia remains an open question. The results from epidemiological studies are not supported by laboratory research, and researchers agree that even if a causal relationship exists, ELF magnetic fields would be responsible for only a small fraction of childhood leukaemia cases. Recent findings tend to weaken the possibility that a link exists. Research on possible links with neurodegenerative diseases has provided inconsistent results." [p. 14]

213 2022 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Sixteenth Report from SSM's Scientific Council on Electromagnetic Fields

"No new established causal relationships between EMF exposure and health risk have been identified." [p. i] "Regarding the exposure to ELF magnetic fields and the development of childhood leukaemia associations have been observed, but a causal relationship has not been established." [p. 6]

212 2022 Health Council of the Netherlands

Power lines and health: neurodegenerative diseases

"Based on the current state of knowledge, the committee does not consider it possible to provide an unambiguous answer to the question of whether exposure to magnetic fields can cause neurodegenerative illnesses. At least, the residential studies did not give any indication that ALS, Alzheimer's disease, Parkinson's disease or MS are more prevalent in people who live closer to overhead power lines. Therefore, the committee does not believe that precautionary measures to limit exposure are currently necessary." [p. 4]

211 2022 Health Council of the Netherlands

Power lines and health: cancers in adults

"Residential studies revealed an association between the proximity of overhead power lines and an increased risk of leukaemia in adults. In occupational studies, exposure to magnetic fields above the background level was also found to be associated with an increased risk of leukaemia. The Committee considers this to be suggestive of a causal relationship. … In order to establish a causal relationship, additional information from experimental research (including animal studies) and mechanistic studies is necessary. The most recent reviews of such studies do not provide additional support for a causal relationship." [p. 5]

210 2022 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 140]

209 2021 Institution of Engineering and Technology

Electromagnetic fields and health

"[T]here is no evidence that EMFs, as used in society, cause damage to human health. … The existing evidence indicates that there is no need to take precautionary measures, that have a significant impact on lifestyle, for safety reasons." [p. 4]

208 2021 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2021

"The Committee's position, based on its scrutiny of the literature, is that epidemiological evidence is lacking for a consistent and reproducible association between exposure to power frequency electromagnetic fields and adverse health outcomes in humans." [p. 14]

207 2021 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Fifteenth Report from SSM's Scientific Council on Electromagnetic Fields

"No new causal relationships between EMF exposure and health risks have been established." [p. i] "Regarding the exposure to ELF magnetic fields and the development of childhood leukaemia associations have been observed, but a causal relationship has not been established." [p. 6]

206 2021 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 134]

205 2020 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2020

"The Committee's position, based on its scrutiny of the literature, is that epidemiological evidence is lacking for a consistent and reproducible association between exposure to power frequency electromagnetic fields and adverse health outcomes in humans." [p. 9]

204 2020 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Fourteenth Report from SSM's Scientific Council on Electromagnetic Fields

"No new causal relationship between EMF exposure and health risks have been established." [p. i] "Recent studies do not alter the current interpretation of the observed association of residential exposure to ELF-MF

and childhood leukaemia with no causal explanation. Research on other outcomes including neurodegenerative disease is scarce and does not provide new insights for health risk assessment. [p. 23]

203 2020 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 137]

202 2020 Health Canada

Power lines and electrical products: Extremely low frequency electric and magnetic fields

"The potential health effects of extremely low frequency EMF has been studied extensively. While some people are concerned that long term exposure to extremely low frequency EMF may cause cancer, the scientific evidence does not support such claims. … Extremely low frequency EMF exposures in Canadian homes, schools and offices are far below the limits recommended in the ICNIRP guidelines. You don't need to take precautions to protect yourself from these kinds of exposures."

201 2019 U.S. National Institutes of Health U.S. National Cancer Institute

Electromagnetic Fields and Cancer

"Numerous epidemiologic studies and comprehensive reviews of the scientific literature have evaluated possible associations between exposure to non-ionizing EMFs and risk of cancer in children. (Magnetic fields are the component of non-ionizing EMFs that are usually studied in relation to their possible health effects.) Most of the research has focused on leukemia and brain tumors, the two most common cancers in children. Studies have examined associations of these cancers with living near power lines, with magnetic fields in the home, and with exposure of parents to high levels of magnetic fields in the workplace. No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found. … No mechanism by which ELF-EMFs or radiofrequency radiation could cause cancer has been identified. … Studies of animals have not provided any indications that exposure to ELF-EMFs is associated with cancer."

200 2019 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2019

"The Committee's position, based on the research reviewed by the Committee, is that there is no substantive evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 12]

199 2019 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 134]

198 2019 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Thirteenth Report from SSM's Scientific Council on Electromagnetic Fields

"No new causal relationship between EMF exposure and health risks have been established." [p. i] "Regarding the exposure to ELF magnetic fields and the development of childhood leukaemia, the latest studies did not consistently observe an association. However, these studies did not use new approaches and the same limitations as in previous research apply. Thus, the conclusion from previous Council reports still holds: epidemiologically, associations have been observed, but a causal relationship has not been established." [pp. 5-6]

197 2018 New Zealand Ministry of Health

Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2018

"Overall, the picture is still largely unchanged since the publication of the WHO (2007) review. The possibility that long-term exposures to relatively strong magnetic fields (albeit low in comparison with the recommended exposure limits) somehow increases the risk of developing childhood leukaemia remains an open question. The results from epidemiological studies are not supported by laboratory research, and researchers agree that even if a causal relationship existed, ELF magnetic fields would be responsible for only a small fraction of childhood leukaemia cases. Research on possible links with neurodegenerative diseases has not provided consistent results." [p. 14]

196 2018 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2018

"The Committee's position, based on the research reviewed by the Committee, is that there is no substantive evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 12]

195 2018 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 141]

194 2018 Health Council of the Netherlands

Power lines and health part 1: childhood cancer

"Overall, based on the available data on associations between magnetic field strength and an increased risk of childhood leukaemia, the Committee sees 'suggestions' of a causal relationship. According to the Committee, the EPA classifications 'causal relationships likely' and 'causal relationship proven' are not applicable, because there is hardly any additional evidence from animal experiments or in vitro studies, and a clear insight into a possible underlying mechanism has not yet been provided." [p. 24]

193 2018 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Twelfth Report from SSM's Scientific Council on Electromagnetic Fields

"Regarding the exposure to ELF magnetic fields (ELF-MF) and the development of childhood leukaemia, the latest studies did not consistently observe an association. However, these did not use new approaches and the same limitations as in previous research apply. Thus, the conclusion from previous Council reports still holds: associations have been observed, but a causal relationship has not been established." [p. 6]

192 2017 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2017

"The committee's position, based on the research reviewed by the committee, is that there is no substantive evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 19]

191 2017 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 141]

190 2016 Institution of Engineering and Technology

Do low-level Electromagnetic Fields up to 300 GHz harm us?

"At power frequencies (50 or 60 Hz, as used for electricity supply), the balance of evidence from the large body of scientific papers, built up over several decades, suggests that the existence of harmful health effects from environmental levels of exposure remains unsubstantiated." [p. 2]

189 2016 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2016

"The Committee's position, based on the research reviewed by the committee, is that there is no substantive evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 17]

188 2016 U.S. National Institutes of Health U.S. National Cancer Institute

Electromagnetic Fields and Cancer

"Numerous epidemiologic studies and comprehensive reviews of the scientific literature have evaluated possible associations between exposure to non-ionizing EMFs and risk of cancer in children. (Magnetic fields are the component of non-ionizing EMFs that are usually studied in relation to their possible health effects.) Most of the research has focused on leukemia and brain tumors, the two most common cancers in children. Studies have examined associations of these cancers with living near power lines, with magnetic fields in the home, and with exposure of parents to high levels of magnetic fields in the workplace. No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found." [p. 3]

187 2016 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Eleventh Report from SSM's Scientific Council on Electromagnetic Fields

"Regarding the exposure to ELF magnetic fields (ELF-MF) and the development of childhood leukaemia, the latest studies did not consistently observe an association. However, these did not use new approaches and the same limitations as in previous research apply. Thus, the conclusion from previous Council reports still holds: associations have been observed, but a causal relationship has not been established." [p. 16]

186 2016 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 138]

185 2015 National Institute for Public Health and the Environment of the Netherlands, Report Prepared for Irish Ministry of Health

Electromagnetic Fields in the Irish Context

"To date, there is insufficient evidence to establish a causal relationship between exposure to ELF magnetic and electric fields and cancers. However, epidemiological studies have indicated a statistical relationship between long-lasting exposure to ELF magnetic fields from power lines and a more frequent occurrence of childhood leukaemia. Other studies have been unable to discover a mechanism that could explain this association. This means that the assumption of a causal relationship cannot be supported, in spite of the number of studies that have been undertaken since 1979." [pp. 9-10]

184 2015 Australian Radiation Protection and Nuclear Safety Agency

Electricity and Health

"The scientific evidence does not establish that exposure to ELF EMF found around the home, the office or near powerlines and other electrical sources is a hazard to human health." [p. 2]

183 2015 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 128]

182 2015 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2015

"The Committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 16]

181 2015 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Tenth Report from SSM's Scientific Council on Electromagnetic Fields

"Regarding the exposure to ELF magnetic fields (ELF-MF) and the development of childhood leukaemia, the latest studies did not consistently observe an association. However, these did not use new approaches and the same limitations as in previous research apply. Thus, the conclusion from previous Council reports still holds: associations have been observed, but a causal relationship has not been established." [p. 9]

180 2015 New Zealand Ministry of Health

Interagency Committee on the Health Effects of Non-ionizing Fields: Report to Ministers 2015

"Overall, the picture is largely unchanged since publication of the WHO review in 2007. The possibility that long-term exposures to relatively strong magnetic fields (albeit low in comparison to the recommended exposure limits) remains an open question, with the results from epidemiological studies not supported by laboratory research, and agreement that even if there were to be a causal relationship, ELF magnetic fields would only be responsible for a small fraction of childhood leukaemia cases. Research on possible links with neurodegenerative diseases has provided no consistent results." [p. 10]

179 2015 European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)

Health Effects of Exposure to EMF

"Overall, existing studies do not provide convincing evidence for a causal relationship between ELF MF exposure and self-reported symptoms. The new epidemiological studies are consistent with earlier findings of an increased risk of childhood leukaemia with estimated daily average exposures above 0.3 to 0.4 µT (3-4 mG). As stated in the previous Opinions, no mechanisms have been identified and no support is existing from experimental studies that could explain these findings, which, together with shortcomings of the epidemiological studies prevent a causal interpretation." [p. 7]

178 2014 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2014

"The Committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 11]

177 2014 Institution of Engineering and Technology

Are there harmful Biological Effects of Low-Level Electromagnetic Fields at frequencies up to 300 GHz – 2014 Position Statement

"At power frequencies (50 or 60 Hz, as used for electricity supply), the balance of evidence from the large body of scientific papers built up over several decades suggests that the existence of harmful health effects from environmental levels of exposure remains unsubstantiated." [p. 3]

176 2014 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 132]

175 2014 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk – Ninth Report from SSM's Scientific Council on Electromagnetic Fields, 2014

"Regarding the exposure to ELF magnetic fields and the development of childhood leukaemia, the conclusion from previous Council reports still holds: a consistent association has been observed, but a causal relationship has not been established." [p. 8]

174 2013 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2013

"The Committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans. The additional evidence reviewed by the committee during the year has not altered that position." [p. 10]

173 2013 Institution of Engineering and Technology

Factfile: Electromagnetic Fields and Health

"[O]verall the evidence that magnetic fields cause cancer, even for [childhood leukaemia], is weak, a view endorsed by the PHE and the World Health Organization. One major consideration is that the limited epidemiological evidence has no real support from the majority of laboratory studies that have been performed. Frequently, when a seemingly positive laboratory result is reported, other scientists are unable to reproduce it, casting doubt on all such results. Further, scientists have been unable to demonstrate a plausible biophysical mechanism whereby these effects may occur." [p. 4] [back]

172 2013 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Chemical Substances and Physical Agents

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 134]

171 2013 Swedish Radiation Safety Authority (SSM)

Eight Report from SSM's Scientific Council on Electromagnetic Fields

"Regarding the exposure of ELF magnetic fields and the development of childhood leukaemia, the conclusion from previous Council reports still holds: a consistent association has been observed, but a causal relationship has not been established…. Because no new studies on residential exposure to ELF magnetic fields and Alzheimer's disease have appeared since the last report, the corresponding uncertainty remains unchanged. Only little new information regarding parental exposure and risk of childhood cancer has become available, which does not materially change the conclusion from the previous report: 'There appears to be little support for the hypothesis relating parental exposure to cancer in the offspring.' New evidence regarding adult brain tumours and leukaemia and exposure to high voltage power lines were compatible with an earlier meta-analysis that showed very small increased risks in those exposed." [p. 7, 8]

170 2012 Institution of Engineering and Technology Biological Effects Policy Advisory Group (BEPAG)

The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz – 2012 Position Statement

"BEPAG has concluded that the balance of scientific evidence to date does not indicate that harmful effects occur in humans due to low-level exposure to EMFs." [p. 3]

169 2012 Health Canada

It's Your Health: Electric and Magnetic Fields

"The International Agency for Research on Cancer (IARC) has classified ELF magnetic fields as "possibly carcinogenic to humans". The IARC classification of ELF magnetic fields reflects the fact that some limited evidence exists that ELF magnetic fields might be a risk factor for childhood leukemia. However, the vast majority of scientific research to date does not support a link between ELF magnetic field exposure and human cancers. At present, the evidence of a possible link between ELF magnetic field exposure and cancer risk is far from conclusive and more research is needed to clarify this "possible" link." [p. 2]

168 2012 European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN)

Risk analysis of human exposure to electromagnetic fields (revised)

"Although numerous studies have been completed in this field, the evidence remains ambiguous. The major reasons for this are that study results are inconsistent and many studies have suffered from methodological shortcomings.... For none of the diseases is there sufficient evidence for a causal association between exposure to low frequency fields and the risk of the respective disease." [pp. 6, 10]

167 2012 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2012

"The committee's position is that, based on the entire database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 9]

166 2011 German Commission on Radiological Protection (SSK)

Comparative Assessment of the Evidence of Cancer Risks from Electromagnetic Fields and Radiation

"Epidemiological studies offer incomplete evidence for a link between exposure to ELF magnetic fields and the risk of developing childhood leukaemia, but this is not supported by action models or other investigative approaches. Overall, therefore, there is only weak evidence for a link with childhood leukaemia; this conclusion is in agreement with IARC's classification (Table 6). There is a lack of or insufficient evidence for a link with other types of cancer in adolescents and with cancer, including leukaemia, in adult." [p. 49]

165 2011 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2011

"The committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans. The additional evidence reviewed by the committee during the year has not altered its position." [p. 10]

164 2011 Canadian Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC)

Radiation Issue Notes: Power Frequency Electric and Magnetic Fields

"In summary, it is the opinion of the Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC) that there is insufficient scientific evidence showing exposure to EMFs from power lines can cause adverse health effects such as cancer." [p. 1]

163 2010 International Commission On Non-Ionizing Radiation Protection (ICNIRP)

ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)

"It is the view of ICNIRP that the currently existing scientific evidence that prolonged exposure to low frequency magnetic fields is causally related with an increased risk of childhood leukemia is too weak to form the basis for exposure guidelines. In particular, if the relationship is not causal, then no benefit to health will accrue from reducing exposure." [p. 824]

162 2010 Swedish Radiation Safety Authority (SSM)

Recent Research on EMF and Health Risk: Seventh annual report from SSM's Independent Expert Group on Electromagnetic Fields

"For ELF magnetic fields and risk of childhood leukaemia, previous conclusions still hold: a consistent association has been observed, but a causal relationship has not been established. Evidence regarding breast cancer weighs against an increased risk. Little new information has become available concerning parental exposure and risk of childhood cancer. Some evidence for a possible association of Alzheimer"s disease with ELF magnetic field exposure has been obtained and further research is warranted." [p. 5]

161 2010 French Agency for Environmental and Occupational Health Safety (AFSSET—Agence Française de Sécurité Sanitaire de L'Environnement et du Travail)

Health Effects of ELF Electromagnetic Fields (translated from French)

"With regard to possible long-term effects, there is a strong convergence between the different assessments of international expertise (organizations, experts or research groups groups), which are maintained over time. An association between exposure to extremely low frequency magnetic fields and childhood leukemia, from a residential exposure averaged 0.2 to 0.4 microT was shown with some consistency of epidemiological studies, but an interpretation of the correlation terms of cause and effect is not supported by studies on animals or by in vitro studies in cell systems." [p. 12]

160 2010 Health Canada

Electric and Magnetic Fields at Extremely Low Frequencies

"You do not need to take action regarding daily exposures to electric and magnetic fields at extremely low frequencies. There is *no conclusive evidence* of any harm caused by exposures at levels found in Canadian homes and schools, including those located just outside the boundaries of power line corridors." [p. 2]

"At present, there are no Canadian government guidelines for exposure to EMFs at ELF. Health Canada does not consider guidelines for the Canadian public necessary because the scientific evidence is not strong enough to conclude that exposures cause health problems for the public." [p. 2]

159 2010 European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN)

Risk analysis of human exposure to electromagnetic fields

"Although numerous studies have been completed in this field, the evidence remains ambiguous. The major reasons are that study results are inconsistent and many studies suffered from methodological shortcomings. …For none of the diseases is there sufficient evidence for a causal association between exposure to low frequency fields and the risk of the respective disease. [pp. 5, 7]

158 2010 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Physical Agents in the Work Environment

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 124]

157 2010 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2010

"The Committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 12]

156 2010 European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN)

Report on the analysis of risks associated to exposure to EMF: in vitro and in vivo (animals) studies

"The few new epidemiological and animal studies that have addressed ELF exposure and cancer do not change the previous assessment that ELF magnetic fields are a possible carcinogen and might contribute to an increase in childhood leukaemia. At present, in-vitro studies did not provide a mechanistic explanation of this epidemiological finding. … Many new findings have been published in the last years. They are mostly uncorrelated and performed under high-level exposure, i.e., in the mT range. Moreover, most of them are not addressing the main issue, which is the association between exposure and childhood leukaemia." [pp. 18, 22]

155 2010 Institution of Engineering and Technology Biological Effects Policy Advisory Group (BEPAG)

The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz – 2010 Position Statement

"BEPAG has concluded that the balance of scientific evidence to date does not indicate that harmful effects occur in humans due to low-level exposure to EMFs. This conclusion is the same as that reached in its previous position statements, the last being in May 2008, and our findings have not been substantially altered by the peer-reviewed literature published in the past two years." [p. 3]

154 2009 Australian Radiation Protection and Nuclear Safety Agency

Magnetic & Electric Fields From Power Lines

"On balance, the scientific evidence does not indicate that exposure to 50 Hz EMFs found around the home, the office or near power lines is a hazard to human health." [p. 126]

153 2009 British Columbia Centre for Disease Control

Power Lines

"Results have not provided convincing evidence that exposure to ELF fields causes adverse health effects such as cancer. Epidemiological studies have not established an association between exposures to ELF fields and the development of cancer in adults. The epidemiological evidence associating cancer in children with exposure to ELF fields is inconclusive." [p. 126]

152 2009 Health Council of the Netherlands

Electromagnetic Fields: Annual Update 2008

"What remains is the possibility of long-term effects, especially with regard to a possible increase in the risk of childhood leukaemia. Epidemiological research has found an association between this and living close to overhead power lines and the long-term exposure to the stronger magnetic field associated with them. However, there are no indications that this link is causal." [p. 79]

151 2009 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Physical Agents in the Work Environment

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 126]

150 2009 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2009

"The Committee's position is that, based on the total database of scientific research, there is insufficient evidence to conclude that exposure to normally encountered environmental levels of power frequency electromagnetic fields causes adverse health effects in humans." [p. 11]

149 2009 European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)

Health Effects of Exposure to EMF

"In its opinion from 2007 the SCENIHR concluded that the previous conclusion regarding ELF fields is still valid, i.e. ELF magnetic fields are a possible carcinogen. It was also concluded that no consistent relationship between ELF fields and self-reported symptoms had been demonstrated. In addition, for breast cancer and cardiovascular disease, an association was considered unlikely. For neurodegenerative diseases and brain tumours, the link to ELF fields remained uncertain. Based on the scientific rationale presented here the SCENIHR has updated the previous opinion and concludes the following: The new information available is not sufficient to change the conclusions of the 2007 opinion." [p. 9]

148 2008 Health Council of the Netherlands

Advisory Letter on BioInitiative Report

"In view of the way the BioInitiative report was compiled, the selective use of scientific data and the other shortcomings mentioned above, the Committee concludes that the BioInitiative report is not an objective and balanced reflection of the current state of scientific knowledge. Therefore, the report does not provide any grounds for revising the current views as to the risks of exposure to electromagnetic fields." [p. 4]

147 2008 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Physical Agents in the Work Environment

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 128]

146 2008 Canadian Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC)

Response Statement to Public Concerns Regarding Electric and Magnetic Fields (EMFs) from Electrical Power Transmission and Distribution Lines

"In summary, it is the opinion of the Federal-Provincial-Territorial Radiation Protection Committee that there is insufficient scientific evidence showing exposure to EMFs from power lines can cause adverse health effects such as cancer. Therefore, a warning to the public to avoid living near or spending time in proximity to power lines is not required." [p. 1]

145 2008 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2008

"The additional evidence reviewed by the Committee concerning possible health effects of power frequency electromagnetic fields has not altered the Committee's position that based on the total database of scientific research, there is insufficient evidence to conclude that exposure to the normally encountered environmental levels cause adverse health effects in humans." [p. 10]

144 2008 Health Council of the Netherlands

Advisory Letter: Power lines and Alzheimer's Disease

"On the basis of the epidemiological data currently available, the Committee cannot draw any conclusions on a possible causal relationship between prolonged exposure to low-frequency magnetic fields and an elevated risk of death caused by or involving Alzheimer's disease. Moreover, there are currently no indications for a biological mechanism." [p. 2]

143 2007 World Health Organization

Extremely Low Frequency Fields – Environmental Health Criteria Monograph No. 238

"Scientific evidence suggesting that everyday, chronic, low-intensity ELF magnetic field exposure poses a possible health risk is based on epidemiological studies demonstrating a consistent pattern of an increased risk of childhood leukaemia. Uncertainties in the hazard assessment include the role of control selection bias and exposure misclassification. In addition, virtually all of the laboratory evidence and the mechanistic evidence fails to support a relationship between low-level ELF magnetic field exposure and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal and therefore ELF magnetic fields remain classified as possibly carcinogenic. [p. 350-351]

"[T]he evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted." [p. 355 -56]

[E]lectric power brings obvious health, social and economic benefits, and precautionary approaches should not compromise these benefits. Furthermore, given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus the costs of precautionary measures should be very low." [p. 13]

142 2007 Republic of Ireland Department of Communications, Marine and Natural Resources Expert Group on Health Effects of Electromagnetic Fields

Health Effects of Electromagnetic Fields

"No adverse health effects have been established below the limits suggested by international guidelines. There is limited scientific evidence of an association between ELF magnetic fields and childhood leukaemia. This does not mean that ELF magnetic fields cause cancer, but the possibility cannot be excluded. However considerable research carried out in laboratories has not supported this possibility, and overall the evidence is considered weak, suggesting it is unlikely that ELF magnetic fields cause leukaemia in children. Nevertheless the evidence should not be discounted and so no or low cost precautionary measures to lower people's exposure to these fields have been suggested." [p. 3]

141 2007 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report 2007

"The additional evidence reviewed by the Committee concerning possible health effects of power frequency electromagnetic fields has not altered the Committee's position that based on the total database of scientific research, there is insufficient evidence to conclude that exposure to the normally encountered environmental levels cause adverse health effects in humans." [p. 8]

140 2007 European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)

Possible Effects of Electromagnetic Fields (EMF) on Human Health

"The previous conclusion that ELF magnetic fields are a possible carcinogen, chiefly based on childhood leukaemia results, is still valid. There is no generally accepted mechanism to explain how ELF magnetic field exposure may cause leukaemia. Animal studies have not provided adequate evidence for a causal relationship. No consistent relationship between ELF fields and self-reported symptoms (sometimes referred to as electrical hypersensitivity) has been demonstrated. In addition, for breast cancer and cardiovascular disease, recent research has indicated that an association is unlikely. For neurodegenerative diseases and brain tumours, the link to ELF fields remains uncertain." [p. 41-42]

139 2007 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Physical Agents in the Work Environment

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p.123]

138 2006 U.K. Health Protection Agency Advisory Group on Non-Ionizing Radiation

Power Frequency Electromagnetic Fields, Melatonin and the Risk of Breast Cancer

"On the basis of the epidemiological data currently available, the There is no consistent evidence, from research using cells, animals and humans, that EMF exposure is a cause of breast cancer, nor has any mechanism for such an association been demonstrated. … In aggregate, the evidence to date does not support the hypothesis that exposure to power frequency EMFs affects melatonin levels or risk of breast cancer." [p. 161]

137 2006 Institution of Engineering and Technology Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields

The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz – IET Position Statement – May 2006

"The Institution of Engineering and Technology … has concluded that the balance of scientific evidence to date does not indicate that harmful effects occur in humans due to low-level exposure to electromagnetic fields ("EMF"). … In summary, the absence of robust new evidence of harmful effects of EMFs in the past two years is reassuring. The Group is of the opinion that this should be a major factor to take into account by policy makers when considering both the implementation of precautionary approaches to public exposure and also during the development of exposure guidelines. [p. 1-2]

136 2006 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report for the year ending September 2006

"The additional evidence reviewed by the Committee concerning possible health effects of power frequency electromagnetic fields has not altered the Committee's position that based on the total database of scientific research, there is insufficient evidence to conclude that exposure to the normally encountered environmental levels cause adverse health effects in humans." [p. 11]

135 2006 Swedish Radiation Protection Institute (SSI)

Recent Research on EMF and Health Risks: Fourth Annual Report from SSI's Independent Expert Group on Electromagnetic Fields

"The majority of previous animal and in vitro studies have found no evidence of genotoxicity of ELF magnetic fields at field strengths relevant to human exposure. The results of recent studies have not strengthened the evidence of genotoxic effects from ELF magnetic fields alone." [p. 4]

"It is widely agreed that while epidemiology consistently demonstrates an association between ELF magnetic fields and increased occurrence of childhood leukaemia, the little support from observations in experimental models on leukaemia and the lack of support for plausible biophysical mechanisms of action leads to a rather weak overall evaluation: in IARC's terminology ELF magnetic fields are considered as 'possibly carcinogenic to humans' (Group 2B)." [p. 14]

134 2005 British Columbia Centre for Disease Control

Health Concerns of Power Frequency Electric and Magnetic Fields

"Epidemiological studies (study of the various factors influencing the occurrence of disease in a defined human population) have not established an association between exposure to the fields the development of cancer in adults. The evidence associating cancer in children with exposure to power-frequency EMF's is considered inconclusive for higher field exposures and not established for lower field exposures. Therefore the available scientific evidence to date does not support the assumption that adverse health effects from exposure to these fields at levels normally encountered in our homes, schools and offices pose a risk to human health." [p. 1]

133 2005 American Conference of Governmental Industrial Hygienists

Threshold Limit Values for Physical Agents in the Work Environment

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 146]

132 2005 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report for the year ending September 2005

"The additional evidence reviewed by the Committee concerning health effects of power frequency has supported the Committee's position that overall, there is insufficient evidence to conclude that exposure to power frequency electric and magnetic fields, normally encountered in the environment, causes adverse health effects in humans." [p. 24]

131 2005 Health Council of the Netherlands Electromagnetic Fields Committee

Electromagnetic Fields: Annual Update 2005

"All things considered, the evidence of DNA damage in the REFLEX study is weak. The Committee also emphasizes the fact that this is *in vitro* research, i.e. research on cells that are in an unnatural situation. For example, cells derived from tissues or organs do not have the opportunity to interact. It is highly questionable whether cells react in the same way under such circumstances as they would in a natural situation. If effects are, in fact, identified in such *in vitro* research, it is still questionable whether they will also occur *in vivo* and if so, whether they can then give rise to health effects." [p. 119]

130 2005 Canadian Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC)

Health Effects and Exposure Guidelines Related to Extremely Low Frequency Electric and Magnetic Fields

"Based on the available scientific evidence to date, the Federal Provincial Territorial Radiation Protection Committee (FPTRPC) concludes that adverse health effects from exposure to power-frequency EMFs, at levels normally encountered in homes, schools and offices, have not been established." [p. 268]

129 2004 U.K. National Radiological Protection Board

Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300 GHz)

"In the view of the NRPB, the epidemiological evidence that time-weighted average exposure to power frequency magnetic fields above 0.4 μ T [4 mG] is associated with a small absolute raised risk of leukaemia in children is, at present, an observation for which there is no sound scientific explanation. There is no clear evidence of a carcinogenic effect of ELF EMFs in adults and no plausible biological explanation of the association can be obtained from experiments with animals or from cellular and molecular studies." [p. 15]

128 2004 Institution of Electrical Engineers Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields

The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz – IEE Position Statement – May 2004

"The Institution of Electrical Engineers Policy Advisory Group on the Biological Effects of low-level Electromagnetic Fields (the "Group") has concluded that the balance of scientific evidence does not indicate that harmful effects occur in humans due to low-level electromagnetic field exposure. This conclusion is the same as that reached in its previous position statements, the last being in May 2002 and has not been changed by the peer-reviewed literature of the past two years." [p. 1]

127 2004 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV [Threshold Limit Value] for time-weighted average exposures." [p. 142]

126 2004 Connecticut Department of Public Health Division of Environmental Epidemiology & Occupational Health

Electromagnetic Fields (EMF): Health Concerns

"Despite extensive research over the past 20 years, the health risk caused by EMF exposure remains an open question. Two national research organizations have looked at the studies and have concluded that there is not strong evidence suggesting that EMF exposures pose a health risk. However, some studies have shown a weak link between household EMF exposure and a small increased risk of childhood leukemia at average exposures above 3 mG. For cancers other than childhood leukemia, none of the studies provide evidence of an association." [p. 2]

125 2003 Florida Department of Environmental Protection

2003 Annual Report on EMF Research

"Over the last six years a number of scientific and governmental organizations have reviewed EMF health effects research. … The conclusion of the reviewing scientific committees is that there is no consistent, significant link between cancer and power line EMFs." [pp. 2-3]

124 2003 Australian Radiation Protection and Nuclear Safety Agency

The Controversy Over Electromagnetic Fields and Possible Adverse Health Effects

"On balance, the scientific evidence does not indicate that exposure to 50 Hz EMFs found around the home, the office or near power lines is a hazard to human health." [p. 4]

123 2003 International Commission on Non-Ionizing Radiation Protection (ICNIRP)

Exposure to Static and Low Frequency Electromagnetic Fields, Biological Effects and Health Consequences (0-100 kHz)

"In the absence of evidence from cellular or animal studies, and given the methodological uncertainties and in many cases inconsistencies of the existing epidemiological literature, there is no chronic disease outcome for which an aetiological relation to EMF exposure can be regarded as established." [p. 479]

122 2003 Health Council of the Netherlands Electromagnetic Fields Committee

Electromagnetic Fields: Annual Update 2003

"What are the ramifications of this [IARC] conclusion? Firstly, the Committee emphasizes that this does not mean that ELF magnetic fields are actually carcinogenic, simply that they *might* be. … The Committee, like the IARC itself, points out that there is no evidence to support the existence of a causal relationship here. Nor has research yet uncovered any evidence that a causal relationship might exist." [pp. 75-76]

121 2003 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for the time-weighted average exposures." [p. 144]

120 2003 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report of the Radiation Advisory Committee for the year ending September 2003

"The additional evidence concerning health effects of electromagnetic fields reviewed by the Committee during the past year has not been sufficiently compelling to alter the Committee's position concerning the issue. That is that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electric and magnetic fields." [p. 20]

119 2002 U.S. National Institutes of Health U.S. National Institute of Environmental Health Sciences (NIEHS)

EMF Questions & Answers: Electric and Magnetic Fields Associated with the Use of Electric Power

"Over the past 25 years, research has addressed the question of whether exposure to power-frequency EMF might adversely affect human health. For most health outcomes, there is no evidence that EMF exposures have adverse effects. There is some evidence from epidemiology studies that exposure to power-frequency EMF is associated with an increased risk for childhood leukemia. This association is difficult to interpret in the absence of reproducible laboratory evidence or a scientific explanation that links magnetic fields with childhood leukemia." [p. 57]

118 2002 Institution of Electrical Engineers Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields

The Possible Harmful Biological Effects of Low Level Electromagnetic Fields of Frequencies up to 300 GHz

"The Institution of Electrical Engineers Policy Advisory Group on the Biological Effects of Low Level Electromagnetic Fields has concluded that there is still no convincing scientific evidence that shows harmful effects of low-level electromagnetic fields on humans." [p. 1]

117 2002 Minnesota State Interagency Working Group on EMF Issues

A White Paper On Electric and Magnetic Field (EMF) Policy and Mitigation Options

"The Minnesota Department of Health concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse health effects." [p. 36]

116 2002 Australian Radiation Protection and Nuclear Safety Agency

Electricity and Health

"The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health. In view of the epidemiological studies, however, the possibility remains that intense and prolonged exposures to magnetic fields may increase the risk of leukaemia in children. If exposure to higher-than-normal magnetic fields does actually cause leukaemia at the level indicated in the Doll report, then, on average, there would be one extra case in Australia every two years. The evidence does not allow health authorities to decide whether there is a specific magnetic field level above which continuous exposure is dangerous or compromises human health." [p. 4]

115 2002 Italy - Ministries of Environment, Health & Telecommunications International Evaluation Committee to Investigate the Health Risks of Exposure to Electric, Magnetic, and Electromagnetic Fields

Statement of the International Evaluation Committee

"Reviews of current scientific information have all indicated that, while there are gaps in knowledge requiring further research before better health risk assessments can be made, there have not been any adverse health consequences confirmed from EMF exposures below the ICNIRP (1998) guideline limits." [p. 2]

114 2002 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time-weighted average exposures." [p. 144]

113 2002 California Department of Health Services California EMF Program

An Evaluation of the Possible Risks from Electric and Magnetic Fields (EMFs) from Power Lines, Internal Wiring, Electrical Occupations and Appliances

"To one degree or another all three of the DHS scientists are inclined to believe that EMFs can cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's Disease, and miscarriage. They strongly believe that EMFs do not increase the risk of birth defects, or low birth weight. They strongly believe that EMFs are not universal carcinogens, since there are a number of cancer types that are not associated with EMF exposure. To one degree or another they are inclined to believe that EMFs do not cause an increased risk of breast cancer, heart disease, Alzheimer's Disease, depression, or symptoms attributed by some to a sensitivity to EMFs. However, all three scientists had judgments that were close to the dividing line between believing and not believing that EMFs cause some degree of increased risk of suicide, or for adult leukemia, two of the scientists are close to the dividing line between believing or not believing and one was prone to believe that EMFs cause some degree of increased risk." [p. 3]

112 2002 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report of the Radiation Advisory Committee

"The additional evidence concerning health effects of electromagnetic fields reviewed by the Committee during the past year has not been sufficiently compelling to alter the Committee's position concerning the issue. That is that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electric and magnetic fields." [p. 25]

111 2001 Florida Department of Environmental Protection

2001 Annual Report on EMF Research

"We seem to be approaching a time when some aspects of EMF exposure may be deemed a slight risk, but we are still lacking knowledge of EMF impact mechanisms and adequate scientific proof to allow a valid estimate of risk to the public and the knowledge to set a regulatory standard to manage the risk." [p. 5]

110 2001 World Health Organization

Electromagnetic Fields and Public Health: Extremely low frequency fields and cancer

"There is no consistent evidence that exposure to ELF fields experienced in our living environment causes direct damage to biological molecules, including DNA. Since it seems unlikely that ELF fields could initiate cancer, a large number of investigations have been conducted to determine if ELF exposure can influence cancer promotion or co-promotion. Results from animal studies conducted so far suggest that ELF fields do not initiate or promote cancer. However, two recent pooled analyses of epidemiological studies provide insight into the epidemiological evidence that played a pivotal role in the IARC evaluation. These studies suggest that, in a population exposed to average magnetic fields in excess of 0.3 to 0.4 μT, twice as many children might develop leukaemia compared to a population with lower exposures. In spite of the large number data base, some uncertainty remains as to whether magnetic field exposure or some other factor(s) might have accounted for the increased leukaemia incidence." [p. 3]

109 2001 International Commission on Non-Ionizing Radiation Protection, Standing Committee on Epidemiology

Review of the Epidemiologic Literature on EMF and Health

"In the absence of experimental evidence and given the methodological uncertainties in the epidemiologic literature, there is no chronic disease for which an etiological relation to EMF can be regarded as established. … Among all the outcomes evaluated in epidemiologic studies of EMF, childhood leukemia in relation to postnatal exposures above 0.4 μT is the one for which there is most evidence of an association. … On the basis of epidemiologic findings, evidence shows an association of amyotrophic lateral sclerosis with occupational EMF exposure although confounding is a potential explanation. Breast cancer, cardiovascular disease, and suicide, and depression remain unresolved." [p. 911]

108 2001 U.K. National Radiological Protection Board Advisory Group on Non-Ionizing Radiation

ELF Electromagnetic Fields and Neurodegenerative Disease

"There is no good ground for thinking that exposure to extremely low frequency electromagnetic fields can cause Parkinson's disease and only very weak evidence to suggest that it could cause Alzheimer's disease." [p. 21]

107 2001 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report of the Radiation Advisory Committee

"The additional evidence concerning health effects of electromagnetic fields reviewed by the Committee during the past year has not been sufficiently compelling to alter the Committee's position concerning the issue. That is that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electric and magnetic fields." [p. 22]

106 2001 European Commission Directorate-General Health and Consumer Protection Scientific Committee on Toxicity, Ecotoxicity and the Environment

Opinion on Possible Effects of Electromagnetic Fields (EMF), Radiofrequency Fields (RF) and Microwave Radiation on Human Health

"Combined analysis of the epidemiological studies on the association between exposures to ELF and childhood leukaemia have strengthened the evidence of an association. However, given some inconsistencies in exposure measurements and the absence of other criteria commonly used in assessing causality (particularly a plausible explanation of underlying biological mechanisms, see above), the association does not meet adequate criteria for being causal. Thus, the overall evidence for 50/60 Hz magnetic fields to produce childhood leukaemia must be regarded as being limited. … There is no convincing suggestion of any other carcinogenic effect of ELF on either children or adults." [p. 10]

105 2001 German Commission on Radiological Protection (SSK)

Limit values and precautionary measures to protect the public against electromagnetic fields

"Since 1998, various results of studies involving animal experiments looking at a possible carcinogenic effect of low-frequency fields have been published. These results are mostly negative and tend to argue against the existence of a risk. … The link found in the epidemiological studies with the occurrence of leukaemia in children is insufficient with respect to the lack of evidence of carcinogenic effects in adults or a plausible explanation of the experiments carried out on animals and isolated cells, to warrant the unequivocal conclusion that the fields in question cause leukaemia in children." [Pt. 3.2.1]

104 2001 International Agency for Research on Cancer Working Group on the Evaluation of Carcinogenic Risks to Humans

Non-Ionizing Radiation, Part 1: Static and Extremely Low-Frequency (ELF) Electric and Magnetic Fields

"There is *limited evidence* in humans for the carcinogenicity of extremely low frequency magnetic fields in relation to childhood leukaemia. There is *inadequate evidence* in humans for the carcinogenicity of extremely low-frequency magnetic fields in relation to all other cancers. There is *inadequate evidence* in humans for the carcinogenicity of static electric or magnetic fields and extremely low-frequency electric fields. There is *inadequate evidence* in experimental animals for the carcinogenicity of extremely low-frequency magnetic fields. No data relevant to the carcinogenicity of static electric or magnetic fields and extremely low-frequency electric fields in experimental animals were available. Extremely low-frequency magnetic fields are *possible carcinogens to humans (Group 2B).*" [p. 338]

103 2001 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for the time-weighted average exposures." [p. 142]

102 2001 Health Council of the Netherlands Electromagnetic Fields Committee

Electromagnetic Fields: Annual Update 2001

"[R]ecent meta-analysis show a consistent association between relatively high measured or calculated magnetic field strengths and an increased risk of childhood leukaemia. However, from an epidemiological point of view, an association with a relative risk of smaller than 2 is to be considered as weak. … The committee would emphasize that there is no known mechanism that could account for the association referred to above. Because the association is weak and without a reasonable biological explanation, it is not unlikely that it could also be explained by chance or by an artifact. The committee therefore sees no reason to modify its earlier conclusion that the association is not likely to be indicative of a causal relationship. It therefore remains the committee's belief that it is not likely that children (or adults) living near to high-voltage power lines are at risk through exposure to electromagnetic fields generated by those lines." [p. 41]

101 2001 U.K. National Radiological Protection Board Report of an Advisory Group on Non-Ionising Radiation

ELF Electromagnetic Fields and the Risk of Cancer

"Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is, however, some epidemiologic evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children. … In the absence of clear evidence of a carcinogenic effect in adults, or of plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukaemia in children. Unless however, further research indicates that the finding is due to chance or some currently unrecognized artifact, the possibility remains that intense and prolonged exposures to magnetic fields can increase the risk of leukaemia in children." [p. 164]

100 2000 Swedish Council for Work Life Research Health Risks of EMF

Electromagnetic hypersensitivity and health risks from electric and magnetic fields. Research review and evaluation.

"*Extremely low frequency magnetic fields,* i.e. between 1 and 300 Hz, are regarded as possible carcinogenic factors, primarily based on the results of epidemiological studies. This evaluation is based on studies of leukemia in children living close to power lines, and studies of primarily chronic lymphatic leukemia among adults who in their work are exposed to elevated magnetic field levels. Concerning other cancer forms, scientific data are currently insufficient for any conclusions to be drawn. For neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS), and diseases in the cardiovascular system, some indications for effects of occupational exposure to extremely low frequency magnetic fields exist, but these indications are currently insufficient for conclusions." [p. 3]

99 2000 Virginia Department of Health Division of Health Hazards Control

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Final Report)

"Based on the review and analysis of the exhaustive literature review and other research projects completed under the EMF-RAPID program, the Virginia Department of Health is of the opinion that there is no conclusive and convincing evidence that exposure to extremely low frequency EMF emanated from nearby high voltage transmission lines in causally associated with an increased incidence of cancer or other detrimental health effects in humans." [p. 20]

98 2000 Radiation Advisory Committee (State of Victoria, Australia)

Annual Report of the Radiation Advisory Committee for the year ending September 2000

"The additional evidence concerning health effects of electromagnetic fields reviewed by the Committee during the past year has not been sufficiently compelling to alter the Committee's position concerning the issue. That is that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electric and magnetic fields." [p. 21]

97 2000 Health Council of the Netherlands ELF Electromagnetic Fields Committee

Exposure to electromagnetic fields (0 Hz – 10 MHz)

"The concern that is regularly voiced over supposed dangers of exposure to ELF EM fields is, in virtually every case, based on outcomes of the epidemiological research. The Committee finds that the quality of that research has improved substantially in recent years. However, it has not yet led to unequivocal, scientifically reliable conclusions. … Based on the totality of the results from epidemiological research, and taking into consideration the strengths and weaknesses of the different studies, the Committee believes that there is a reasonably consistent association between the occurrence of leukemia in children and residence near overhead power lines (both high-voltage and distribution lines). As has already been indicated, however, the date does not point directly to a causal link with exposure to ELF EM fields." [p. 41, 43]

96 2000 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for the time-weighted average exposures." [p. 147]

95 1999 U.S. National Institutes of Health U.S. National Institute of Environmental Health Sciences (NIEHS)

Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields

"The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm. The NIEHS concludes that ELF-EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern." [p. 36]

94 1999 Florida Department of Environmental Protection

1999 Annual Report on EMF Research

"The overall conclusion of the Department's review of the literature and the material presented at conferences is that here is still not conclusive scientific evidence of adverse health effects. There is no justification to warrant revising our regulatory standards." [p. 5]

93 1999 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for the time-weighted average exposures." [p. 143]

92 1999 U.S. National Academy of Sciences National Research Council

Research on Power-Frequency Fields Completed Under the Energy Policy Act of 1992

"We conclude that no finding from the EMF-RAPID program are alters the conclusion of the previous NRC review on the Possible Effects of Electromagnetic Fields on Biologic Systems (NRC 1997). In view of the negative outcomes of EMF-RAPID replication studies, it now appears even less likely that MFs in the normal domestic or occupational environment produce important health effects, including cancer." [p. 8]

91 1998 World Health Organization

WHO Fact Sheet No. 205: Electromagnetic Fields and Public Health: Extremely Low Frequency (ELF)

"There is no convincing evidence that exposure to ELF fields causes direct damage to biological molecules, including DNA. It is thus unlikely that they could initiate the process of carcinogenesis. However, studies are still underway to determine if ELF exposure can influence cancer promotion or co-promotion. Recent animal studies have no found evidence that ELF field exposure affects cancer incidence. … Therefore, a cause-and-effect link between ELF field exposure and cancer has not been confirmed." [p. 4]

90 1998 Virginia Department of Health Department of Hazards Control

Annual Report of the Virginia Department of Health on Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Thirteenth Annual Report)

"Based on the review and analysis of the available scientific literature to date, the preponderance of evidence for causation of cancer or any other deleterious effects in humans from exposure to EMF from nearby high voltage transmission lines is neither convincing nor consistent." [p. 25]

89 1998 Florida Department of Environmental Protection

1998 Annual Report on EMF Research

"There continue to be many more studies that fail to demonstrate adverse outcomes due to EMF exposure. However, there are still enough studies that hint of enough of a possibility of a biological impact that additional studies should be continued. There are still only a few studies that show bioeffects at magnetic field intensities likely to be experienced in normal lifestyle situations. … No one can demonstrate a scientifically valid, harmful dose of EMF. Consequently, no one can say what is harmful exposure or what is safe exposure. Based on my review of the scientific research and literature to date, I find no credible evidence at this time to support initiating a revision of Florida's existing EMF rules to more restrictive levels." [p. 5]

88 1998 Canadian Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC)

Health Effects and Exposure Guidelines Related to Extremely Low Frequency (ELF) 50/60 Hz Electric and Magnetic Fields: An Overview

"Research into the effects of (ELF) electric and magnetic fields have shown that some interaction between biological systems and the fields result in certain responses. However, significant detrimental interactions at ambient fields to which human and animals are typically exposed remains to be demonstrated. The research taken overall indicates that the evidence is insufficient to conclude that electric or magnetic fields cause a risk of cancer." [p. 9]

87 1998 International Commission on Non-Ionizing Radiation Protection (ICNIRP)

Guidelines for limiting exposure to time varying electric, magnetic and electromagnetic fields (up to 300 GHz)

"In the case of potential long-term effects of exposure, such as an increased risk in cancer, ICNIRP concluded that available data are insufficient to provide a basis for setting exposure restrictions, although epidemiological research has provided suggestive, but unconvincing, evidence of an association between possible carcinogenic effects and exposures at levels of 50/60 Hz magnetic flux densities substantially lower than those recommended in these guidelines." [p. 3]

86 1998 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for the time-weighted average exposures." [p. 144]

85 1997 Virginia Department of Health Department of Hazards Control

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Twelfth Annual Report)

"The results of most studies which imply a link between exposure to EMF and an increased risk of cancer are only suggestive and are far from elucidating causation. … Based on the available literature to date, the overall evidence for a causal link between exposure to power frequency EMF and increased incidence of cancer appears to be frail, contradictory and inconsistent, and lacks a clear dose-response pattern." [p. 19]

84 1997 U.S. National Academy of Sciences National Research Council

Possible Health Effects of Exposure to Residential Electric and Magnetic Fields

"Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects." [p. 1]

83 1996 Swedish National Board of Occupational Safety and Health
Swedish Board of Housing, Building and Planning
Swedish National Electrical Safety Board
Swedish National Board of Health & Welfare
Swedish Radiation Protection Institute

Low-Frequency Electrical and Magnetic Fields: The Precautionary Principle for National Authorities, Guidance for Decision-Makers

"The research findings presented hitherto afford no basis for and cannot be said to justify any limit values or other compulsory restrictions on low-frequency electrical and magnetic fields." [p. 2]

82 1996 European Commission
Directorate General For Employment, Industrial Relations, and Social Affairs

Public Health and Safety Work, Non-ionizing Radiation, Sources, Exposures and Health Experts

"There is no clear evidence that exposure to electromagnetic fields and radiation results in an increased risk of cancer. Whereas biological studies have demonstrated that UVR [ultraviolet radiation] can damage DNA directly and thereby initiate cancer, there is no such evidence in relation to electromagnetic fields. Neither is there persuasive evidence that electromagnetic fields can promote the development of cancer." [p. 1]

81 1996 U.K. National Radiological Protection Board

Radon and Electromagnetic Fields Seen as Separate Health Issues

"The position of the Board in relation to the possibility that EMFs induce cancer is that there is no convincing evidence that the electric and magnetic fields generated by overhead power lines or electrical apparatus are harmful to health." [p. 2]

80 1996 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Eleventh Annual Report)

"The preponderance of evidence for an increased risk of cancer in humans from exposure to EMF presented in the epidemiologic studies published so far, taken individually or collectively, can best be construed as tenuous, and does not allude to an inordinate hazard. … [I]t is not currently possible to state with any certainty that there is a human health risk associated with exposure to EMF or with living near high voltage transmission lines." [p. 18]

79 1996 U.S. National Institute for Occupational Safety and Health

NIOSH Fact Sheet: EMFs in the Workplace

"The National Institute for Occupational Safety and Health (NIOSH) and other government agencies do not consider EMFs a proven health hazard. Because some studies have associated high magnetic field exposures with increased cancer risks, the government will continue studying EMFs." [p. 5]

78 1995 Swedish Criteria Group for Physical Risk Factors

Epidemiological Studies of Possible Associations Between Occupational Exposure to Magnetic Fields and Cancer--A Review

"In conclusion, we find - despite the comparatively high degree of credibility that can be given positive findings in some studies - that the results of these studies have not with sufficient degree of certainty shown that occupational exposure to extremely low frequency magnetic fields is associated with cancer." [p. 24]

77 1995 Swedish National Board of Health & Welfare

Evaluation of the Effects of Electrical and Magnetic Fields.

"The existing epidemiological data cannot be used to support any definite conclusions as to whether exposure to electromagnetic fields increases the cancer-risk in any organ system." [p. 1]

76 1995 Swedish National Board of Health & Welfare

Can Electrical and Magnetic Fields Cause Adverse Health Effects?

"There is no convincing support for a connection between exposure to electric and magnetic fields (EMF) and health effects such as cancer and reproductive disorders (spontaneous abortions, low birth weight, miscarriages)." [p. 1]

75 1995 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Tenth Annual Report)

"In view of the inconsistent and contradictory results in the literature currently available, the notable lack of a dose-response or an exposure-effect relationship, as well as the constraints of epidemiologic studies, it is not yet possible to ascribe EMF from high voltage transmission lines as an etiologic factor for cancers in humans." [p. 3]

74 1995 Swedish Criteria Group for Physical Risk Factors

Magnetic Fields and Cancer: A Criteria Document

"After a review of studies of the possible cancer effect of magnetic fields, the Criteria Group concludes that these studies do not form the scientific basis for developing exposure limits for low-frequency magnetic fields under the 'health based threshold limits as a base for exposure limits' system." [p. 11]

73 1995 Swedish National Electrical Safety Board

Magnetic Fields - No Limit Values But Some Caution

"According to the authorities mutual evaluation, our knowledge regarding how weak magnetic fields affect humans is not sufficient to set any limit values. Suspicions of a link between exposure to magnetic fields and cancer do, however, allow for a certain amount of caution to be recommended." [p. 1]

72 1995 American Physical Society

Power Line Fields and Public Health

"The scientific literature and the reports of reviews by other panels show no consistent, significant link between cancer and power line fields. This literature includes epidemiological studies, research on biological systems, and analyses of theoretical interaction mechanisms. No plausible biophysical mechanisms for the systematic initiation or promotion of cancer by these power line fields have been identified. Furthermore, the preponderance of the epidemiological and biophysical/biological research findings have failed to substantiate those studies which have reported specific adverse health effects from exposure to such fields." [p. 1]

71 1995 European Committee for Electrotechnical Standardization (**Comite Europeen de Normalisation Electrotechnique)**

Human Exposure to Electromagnetic Fields Low-frequency (0 Hz to 10 kHz)

"Some epidemiological results suggest the possibility of other effects on health, including carcinogenesis, from exposure to fields at levels much lower than those given in this standard. During 1991 to 1994, several reviews of this questions were carried out by international and national bodies. These concluded that no adverse effects of such lower-level fields had been established." [p. 15]

70 1995 Australian Department of Health Radiation Advisory Committee

The Annual Report of the Radiation Advisory Committee for the Year Ending September 1995

"Overall there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electromagnetic fields." [p. 15]

69 1995 U.S. National Institute of Environmental Health Sciences & U.S. Department of Energy

Questions and Answers about EMF: Electric and Magnetic Fields Associated with Use of Electric Power

"Some epidemiological studies have suggested that a link may exist between exposure to power-frequency electric and magnetic fields (EMFs) and certain types of cancer, primarily leukemia and brain cancer. Other studies have found no such link. Laboratory researchers are studying how such an association is biologically possible. At this point, there is no scientific consensus about the EMF issue—except a general agreement that better information is needed. A national EMF research effort is under way, and major study results are expected in the next few years." [p. 1]

68 1994 American Medical Association Council on Scientific Affairs

Effects of Electric and Magnetic Fields

"[N]o scientifically documented health risk has been associated with the usually occurring levels of electromagnetic fields; nevertheless, the American Medical Association should continue to monitor developments and issues related to the subject." [p. 12]

67 1994 The Institution of Electrical Engineers

The Possible Biological Effects of Low-Frequency Electromagnetic Fields

"The studies surveyed this year do not show firm evidence of biological effects of low-level, low-frequency electromagnetic fields. The quest for such effects has been primarily driven by epidemiological studies that suggest a link between exposure and leukaemia and other cancers. A plausible mechanism to explain any such effects has yet to emerge and hence the relevant electromagnetic field parameters are not known." [p. 6]

66 1994 Connecticut Department of Environmental Protection and Department of Health Services Interagency Task Force Studying Electric and Magnetic Fields

Connecticut 1994 Report on Task Force Activities to Evaluate Health Effects From Electric and Magnetic Fields

"No definitive cause and effect relationship between exposure to EMF and an increase in health risk has been established." [p. 3]

65 1994 U.K. National Radiological Protection Board

Health Effects Related to the Use of Visual Display Units

"Thus, at present, there is no persuasive biological evidence that ELF electromagnetic fields can influence any of the accepted stages in carcinogenesis. There is no clear basis from which to derive a meaningful assessment of risk nor, is there any indication of how any putative risk might vary with exposure." [p. 80]

64 1994 Australian Department of Health and Community Services Radiation Advisory Committee

The Annual Report of the Radiation Advisory Committee For the Year Ending September 1994

"Overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power frequency electromagnetic fields." [p. 11]

63 1994 Swedish National Electrical Safety Board

Magnetic Fields -- Uncertainty Regarding Health Risks Remains

"Knowledge is currently insufficient regarding weak magnetic fields' affects on humans. Therefore, we do not have a basis of knowledge on which to set limits." [p. 25]

62 1994 Maryland Department of Natural Resources

Status Report on Potential Human Health Effects Associated with Power Frequency Electric and Magnetic Fields. Reporting Period: June 1993 - June 1994

"It is impossible to predict effects (or lack of effects) with any certainty, and it is not clear which biological effects observed in cellular or animal studies (if any) could have significant human health implications. [p. ES-2] … There is no definitive indication that EMF exposure does or does not cause adverse health effects." [p. X-9]

61 1994 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of high Voltage Transmission Lines (Ninth Annual Report)

"The scientific community has yet to arrive at a consensus on the issue of whether observed association between EMF exposure and disease incidence are causally linked." [p. 3]

60 1994 American Conference of Governmental Industrial Hygienists

TLVs and BEIs

"At this time, there is insufficient information on human responses and possible health effects of magnetic fields in the frequency range of 1 Hz to 30 kHz to permit the establishment of a TLV for time weighted average exposures." [p. 113]

59 1994 Danish Ministry of Health Expert Group on Non-Ionizing Radiation

Report on the risk of cancer in children living in homes exposed to 50 Hz magnetic fields from high-voltage lines

"The opinion of the group is that both the Danish and the Swedish study support the hypothesis of previous studies that children living near high-current plants have an increased frequency of cancer, but the results do not exclude the possibility that the association might be due to chance. If the increased cancer risk is due to 50 Hz magnetic fields, the uncertainty in the assessment of exposures to magnetic fields would result in a decreased association and thus a possible underestimation of the potential risk." [p. 65]

58 1993 Maryland Department of Natural Resources

Status Report on Potential Human Health Effects Associated with Power Frequency Electric and Magnetic Fields Reporting Period: June 1992-June 1993

"[I]t is still not possible to arrive at definitive conclusions regarding the health effects from EMF exposure, based on the existing body of scientific evidence. There is no definitive indication that EMF exposure does or does not cause adverse health effects." [p. X-7]

57 1993 American Industrial Hygiene Association

American Industrial Hygiene Association Expanded Position Statement on Extremely Low Frequency and Magnetic Fields

"At present, the AIHA finds that the lack of replicated studies, an accepted interaction mechanism in the laboratory studies, and an absence of significant associations with measured fields in the epidemiological studies, make it impossible to come to a definite decision regarding the magnitude of health effects associated with exposure to ELF." [p. 1]

56 1993 Connecticut Department of Environmental Protection and Department of Health Services Interagency Task Force Studying Electric and Magnetic Fields

Connecticut 1993 Report on Task Force Activities To Evaluate Health Effects From Electric And Magnetic Fields

"No definitive cause and effect relationship between exposure to EMF and an increase in health risk has been established." [p. 1-4]

55 1993 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Eighth Annual Report)

"Based on the information available to date, scientific consensus cannot incriminate exposure to EMF (including those from high voltage transmission lines) as an etiologic factor for cancer." [p. 3]

54 1993 Swedish National Electrical Safety Board

Magnetic Fields and Cancer

"Within the scientific community, there is general agreement that the connection between magnetic fields and cancer still lacks scientific verification while, at the same time, the suspicion that such a connection exists has grown stronger." [p. 1]

53 1993 Australian Department of Health and Community Services Radiation Advisory Committee

The Annual Report of the Radiation Advisory Committee For the Year Ending September 1993

"In the absence of a clearly identified mechanism of cancer initiation or promotion by magnetic fields it cannot be presumed that reducing field levels will reduce risk. … Clearly, the point has still not been reached where scientific studies can unequivocally lead to a conclusion that powerline magnetic fields either do or do not contribute to serious illness." [p. 25]

52 1993 Danish Ministry of Health SEIIS No. 2 Expert Group on Non-ionizing Radiation

Rapport on risiko for Kraeft ved udsaettelse for ekstreme lavfrekvente magnetfelter I arbejdet

"On the basis of the Swedish study in particular, the suspicions harbored by the task force regarding a link between exposure to magnetic fields and an increased risk for leukemia have been reinforced; however, it was also noted that there is no correlation between the latest studies. … The task force finds that the most recent studies have not increased the suspicion of a possible link between occupational exposure to low-frequency electromagnetic fields and an increased occurrence of brain cancer." [p. 96]

51 1993 Danish Ministry of Health SEIIS No. 1 Expert Group on Non-ionizing Radiation

Rapport on risiko for Kraeft hos bern med bopael eksponeret for 50 Hz magnetfelter fra hojspaendingsanlaeg

"The expert group believed that neither the earlier nor the latest studies offers sufficient documentation to characterize 50 Hz magnetic fields in homes adjacent to high-current electricity supply plants as a cancer-inducing factor among children. The studies described do not, however, allow this assumption to be dismissed." [p. 70]

50 1993 U.K. National Radiological Protection Board

Board Statement on Restrictions on Human Exposure to Static and Time Varying Electromagnetic Fields and Radiation

"[T]here is no clear evidence of adverse health effects at the levels of electromagnetic fields to which people are normally exposed. In particular, the epidemiological data do not provide a basis for restricting human exposure to electromagnetic fields and radiation…." [p. 1]

49 1993 U.S. National Academy of Sciences Committee on Assessment of the Possible Health Effects of Ground Wave Emergency Network Board on Radiation Effects Research Commission on Life Sciences National Research Council

Assessment of the Possible Health Effects of Ground Wave Emergency Network

"Taken as a whole, the epidemiological literature indicates that there are not enough data to identify unequivocally, let alone to quantify, ELF-related cancer risks." [p. 9]

48 1993 French National Institute of Health and Medical Research Department of the Partnership for Social and Economic Development

Effects des Champs Electriques et Magnetiques du Tres Basse Frequence sur la Sante: Analyse de la Litterature Epidemiologique

"As long as the possibility of a confounding effect has not been formally eliminated, EMF can not be formally incriminated [in childhood cancer]. [p. 29] … The results [of adult residential studies] do not indicate in general associations between the measurements of EMF and cancer in adults. [p. 31] … Among the effects considered in the present report, those that concern health in general, depression and suicide, reproduction, cancer in the children of exposed subjects, were evoked as a result of very few discordant studies, often with a methodology highly subject to criticism. At present, there does not seem to exist any serious argument that permits the implication of electric and magnetic fields in these pathologies." [p. 46]

47 1993 International Commission On Non-Ionizing Radiation Protection (ICNIRP)

Press Release, 12 May 1993

"The most recent data reflect some improvement in methodology in laboratory studies and in epidemiological studies of both occupational and general populations. After careful consideration of this evidence, the Commission concludes that the data related to cancer do not provide a basis for health risk assessment of human exposure to power frequency fields." [p. 1]

46 1993 U.S. Department of Energy Bonneville Power Administration

Electrical and Biological Effects of Transmission Lines: A Review

"During the last 10 years, the number of studies looking for an effect of powerlines on human health has continued to increase. Laboratory studies have documented some short-term changes in physiological functions in people exposed to electric and magnetic fields. No harmful effects have yet been identified, however." [p. 52]

45 1993 Oregon Department of Energy

Report of the EMF Committee to the Energy Facility Siting Council

"Some early epidemiological studies have suggested an association between EMF exposure and increased risk for diseases such as leukemia in children, brain cancer, male breast cancer, lymphoma, miscarriages and birth defects. However, research to date has not shown that EMF exposure causes these diseases." [p. 3]

44 1992 U.S. Environmental Protection Agency

Questions And Answers About Electric and Magnetic Fields (EMFs)

"The bottom line is that there is no established cause and effect relationship between EMF exposure and cancer or other disease. For this reason, we can't define a hazardous level of EMF exposure." [p. 9]

43 1992 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Seventh Annual Report)

"Based on the contradictory and inconclusive information available in the literature to date, it is impossible to ascertain whether or not electromagnetic fields from high voltage transmission lines pose an increased risk of cancer in humans." [p. 4]

42 1992 Health Council of the Netherlands

Extremely Low-Frequency Magnetic Fields and Health

"There is at present insufficient scientific proof that chronic exposure to ELF EMF with low field strengths as found in the domestic or professional environment results in adverse health effects. Such exposure neither influences the initiation or development of cancer, nor results in premature termination of pregnancy nor adversely influences fetal development." [p. 6]

41 1992 Victoria Department of Health (Australia) Health and Community Services

Report of the Panel on Electromagnetic Fields and Health to the Victorian Government

"At present there is no agreed scientific argument to specify a field value between safe and unsafe fields other than that set by the International Radiation Protection Association [IRPA]." [appendix 6, p. iv] … Because there is no established mechanism relating health and magnetic fields and because there is no certainty even that higher magnetic fields increase health risks, electricity supply authorities argue that there is no logic in specifying lower fields than those set by IRPA. … Electric field exposure has not been linked to health in studies so far undertaken." [appendix 6, p. 56]

40 1992 U.K. National Radiological Protection Board

Electromagnetic Fields and the Risk of Cancer

"In summary, the epidemiological findings that have been reviewed provide no firm evidence of the existence of a carcinogenic hazard from exposure of paternal gonads, the fetus, children, or adults to the extremely low frequency electromagnetic fields that might be associated with residence near major sources of electricity supply, the use of electrical appliances, or work in the electrical, electronic, and telecommunications industries. … In the absence of any unambiguous experimental evidence to suggest that exposure to these electromagnetic fields is likely to be carcinogenic, in the broadest sense of the term, the findings to date can be regarded only as sufficient to justify formulating a hypothesis for testing by further investigation." [p. 132]

39 1992 Department of Energy (Ireland)

Electromagnetic Fields: A Review of Recent Developments in Research and Public Attitudes, and the Response of Authorities to These Developments

"There is still no agreement among research workers that electromagnetic fields from powerlines are a potential hazard to health. [p. xviii] … Without exception these reports [from international agencies that have examined EMF] and the positions taken by the organizations concerned do not see enough evidence to be able to indict electromagnetic fields as a hazard to health." [p. xx]

38 1992 Oak Ridge Associated Universities Panel for the Committee on Interagency Radiation Research and Policy Coordination

Health Effects of Low-Frequency Electric and Magnetic Fields

"This review indicates that there is no convincing evidence in the published literature to support the contention that exposures to extremely low-frequency electric and magnetic fields (ELF-EMF) generated by sources such as household appliances, video display terminals, and local power lines are demonstrable health hazards. Epidemiologic findings of an association between electric and magnetic fields and childhood leukemia or other childhood or adult cancers are inconsistent and inconclusive. No plausible biological mechanism is presented that would explain causality. Neither is there conclusive evidence that these fields initiate cancer, promote cancer or influence tumor progression. Likewise, there is no convincing evidence to support suggestions that electric and magnetic fields result in birth defects or other reproductive problems. Furthermore, any neurobehavioral effects are likely to be temporary and do not appear to have health consequences." [p. ES-11]

37 1992 Texas Public Utility Commission

Health Effects of Exposure to Power-Frequency Electric and Magnetic Fields

"The Committee believes that, based on its evaluation of the existing EMF research, the evidence at this time is insufficient to conclude that exposure to EMF from electric power transmission lines poses an imminent or significant public health risk. … The Committee concludes that at present there is insufficient evidence regarding human health effects of EMF to provide the basis for a health-based standard." [p. xxi]

36 1992 Maryland Department of Natural Resources

Status Report on Potential Human Health Effects Associated with Power Frequency Electric and Magnetic Fields. Reporting Period: June 1991-June 1992

"The body of scientific evidence regarding the health effects from EMF exposure remains unclear. There is no definitive indication that EMF exposure does or does not cause adverse health effects." [p. VIII-12]

35 1992 Illinois Department of Public Health
Illinois Environmental Protection Agency

Possible Health Effects of Extremely Low Frequency Electric and Magnetic Field Exposure: A Review

"Whether these observed ELF bioeffects cause adverse health effects in humans and animals is not yet clear. No scientific consensus has been reached on this issue. Without sufficient information, health risks from exposure to these fields cannot be properly determined. [p. iii] … Because some studies have identified positive associations between ELF field exposure and certain adverse health effects, while other studies have not, the data obtained to date are far from conclusive." [p. 53]

34 1992 Connecticut Academy of Science and Engineering
Prepared for the Connecticut Department of Health Services

Response to Inquiry -- Electromagnetic Field Health Effects

"Absolute proof of the occurrence of adverse effects of ELF fields at prevailing magnitudes cannot be found in the available evidence, and the same evidence does not permit a judgment that adverse effects could not occur, as is true for any putative hazard without a solid base of evidence. … [T]he epidemiological literature does not presently support a conclusion that electromagnetic field exposure unequivocally increases risk for cancer or any other adverse health outcome." [p. 7]

33 1992 U. S. Environmental Protection Agency
Scientific Advisory Board (SAB)
Radiation Advisory Committee
Non-Ionizing Electric and Magnetic Fields Subcommittee

An SAB Report: Potential Carcinogenicity of Electric and Magnetic Fields -- Review of the ORD's "Potential Carcinogenicity of Electromagnetic Fields"

"There is insufficient evidence from the human epidemiology data and from animal/cell experiments to establish cause-and-effect relationships between low-frequency electric and magnetic field exposure and human health effects and cancer." [p. 5]

32 1991 American Conference of Governmental Industrial Hygienists

Documentation of the Threshold Limit Values and Biological Indices, Sixth Edition

"Overall, the epidemiological studies on the possible correlation between cancer risk and residential exposure to electromagnetic fields do not support the conclusion of a strong association. …These considerations, as well as the primarily negative outcomes of the most recent epidemiological studies, suggest that ELF fields in the residential environment pose little, if any, cancer risk." [p. 60]

31 1991 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Sixth Annual Report)

"Despite the availability of a plethora of epidemiological reports, experimental studies in animals, and regulatory documents on the subject, two basic questions concerning the public health implications yet remain to be answered. (1) What are the adverse health effects that can be indubitably attributed to long-term exposure to either an electric fields or a magnetic fields or both? (2) If there are any adverse effects, what levels and or duration of exposure are responsible for associated effects? [p. 3] … Although experimental and epidemiological results have provided evidence for various biological effects of ELF fields, the conclusion that these effects present a health hazard seems premature." [p. 9]

30 1991 U.K. National Radiological Protection Board

Biological Effects of Exposure to Non-Ionizing Electromagnetic Fields and Radiation: II. Extremely Low Frequency Electric and Magnetic Fields

"It is acknowledged that there are several possible areas of biological interaction which have health implications and about which our knowledge is limited. These include possible changes in night-time melatonin levels in the pineal gland and alterations in circadian rhythms induced in animals by exposure to ELF electric fields, and possible effects of ELF electric or magnetic fields on the processes of development and carcinogenesis. … These effects are not well established and do not provide a basis for establishing restrictions on human exposure, although further investigations are warranted." [p. Ab-1]

29 1991 U.S. Committee on Interagency Radiation Research and Policy Coordination

Review of U.S. EPA Report 'Evaluation of the Potential Carcinogenicity of Electromagnetic Fields'

"We conclude that the evidence presented in the [EPA] report does not provide a scientifically sound basis for linking cancer to exposures to electric and magnetic field." [p. 4]

28 1991 Department de Sante Communautaire du Centre Hospitalier de l'Universite Laval, Quebec, Canada

Les Effects des Champs Electromagnetiques de 50/60 Hz sur la Sante: Bilan et Perspectives de Sante Publique Pour le Quebec

"Can 60 Hz electromagnetic fields, which we are regularly exposed to in our daily lives, be damaging to our health? It actually is not possible to respond to that question in a definitive manner." [p. 218]

27 1991 New South Wales Government (Australia)

Inquiry into Community Needs and High Voltage Transmission Line Development

"It has not been established that electric fields or magnetic fields of power frequency are harmful to human health, but since there is some evidence that they may do harm, a policy of prudent avoidance is recommended. No reason exists for concern as to the effect of the fields on animals or plants." [p. 162]

26 1991 Maryland Department of Natural Resources

Status Report on Potential Human Health Effects Associated with Power-Frequency Electric and Magnetic Fields. Reporting Period: August 1990-June 1991

"[T]he lack of conclusive results from the epidemiological studies and the lack of a dose/response relationship in whole animal and cell-level studies suggests that developing EMF regulations based on the results of the studies reviewed in this report may be premature." [p. 81]

25 1990 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Fifth Annual Report)

"Based on the information available in the literature to date, the scientific consensus remains supportive of the conclusion that it has not been established that electric and magnetic fields can cause an increased incidence of leukemia in humans. … A causal relationship between exposure to these fields and cancer is still not established and remains a hypothesis even in those studies which claim to suggest an association." [p. 3]

24 1990 Swedish National Energy Administration

Power-Frequency Electric and Magnetic Fields

"[N]o negative health effects have so far been proven upon exposure to power frequency magnetic fields up to circa 50 uT. The hypothesis regarding a connection between cancer and magnetic fields can today neither be accepted nor rejected." [p. 2]

23 1990 Commonwealth of Pennsylvania House of Representatives House Conservation Committee

Report of the House Conservation Committee Study of Electro Magnetic Fields Pursuant to House Resolution 38, November 30, 1990

"Because the scientific community does not indicate a clear causal connection between electromagnetic fields and both cancers and leukemias, it appears to be premature for Pennsylvania to label electromagnetic fields as health hazards without further study." [p. 15]

22 1990 U.S. Environmental Protection Agency Office of Health and Environmental Assessment Office of Research and Development

Evaluation of the Potential Carcinogenicity of Electromagnetic Fields, External Review Draft, October 1990

"In evaluating the potential for carcinogenicity of chemical agents, the U.S. EPA has developed an approach that attempts to integrate all of the available information into a summary classification of the weight of evidence that the agent is carcinogenic in humans. At this time, such a characterization regarding the link between cancer and exposure to EMF fields is not appropriate because the basic nature of the interaction between EM fields and biological processes leading to cancer is not understood. … With our current understanding, we can identify 60 Hz magnetic fields from power lines and perhaps other sources in the home as a possible, but not proven, cause of cancer in humans." [p. 1-5]

21 1990 International Radiation Protection Association International Non-Ionizing Radiation Commission

Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields

"The epidemiologic studies are not conclusive. Although, these epidemiological data cannot be dismissed, there must be additional studies before they can serve as a basis for health hazard assessment. Furthermore, scant laboratory evidence is available to support the hypothesis that there is an association between 50/60 Hz fields and increased cancer risk." [p. 120]

20 1989 California Public Utilities Commission California Department of Health Services

Potential Health Effects of Electric Power Facilities -- Draft Report

"It is recommended that California take no action at the present to regulate electric and magnetic fields around electric power facilities. Any such actions are premature given current scientific understanding of this public health issue. Too little is known presently to be able to determine where or what rules would provide useful protection. Existing research data are not sufficient for adequate accurate risk assessment. We do not know which components, if any, of electric power utility operations pose significant health hazards. Although biological effects are clearly established, the relationship of these effects to possible public health risks is not yet established." [p. B-4]

19 1989 U.S. Congress, Office of Technology Assessment

Biological Effects of Power-Frequency Electric and Magnetic Fields -- Background Paper

"As recently as a few years ago, scientists were making categorical statements that on the basis of all available evidence there are no health risks for human exposure to power-frequency fields. In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is significant risk." [p. 3]

18 1989 U.S. Department of Energy Bonneville Power Administration

Electric and Biologic Effects of Transmission Lines: A Review

"During the last 10 years, the number of studies looking for an effect of powerlines on human health has continued to increase. Laboratory studies have documented some short-term changes in physiological functions in people exposed to electric and magnetic fields. No harmful effects have yet been identified, however." [p. 52]

17 1988 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Fourth Annual Report)

"The results obtained from these [recent epidemiologic] studies are equivocal and disputatious, open to varying interpretations, and are far from establishing a definitive causal relationship between exposure and [adverse health] effect. The studies are only suggestive of a tenuous association, if any, do not obviate other confounding and etiological factors, and virtually lack a dose-response relationship." [p. 2]

16 1988 Swedish National Energy Administration

Power Generated Magnetic Fields -- An Important Research Area

"[The National Energy Administration's] evaluation, that there are no health risks associated with electric and magnetic fields of the magnitude found along power lines, is supported by current research. At the same time, however, it must be stated that the collective epidemiological information has shown indications that the magnetic fields can be of importance in the occurrence of cancer." [p. 1]

15 1988 Department of Energy (Ireland)

Electromagnetic Fields from High Voltage Transmission Lines: A Report to Mr. Michael Smith, T.D. Minister for Energy

"There is no widespread agreement among research workers that electromagnetic fields from power lines present a potential hazard to the health of people or animals. What evidence there is of adverse health effects comes from a small number of epidemiological studies where an association has been observed between cancer in children and the proximity of their homes to concentrations of overhead electricity cables. Many other epidemiological studies have observed no such associations." [p. S-1]

14 1987 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Third Annual Report)

"The overall evidence from epidemiological and experimental studies available to date is still somewhat rarefied and incongruous, and does not unambiguously elicit exposure to electric and magnetic fields in the magnitude produced by high voltage transmission lines as a cause of cancer or any other significant deleterious effects in humans." [p. 7]

13 1987 World Health Organization

Environmental Health Criteria 69. Magnetic Fields

"The preliminary nature of the epidemiological evidence, and the relatively small increment in reported incidence, suggest that, although these epidemiological data cannot be dismissed, there must be considerable further study before they can be accepted." [p. 22]

12 1987 Royal Swedish Academy of Engineering Sciences Committee on the Biological Effects of Electromagnetic Fields

Biological Effects of Power-Frequency Electric and Magnetic Fields, Royal Swedish Academy of Engineering Sciences

"In our 1983 report (IVA Report # 240), we stated that there are a number of well-established effects caused by power-frequency electric and magnetic fields, but that none of these effects were judged to constitute a health hazard. Since that time, international research in this area has been intensive, and a large number of studies have been published. After consideration of the situation at present, we feel that the above evaluation is still generally correct. However, more studies than before have shown the existence of effects which are of such a type as to constitute a health hazard, assuming that they can be proven and related to effects on humans. It is primarily magnetic fields which are thought to cause these effects." [p. 1]

11 1987 Ontario Ministry of Health (Canada) Disease Control and Epidemiology Service

Health Effects of Extremely Low-Frequency Electromagnetic Fields: A Review of Clinical and Epidemiological Studies

"The literature available to date on human health effects of exposure to ELF fields examines the incidence of cancer, adverse reproductive outcomes and physical and psychological general health effects. This literature fails to provide conclusive or convincing evidence that there is a significant public health risk associated with ELF fields. General agreement exists among scientific researchers that the ambiguities present in the current literature require clarification." [p. I]

10 1987 Swedish National Energy Administration

Power Generated Electric and Magnetic Fields -- A Health Risk?

"Existing knowledge gives no support to any health risks associated with exposure to electric fields of the strength of Swedish power lines. … Regarding magnetic fields of the strength found along Swedish power lines, no biological effects have been shown. Comprehensive research continues to clarify whether or not there is a connection between exposure to magnetic fields and cancer, above all child cancer. The difficulties in showing such connections are great." [p. 2]

9 1987 Florida State Department of Environmental Regulation

Report of the Florida Electromagnetic Fields Science Advisory Panel. Final Report

"Although a large number of studies indicate no health effects on people, some studies indicate potential health risks. There appears to be some evidence of biological effects due to exposure to EMF. The exposure levels that appear to cause effects in laboratories occur at field strengths higher than people normally experience. Not enough is known about the mechanisms that might cause adverse effects due to exposure to EMF. It is not possible from current knowledge to say with any confidence how safe or dangerous long term exposure to EMF might be." [p. v]

8 1986 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines (Second Annual Report)

"The results of a number of community health surveys, mortality studies, and exhaustive reviews of the literature seem to be in general agreement that exposure to electric and magnetic fields in the magnitude produced by high voltage transmission lines has not been shown unequivocally to cause significant adverse health effects in humans." [p. 7]

7 1986 Swedish National Energy Administration

Biological Effects of the Electric and Magnetic Fields of Power Lines

"A comprehensive assessment of the results of published research in Sweden and other countries shows that no health risks, from electric and magnetic fields of the strength found along Swedish power lines, have been determined." [p. 2]

6 1985 Virginia Department of Health

Monitoring of Ongoing Research on the Health Effects of High Voltage Transmission Lines

"The scientific consensus supports the conclusion that it is unlikely that electric and magnetic fields associated with high voltage transmission lines give rise to significant health consequences. Nonetheless, some ambiguities in the currently available literature preclude categorically concluding that no public health problem will ever arise. This is in view of the fact that no reasonable amount of research would ever allow a determination of zero risk." [p. 10]

5 1985 American Institute of Biological Sciences

Biological and Human Health Effects of Extremely Low Frequency Electromagnetic Fields. Post-1977 Literature Review Assessment and Viewpoints on the Biological and Human Health Effects of Extremely Low Frequency (ELF) Electromagnetic Fields

"Results of studies on cancer and residential and occupational exposures to ELF electric and magnetic fields do not demonstrate that such fields are causally related to cancer risk. Although valid questions of possible association between exposure to ELF electric and magnetic fields and reproduction have been raised, currently available scientific data do not demonstrate deleterious effects of such exposure during either prenatal or perinatal development." [p. 20]

4 1985 Florida Department of Environmental Regulation

Biological Effects of 60-Hz Power Transmission Lines: A Report of the Electric and Magnetic Fields Science Advisory Commission Effects of 60-Hz Electric Fields on Embryo and Chick Development, Growth, and Behavior (Final Report)

"The Commission unanimously believes that the scientific information now available supports the conclusion that it is unlikely that 60-Hz electric and magnetic fields associated with high voltage transmission lines has led, or can lead, to public health problems. However, some ambiguities in the currently available science precludes our categorically concluding that absolutely no public health problem exists." [p. 194]

3 1984 World Health Organization

Environmental Health Criteria 35. Extremely Low Frequency (ELF) Fields

"Studies have been performed on workers with long-term exposure to electric and magnetic fields, but no adverse health effects have been identified. However, these studies were not designed to evaluate effects on reproductive functions, or long-term carcinogenic risks. ... A suggestion of increased cancer incidence has been reported by a number of investigators who have examined occupational and general population groups exposed to electric and magnetic fields. The studies performed have serious deficiencies in epidemiological design and do not adequately characterize levels and duration of exposure." [p. 17]

2 1983 The Royal Swedish Academy of Engineering Sciences Committee on Biological Effects of Electromagnetic Fields

IVA Report 240

"[T]here is sufficient evidence of the existence of biological effects of high-tension line electromagnetic fields. The Committee's research evaluation does not deem these effects as hazardous to health." [p. 1]

1 1977 U.S. National Academy of Sciences

Biologic Effects of Electric and Magnetic Fields Associated with Proposed Project Seafarer

"The Committee's considered opinion is that such fields will not cause a significant and adverse biologic disturbance, except in the event of electric shock, which is of serious concern. In fact, apart from the possible result of electric shock, the Committee cannot identify with certainty any specific biologic effects that will definitely result from exposure to the proposed Seafarer fields." [p. 51]