Exposure to non-ionizing radiation is ubiquitous. Sources include visible light, lasers, infrared radiation, radio frequency (RF) radiation from wireless communication facilities: cellphones, cellular networks, television and radio broadcast facilities, as well as radiation of extremely low frequency (ELF) from electrical facilities. Exposure to sources of non-ionizing radiation has been associated with negative health effects. Exposure to radio waves, for example can cause localized tissue heating. Non-thermal effects have yet to be proven, but they are the subject of much ongoing research. Epidemiological research indicates that exposure to magnetic fields around electrical facilities at levels of 3–4 milligauss increases risk of leukemia in children.

Current Regulations and Policy

The Non-Ionizing Radiation Law (2006) entered into effect in January 2007 with the goal of protecting the public and the environment from the effects of exposure to non-ionizing radiation, in accordance with the precautionary principle. Standards addressing non-ionizing radiation were approved in 2009.

The law and the standards which pertain to exposure to non-ionizing radiation from artificial sources regulate both licensing and the level of expertise required for individuals working with sources of non-ionizing radiation. In addition, the regulations mandate monitoring levels of non-ionizing radiation and publicizing the information.
Radio Frequency Radiation
The law requires that the Ministry of Environmental Protection (MoEP) define maximum levels of exposure permitted for RF radiation. The levels of permitted exposure are based on World Health Organization (WHO) recommendations regarding the health threshold for non-ionizing radiation (a value below which there is no known negative health impact from thermal effects). The health threshold refers to acute (short-term) exposure only. The environmental threshold, which refers to continuous long-term exposure, takes into account risks other than those defined in the health threshold. In areas such as parks, roofs, and courtyards where exposure is not continuous, permits are not granted for facilities that expose the population to non-ionizing radiation of more than 30% of the health threshold, whereas in areas where people are continuously present and for long periods of time – such as educational institutions, homes, and hospitals – the maximum exposure permitted is only 10% of the health threshold.

Magnetic Fields (Power Lines and Electrical Appliances)
The Non-Ionizing Radiation Law does not define a threshold for exposure to magnetic field radiation. A threshold value of 1,000 milligauss for acute short-term exposure (momentary exposure) was recommended by an expert committee on public exposure to magnetic field radiation from the electrical grid. While there is no standard for long-term exposure to magnetic fields, the MoEP and the Ministry of Health (MoH) jointly recommend a threshold of two milligauss on an average annual basis when planning an electrical facility or four milligauss on a daily average. At this stage, existing electrical facilities are being targeted for action, with highest priority assigned to facilities that generate an average exposure of over four milligauss. In addition, new building regulations limit electromagnetic fields (EMF) generated by the power grid to four milligauss. The MoEP published recommendations for planners and the Israel Electric Corporation (IEC) pertaining to the operation of electric facilities, risk assessment and calculation of levels of exposure to EMF. The MoEP has defined minimum distances between electrical facilities and buildings such as homes, educational institutions, hospitals, etc. (Table 1). The IEC website reports results of measurements performed near electrical facilities.

### Ministry of Environmental Protection Recommendations on Distance between Electrical Facilities and Buildings

<table>
<thead>
<tr>
<th>Type of line</th>
<th>Short-term exposure</th>
<th>Long-term exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low voltage line</td>
<td>2 meters from nearest phase conductor</td>
<td>3 meters from nearest phase conductor</td>
</tr>
<tr>
<td>Medium voltage line (13, 22, 33 kilowatts)</td>
<td>3 meters from nearest phase conductor</td>
<td>5 meters from nearest phase conductor</td>
</tr>
<tr>
<td>High voltage line (161 kilowatts)</td>
<td>20 meters from the path of the power line</td>
<td>30 meters from the path of the power line</td>
</tr>
<tr>
<td>Extra-high voltage line (400 kilowatts)</td>
<td>35 meters from the path of the power line</td>
<td>50 meters from the path of the power line</td>
</tr>
<tr>
<td>Distribution transformer</td>
<td>3 meters from each part of the transformer and extending wires</td>
<td>5 meters from each part of the transformer and extending wires</td>
</tr>
</tbody>
</table>
Public and home use of electrical and electronic devices is regulated within the framework of the Non-Ionizing Radiation Law. In recent years, researchers and policy makers have raised concerns about possible health effects from exposure to EMF in the range of the power grid at frequencies of 50 hertz. In 2001, the International Agency for Research on Cancer (IARC) classified extremely low-frequency magnetic fields as possibly carcinogenic to humans. The WHO recommends a maximum permissible exposure of 1,000 milligauss for acute short-term exposure and encourages application of the precautionary principle vis-à-vis continuous and long-term exposure. The MoEP publishes tables listing the levels of exposure from home electrical devices.

**Cellular Communication**

Cellular communication requires both a base station (antenna) and a telephone device. Categories of base stations are defined under the Communications Law from 1982 and the National Outline Plan 36 on Small and Miniature Broadcast Facilities from 2002. Cellular companies are responsible for choosing the location of base stations, a function subject to permit and oversight by the MoEP. In Israel, cellular broadcasts are limited to the range of non-ionizing radiation: 700–2,500 megahertz. As a rule, the taller the antenna and the more powerful its transmission, the wider the geographic range that it covers. The MoEP website includes an interactive map which shows the location of both existing and planned antennas.

Manufacturers are required to measure Specific Absorption Rate (SAR) in accordance with international (US and European) guidelines and manufacturing standards for cellphone devices. The SAR index describes the amount of energy absorbed by a unit of mass of biological material under conditions of maximum transmission capacity. According to the guidelines, the devices cannot cause a local increase in body temperature of more than one degree Celsius (°C).

Although the MoH lacks authority under the Non-Ionizing Radiation Law, the Ministry publishes recommendations on reducing public exposure. The MoH recommends sensible use of cellular and wireless technology, including: considering alternatives like landline telephones, use of a speaker while talking on a cellphone, and refraining from installing the base of wireless phones in a bedroom, work room, or children’s room. In addition, according to a 2002 directive from the MoH’s Medical Administration, cellphones should not be used within 30–50 centimeters of medical equipment.

In general, the MoH’s recommendations are based on guidelines from international organizations:
- Use a speaker or hands-free phone accessory or (non-wireless) personal earphone in order to distance the telephone from the body, reduce the amount and duration of calls, with the goal of reducing exposure.
- In areas with few antennas where reception is weak, the level of radiation from the device is high and the number and duration of calls should be reduced.
- Precautions should be strictly enforced with regard to children, who are more sensitive to developing cancer.
• When driving, a hands-free device should be used for calls (Traffic Regulation No. 28B). It is recommended to install an antenna outside the vehicle and to use a line connection between the telephone and the speaker as opposed to using Bluetooth.
• The MoH recommends not using cellphones in closed places (for example, elevators, buses, trains) due to amplified radiation in such places.

In March 2012, a bill was proposed requiring all cellphones sold in Israel to bear a health-hazard warning label. The proposed bill also requires that all mobile phone advertisements bear a similar warning and bans all advertising targeting minors. The bill has yet to be approved by the Knesset.

Data on Exposure to Non-Ionizing Radiation in Israel

In September 2010, the MoEP developed an automatic system to conduct ongoing monitoring of radiation from antennas. An initial report on data from the monitoring system was published in 2012.

In 2003, in an effort to determine levels of radiation in public places, levels of non-ionizing radiation were measured in 25 schools nation-wide. In addition, electrical facilities located within schools were tested, including electrical distribution networks (electrical panel boards, electrical cabinets, distribution lines), fluorescent lighting, wireless internet networks, and electric motors. The results revealed that exposure to non-ionizing radiation in schools is very low, with the exception of classrooms and staffrooms close to electric panel boards. Based on these findings, the MoEP recommends that students remain at a distance of at least 1.5 meters from electrical cabinets and that use of wireless communication networks in schools be reduced.

Despite the fact that hybrid vehicles are liable to emit non-ionizing radiation, the MoEP has no authority under the Non-Ionizing Radiation Law to license or monitor radiation from hybrid vehicles. In 2010, an expert committee convened to evaluate EMF generated by hybrid vehicles and recommended measuring radiation levels in hybrid cars. The MoEP conducted comprehensive tests for non-ionizing radiation in various hybrid vehicles and publicized the results. Based on the findings, the MoEP concluded that hybrid cars are indeed recommended for public use – due to their low levels of radiation as well as their offering a major reduction in transport-related air pollution.

Research on Health Effects of Non-Ionizing Radiation in Israel

In 2006 a national center to study the public health impact of non-ionizing radiation was established. Pursuant to government decision, a scientific steering committee was formed with representatives from the Ministries of Defense, Communications, Environmental Protection,
Health, and National Infrastructures, Energy and Water Resources. In 2012, a tender was published to establish the Center, with three years of funding from the Ministry of Science and the MoEP. The Center (TNUDA), which opened in 2013 in collaboration with the Cancer and Radiation Epidemiology Unit at the Gertner Institute for Epidemiology and Health Policy Research, provides responses to queries including those from various government ministries. At a later stage it will conduct basic, epidemiological research and risk-assessment.

During the past five years (2010–2014), a small number of studies have been conducted in Israel to test the health impacts of non-ionizing radiation, in particular the effect of EMF radiation on nerve cells and on cellular stress.

Israel participated in the INTERPHONE research project, following a 1996 recommendation by IARC to conduct a comprehensive epidemiological study to examine the association between the use of cellphones and cancer. Findings in Israel clearly indicated a link between cellphone use for more than 10 years and the development of tumors in the salivary glands, particularly among people who held the telephone on the same side where the tumor developed and individuals in the highest category of exposure (heavy use in rural areas).

Israel is currently a partner in two additional international studies: (1) MOBI-Kids, a multi-center study involving experts from 16 countries who are examining potential associations between use of communication devices and other environmental factors and risk of brain tumors, and (2) the GERoNiMO (Generalised EMF Research using Novel Methods) project, which uses an integrated approach and expertise from 13 countries to further the state of knowledge on EMF and health. Both studies are funded by the European Union and managed (in Israel) at the Gertner Institute’s Cancer and Radiation Epidemiology Unit.

**Progress and Challenges**

- Establishment of a National Center for Information on the Health Effects of Non-Ionizing Radiation, and the launch of an interactive website which provides information on planned and existing cellular antennas, has significantly improved transparency regarding non-ionizing radiation and potential health effects.
- There is a lack of public awareness regarding proper use of products that emit non-ionizing radiation – including cellphones, microwaves, adjustable beds, and laptop computers.
- There are significant challenges in regularly monitoring devices in public spaces (such as transformers and power lines) and conducting measurements to enable accurate exposure assessment.
- Standards regarding cellphone use are based solely on thermal impacts (localized heating of tissue). As new findings regarding additional health effects emerge, Israel will need to re-evaluate non-ionizing radiation standards in accordance with international regulatory developments.
References


