

Regulatory evolution of electromagnetic environmental parameters in Argentina

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Background

This paper presents a summary of the historical evolution of the regulation for electromagnetic environmental values in Argentina, justifying the reasons for the existing limits for the general public at power frequency.

First Reference

The National Energy Plan 1986 - 2000 established among its objectives to "Evaluate and Control the environmental effects of the energy supply", constituting the first background of an environmental policy for the energy sector.

Res. SE 475/1987

In 1987, the Secretary of Energy (SE) published Res. SE 475/1987, which gave the mechanisms for the elaboration of normative proposals to incorporate the environmental issue into energy projects and works.

This mechanisms resulted in the incorporation of environmental aspects in the design, construction and operation of Extra High Voltage Transmission Lines and Substations, from the project to the operation stage.

Technical commission

The SE carried out a call for the creation of a technical commission, which objective was to propose norms for incorporating environmental aspects in the elaboration of the projects, construction and operation of the extra-high voltage electrical energy transport system.

Res. SE 15/1992

As a result of the proposals, Res. SE 15/1992 was published, which presents an environmental management manual for the extra-high voltage electrical transport system.

Guidance values were indicated for electric and magnetic field, Radio Influence Voltage (RIV), audible noise, visual Corona and gas production, for 500 kV OHL.

► Electric field (EF)

- 13-15 kV/m, for Rural/restricted access areas.
- 7.6-10.5 kV / m for route crossings.
- 2 kV/m in ROW

► Magnetic field (MF)

- No limits was recommended
- Minimum height of the conductors to ground (HOC)
- For the crossing of routes or highways, the HOC to ground was fixed by the maximum level of EF so as not to exceed the safety limit for contact currents (5 mA) in case of child over wet ground and large vehicle on dry pavement.

- ▶ The EF levels were calculated considering in some cases the maximum service voltage and conductors at the average annual maximum temperature and in others with the nominal voltage and conductors at maximum annual temperature.
- ▶ **RIV**
 - For the OHL El Chocón-Ezeiza was set at a limit of 40 and 30 db of medium level in good weather conditions and at 30 and 61 m of the axis of the lines respectively.
- ▶ **Audible noise**
 - The limit set was 53 to 55 dbA, a value that should not be exceeded 50% of the time for wet conductors, at 30 m from the center of the line or the ROW.
- ▶ **Visual Corona**
 - No limits was recommended

IITREE Measurements

- Until 1992 the IITREE-LAT-FI-UNLP developed measuring equipment for Electric Field and RIV.
- Campaigns were carried out to measure these parameters in HV OHL.

1996

- In 1996 different conflicts took place in different parts of the country.
- The SE commissioned IITREE to carry out an international review and analysis of the publications in terms of exposure levels of E and B fields.
- For this task an interdisciplinary team of professionals was formed and a report was prepared, which was published that same year.
- This was subjected to an analysis by different agents.

Res. SE 77/1998

- In 1998 the Res. SE 77/1998 was published with the limit values for the electric and magnetic fields for general public exposure.

- Aspects related to visual impact, contact current, RIV and audible noise were incorporated.
- In the same year, ICNIRP published recommended limits for the general public and occupational exposition.

▶ **Electric field (EF)**

- 3 kV/m in border of ROW.
- The maximum EF level, in any position, shall be such that the contact currents for a control case: child on wet ground and large vehicle on dry asphalt, shall not exceed the safety limit of 5 mA.

▶ **Magnetic field (MF)**

- 25 μ T in border of ROW.
- The maximum MF level, at any position, shall be such that the steady state contact currents due to contact with long metallic objects near the lines shall not exceed the 5 mA.
- Measured at 1 m from the ground level, at the edge of the ROW and in the edge of substations.
- Considering values as low as reasonably achievable for By Efields.
- Tending to guide the choice of designs of future facilities that generate the lowest field values.
- Where the ROW is not defined, the field level shall be equal to or less than that value at the points resulting from the application of the minimum safety clearances.
- The criterion adopted to establish the limits was that the new facilities, to be built, do not generate field values that are higher than those generated by existing facilities (until 1996.)

▶ **RIV**

- The level must be 30 dB below the level of the desired signal at the limit of ROW.

▶ **Audible noise**

- The limit set was 53 dbA, a value that should not be exceeded 50% of the time for wet conductors, at 30 m from the center of the line or the ROW.

ICNIRP 1998

- ▶ In 1998, ICNIRP published the Guide for the exposure

limits of electric, magnetic and electromagnetic fields (up to 300 GHz).

- ▶ The limit values recommended consider short term effects, for which it establishes that the current density induced in the body must not be exceeded .
 - For the frequency of 50 Hz, it establishes that the current density for the general public is 2 mA/m².
- For occupational it is 10 mA/m².
- ▶ For general public the limits was 5 kV/m (E) and 100 μT (B).
- ▶ For occupational the limits was 10 kV/m (E) and 500 μT (B).

2002 IARC/IEEE

- ▶ In 2002 IARC published
 - “Monographs on the Evaluation of Carcinogenic Risks to Humans Non Ionizing Radiation, Part 1: Static and Extremely Low Frequency (ELF) Electric and Magnetic Fields” Volume 80.
- ▶ In 2002 IEEE published
 - The IEEE Std. C95.6-2002, which defines as the basic restriction criterion the induced current limit value that avoids adverse effects. This is why different values are established for different parts of the body.
 - For general public the limits, @50 Hz, was 5 kV/m(E) and 904 μT (B).
 - For occupational the limits , @50 Hz, was 20 kV/m(E) and 2710 μT (B).

Res. MTESS 295/2003

- ▶ Ministry of Labor, Employment and Social Security
- ▶ For occupational exposure
 - The EF the limit adopted is 25 kV/m(0 to 100 Hz)
 - The MF the limit adopted is 1200 μT(at 50 Hz)

2009 ICNIRP

- ▶ In 2009 ICNIRP publishes recommendations for exposure to static B fields.
 - A level of 400 mT is recommended for exposure of

the general public considering any part of the body.

- For people with electronic implants or containing ferromagnetic materials should adopt a limit of 0.5 mT.
- For occupational exposure the recommended values was:
 - 2 T considering head and torso
 - 8 T for extremities.
- ▶ For static E fields, was not recommended exposure limits.

2010 ICNIRP

- ▶ In 2010, ICNIRP publishes ICNIRP GUIDELINES FOR LIMITING EXPOSURE TO TIME VARYING ELECTRIC AND MAGNETIC FIELDS (1 HZ – 100 KHZ).The basis for the guidelines is two-fold:
 - Exposure to low-frequency electric fields may cause well-defined biological responses, ranging from perception to annoyance, through surface electric-charge effects.
 - In addition, the only well established effects in volunteers exposed to low frequency magnetic fields are the stimulation of central and peripheral nervous tissues and the induction in the retina of phosphenes, a perception of faint flickering light in the periphery of the visual field.
- ▶ For general public the limits was 5 kV/m (E) and 200 μT (B @50 Hz).
- ▶ For occupational the limits was 10 kV/m (E) and 1000 μT(B @50 Hz).

RESUME E FIELD

Ref.	Rec. / Std.	Exposure	E [kV/m]
ICNIRP	1998	General public	5
		Occupational	10
	2010	General public	5
		Occupational	10
IEEE	C95.6-2002	General public	5
		Occupational	20
Argentina	Res. 77/1998	General public	3
	Res. METSS 295/2003	Occupational	25

RESUME B FIELD

Ref.	Rec. / Std.	Exposure	B [μT]
ICNIRP	1998	General public	100
		Occupational	500
	2010	General public	200
		Occupational	1000
IEEE	C95.6-2002	General public	904
		Occupational	2710
Argentina	Res. 77/1998	General public	25
	Res. METSS 295/2003	Occupational	1200

- ▶ The regulation in Argentina, for general public exposure, was defined in the year 1998.
- ▶ The principle adopted was that the values of electromagnetic fields of the future installations, should not generate higher levels than those that were in operation until that moment.
- ▶ Similar criterion to that adopted in other parts of the world at that time, states of New York and Florida USA.
- ▶ The other recommendations or standards, adopt criteria to define their limits that consider aspects related to health.