

II – 3 Maintaining Harmony with the Local Environment

1 Electromagnetic Field

With the advancement of technology, electricity use expanded in various fields, and became indispensable in our industrial development and improvement of our everyday lives. This trend raised a concern that the electromagnetic field (electric field and magnetic field) created by power facilities might have an impact on human health, and subsequent research and surveys were conducted. This effect has been evaluated in reports by international organizations and other investigations. The conclusion from such research was that no harmful biological effect has been observed, in regard to electromagnetic fields in living environments, such as those existing around power facilities and home appliances. However, there is heightened interest in this matter in Kyushu with the introduction of information regarding research conducted in other countries. Here, through this article, a brief explanation on the electromagnetic fields seen around power facilities is offered.

Electromagnetic field

Generally speaking, "electromagnetic field" is a term that refers collectively to "electric field" and "magnetic field".

◆Electric field

When you rub a plastic sheet against a sweater and hold it over your head, you can see your hair standing on end. There is an electric field at work, namely static electricity, produced between the plastic sheet and your body.

- 1 In terms of electricity, the "field" occurring around objects to which "voltage" is applied is the "electric field".
- 2 "Electric fields" are created not only from power facilities such as transmission lines, but also from electric appliances at home. It is also present between thunderclouds and the ground.
- 3 The strength of an "electric field" is expressed in kV/m (kilovolt per meter).

◆Magnetic field

When you place a plastic sheet over a magnet, and sprinkle iron sands on the sheet, you will see patterns that connect north and south poles. They are created by the effect of the magnetic field.

- 1 In terms of electricity, the "field" occurring around objects, in which "electric current" flows, is the "magnetic field".
- 2 "Magnetic fields" are created around electric appliances at home just as electric fields are. Also, the earth is responsible for a magnetic field as geomagnetism, since the earth is one big magnet.
- 3 The strength of a "magnetic field" is expressed in G (gauss) (1gauss(G) = 1,000 milligauss(mG))

Difference between electromagnetic field and electromagnetic wave

Electric fields and magnetic fields exist in electromagnetic waves just as in electromagnetic fields. However, electromagnetic waves have higher frequency, and electric fields and magnetic fields interact, intertwine and travel far into the space as a wave. The electric wave for TV and radio, and sunrays, are also electromagnetic waves.

The electromagnetic fields around the power facilities and electric appliances for households have a very low frequency of about 50-60Hz. Electric fields and magnetic fields don't interact with each other; therefore, they don't travel far as a wave. They weaken rapidly with distance. Thus, they are called "electromagnetic fields" to differentiate them from electromagnetic waves which have higher frequency. Among electromagnetic waves, "ionizing radiations" such as X-rays and gamma-rays, with frequencies of over 3,000 trillion Hz, have huge energy and could cause damage to genes or DNA (deoxyribonucleic acid) ; and ultraviolet rays (sunrays) could lead to sunburn.

"Non-ionizing radiations" with a frequency of 3,000 trillion Hz or less don't have enough energy to damage DNA, thus would not affect the human body. Some non-ionizing radiation, such as microwaves used in microwave ovens, is able to warm objects. However, electromagnetic fields around power facilities such as transmission lines and household appliances have a very small energy, and would not damage cells or generate heat.

Criteria for the strength of electromagnetic fields

The environmental health criteria set by the World Health Organization (WHO) are international criteria for electric fields. In Japan, the technical standard for electric facilities by the Ministry of

International Trade and Industries stipulates that the power facilities are to be constructed so that the "strength of the electric fields under the transmission lines is 3kV/m or less at 1m above ground". There is no standard for magnetic fields in Japan; however, those acknowledged internationally are the environmental health criteria by WHO and the guideline by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) of 3×10^{11} Hz or less.

Criteria for electromagnetic fields

| Category | Environmental health criteria set by WHO | Guidelines by ICNIRP (for general public) |
|-----------------|---|---|
| Electric fields | 10kV/m or less: no need to restrict access | 4.2kV/m |
| Magnetic fields | 50,000mG or less: no harmful biological effect 5,000mG or less: no biological effect of any kind | 833mG |

The levels of electric fields and magnetic fields on the ground attributable to Kyushu Electric Power's transmission lines are approximately 3kV/m and 200mG, respectively, even at the strongest points and are significantly lower than the guidelines set by ICNIRP.

Actions by Kyushu Electric Power

Based on these environmental health criteria set by WHO and guidelines by ICNIRP, Kyushu Electric Power believes that electromagnetic fields from the power facilities in living environments do not have any effect on the health of people, and the current operational practice of power facilities should not create a problem. However, for the better understanding and peace of mind of our customers, Kyushu Electric Power will continue its research and investigation to accumulate scientific knowledge and findings on electromagnetic fields around its power facilities.

Frequency and wavelength of electromagnetic waves (electromagnetic fields)

| Frequency (Hz) | Wavelength | Applications |
|--------------------|-------------------------------------|-------------------|
| 3×10^{18} | Gamma-rays | Medical treatment |
| 3×10^{16} | X-rays | Material test |
| 3×10^{15} | Ultraviolet rays | X-ray photograph |
| 3×10^{13} | Visible rays | |
| 3×10^{12} | Infrared rays | |
| 3×10^{11} | Submillimeter waves | |
| 3×10^{10} | Millimeter waves (EHF) | 0.1mm |
| 3×10^9 | Centimeter waves (SHF) | 1cm |
| 3×10^8 | Microwaves (UHF) | 10cm |
| 3×10^7 | Ultrashort waves (VHF) | 1m |
| 3×10^6 | Short waves (HF) | 10m |
| 3×10^5 | Medium waves (MF) | 100m |
| 3×10^4 | Long waves (LF) | 1km |
| 3,000 | Very low frequency waves (VLF) | 10km |
| 50~60 | Extremely low frequency waves (ELF) | 100km |
| | | 5,000~6,000km |