§13. Measurement of Static and Time Varying Electromagnetic Fields Considering Occupational Safety Management

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Environmental electric and magnetic field strength around a large magnetic plasma experimental facility like LHD and the auxiliary heating devices had been measured. The international guidelines for various electromagnetic fields namely non-ionizing radiation has been proposed by the World Health Organization (WHO) and the International Commission on Non-ionizing Radiation Protection (ICNIRP). Also the Association of Radio Industries and Business proposed guidelines for radiofrequency-exposure protection named RCR STD-38 2.0 in Japan. The property of environmental electromagnetic fields around the magnetic fusion experimental facilities is to be generated statistically, that is including various frequencies of radio wave. The frequencies are from extremely low frequency (ELF) to extremely high frequency (EHF). Of course the devices are designed not to leak out the electromagnetic fields, however not less electric and magnetic fields are leak out. The static magnetic field is caused from the LHD super conductive magnetic coils system, and three plasma heating devices like Neutral Beam Injector (NBI: ELF), Ion Cyclotron Ranges of Frequency (ICRF: 25-100 MHz), and Electron Cyclotron Heating (ECH:84-168 GHz). Another is a discharge cleaning device of 2.45 GHz. The leakage of static magnetic field strength has been measured since the first plasma experiment of the LHD in 1998. It had been measured with Gauss Meter 9900 (F.W. Bell Co) and three axial probe ZOA99-3208, at the fixed monitoring point where is 23 m far from the center of the LHD in south direction. On the LHD plasma experiment, it increased only 0.1 -0.2 mT. But in case of quickly decreased the magnetic system it increased to 1.2 mT.

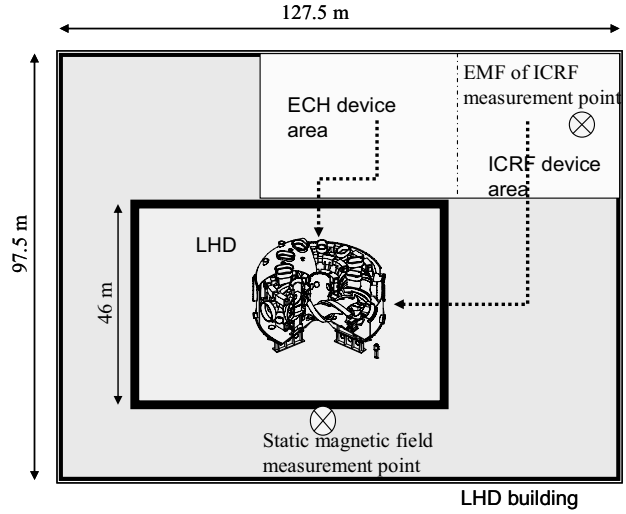

Fig. 1 Layout of LHD and ICRF RF power source

To continuously measure the high frequency of electric and magnetic fields, a data logging system had been developed and they were set around the ICRF source devices. The measurement instrument is EMC-300 and three axes electric field probe Type 18 and magnetic field probe Type 10 (Narda S.T.S.). The devices arrangement and the probes setting point are shown in Fig.1. The data logging time is 5 Hz, 0.2 sec, and mean values of optionally selected time can be calculated.

As shown in Fig. 2, the electric field had been observed and the level was a few V/m and average in 6 minute was extremely low. However the magnetic field could not be detected by the EMC-300 type10 magnetic probe. To find the level of magnetic field we tried to measure using high sensitive SRM-3000 detector. Also it is possible to measure the spectrum of the radio frequency. However to continuously measured the level by using such high sensitive detector is not suitable considering load to the data processing system. From occupational safety management point of view, we had tried to using much convenient and economical personal monitor. It might be valuable if these perusal monitors are applicable as monitoring system.

The feature of electromagnetic fields in the large fusion plasma facilities is complex and statistically variable electromagnetic fields. They should be precisely concerned as the future environmental electromagnetic fields safety management issues.

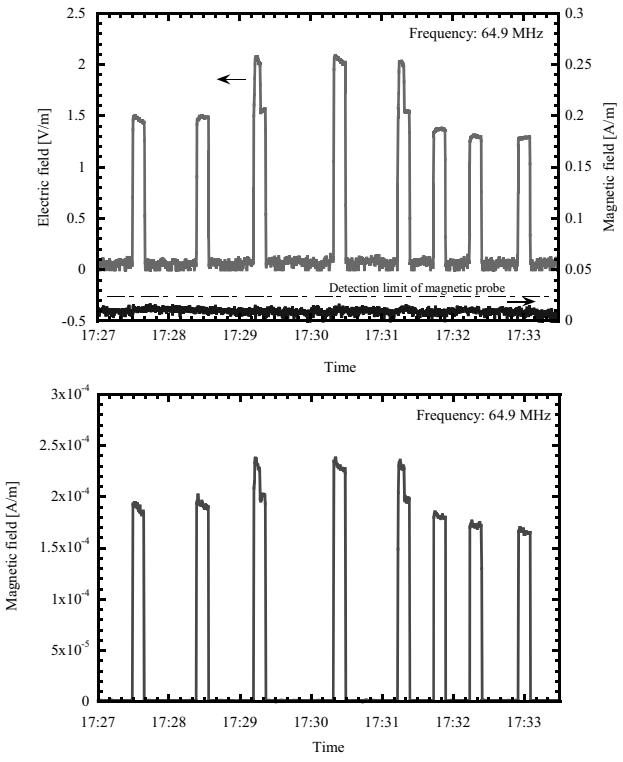

Figure 2 Electric and magnetic field leakage around the ICRF source devices.Upper(1) is measured by EMC300 and lower (2) was measured by SRM-3000