

§3. Characteristics of RMSAFE and Radiation Monitors

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We are constructing the radiation monitoring system in order to evaluate radiation dose due to experiments. The main interests in this test-run phase are given on the background database establishment and the reliability check of the system characteristics.

RMSAFE (Radiation Monitoring System Applicable to Fusion Science) is an area-monitoring network system installed in the Toki Site. This is the main system of the radiation monitoring. RMSAFE is capable of accumulating the burst-like exposures due to plasma experiments as well as observing the continuous background radiation levels. The system has been brought into operation since 1992. Total 37 radiation detectors are now installed in 26 points. The detectors are selected as pressurized argon ionization chamber or air filled ionization chamber for X-rays, He-3 proportional counter for neutrons. In the BG Mode of the system operation, signal counts from each monitoring sensor are sampled every 30 seconds, and dealt with by a central processor.

An operator can observe the monitoring results by the indication instrument, personal computer. Measured radiation dose at each point is displayed in the form of real time trend graph, integrated dose, daily or weekly dose trend, burst dose and so on. These data tables or graphs can be printed out by printer. If dose of site boundary becomes over self-imposed dose limit, interlock signal is transmitted to the LHD control system, in order to prohibit the next plasma experiment.

Energy sensitivity of X-ray detectors were

checked at Institute of Radiation Measurements. Irradiation energy were from 30 keV to 1.25 MeV, which were used X-ray generator, these effective energies are 32, 49, 57, 65, 80, 97, 120, 197 keV, standard gamma ray sources, Cs-137 and Co-60. These irradiation dose rate was 0.5 mSv / h. Figure 1 shows the results. The responses are normalized at 662 keV. The pressurized argon ionization chambers have little sensitivity below 60 keV. We have to note this energy response.

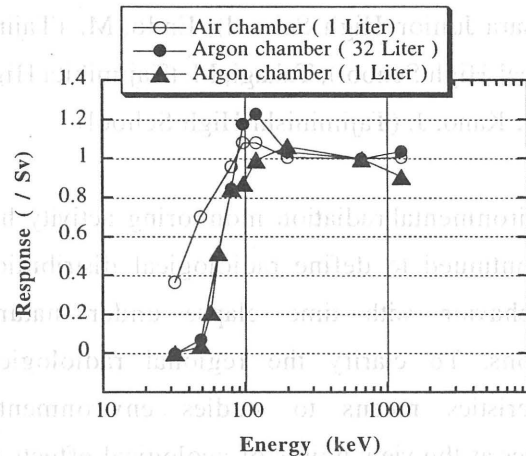


Fig. 1. Energy response of ionization chambers.

Data process mode of RMSAFE shifts to BURST or TIME PROFILE mode, when count at one monitor exceed burst detection level. The burst detection level is set by total count per 50 msec. It has been determined for each zone, 200 nSv / 50 msec in the LHD hall, 0.3 nSv / 50 msec in the outdoors, respectively. Generally, burst-like radiation is detected with the monitors in the LHD experimental hall. Considering concrete wall shielding, we can detect and evaluate the dose of site boundary less than 0.2 nSv per 10 seconds plasma shot. On the other hand, less than 60 nSv per one plasma shot can be recorded by only outdoor monitors.