

(2) Safety Management Research

The Radiation safety managements of experimental devices, such as LHD, plasma heating devices like NBI, ECH and ICRH, and an accelerator for the Heavy Ion Beam Probe, are the major issues in the LHD research. For safety operation of LHD and related devices, radiation management system and access-control system were well integrated. Radiation monitoring by the Radiation Monitoring System Applicable to Fusion Experiments (RMSAFE) has been working successfully. The other radiation safety issues are a plan of the safety management system and development of precise radiation monitors considering the deuterium (D) plasma experiments in LHD, especially neutron protection and tritium treatment. Topics of these activities on the safety management research during FY 2013 are summarized as follows:

(i) Radiation management and monitoring

For the occupational workers in radiation control area, educational training and registration system have been established. The radiation management in NIFS had been performed by radiation safety control office in the Division for health and safety promotion. It is required that the annual exposure dose caused by operation of some radiation emission devices should not exceed 50 μ Sv in a year on the site boundary. To ensure this limit, a monitoring system RMSAFE works to detect burst X-ray and to discriminate the radiation caused by plasma experiment from the natural radiation and to accumulate the exposure dose. Also the environmental radiation has been measured every three months using a radio-photo luminescence dosimeter and an electrical personal dosimeter. These results are opened on the NIFS Web Site and updated continually.

(ii) Studies of tritium treatment system and safety

Tritium and neutron are key issues from view point of radiation safety for the D experiment in LHD and for a future nuclear fusion facility. The specific technologies are extremely low level tritium monitoring and removing or recovering of tritium from the vacuum pumping gas or exhausting air from the vacuum vessel. It is also important to grasp tendency of the environmental radioactivity before D experiments in LHD. The topics of research and developments are an evaluation of the oxygen effect on the gaseous tritium recovery system, research in tritium monitoring system, and environmental radioactivity measurement.

(iii) Non-ionizing radiation monitoring and management

Leakage of static magnetic field and variable frequencies of electromagnetic fields are concerned in a magnetic fusion plasma experimental facility. Although high power electromagnetic waves are utilized for plasma heating in LHD, electric and magnetic field strength around the LHD hall were less than the occupational regulation level proposed as guide line by the ICNIRP. The visualization technique of the leakage electromagnetic field

with a positional sensing system using the IR camera of a Wii-remote was proposed last fiscal year and applied to measure the field distribution around the RF oscillator in this year.

(iv) Education and other activities

We have a training program on the radiation protection for new workers in NIFS. The fabricated radiation sources which were not legal radioisotopes were applied to the radiation education courses in high school. Through this education course, students understood well the existence of natural radiation and radioisotopes around us, and learned the principles of radiation protection. And the practical research on the radiation education was also developed. Monitoring cart for on-site radiation measurement with high mobility has been developed and the practical design with the sufficient sensitivity has been proposed.

(Nishimura, K.)

List of Reports

1. "Effect of Oxygen Concentration on Hydrogen Combustion by Pt-Al₂O₃ Catalyst for a Vacuum Exhaust Gas Processing System", Tanaka, M.
2. "Development of Tritium-in-Air Monitor Attached with Proton Conductor as Membrane Separator", Tanaka, M. (NIFS)
3. "Comparative Testing of Various Flow-Cell Detectors Fabricated using CaF₂ Solid Scintillator", Kawano, T. (NIFS)
4. "Sensitivity improvement of plastic scintillator by surface treatment- early stabilization", Furuta, E. (Ochanomizu Univ.)
5. "Effectiveness of Decompression Procedure for Reducing Adverse Influence of Air on Energy Spectra Measured by Proportional Gas Counter", Kawano, T. (NIFS)
6. "Variation Factor for Long-term Background Radiation Monitoring Data at Toki", Yokoyama, S. (Fujita Health Univ.)
7. "Visualization of Leakage EM Field around RF Oscillators for Ion Cyclotron Resonance Heating", Kamimura, Y. (Grad. School of Eng., Utsunomiya Univ.)
8. "Radiation Education for High School Students by Measurement Sharing Method Using Potassium Chloride Radiation Sources", Kawano, T. (NIFS) Education
9. "Practical Research on Radiation Education", Fukutoku, Y. (Nat. Sci. Cntr. Res. Educ. Kagoshima Univ.)
10. "Weight Saving and Performance Evaluation of On-Site Radiation Monitoring Cart", Kawano, T. (NIFS)