

Radiation and Operation Safety

Safety-related activities conducted in 2001 were focused on radiation monitoring, personnel dosimetry, beamline safety review, experimental safety control and safety training. Followings are the summaries of these activities.

Radiation Monitoring

Radiation monitoring systems worked smoothly this year. Monitoring data show that radiation impact due to operation of SRRC is well under controlled.

In order to monitor the environmental neutron dose reliably, the sensitivity of the detection system to that of the natural background cosmic-ray neutrons must be established. Lots of the efforts have been devoted to studying the characteristics of the cosmic-ray neutrons near air/ground and air/water interfaces. According to our measurements and calculations, the annual neutron effective doses at sea level of Taiwan are 26 (air/ground) and 22 μSv (air/water), corresponding to neutron fluence rates of 5.6×10^{-3} and 3.7×10^{-3} $\text{n cm}^{-2} \text{s}^{-1}$ respectively. The energy spectra of the cosmic-ray neutrons near air/ground and air/water interfaces were also unfolded and plotted as that shown in Fig.1. With this established sensitivity data and detection technique, we are able to measure the skyshine neutron doses from the operation of high-energy accelerators.

Two Monte Carlo codes, FLUKA and MCNPX, were introduced to simulate the radiation field around SRRC this year. The features of these codes include hadronic and electromagnetic interactions, charged particle tracking, low energy neutron transport and full tracing of secondary particles. They are capable of dealing with high-energy electron, photon and neutron coupled problems. Fig.2 shows the calculated photon and neutron energy spectra outside the shielding tunnel of the storage ring.

Multiplying with the energy dependent fluence-to-dose conversion factors, photon and neutron dose can be determined to be 1.3×10^{-11} and 5.3×10^{-13} μSv per electron loss respectively. Within the effective detection ranges of available photon and neutron detectors, the agreement between calculation and measurement results is very satisfactory.

Personnel Dosimetry

The personal dose of each user/staff is evaluated monthly by reading the TLD dosimeters. The dose assessment work is made by our own personnel dosimetry laboratory which had been certificated by the Chinese National Laboratory Accreditation (CNLA). The statistics of the personal dose are shown in Table 1. It reveals that most of the TLD users receive extremely low radiation doses that are indistinguishable to that of the natural background. It also shows that the radiation exposure from working at SRRC is minimal and well under control.

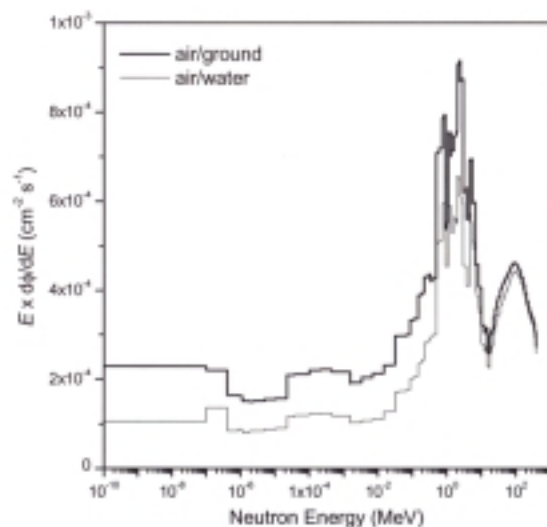


Fig. 1: Cosmic-ray neutron spectra near the air/ground and air/water interfaces.

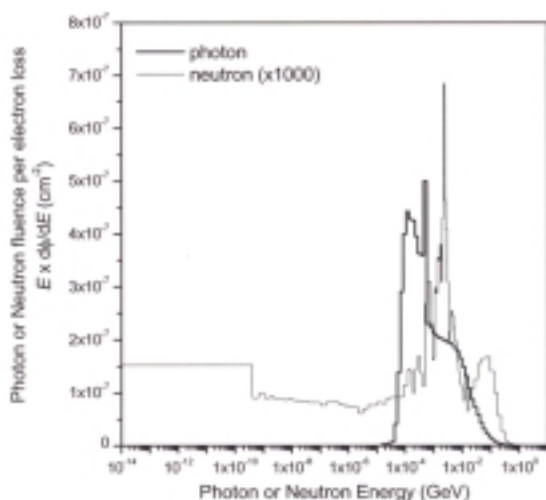


Fig. 2: Photon and neutron energy spectra outside the shielding tunnel of the storage ring.

Beamline Safety Review

Almost all the available beam ports in SRRC have been occupied by beamlines. No new beamline construction proposal had been reviewed in 2001. The Beamline Review Committee had called a readiness review meeting to check the modification of BL20B, the multiple-purpose X-ray beamline that intended to accommodate small angle scattering capability by elongating the beamline. Review results show that the modification is workable and complies with SRRC safety requirements. As discussed in the Committee, new and unified beamline interlock system developed with Programmable Logic Circuit was scheduled to replace the old relay-based system. Functional tests were carried out to ensure the safe operations of the beamlines. Currently, PLC-based control panels were installed in High-Flux, SEYA, LSGM, U5 and HSGM beamlines.

Experimental Safety Control

Four seasonal meetings were scheduled by the Experimental Safety Review Committee in 2001 to review the increasing number of experimental proposals. The Committee identified the potential hazards of the experimental proposals and issued reasonable safety precautions to users especially on the experimental samples and operation procedures. Most of the hazardous materials to be used in SRRC had been discussed before, and only several new items were verified this year. Safety Approval Form was modified to intensify the clarification of hazard property and quantity of sample. This new format had been approved by the committee and incorporated into the proposal application form.

Safety Training

Two major improvements in safety training were made to upgrade the training quality and to cover new safety regulations. A revised Safety Training Handbook was completed and given to new users and staff members. Internet download this document will be available soon. The training course conducted by watching a video tape now will be changed to interacting with a computerized interactive multi-media next year. This will enable users to have a self-control training process. Testing will be integrated into each chapter accordingly to highlight important safety notes.

Table 1: SRRC Annual Dose Statistics (2001).

Dose Range (mSv)	Number of Person	Collective Dose (man-mSv)
≅ Background (B.G)	727	0.0
B.G ~ 0.1	110	3.39
0.1 ~ 0.2	8	1.16
0.2 ~ 0.3	1	0.29
0.3 ~ 0.4	0	0.0
Total	84	64.84