# Safety

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## Radiation Shielding Design

### *1. Accelerators*

Based on the ALARA principle, we employed for shielding calculations the dose limit at the boundary of controlled area to be 2μSv/h and that to the general public at the nearest access to be 50μSv/y. The shielding calculation includes bulk shielding, duct streaming and skyshine. For forward bulk shielding calculations, ESRF's formula[1] was used and in the transverse direction against the electron beam direction, Jenkins' formulas[2] for neutrons and photons were used. For the skyshine calculation, Stevenson-Thomas' formula[3] was employed for an annual operation time of 5,500 hours, obtaining the annual dose of 23μSv, which is well below the dose limit to the public of 50μSv/y.

### *2. Beamlines*

Shielding design calculations for the beamlines are now in progress using a newly developed beamline shielding design code STAC-8[4], supported by detailed calculation with a Monte Carlo simulation code EGS4[5]. Its validity was verified through comparison with the measurements. Using the same code, the dose outside the hutch wall of the beamline ID-15 at ESRF was analyzed. Through the analysis we got some practical experiences which is rather useful for the shielding design calculations of the SPring-8 beamlines. Preliminary shielding calculations were already done for the beamline of the typical bending magnet and the pilot balminess of wiggler and undulator. Thicknesses of lead shields for each main beam shutter, photon stopper and hutch wall were determined so that the doses just behind each shielding component be lower than the design criterion of 6.67μSv/h.

## Radiation Experiment at PF

Two radiation physics experiments to measure absorbed and exposure doses were carried out at the BL-14C PF beamline of KEK. One experiment is the measurement of the absorbed dose of monochromized 40 keV synchrotron radiation in optical elements simulating a Si crystal target of a beamline. LiF and CaSO4 TLDs were employed for the measurement. The other is to measure the exposure distribution within a hutch due to white synchrotron radiation scattered by some optical elements. The dosimeter we used are LiF TLD. Analysis of the experiments are now in progress with STAC-8 and EGS4.

## Measurement of Environmental Radiation and Radioactivity

For accurate estimation of radiation levels originated from the SPring-8, it is necessary to measure environmental radiation and radioactivity, in advance of operation of the facility. Thus we started the measurement in 1994 FY, measuring integral photon and neutron doses separately and also radioactivity involved in air dust, water, plants and soils at the facility site and its neighborhood. Photon and neutron integral doses were measured with glass dosimeters and etch pit dosimeters, respectively, which were arranged at the 10 monitoring posts in the site. Samples for measuring radioactivities were collected at the 4 points individually. Measurements were carried out every 3 months, that is, totally 4 times during the fiscal year. The same measurements are scheduled to be continued in 1995 FY.

## Radiation Control System

Radiation control for the SPring-8 mainly consists of

1) monitoring of radiation dose rate,
2) management of radioactivation products, exhausted air and waste water,
3) exposure control for radiation workers,
4) control of personnel coming in and out of the controlled areas and
5) the computer system for an efficient performance of the complete control system.

Design study of the radiation monitors was completed and they were already contracted. The monitors for neutrons and photons were designed for both indoor and outdoor uses. We developed a low energy photon monitor with a tissue equivalent ionization chamber on an experimental basis, ranging from 0.01 to 1.0

MeV and its response to pulsed radiations was examined. Furthermore, energy response of the glass dosimeters were measured for lower energy photons to show meaningful response at lower than 10 keV.

Another contract was also made of the personnel entrance control system which consists of ID card, card reader, electric signal converter, terminal controller (to open or close doors), automatic status display device, network, data processing system and ID card maker.

**Safety and Hygiene Issues**

Safety and hygiene control committee was organized to ensure better performance on radiation and general safety and hygiene issues. During 1994 FY, the committee was held three times and safety check was carried out two times, pointing out some remarks on operation and maintenance of cranes, and storaging and handling of organic solvents. Training for safety and hygiene was occasionally carried out to the personnel at the site. Besides, a lot of personnel attended other training classes, such as fire prevention, handling of manufacturing machineries, crane operation, radiation works and so on.

**References**


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