Table 2 Individual dose monitoring results in 2014.

Time	Number of monitored individuals	Annual collective effective dose/mSv	Average annual effective dose/mSv	Number of individuals with different annual effective dose/mSv					
				<0.1	0.1∼1	1∼5	5∼10	10∼20	≥20
2014	291	34.92	0.12	35	252	4(1.49 mSv)	0	0	0

Table 3 Total α, β radioactivity of the environmental samples in 2014.

Site	Water/(Bq/L)		Site	Soil/(Bq/kg)		Plant/(Bq/kg)	
	α	β		α	β	α	β
Huanghe new bridge	0.9	0.14	North of CSRe	591.3	731.3	13.1	107.9
Sangyuanzi bridge	0.13	0.17	South of the institute	726.6	860.2	22.4	155.1
Tap water	0.093	0.06	North of 6# building	494.8	850.9	13.8	120.7
Waste water	0.1	0.14	West of 6#building	555.4	888.1	14.9	97.0
			North of RWS	594.1	959.0	20.9	173.0
			West of RWS	698.8	858.5	23.0	129.0
			East of RWS	744.3	842.4	23.1	152.6
			South of RWS	565.1	725.1	14.0	172.7

Total α, β radioactivity in soil, water, plant samples from environment around HIRFL and soil, plant samples from Radioactive Waste Storeroom (RWS) are measured with BH1216 low background α, β Measuring Instrument, the results are shown in Table 3, and compared with the background level of China[2].

Radiation safety license of IMP which was awarded by Ministry of Environmental Protection was renewed in 2015, furthermore, several radiation facilities were list in the permit, which means all of these radiation facilities running in IMP yard were permitted by law.

References

[1] Chunting Liu, Shuming Bai, Xiuying Ren, et al., Radiation Protection, 16(1996)121.

[2] The investigation group of national environmental natural radioactivity level, Radiation Protection, 12(1996)122.

6 - 23 Comparison Results of National Individual Dose of IMP in 2014

Mao Wang, Li Wuyuan and Su Youwu

IMP participated in the comparison of national individual dose which was organized by National Institute for Radiological Protection, China CDC, and the comparison results were corrected and was granted with certificate. In the comparison, RGD-3B reader, LiF(Mg,Cu,P)detectors, FJ411B annealing furnace and TLD400 detector box were used. The RGD-3B measuring system and LiF(Mg,Cu,P) thermoluminescence detectors were calibrated in 2014. Five groups dosimeters marked number 1 to number 5 which used for routine monitor were selected to the comparison, each group with ten detectors. The first five groups were bland samples. Group 6 was standby sample and group 7 was for background dose monitor. The first 5 groups were exposed by the organizer in a standard flat water phantom in unknown direction with X or γ rays (according to ISO spectrum norm) with five different unknown individual dose equivalent values Hp(10). The measured values were obtained according to calibration factors, readout values, and the corresponding background values.

The relative error of each group in the comparison can be calculated as follows:

$$P_i = [H_i' - H_i]/H_i, \tag{1}$$

where H_i' is measured value, H_i is the exposed value which we don't know in advance, P_i is the relative error. If $|P_i| \leq 0.4$[1], P_i of all the five groups is within 0.4, the results were considered to be credible.

The results are shown in Table 1, the maximum relative error is 18%, and the minimum is 0.3%. To enhance the precise of measurement, further quality control is needed.

Table 1 Comparison results of national individual dose of IMP in 2014.

Group number	Ray energy/keV	Exposed direction/degree	Exposed value /mSv	Measured value/mSv	Relative error
1	83	0	0.30	0.301	0.003
2	662	60	1.34	1.44	0.07
3	83	60	0.95	1.12	0.18
4	65	0	0.30	0.344	0.15
5	662	40	1.80	1.85	0.03

Reference

[1] Liangan Zhang. GBZ07-2008 Test criteria of personnel dosimetry performance[S], (2008)5.

6 - 24 Summary of Magnet Division's Work in 2014

Ma Lizhen, Yao Qinggao and Zhang Bin

In 2014, magnet division has contributed a lot of normal conducting and superconducting magnets to HIMM and ADS projects. Research efforts are also ongoing to develop the new technologies for future projects, such as fast cycling superconducting dipole and Canted Cos-Theta(CCT) dipole for HIAF, magnetic lifting device for ADS target system, superconducting magnets for SECRAL II ECRIS.

1. HIMM project

The Heavy Ion Medicine Machine is composed of LEBT, cyclotron accelerator, MEBT, synchrotron accelerator and HEBT. There are 155 of 34 kinds of magnets and an electrostatic septum in HIMM. Until the end of 2014, almost all magnets and electrostatic septum in synchrotron accelerator have been produced and measured. Now the magnets in MEBT and synchrotron accelerator have been installed. The electrostatic septum has also been installed. The magnets in cyclotron accelerator and the other magnets in HEBT are been installed and will be finished several months later. The pictures below show the assemble site in Wuwei city.

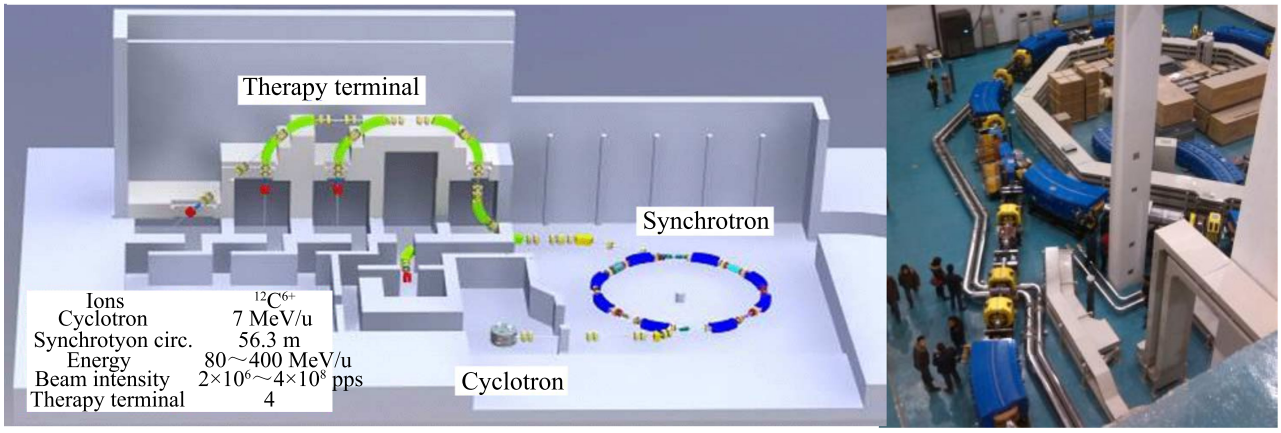

Fig. 1 (color online) (Left) The layout of HIMM. (Right) The assemble site of HIMM in Wuwei City.

The cyclotron magnet has already been tested for several times, and the measurement results prove that the development of cyclotron magnet is successful. As shown in the Fig. 2(a), the measurement values are in good agreement with the theoretical values. Fig. 2(b) shows the isochronous magnetic field in static equilibrium orbits.