

HJ

INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

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Requirements of radiation safety and protection for radiotherapy (English Translation)

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1 Scope

This standard specifies the radiation safety and protection requirements for medical institutions to carry out radiotherapy.

This standard applies to radiation safety and protection management of radiation workers and the public, in radiation therapy-related activities in medical institutions.

This standard does not apply to radionuclide therapy, patch therapy, radioactive seed implantation therapy, boron neutron capture therapy, radiotherapy simulation diagnosis.

The production, commissioning, repair and maintenance activities and scientific research activities of radiotherapy equipment can be carried out, with reference to this standard.

2 Normative references

This standard refers to the following documents or their clauses. For dated references, only the dated version applies to this standard. For undated references, the latest edition (including all amendments) applies to this standard.

GB 18871-2002 Basic standards for protection against ionizing radiation and for the safety of radiation sources

"Radioactive waste classification" (Announcement of Ministry of Environmental Protection, No.65 of 2017)

3 Terms and definitions

The following terms and definitions apply to this standard.

3.1

Radiation worker

Those who are or may be exposed to ionizing radiation, in medical institutions, engaged in radiation therapy-related activities, including physicians, medical physicists, technicians and nurses, as well as formal staff, temporary staff and interns, such as radiation therapy equipment installation and commissioning engineers, maintenance engineers, radiation protection managers, etc.

3.2

Survey system

A system, through which the radiation workers use reset buttons and other methods to clear and inspect the areas accessible to personnel in the accelerator hall or treatment room according to a certain line sequence, meanwhile verify personnel retained or other abnormal situations, before the beams of large accelerator devices, such as proton/heavy ion accelerators, are released. It is generally set up in areas related to large accelerators, such as proton/heavy ion accelerators.

4 General requirements

4.1

Medical institutions, that are engaged in radiotherapy, shall be fully responsible for the radiation safety and protection of radiotherapy activities; achieve the goal of protecting radiation workers engaged in radiotherapy, public health and environmental safety.

4.2

Medical institutions engaged in radiation therapy shall establish a sound radiation safety and protection management system; formulate a radiation safety and protection program; implement management systems such as job responsibilities and operating procedures.

4.3 In the process of planning, designing, constructing radiotherapy workplaces and

carrying out radiotherapy activities, medical institutions engaged in radiotherapy shall follow the justification of practice, optimization of safety and protection, dose limitation and potential exposure risk limitation, to ensure that radiation doses exposed by the radiation workers and the public involved in the treatment are at a safe and reasonable level.

4.4 Medical institutions engaged in radiotherapy shall set up appropriate multi-layer

protection and safety measures, according to the potential exposure hazard level of radiotherapy activities and the principle of defense in depth, so as to ensure that when a certain level of defense measures fails, the defensive measures of the next level are used for remedy or correction, so as to:

- a) Prevent accidents that may cause false exposure;
- b) Mitigate the radiological consequences of accidents;
- c) Restore radiotherapy equipment to a safe state.

4.5 The items constituting the safety interlocking system of radiotherapy-related radiation workplaces shall meet the following requirements:

- a) It shall meet the redundancy requirements; the items used shall be the minimum number of items necessary to complete a certain safety function, so as to ensure that the whole function will not be lost, when an item fails or does not work during operation;
- b) It shall meet the diversity requirements, including system diversity and multiple dose monitoring, using different operating principles, different physical variables, different operating conditions, different components, etc.;
- c) It shall meet the independence requirements. When a certain safety component fails, it will not cause the failure or loss of function of other safety components;
- d) It shall meet the requirements of failure safety. When a certain safety item or component fails, it shall ensure that the radiotherapy device returns to a safe state.

4.6 Medical institutions engaged in radiotherapy shall standardize the collection, proper temporary storage, disposal of radioactive waste, which is generated in radiotherapy activities.

4.7 Medical institutions engaged in radiotherapy shall conduct regular radiation monitoring and evaluation of the radiotherapy site and surrounding environment, to prove the effectiveness of the radiation safety and protection measures taken.

4.8 The radiation exposure of radiation workers and members of the public shall comply with the relevant requirements on dose limits in GB 18871-2002.

4.9 The dose constraint values for occupational exposure of staff engaged in radiotherapy and public exposure shall meet the following requirements:

- a) In general, the dose constraint value for occupational exposure of workers engaged in radiotherapy is 5 mSv/a.
- b) The dose constraint value for public exposure shall not exceed 0.1 mSv/a.

4.10 Medical institutions carrying out radiotherapy activities shall formulate corresponding emergency plans for radiation accidents; do a good job in emergency preparations, emergency drills, emergency responses for radiation accidents, to ensure effective prevention of radiation accidents or mitigation of the consequences of radiation accidents.

5.1 Site selection and layout

5.1.1

The site selection of radiotherapy sites shall fully consider its radiation impact on structural performance and protective performance; meet the optimization requirements.

Neutron shielding must be considered, when using neutron source radiotherapy equipment, proton/heavy ion accelerators or X-ray radiotherapy equipment greater than

10 MV.

6.1.3 When the pipeline passes through the shielding object, the method that does not affect its shielding effect shall be adopted, meanwhile shielding compensation shall be carried out. The overlap between the protective door and the wall shall be fully considered, to ensure that the radiation protection requirements outside the shielding object are met.

6.1.4 Dose control shall meet the following requirements:

a) At 30 cm from the outer surface of the treatment room's wall and entrance door, points of concern adjacent to the treatment room, near the ground and floors outside the roof of the treatment room, built or proposed two-floored buildings above the treatment room or next to the treatment room, or when the height of the adjacent building exceeds the solid angle area spanned by the edge of the inner surface of the roof of the treatment room from the radiation source point, THEN, the surrounding dose equivalent rate, at a distance of 30 cm from the outer surface of the treatment room roof AND the high-rise buildings where personnel reside within the solid angle area, shall meet the dose rate reference control level, which is determined by the following 1) and 2) at the same time:

1) Using the weekly workload of radiotherapy, the use factor and residence factor of the point of interest (which can be selected according to Appendix A), the derived dose rate reference control level of the point of interest is obtained, from the following weekly dose reference control level ():

Radiation workers outside the machine room: $\leq 100 \mu\text{Sv/week}$;

Non-radiation workers outside the machine room: $\leq 5 \mu\text{Sv/week}$.

2) Determine the highest dose rate reference control level ($\mu\text{Sv/h}$) of the point of interest, according to the difference of the personnel residence factors in the point of interest:

Places with personnel residence factor $T > 1/2$: $\leq 2.5 \mu\text{Sv/h}$;