

25 YEARS RADIATION PROTECTION PRACTICE  
AT LOW ENERGY PARTICLE ACCELERATORS

P.F. Sauermann, J. Knieper and H. Printz  
Nuclear Research Centre Jülich,  
P.O.B. 1913, D-5170, Jülich, Germany

ABSTRACT

Small high yield particle accelerators, such as neutron generators and minicyclotrons, are used in various areas of physical, chemical and medical research. Since they are strong sources of neutrons and  $\gamma$ -radiation a number of radiation protection problems must be solved to achieve a proper protection of workers and environment. In our paper we give recommendations to solve these problems according to our long practice.

The main problems at neutron generators concern the behaviour of tritium. Our paper informs about our experiences with the leakage of tritium into the environment with respect to transport, storage, installation and change of high activity tritium targets. Furthermore, we inform about the release of tritium to the environment during normal operation of neutron generators and our measures to reduce the releases. Finally, the procedures suitable for the conditioning of tritium in pump oils, cooling water and absorption cartridges are described. These procedures were also applied to the safe decommissioning of a neutron generator at the end of 15 years of operation.

At minicyclotrons three radiation protection problems are dominating: proper design of shields, induced activity and exposure to workers. In our paper we give recommendations for shield design on the basis of our extensive attenuation measurements performed in the last twenty years. Furthermore we give recommendations for the planning of Ventilation Systems which are in harmony with the ALARA-principle. Since minicyclotrons are mainly used to provide short-lived radionuclides the handling of the radionuclides possibly results in high whole body and hand doses to workers. Our paper gives a dose record for the years 1971 to 1988.