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Clearance of accelerators and the removal of accelerator parts from radiation protection areas

Statement by the Commission on Radiological Protection

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Freigabe von Beschleunigern und Herausbringen von Beschleunigerteilen aus Strahlenschutzbereichen

Stellungnahme der Strahlenschutzkommission

The knowledge of the history of an accelerator that is the mode and the time of operation as well as the knowledge of the type of the accelerated particles, the material composition of the different parts of the accelerator and the presumed activation reactions is necessary for the clearance of accelerators or parts of it. These data provide a basic to identify the radionuclides that will have to be taken into account which is the requirement to sort the parts of the accelerator with respect to the nuclide vectors which are representative for the clearance procedure. Different clearance paths may also require sorting.

The answer of the question if a certain "simplified clearance limit" can be developed for accelerators, which is not based on nuclide-specific examinations, is no. Even a simplified clearance procedure requires the knowledge of the nuclide vectors which are radiological relevant for the specific materials of an accelerator, because the clearance of accelerators is always subject to consideration of the radiological relevant radionuclides. Generally it is possible to identify material groups, depending on the operation mode and the potential activation reactions. From a known nuclide vector for each part of the accelerator it is possible to derive a maximum admissible gamma local dose rate or fluence rate; in this case it is acceptable to apply a procedure which does not involve nuclide-specific measurements (e. g. gamma local dose rate), as long as the sensitivity of the measuring instruments is sufficient, that is the detection limit must be below the "clearance level" by at least a factor of 3.

An example for the allocation of radionuclides to material classes is shown in table 1; based on the results of a selected clearance procedure for accelerators[1].

Table 1 is a non exhaustive list of possible materials and their representative nuclides. As a rule, the nuclide vector must be determined for every single accelerator part. In the case of medical accelerators which are used in large numbers, it might be possible to determine the nuclide vectors for the "clearance relevant" assembly groups in order to use them for all accelerators of this type.

Apart from the specific activity, the parts need to be checked for surface contamination. If surface contamination is detected, the contamination has to be included in the clearance procedure. It might be necessary to perform appropriated decontamination procedures.

The approach of the public authorities to the procedures for the dismantling and the clearance of accelerators used in the scientific and medical fields, are very different. In order to harmonize these procedures it would be helpful to develop a guideline or checklist containing the fundamental requirements for the clearance of accelerators and to make them available to both public authorities and operators.

Since there are no rules concerning the removal of exclusively activated parts from radiation protection zones, the Commission on Radiological Protection recommends considering this aspect in the next revision of the Radiation Protection Ordinance.

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[1] External clearance procedure for components at the German DESY research centre
Internal working instruction, N. Tesch, 16 June, 2005

Table 1: Example of an allocation of radionuclides to material classes (accelerators used in a research facility[1])

Material class	**Reference nuclide 1 / (percentage)**	**Reference nuclide 2 / (percentage)**
Lead	Sb-124 / (70%)	
Copper	Co-60 / (90%)	
Brass	Co-60 / (85%)	
Steel/iron	Co-60 / (60%)	Mn-54 / (30%)
Aluminium	Na-22 / (95%)	
Electronics	Co-60 / (60%)	Zn-65 / (20%)

[1] External clearance procedure for components at the German DESY research centre, Internal working instruction, N. Tesch, 16 June 2005