



Strahlenschutzkommission

Geschäftsstelle der
Strahlenschutzkommission
Postfach 12 06 29
D-53048 Bonn

<http://www.ssk.de>

**Radiological protection principles concerning the release
for further commercial or industrial use
of buildings used for commercial or industrial purposes
and the disposal of building debris
from uranium mining and milling**

Recommendation of the German Commission on Radiological Protection

Adopted at the 107th session of the Commission on Radiological Protection
on December 12/13, 1991

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**Strahlenschutzgrundsätze für die Freigabe
von gewerblich genutzten Gebäuden zur weiteren gewerblichen
Nutzung sowie für die Beseitigung von Bauschutt
aus dem Bereich des Uranerzbergbaus**

Empfehlung der Strahlenschutzkommission

**In the event of any doubts about the meaning,
the German original as published shall prevail.**

Table of Contents

- 1 **Scope** 4
- 2 **General principles** 4
- 3 **Criteria for release**..... 5

1 Scope

Within the scope of the shut-down of or remedial measures for the uranium producing plants in Saxony and Thuringia, commercially or industrially used buildings are intended to be partly directed to other uses, partly pulled down. The following recommendation is applicable to the release of these buildings for new commercial or industrial use, or to the release for conventional disposal of the debris produced when these buildings are pulled down, as well as to the debris already existing. In cases of contaminations with tailings or uranium concentrate it must be checked on a case-by-case basis whether and on which additional conditions a release is possible. This is also applicable to the use of tailings as building materials.

2 General principles

As a result of uranium mining in Saxony and Thuringia, different environmental media have been contaminated with uranium and its daughter products. In this given situation, the radioactive contaminations and resulting exposures can only retrospectively be controlled, restricted and reduced subject to optimization. If buildings from these areas are intended for commercial or industrial use by a third party, it has to be considered whether this is possible. The same applies for the deposition of the debris brought about during demolition.

For the assessment and evaluation of the individual radiation exposure levels for unrestricted use are recommended below which an unconditional release is possible. Furthermore, additional levels for building debris are recommended for a range within which certain preconditions for release have to be fulfilled. Above this range, appropriate measures have to be set out within the scope of an optimization procedure, allowing for case-specific conditions.

The levels for unrestricted use are orientated on an additional potential radiation exposure of 1 mSv/a (effective dose) due to uranium mining activities. This value is within the variation of natural radiation exposure. For the individual environmental media, too, the recommended levels for unrestricted use are within the range of values known from the surveys on natural radiation exposure. Radon exposure indoors is not accounted for, as it is subject of the Recommendation of the Commission on Radiological Protection of June 30, 1988.

With regard to uses of contaminated buildings generally all significant exposure pathways have to be evaluated, i.e.:

- external exposure to gamma radiation from the building materials,
- radiation exposure by inhalation of radon daughter products,
- radiation exposure by inhalation of dust contaminated with long-lived alpha emitters, and
- further spreading of non-adhesive surface contamination.

With regard to the use of sites on which building debris has been deposited, also generally all relevant exposure pathways have to be evaluated. Consideration must be given to:

- external exposure to gamma radiation from the areas covered with debris,
- radiation exposure by inhalation of radon daughter products outdoors,
- radiation exposure by inhalation of dust contaminated with long-lived alpha emitters outdoors,
- direct ingestion of dust and soil contaminated with long-lived alpha emitters by children playing outdoors,
- radiation exposure by consumption of agricultural or horticultural products, and
- radiation exposure by consumption of game and wild plants.

In addition the radiation exposure of the public due to potential ground water contaminations must be considered.

Assuming conditions as realistic as possible but sufficiently conservative, the dose estimates for the use of buildings reveal that the external gamma radiation from the building materials still remains the relevant exposure pathway even after careful cleaning of the buildings (except for the inhalation of radon and its decay products).

The results applicable to the use of building debris landfills are those obtained in connection with the Recommendation of the Commission on Radiological Protection entitled "Radiological protection principles concerning the use for forest and agricultural purposes and as public gardens (parks) and residential areas of areas contaminated by uranium mining" as of October 8, 1991. In this context the dose estimates show that, assuming conditions as realistic as possible but sufficiently conservative, the external gamma dose rate and the potential input of activity into the ground water are relevant exposure pathways for all uses of contaminated sites considered here. Additional specific exposure pathways of importance for the use as residential area and as public park are the radiation exposure from direct ingestion of dust and soil contaminated with long-lived alpha emitters by children playing outdoors as well as for agricultural uses the radiation exposure from consumption of local food products.

3 Criteria for release

3.1 Release of buildings for commercial or industrial use

Buildings may be released for commercial or industrial use if the following criteria are fulfilled:

- Potential contamination may have occurred only from waste rock or from uranium ore.
- Ceilings, walls and floors must be cleaned so that soiling is no longer detectable.
- The local dose rate must not exceed 0.3 $\mu\text{Sv/h}$ in any room.
- If a building released for use is pulled down at a later time, the debris has to be handled as specified under Section 3.2.

3.2 Release of building debris for deposition

Depending on the specific activity of the building debris the following criteria are applicable: The decisive factor for the radiation exposure resulting from contaminated debris is the activity concentration of the U-238 decay chain, whereby radioactive equilibrium is assumed in general. In the absence of equilibrium the radionuclide with the highest specific activity in the debris has to be considered. The activity concentration is expressed in terms of specific activity of the relevant radionuclide of the decay chain (i.e. Ra-226) in Becquerel per gram dry matter of the debris.

- If the specific activity of the debris is less than 0.2 Bq/g, an unrestricted release for deposition may be pronounced.
- Debris with a specific activity between 0.2 Bq/g and 1 Bq/g should preferentially be deposited on contaminated sites which are not intended for unreserved release anyhow. In cases of deposition in such landfills it is assumed that the material will not be recycled and that the landfills will be recultivated after closure. With regard to uses for forest and agricultural purposes, or as park or residential area, the Recommendation of the Commission on Radiological Protection as of October 8, 1981 must be observed.
- In cases of debris with a specific activity exceeding 1 Bq/g the feasibility of depositing must be checked in accordance with radiological protection aspects in each individual case.