Strahlenschutzkommission

Geschäftsstelle der
Strahlenschutzkommission
Postfach 12 06 29
D-53048 Bonn
Germany
http://www.ssk.de

Treatment of difficult to recover Co-60 sources in former drinking-water wells

Comment of the German Commission on Radiological Protection

Adopted at the 128th session of the Commission on Radiological Protection on 08/09 December, 1994

The German original of this English translation was published in 1994 under the title:

Behandlung von schwer zu bergenden Co 60-Quellen in ehemaligen Trinkwasserbrunnen

in Volume 36 of the Series “Publications of the Commission on Radiological Protection”.

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

Contents

1 Problems

In 1991, the Commission on Radiological Protection (CRP) gave several recommendations (CRP 92) regarding radiological protection problems with typical intervention situations such as the use and release of areas, slag-heaps and buildings which have been contaminated by uranium mining. These recommendations did not include, for instance, slag-heaps with increased pyrites content, leached lean iron ore heaps, residual heaps from metallurgical and chemical processes and industrial settling plants. Regarding heaps with a specific Ra-226 activity > 0.2 Bq/g, the recommendations of the Commission on Radiological Protection were limited to small heaps, i.e. with an area extending < 1 hectare or a deposed material quantity of < 105 m^3. Additionally, with specific activities of > 1 Bq/g and already existing use, investigations were recommended in accordance with the specific conditions at the location.

During examination of all possibly relevant ways of exposure we came to the conclusion that, regarding those dilapidated mines which were included in these 1991 recommendations, an exposure by inhalation of radon decay products in open air does not belong to the relevant ways of exposure for all consecutive utilisations taken into consideration. Regarding the exposure through radon decay products in buildings we referred to a special CRP recommendation of 1988.

But with large dilapidated mines or other facts which exceed the current recommendations in kind and contamination, we cannot rule out that radon emissions released from them could lead to exposures which cannot be disregarded from the mathematical standpoint. We must take into consideration that the radon emission from dilapidated mines not only occurs in the open air but contributes too to an increase of already existing radon contents in buildings if they are located near to dilapidated mines. This influence on the internal air concentration possibly leads, due to the fact that people remain in rooms for longer periods of time, to a considerable exposure to radon from dilapidated mines and demands, regarding radiological assessment, the same treatment as the exposure to other radon or radon decay product concentrations in buildings, triggered by geogenic or technogenic causes.

The CRP 1994 passed a recommendation (CRP 94) regarding exposure through radon decay products in buildings which included a further development of former recommendations and was orientated on new findings and recommendations. Because dosimetric lung models for radon and its decay products are not secured as yet, the CRP did not base its recommendation regarding the limitation of radiological exposure in buildings on dose values but on the normal variation area (so-called “normal area“) of the radon concentration in which reduction measures of this concentration are regarded as necessary, independent of their causes. The upper end of this normal area of radon concentrations in buildings of the Federal Republic of Germany is calculated at a value of 250 Bq/m^3.

2 Guidelines regarding the values of radon concentration in the open air for the assessment of mining influences

The assessment of radon concentrations in open air must be based on the same basic methods and the orientation on the normal Variation area. This is in accordance with the recommendation of the CRP regarding the assessment of radon exposure in houses as well as with the radon recommendation of the ICRP (ICRP 94).

To enable a measurement of the normal Variation area of a radon concentration in open air one must refer to measurements which have been carried out in a similar geological region as the mining area but in which the influence of mining on the radon concentration in open air can be disregarded. Extensive measurement revealed that the upper end of the normal area amounts to a value of 80 Bq/m3.

The CRP recommends therefore a guideline regarding the values of a long-term radon concentration in the open air of residential areas, possible future residential areas and other areas where people live permanently, located near dilapidated mining areas, of 80 Bq/m^3. Due to spreading conditions, the radon concentration is usually lower in open air than in buildings. The guideline regarding the values of radon concentrations in open air is therefore lower than the upper limit of the normal area in buildings (250 Bq/m^3). Both values are orientated on the upper limit of the natural variation area.

If the long-term average values of a radon concentration in the open air of residential areas or possible development areas are below this guideline, restoration of the dilapidated mining area is not regarded as justified due to a reduction of the radon emissions. If this recommended value is exceeded tor a long period of time in the above areas one must investigate whether the increase is caused by the dilapidated mining area.

3 Guidelines regarding the values 01 radon concentration in the open air when considering redevelopment measures

If an investigation in accordance with no 2 reveals that the share of radon concentration, caused by a dilapidated mining area in the open air exceeds 50 Bq/m^3, the need for redevelopment measures must be taken into consideration. The recommendation of the CRP given in this paper means that an assessment of radiological exposure through dilapidated areas of uranium mining, in which the specification of essential interventions is in the foreground, should separate the exposure to radon and its decay products by inhalation from all other ways of exposure. This exposure must not be included into the exposure calculation tor the comparison with the dose guideline of 1 mSv/a tor the sum of contributions of other ways of exposure but be limited by separate guidelines regarding the values. On the one hand, the difficulty in converting activity concentrations into dose values is taken into account (ICRP 94) and, on the other hand, the principle is expressed to orientate the guidelines regarding values for measures and interventions, which are needed in view of the dilapidated uranium mining areas, directly on the natural variation width of radon concentration.

4 Literature

(SSK/CRP 92) Publications of the Commission on Radiological Protection, vol. 23: Principles of Radiological Protection for the Storage, Use or Release of Contaminated Materials, Buildings, Areas or Heaps from Uranium Mining. Recommendations of the Commission on Radiological Protection with explanatory notes. Gustav Fischer Verlag, Stuttgart, 1992

(SSK/CRP 94) Principles of Radiological Protection for the Limitation of Radiological Exposure in Buildings through Radon and its Decay Products. Recommendations of the Commission on Radiological Protection, passed in the 1 24th meeting of the Commission on Radiological Protection on 21 April 1994.

(ICRP 94) International Commission on Radiological Protection; Protection against radon-220 at home and work, ICRP Publication (in print)