Handout “Implementation”

Interlaboratory Comparison and Proficiency Testing of Passive Radon Detectors 2020

Since 2003, the German Federal Office for Radiation Protection (BfS) offers interlaboratory comparisons for instruments to measure radon-222 activity concentration or exposure to radon-222. In 2019 a proficiency testing was implied to comply with the dispositions of the new radiation protection ordinance.

The number of participants is limited to at 30. In case of more applications BfS will conduct a participant selection. If required participation is granted according to §169 of the German Radiation Protection Act (RPA) as well as approved measurement institutions according to §155 of the German Radiation Protection Ordinance (RPO). These are legally obligated to participate in BfS measures for quality assurance. The same accounts for candidates in the approval process.

According the German Federal Budget Code (BHO), the BfS is obliged to charge a registration fee of 720 € plus VAT (19%), if due, for participation in the interlaboratory comparison and proficiency testing. Institutions legally obligated to participate according to RPO will not be charged.

The participants submit a set of passive radon measurement instruments to BfS. Each device has to be labelled with a unique identification code supplied by BfS. Subsequently, the submitted sets will be divided at random into a certain number of exposure groups and one transit group.

Exposure

The exposures will be performed by the BfS Radon Calibration Laboratory. This laboratory is accredited by the German accreditation body Deutsche Akkreditierungsstelle GmbH (DAkkS) according the norm DIN EN ISO/IEC 17025 for measuring the activity concentration of radon-222 in air and the potential alpha energy concentration of short-lived decay products in air.

At the beginning of the exposure period all instruments are unpacked within a short period of time. Instruments with ON/OFF mode are turned into ON mode (ready for measurement). Subsequently, the instruments are stored in a room with low radon-222 activity concentration. Following the exposition schedule the instruments of the exposure groups are put into the calibration containers and exposed to different radon-222 activity concentrations. These can amount up to 10 kBq/m³ under normal room conditions (temperature: 20°C – 25°C, relative humidity: 20% - 60%). The exposures may reach values of up to 3000 kBq·h·m⁻³. The instruments of the transit group are stored in the room with low radon-222 activity concentration over the entire period. At the end of the exposure period measurement instruments with ON/OFF mode are turned into OFF mode. Instruments are repacked as delivered or as indicated by the participant. The participant orders the collection of the instruments from BfS.

Submission of measurement values to BfS

No specific information on the exposure data will be supplied besides the ID codes of the transit group instruments. Each participant will evaluate its instruments. The value of exposure to radon-222 for each instrument (including the instruments of the transit group) and the corresponding measurement uncertainty have to be reported to the BfS. The values

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1 Regarding the volume of a set see table 1.
shall be indicated in the unit kBq·h·m$^{-3}$. The mean value of the indications of the transit group’s instruments is a measure of the effects of transportation and storage, which all submitted measurement instruments are exposed to (“transit background”). It is within the responsibility of the participant to take account of the transit background.

**Report on individual results and proficiency testing**

After having received the measurement values of all participants BfS performs the final evaluation. BfS will calculate the arithmetic mean value and standard deviation of the radon-222 exposure for each exposure group. The mean value will be compared with the reference values of the corresponding radon-222 exposure. Each participant will receive a preliminary report to check for transmission errors. Subsequently, the deviation of the exposed instruments mean values from the respective reference values is evaluated in proficiency testing. The performance is assessed “satisfactory” or “unsatisfactory”. The participant receives the final report.

For approved measurement institutions according to §155 of the German Radiation Protection Ordinance the result of the proficiency testing will be made available to the person in charge within the BfS.

**Comprehensive report**

Each participant will receive a comprehensive report which includes the results of all participants in anonymous form, detailed information on the exposure conditions as well as statistical information on the proficiency testing. BfS is committed to treating the data received and established confidentially. Results will be disclosed to third parties exclusively in anonymous form.

**Table 1: Number of exposure groups, measurement instruments and exposure data**

<table>
<thead>
<tr>
<th></th>
<th>Instruments with solid-state nuclear track detectors</th>
<th>Instruments with electret detectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of exposure groups</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Number of instruments to be</td>
<td>35 ( = 1 set)</td>
<td>24 ( = 1 set)</td>
</tr>
<tr>
<td>submitted for each instrument</td>
<td></td>
<td></td>
</tr>
<tr>
<td>type and by each participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period of exposure</td>
<td>7 to 21 days</td>
<td></td>
</tr>
<tr>
<td>Radon-222 activity concentration</td>
<td>≤ 10 kBq/m$^3$</td>
<td></td>
</tr>
<tr>
<td>Radon-222 exposure</td>
<td>150 to 3000 kBq·h/m$^3$</td>
<td></td>
</tr>
</tbody>
</table>

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2 The values shall be indicated without decimal place. The confidence level of measurement uncertainty shall be 95%.
3 It is recommended to subtract the transit background from the exposure values of each instrument of the exposure group.
4 For information on the applied criteria see handout „Notes on evaluation“.