

## Description of the Dosemeter Badge



1. Front side

The badge is shrink-wrapped in a protective bag which must not be opened or removed!



2. Interior of the dosemeter badge

with Four-Element Detector-Card (blue, labeled) and neutron absorber (white / gray)

## Scope / Field of Application

The official albedo dosimeter is a whole-body dosimeter and is used to determine the personal dose in the depth personal dose measurement quantity in mixed neutron and photon radiation fields. Its use is recommended if the expected neutron fraction is more than 10% of the personal dose to depth. The albedo dosimeter probe may only be used for its intended purpose in personal dosimetry.

## Operating Range and Type Approval

The official Albedo dosimeter Type MPA-Albedo GD02 has a type-approval for the dosimetry of photon radiation by the Physikalisch-Technische Bundesanstalt (PTB) Braunschweig, Germany.  
 Approval mark: DE-17-M-PTB-0068.

Summary of technical Data		
Type of radiation:	Photon radiation	Neutron radiation
Measurement quantity:	Personal deep dose equivalent $H_p(10)$	Personal deep dose equivalent $H_p(10)$
Dose and dose-rate	0.1 mSv to 2.0 Sv and 0.1 $\mu$ Sv/h to 1 Sv/h	0.1 mSv to 10.0 Sv
<b>Operational range:</b>		
Photon energy	20 keV to 7.0 MeV	
Neutron energy		Thermal neutrons to 15 MeV max. energy
Angle of incidence	$0^\circ \pm 60^\circ$	
Ambient temperature	- 10 °C to 40 °C	
rel. Humidity	10 % to 90 %	
Sunlight	0 W/m <sup>2</sup> to 1000 W/m <sup>2</sup>	
mechanical shock	0 m/s <sup>2</sup> to 4900 m/s <sup>2</sup>	

## Usage and Handling

The dosimeter (see illustration) is worn at a location representative of the exposure (e.g. on the front of the body at chest or hip level). When wearing the albedo dosimeter, make sure that the back of the cassette marked "Körperseite" (body side) is facing the body. The preferred direction of beam incidence is perpendicular from the front to the plane of the dosimeter. The geometric center is the reference point for dose measurement.

## Method of Measurement

The albedo dosimeter consists of a detector card with four thermoluminescence detectors (TL detectors), located within a cassette made of ABS plastic. Inside, the cassette has filter elements made of boral, which shield the TL detectors from thermal neutrons on one side each (front and body side). An additional edge made of Boral protects against thermal neutrons from the side. Each TL detector pair consists of one detector that is only sensitive to photons and one that is sensitive to both photons and thermal neutrons. The neutron dose is determined by measuring the neutrons moderated and backscattered in the body of the person wearing the dosimeter

(albedo effect), whereby the measured value difference of the corresponding detector pair on the body side is the neutron-induced measurement effect.

Due to the energy dependence of the neutron response, specific calibration factors are used for each of four application areas (N1 to N4), which are varied taking into account the difference in measured values of the detector pair caused by the incidence of thermal neutrons on the front side of the cassette.

The following table contains those categories of neutron radiation fields which the radiation protection officer shall use to classify the exposed persons into one of the application areas. It must be ensured that a dosimeter is only used in this one area of application.

Application areas for albedo dosimeters	
<p><b>N1</b> <b>REAKTORS AND ACCELERATORS</b> <b>(Heavy shielding)</b></p> <ol style="list-style-type: none"> <li>1. Nuclear power stations, e.g. in reactor core areas, steam generators, sump, settling basin</li> <li>2. Research reactors, e.g. at radiation channels within and outside of the shielding in experimental buildings</li> <li>3. Betatron, linear electron accelerators with electron energy &gt; 8 MeV usage if necessary in therapy, research, engineering, particularly for commissioning, maintenance and repair work.</li> <li>4. Therapy particle accelerators, applications in therapy: (d, T)-generator, 14 MeV-Neutron cyclotron (Proton-/Deuteron-nuclear reaction) especially at the entrance of the irradiation protection room</li> </ol>	<p><b>N2</b> <b>FUEL CYCLE,</b> <b>CRITICALITY ARRANGEMENTS (low shielding)</b></p> <ol style="list-style-type: none"> <li>1. Fuel cycle incl. reprocessing of uranium dioxide, fuel pellet manufacturing, manufacturing of fuel elements, installation/deinstallation / transport of fuel elements, temporary storage of fuel elements or fissionable material, fuel element storage/ Pu storage, decontamination and reprocessing of fissionable material.</li> <li>2. Experimental reactors: fuel element arrangement without or with minor moderation/shielding on experimental/training reactors, work on critical arrangements, e.g. uranyl solution.</li> <li>3. Criticality monitoring: handling of large quantities of fissionable material, handling of fissionable material in water-based solution, chemical work with large quantities/volumes of fissionable material</li> </ol>
<p><b>N3</b> <b>RADIONUCLIDE NEUTRON SOURCES</b></p> <ol style="list-style-type: none"> <li>1. (Am-Be, Pu-Be, Ra-Be, Cf-252) Transport and storage of the sources, laboratory/field usage in research and engineering, without or with moderation through liquid, shielding or soil.</li> </ol>	<p><b>N4</b> <b>ACCELERATOR (RESEARCH)</b></p> <ol style="list-style-type: none"> <li>1. Particle accelerator, usage in research or engineering, cyclotron and 14 MeV generators, frequently changing target or type of particle, accessible radiation rooms or experimental structures without or with minor shielding, less shielded areas of the facility,</li> <li>2. High-energy accelerators for electrons &gt; 50 MeV,</li> <li>3. High-energy accelerators for protons, deuterons, heavy particles, e.g. C-12 to Ar-40 to 400 MeV, proton synchrotron</li> </ol>

### Organisation

The albedo dosimeter is reusable and can be borrowed by the monitoring service as required or ordered on a regular order basis. All dosimeters are shrink-wrapped in a protective bag to prevent contamination. This bag must not be opened or removed! Clips for fastening be requested from the monitoring service if required. These clips must be removed before sending the probes to the measuring point.

**In case a dose of 50 mSv is exceeded, the detector card must be withdrawn. In case the dosimeter was issued on a rental base, the detector card will be invoiced.** An "Assignment and Modification Form" („Zuordnungs- und Änderungsbogen“) is sent with each dosimeter dispatch; it is intended to communicate information on the person, operation and area of application with the monitoring service. This form should only be returned to the service if changes or additions to the information are required. The amended form should be returned immediately (e.g. with the probes to be evaluated from the previous month), not just with the dosimeters listed.

The monitoring period is usually one month, but can be extended by the supervisory authority in justified individual cases at the request of the radiation protection officer. After more than three months since the last evaluation, however, the albedo dosimeter must be sent to the monitoring service for regeneration before being used again.

### Quality Management:

The monitoring service is accredited according to DIN EN ISO/IEC 17025:2018 [D-PL-11142-01-00]. It participates in national and international dosimeter intercomparisons.



**Do not X-Ray**  
**Nicht Röntgen**

X-Rays might induce false-positive dose indications.  
Röntgenstrahlung führt zu falsch-positiven Dosisanzeigen.



**Do not open protective bag**  
**Schutzfolie nicht aufschneiden**

Removing the protective bag might render the dosimeter not evaluable.  
Eine geöffnete Schutzfolie kann zur Unauswertbarkeit des Dosimeters führen.