THE NEUTRON RPL DOSIMETER

The Neutron RPL is the solution for measuring the dose received by employees in mixed photon/neutron radiation fields. In addition to the RPL dosimeter (see RPL Dosimeter product sheet), this dosimeter is equipped with a neutron detector suitable for all neutron spectra: thermal, intermediate and fast, encountered in industry, research and the medical sector.

PRINCIPLE OF DETECTION

- The neutron dosimeter is composed of a polycarbonate detector (CR-39) placed in a polypropylene shell used as a converter to detect fast neutrons. Two additional lithium-6 fluoride converters (one bare and one covered with cadmium) are used to check that the dosimeter has been properly irradiated and to determine the ‘thermal neutron’ dose equivalent.
- The interaction of neutrons with the CR-39 produces irreversible damage called latent tracks. These tracks are revealed by the corrosive properties of an alkaline sodium hydroxide (NaOH) solution.
- The tracks are then quantified by optical microscope and the dose equivalent is calculated using an algorithm which takes into account the number of tracks and their diameter.
BENEFITS OF THE IRSN’S NEUTRON RPL DOSIMETER

- A robust dosimeter with a modular design with three types of attachments: clip, lanyard, crocodile clip.
- A photon/beta component and a neutron component in a single compact and robust case.
- A detector with a larger surface area than most systems currently on the market for increased sensitivity.
- No need for energy correction, whatever the facility, workstation or working environment (dosimeter independent of the neutron field spectrum).
- A Neutron RPL Criticality version integrating high-dose neutron and photon detection elements.

PERFORMANCE OF THE NEUTRON RPL DOSIMETER

<table>
<thead>
<tr>
<th>Neutron particles</th>
<th>Detected energy range(A)</th>
<th>Dose equivalent range</th>
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<tbody>
<tr>
<td>Thermal neutrons</td>
<td>Fast and intermediate neutrons from 75 keV to 14.8 MeV</td>
<td>From 0.10 mSv to 250 mSv</td>
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(A) - NOTE: These values do not represent the operational limits, but correspond to the minimum and maximum energies available in the reference facilities that allowed the tests to be conducted.

Dosimetry laboratory calibration methods

To ensure the best calibration of the neutron dosimeters, the IRSN has unique reference facilities in France:

IRSN Cadarache:

- AMANDE facility, monoenergetic neutrons.
- CEZANE facility, californium and moderated californium.

For thermal neutrons, the reference facilities used are located at the National Physical Laboratory in the UK.