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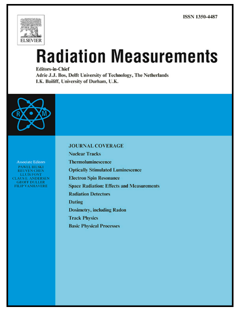

The impacts of a new electrochemical etch cycle for the Public Health England neutron personal dosimetry service

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The impacts of a new electrochemical etch cycle for the Public Health England neutron personal dosimetry service

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HIGHLIGHTS

- Improved dose linearity with a new etch cycle
- Energy dependence of response changes with a new etch cycle
- Effect on workplace field normalization factor with a new etch cycle

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ABSTRACT

The Public Health England (PHE) neutron and radon personal dosimetry services based on electrochemical etching of PADC have been running since 1986. Changes to the detector material have required a new etch cycle to be developed to improve linearity at high doses: A new supplier of PADC was able to meet the stringent criteria for thickness, response and background, but it was found that the tracks were, on average, larger, resulting in increased track overlap, saturation of the signal at lower dose levels and a reduction in the maximum dose measurable. This dose linearity problem meant that a more severe correction was needed, which led to increased measurement uncertainty. A new etch cycle has reduced the mean track size, and reduced track overlap, meaning that the maximum reportable dose is increased and dose assessments at higher doses are more reliable. Also reported on here are the results of tests on the energy and angle dependences of response, and the performance of the dosemeter in workplace fields, with data compared from dosemeters etched with both the old and the new processes. The results show that the new etch cycle produces an improvement to the routine service.

1. Introduction

The PHE neutron (Gilvin et al 2001) and radon personal dosimetry services (Bartlett et al 1988) based on the electrochemical etch of poly–allyl diglycol carbonate (PADC, also known by trade name CR-39®) have been running since 1986. Advantages of PADC are an ability to cover a broad range of fast neutron energies whilst including doses from thermal and epithermal neutrons (with a suitable converter), and the absence of response to photons. Fast neutron response is obtained via interactions in the PADC itself and its holder, whilst sensitivity to thermal neutrons arises from the use of a nylon holder, in which capture interactions take place (Figure 1).

For the radon service the operation principle is that of a radon diffusion chamber. The dosemeter is an enclosure which excludes radon progeny and detritus whilst allowing ingress of radon gas. This radon gas continues to decay, and forms more progeny. The alpha

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