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Mark Kellett, Laurent Vio, Christophe Bobin, Laurine Brondeau, Mikael Cardot-Martin, Hélène Isnard, Lacour Daniel, Marie-Christine Lépy, Valérie Lourenço, M. Marie, et al.

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M.A. Kellett[1], L. Vio[2], C. Bobin[1], L. Brondeau[1], M. Cardot-Martin[1], H. Isnard[2], D. Lacour[1], M.-C. Lépy[1], V. Lourenço[1], M. Marie[2], C. Thiam[1]

[1] *CEA, LIST, Laboratoire National Henri Becquerel (LNE-LNHB), Bât. 602 PC111, CEA-Saclay, 91191 Gif-sur-Yvette Cedex, France*

[2] *CEA, DEN, Laboratoire de développement Analytique Nucléaire Isotopique et Elémentaire (LANIE), Bât. 391 PC33, CEA-Saclay 91191 Gif-sur-Yvette Cedex, France*

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ABSTRACT

The 2011 Decay Data Evaluation Project (DDEP) evaluation for ^{147}Nd includes recommended absolute emission intensities for the two main gamma-rays at 91.105(2) keV and 531.016 (22) keV of 0.284(18) and 0.127(9) respectively, i.e. with uncertainties of 6.3% and 7.1%. These large uncertainties stem from inconsistencies in the published data and are unfit for modern purposes, since the production of ^{147}Nd is used as an important neutron flux dosimeter. Hence the LNE-LNHB has undertaken new absolute gamma-ray emission intensity measurements.

The ^{147}Nd source was produced at the TU Delft, Netherlands, during a one week irradiation in their reactor, using a sample enriched to 97.4% ^{146}Nd. An activity of ~6 MBq was received, following the irradiation of ~150 µg of ^{146}Nd. The deposit was dissolved in 1 M HCl to prepare a 2 MBq/g solution from which the sources were produced.

In order to ensure as little interference as possible from the subsequent decay of the ^{147}Pm daughter, and any possible impurities, a separation was undertaken using High Performance Liquid Chromatography directly coupled with an Inductively Coupled Plasma Mass Spectrometry, by the Laboratoire de développement Analytique Nucléaire Isotopique et Élémentaire (LANIE) of CEA, which developed the necessary procedure.

Absolute activity measurements were performed using two techniques before and after separation: the 4πβ–γ coincidence method and the 4πγ counting technique using a well-type NaI(Tl) detector. The gamma-ray intensities were measured using an N-type high-purity germanium (HPGe) detector with 100 cm^3 germanium crystal equipped with a 500 µm Be entrance window calibrated using standard point sources. Measurements were carried out before and after separation and give consistent results.

The results of these measurements will be presented, along with a full uncertainty budget, and their effect on the recommended data uncertainties will be discussed. For example, for the two main gamma-rays at 91.105(2) keV and 531.016 (22) keV, the absolute emissions intensities have now been measured as 0.2870(35) and 0.1311(13) respectively, i.e. with uncertainties of 1.2% and 1.0%, far smaller than the current uncertainties on the evaluated data.

Corresponding author's email address: mark.kellett@cea.fr