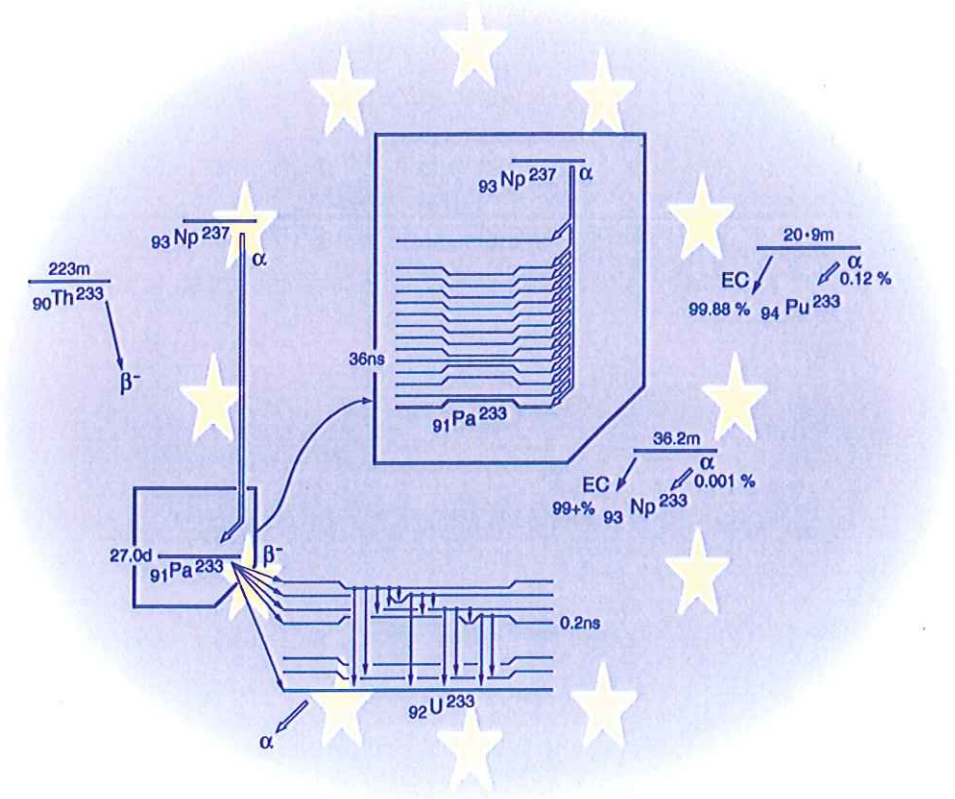
ICRM NEWSLETTER

Issue 14 - February 2000



International Committee for Radionuclide Metrology

Editor : Dietmar F.G. Reher

EUROPEAN COMMISSION

JOINT RESEARCH CENTRE
Institute for Reference Materials and Measurements
IRMM
Geel, Belgium

LABORATORY National Institute of Standards and Technology

NAMES J. T. Cessna, R. Collé

ACTIVITY Calibration of ^{32}P Stents for Contained Activity

RESULTS Samples of stainless steel stents containing ^{32}P activity were submitted to NIST by Forschungszentrum Karlsruhe, on behalf of IsoStent, Inc. of Belmont, California, USA. The stents were produced at four different contained activities, two each in two different lengths. The individual sets were intercompared by integral counting in a NaI(Tl) well crystal detector, using a reproducible geometry. Subsets of each group were then quantitatively destructively assayed. The samples were placed in a small amount of suitable carrier solution and dissolved using 60 µL of concentrated hydrofluoric acid. The resulting solution was then diluted approximately 1:3 with dilute phosphoric acid. All additions of solutions and stents were done gravimetrically, to produce an accurate mass for the final solution. Aliquots of this solution were measured by liquid scintillation counting against a NIST tritium standard using the CIEMAT/NIST method of efficiency tracing. A separate experiment was performed to verify there would be no loss of activity during the digestion of the stent. The activities from the digested stents were used to determine the activities of the remaining intact stents.

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5539
fax: 301-926-7416
jcessna@nist.gov

CONTACT Jeffrey T. Cessna

p. 97

LABORATORY National Institute of Standards and Technology

NAMES R. Collé

ACTIVITY Calibration of ^{32}P "hot wall" angioplasty-balloon-catheter sources by destructive radionuclidic assays

RESULTS A very quantitative, destructive-analysis procedure was devised for assaying the ^{32}P activity content of "hot-wall" angioplasty-balloon catheters. These sources developed and under investigation by Radiance Medical Systems, Inc. (Irvine, CA), are intended for use in the prophylactic inhibition of restenosis following balloon angioplasty in heart-disease patients. They consist of a thin source of ^{32}P which is incorporated directly into the balloon wall of the angioplasty catheter. As a pure beta-particle emitter, the ^{32}P content can not be assayed by nondestructive means since it has no distinctive, external, radioactive signature. The assay was based on performing a physicochemical digestion of the balloon catheter to extract the ^{32}P activity followed by liquid scintillation (LS) spectrometry of the resultant solutions. Measurement-based corrections were applied for the residual activity remaining in the digested balloon debris and on all of the digestion apparatus. The LS spectrometry, with ^{3}H-standard efficiency tracing, utilized a previously developed method for resolving the always-present ^{33}P impurity. The uncertainties in the assays were typically $\forall$ 1% at a two standard uncertainty interval. Initial ionization current measurements on the sources prior to the destructive assays led to the establishment of calibration factors that can be used for subsequent non-destructive radionuclidic measurements on similar balloon-catheter sources. The calibration results were also used to link Monte-Carlo-based theoretic modeling of the absorbed dose spatial distributions to radiochromic-film dosimetric measurements that were performed by the Dosimetry Group.

RELATED PUBLICATIONS

Collé, R., "Chemical Digestion and Radionuclidic Assay of TiNi-Encapsulated ^{32}P Intravascular Brachytherapy Sources," *Applied Radiation Isotopes* **50**, 811-833 (1999).

Collé, R., B.E. Zimmerman, C.G. Soares and B.M. Coursey, "Determination of a Calibration Factor for the Non-Destructive Assay of Guidant ^{32}P Brachytherapy Sources," *Applied Radiation Isotopes* 50, 835-841 (1999).

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé

p. 98

LABORATORY National Institute of Standards and Technology

NAMES R. Collé, B.E. Zimmerman, J.T. Cessna

ACTIVITY Liquid scintillation cocktail composition and mismatch effects

IN PROGRESS Liquid scintillation (LS) spectrometry with ^{3}H-standard efficiency tracing is one of the Radioactivity Group's principal and powerful measurement tools and is being applied to many newly-standardized, important nuclides such as those used in nuclear medicine. In the past few years, a variety of subtle and perplexing LS cocktail composition effects have been observed in various calibrations. Most of these effects appear to arise because of the existence of different chemical species in the various cocktails (e.g., between the ^{3}H standard and the nuclide being calibrated). As a result, efforts to understand these effects through broad, systematic evaluations are ongoing.

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé

LABORATORY National Institute of Standards and Technology

NAMES R. Collé

ACTIVITY Resolution of ^{210}Pb in aged ^{226}Ra solutions

IN PROGRESS A liquid scintillation spectrometry and data analysis technique has been devised for resolving the ^{210}Pb subseries from ^{226}Ra (and ^{222}Rn subseries) in aged radium solutions. The methodology was tested with solutions ranging from having only a few-year accumulation of ^{210}Pb to those nearing radioactive equilibrium. Calibration results for ^{226}Ra in some standard solutions with over a 50-year ^{210}Pb accumulation agreed to within the 0.6 % accuracy of the international Hönigschmid standard. The developed method will be especially powerful for making comparative measurements of radium solutions independent of their ages.

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé

p. 100

LABORATORY National Institute of Standards and Technology

NAMES R. Collé

ACTIVITY Low-Level Radium-226 Solution Standards

RESULTS The preparation, calibration and certification of a new low-level ^{226}Ra-solution standard (SRM 4969) has been completed. This SRM, with a massic activity of nominally 3 $BqAg^{-1}$, extends the range of available radium-standard solutions to a factor of ten lower. The three extant radium solution standards (SRM 4965, 4966 and 4967) have massic activities of nominally 30, 300 and 3000 $Bq \cong g^{-1}$, respectively. The new SRM was extensively intercompared to the previous SRMs to ensure consistency amongst all of the NIST radium standards. The calibration and intercomparisons were based on $4\pi\alpha\beta$ liquid scintillation spectrometry as well as measurements with the pulse-ionization-chamber based primary radon measurement system)

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé

LABORATORY National Institute of Standards and Technology

NAMES R. Collé

ACTIVITY Long-term performance efficacy of the radon emanation standard

RESULTS SRM 4968, which has been available since 1994, consists of a polyethylene-encapsulated ^{226}Ra solution that emanates a known quantity of ^{222}Rn when suitably employed in an accumulation mode. These encapsulated standards are intended to serve as a more convenient alternative to the NIST radium solution standards, and are very popular with users. A replacement batch of these emanation standards has been prepared and calibrated in the past year. Evaluations of the long-term performance of this SRM, primarily in terms of the constancy of the emanation fraction, have been an ongoing enterprise. The evaluation results indicate that the capsules have remained stable, and that the calibrations are still well within their given uncertainty intervals. Over a period of approximately six years, experimentally determined values of the emanation fraction have remained constant and invariant of conditions within statistical variations of about 0.5 % (corresponding to a relative standard deviation of the mean). This small within-capsule variability may be contrasted with the relatively large, but acceptable, between-capsule variability of about 2.5 %. Capsule performance has also been evaluated with respect to ambient conditions and aging effects such as solution transpiration losses.

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé

LABORATORY National Institute of Standards and Technology

NAMES R. Collé, J. T. Cessna, M. P. Unterweger, P. Hodge, L. R. Karam

ACTIVITY Re-evaluations and upgrades of the ^{222}Rn pulse-ionization-chamber measurement system

IN PROGRESS The national standard for radon measurements is embodied in a primary radon measurement system that has been maintained for nearly sixty years to accurately measure radon (^{222}Rn) against international and national radium (^{226}Ra) standards. All of the radon measurements made at NIST and the radon transfer standards and calibration services provided by NIST are directly related to this national radon standard, This primary radon measurement system consists of pulse ionization chambers and ancillary gas handling and gas purification equipment. The system was last modernized (with replacement ionization chambers) nearly a decade ago and several shortcomings in its performance have recently become evident. As a result, a major re-evaluation and upgrade of the system is underway. This work includes conducting extensive systematic evaluations of the system's performance under a variety of operating and sample conditions, re-designing the operating protocols, replacing the data acquisition and analysis hardware, and re-writing the software codes.

ADDRESS NIST
100 Bureau Drive Stop 8462
Gaithersburg, MD 20899-8462 USA
phone: 301-975-5527
fax: 301-926-7416
ronald.colle@nist.gov

CONTACT Ronald Collé