





Fine Arts

January 6, 1986

Dr. John E. Glenn, Chief Nuclear Materials Safety Section B United States Nuclear Regulatory Commission Region 1 Massachusetts 631 Park Avenue King of Prussia, PA 19406

License No. 20-13135-02 Docket No. 030-09399 Control No. 104532

Dear Dr. Glenn:

In response to your recent letter, un-dated but received by us December 24, 1985, I am enclosing the specification sheet from Amersham International Ltd.. Following are the answers to your three questions.

(a) The C-14 source will be leak tested once a week during periods of use. A wipe test will be performed by rubbing a 1" piece of filter paper over the source. The filter paper will be analyzed by holding it 1 cm. from an end window Geiger Mueller (GM) detector. Following periods of storage the source will be wipe tested before use resumes. A record of these surveys will be maintained.

Our Eberline E-120 radiation survey instrument equipped with an end window GM detector is calibrated at 6 month intervals by our consultants, Bolton and Galanek Inc. (NRC license No. 20-13302-01). Our consultants will also perform a leak test of the source at these 6 month intervals.

If any removable contamination is detected with the GM detector, we will immediately notify our consultants so they can perform a leak test and quantify the extent of the removable activity.

- (b) Ms. Elizabeth Lunning will be an independent user. A training session will be provided by our consultants to review potential radiological safety hazards in the use of C-14 sources. Also covered in the training session will be the use of the radiation survey instrument, performance of radiation surveys, maximum permissable and backround radiation exposures, and other related radiation protection topics.
- (c) The C-14 sources will be stored in a secured area. They will be locked in a file cabinet or drawer in a room which, in turn, is kept locked when it is unattended.

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Hoping you find this information helpful and satisfactory,

Sincerely. P. A. England

Pamela A. England Enclosure: Amersham specification NoiDEN-BENEDEN "OFFICIAL RECORD COPY"

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Amersham International Limited White Lion Road Amersham Buckinghamshire HP7 9LL

Product specification

Carbon-14 polymer reference sources

Data sheet 11268



Dimensions in mm

CFP. 21, 22

Carbon-14 polymer sources are sheets, approximately 1mm thick, of pure poly[14C]methyl methacrylate, coloured blue. The sheets are stable, durable and clean to handle with the activity uniformly distributed throughout.

Small sources, as discs 25mm in diameter, codes CFR.2-4, are intended for use as permanent solid reference sources with end-window Geiger counters or proportional counters. They may also be used for the production of [¹⁴C]carbon dioxide of reproducible specific activity.

Larger sheets, codes CFP.21,22, are supplied to order within the dimensions length 1-200mm, width 1-200mm. These sheets may be used as radiation sources for the radiographic examination of paper, and similar materials^(1,2). They may also be cut into suitably sized pieces and mounted, it required, in appropriate holders for use as check sources for multichannel chromatogram analysers.

nominal specific activity'		nominal activity		approximate β-particles per min. per cm ² of plane surface	code
0-1 μCi/g	3·7 kBq/g	0-06 µCi	2·22 kBq	2.6 x 10 ²	CFR.2
1 μCi/g	37 kBq/g	0-6 µCi	22·2 kBq	2.6 x 10 ³	CFR.3
10 μCi/g	370 kBq/g	6 µCi	222 kBq	2.6 x 10 ⁴	CFR.4
80-200 µCi/g	3-7-4 MBq/g	10-25 µCi/cm ²	370-925 kBq/cm ²	2·1-5·2 x 10 ⁵	CFP.21
400-600 µCi/g	15-22 MBq/g	50-75 µCi/cm ²	1 85-2 78 MBq/cm ²	1·0-1·5 x 10 ⁶	CFP.22

*Tolerance for CFR.2-CFR.4: ±25%

A thinner, more flexible carbon-14 polymer shaet, approximately 0.25mm thick, which can readily be cut or bent into shapes, is also available, code CFP.220.

Nominal activity : 10-20 μ Ci/cm² (370-740 kBq/cm²) Approximate β particles per min. from 1cm² plane surface : 1.0-1.5 x 10⁶

This sheet does not have the high degree of surface finish or uniformity of thickness of CFP.21,22 and the distribution of activity may be less good; it has, however, been successfully used for radiography.





A boxed set of eight carbon-14 polymer sources with increasing specific activities and including a blank is also available. These sources are intended for use in producing autoradiography density calibrations according to the method of Reivich *et al*⁽³⁾. Applications include external reference in the mapping of brain activity with 2-deoxy-D-[1*C]glucose⁽⁴⁾, and in thin-layer and paper chromatography. Each active source is a sheet (20 x 20 x 1mm thick) of pure [1*C]methyl methacrylate polymer, coloured blue. The blank is of the same dimensions, but colourless.

Specific activity*	of each source						
µCi/g polymer	0 0 2 5	0.05	0.1	0.3	0.45	0.6	0.75
kBg/g polymer	0.925	1.85	3.7	11-1	16.65	22.2	27.75

*Tolerance: ±25%

Code for boxed set: CFR.10

Construction

[14C] Methyl methacrylate monomer is prepared by the esterification of acrylic acid with [14C] methanol. The monomer is then polymerized after the addition of a small quantity of soluble blue dye. The polymer is cast into sheets and the sources are cut from the sheets to the required size.

Quality control

Surface contamination

Each source is wiped with a swab moistened with water; the activity removed is measured. Acceptance limit: 0.005 μ Ci (185 Bq)

Activity content

These sources are uncalibrated. However, samples from each batch of sources (except CFR.10) are measured using an end-window Geiger counter to determine the rate of emission of beta particles from the surface.

The specific activity of the polymer is measured by dissolving a sample in a scintillant and counting by liquid scintillation counting.

Identification

Sources are individually marked with nuclide, a serial number and the internationally approved trefoil radioactive symbol imprinted in gold.

Handling and storage

Carbon-14 polymer sources are unsealed sources and great care must be taken when handling them to avoid damage to the surface by scratching, abrading or exposure to solvents harmful to polymethyl methacrylate. It is recommended that regular wipe tests be carried out on sources in continual use to ensure that there is no loss of integrity due to mishandling.

In the event of accidental damage, contamination can be removed by careful swabbing with moistened cotton wool or tissue. The source should then be thoroughly washed in clean water and wiped dry. The affected area should then be carefully monitored with a sensitive beta probe to verify freedom from further contamination.

Protective gloves should always be worn when handling the sources to reduce irradiation of the fingers.

The sources must always be stored flat, under cool co. ditions. Where possible it is recommended that they be stored in the packaging provided. Care should be taken to avoid any contact with PVC (polyvinyl chloride) or other halogenated hydrocarbon packing materials.

Packaging

The polymer discs are normally supplied in small plastic boxes. For polymer sheets the packaging varies depending on the size and number of sources. The standards for autoradiography are supplied in a small plastic box together with a pair of tweezers for safe, easy handling.

Availability

Sources are usually available for despatch within 2-4 weeks of receipt of order.

Recommended working life

The recommended working life of a source is that period recommended by Amersham International within which the source should be replaced. The period given has been assessed on the basis of such factors as toxicity of nuclide, total initial activity, source construction, half-life of nuclide, typical application environments, operational experience, test performance data, etc.

The recommended working life for carbon-14 polymer reference sources is 10 years.

Nuclear data

Carbon-14 5730 years Half-life Type of decay : 0-156 MeV (max) - 100% Energy of emission : 0.049 MeV (mean)

Related products

Polymer reference sources labelled with hydrogen-3 (tritium) are also available. Poly[³H]methyl methacrylate discs (25mm diameter, 1mm thick), codes TRR.12-14, are similar to the carbon-14 discs described here, but are coloured pink. They can be used for checking the performance of proportional counters. Tritiated poly-*n*-butyl methacrylate (a softer polymer) is produced in the form of capsules (9mm diameter), codes TRP.71-73, from which thin sections can be cut as required.

Carbon 14 and tritium standards for sample oxidizers, codes CFR 101 and TRR 101 respectively, are available. These standards have been designed to provide a simple and convenient method for routine accurate checking of sample oxidizers.

References

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