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RADIOACTIVITY STANDARDS DISTRIBUTION PROGRAM
1975

by

Quality Assurance Branch
Technical Support Laboratory
National Environmental Research Center
Las Vegas, Nevada

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NATIONAL ENVIRONMENTAL RESEARCH CENTER
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89114

PREFACE

Quality assurance is an integral part of any viable environmental monitoring activity. The primary goals of the U.S. Environmental Protection Agency's (EPA) quality assurance program are to improve and document the credibility of environmental measurements. To achieve these goals, quality assurance is needed in nearly all segments of monitoring activities and should cover personnel, methods selection, equipment, and data handling procedures.

Five major functions, each essential to an effective quality assurance effort, comprise EPA's quality assurance program.

- Promulgation of standardized methods of measurement
- Distribution of standard reference materials
- Issuance of guidelines and procedures
- Training and technical assistance
- Evaluation and certification of monitoring activities

This manual has been prepared to assist laboratories involved with environmental radiation measurements in developing and maintaining a quality control program and documenting the precision and accuracy of their data. All EPA monitoring programs are requested to make use of this document in planning their own radiation measurements and in assisting the States in carrying out radiation monitoring activities.

Comments concerning the utility of this document, along with any suggestions for possible changes and revisions, are welcomed. Questions on matters related to quality assurance of environmental measurements in various fields should be directed to the following person(s):

Air Pollution

Mr. Thomas Clark
Methods Standardization and Performance Evaluation Branch
Quality Assurance and Environmental Monitoring Laboratory
National Environmental Research Center
Research Triangle Park, North Carolina 27711

Water

Mr. John Winter, Chief
Quality Assurance and Laboratory Evaluation Branch
Methods Development and Quality Assurance
Research Laboratory
National Environmental Research Center
Cincinnati, Ohio 45268

Pesticides

Mr. Jack Thompson, Chief
Chemistry Branch
Pesticides and Toxic Substances Effects Laboratory
National Environmental Research Center
Research Triangle Park, North Carolina 27711

Radiation

Mr. Arthur N. Jarvis, Chief
Quality Assurance Branch
Technical Support Laboratory
National Environmental Research Center
Las Vegas, Nevada 89114

Periodically, manuals and documents will be issued which provide guidelines to be followed in all phases of monitoring activities. Use of these guidelines throughout the Agency will enable a uniform approach to be established within EPA which ultimately can be implemented at the State level. This should permit a significant improvement in the validity and reliability of environmental data collected throughout the Nation.

The implementation of a total and meaningful national environmental quality assurance effort cannot succeed without the full support of all monitoring programs. Your cooperation is appreciated.

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PROGRAM OBJECTIVES

Environmental measurements are made daily by many different Federal, State, local and private agencies. The data from these measurements are used for a wide variety of purposes including assessment of health effects, the establishment of standards and guides, and for enforcement activities. It is therefore imperative that the precision and accuracy of the data be assured in order that policy decisions concerning environmental quality be based on valid and comparable data.

The quality assurance program of the U.S. Environmental Protection Agency is designed to encourage the development and implementation of quality control procedures at all levels of sample collection, analysis, data handling, and reporting. Quality control responsibilities, in the radiation area, have been assigned to the Quality Assurance Branch at the EPA's National Environmental Research Center-Las Vegas. This branch, as an integral part of its overall quality assurance effort, prepares and distributes a variety of calibrated low-level radioactive samples for use in the laboratories of Federal, State, and local agencies.

The major objective of this program is to encourage the development of intralaboratory and interlaboratory quality control procedures and thus insure that environmental radiation data are valid. Providing accurately calibrated samples assists laboratories in calibrating new instruments, implementing and maintaining routine instrument calibration programs, evaluating analytical procedures, and developing and revising data processing programs.

The following pages briefly describe standard preparation procedures, list the radionuclides available, and indicate how a laboratory may request standards.

If your laboratory does not currently make use of the services provided by the Quality Assurance Branch at the NERC-LV, it is encouraged to do so.

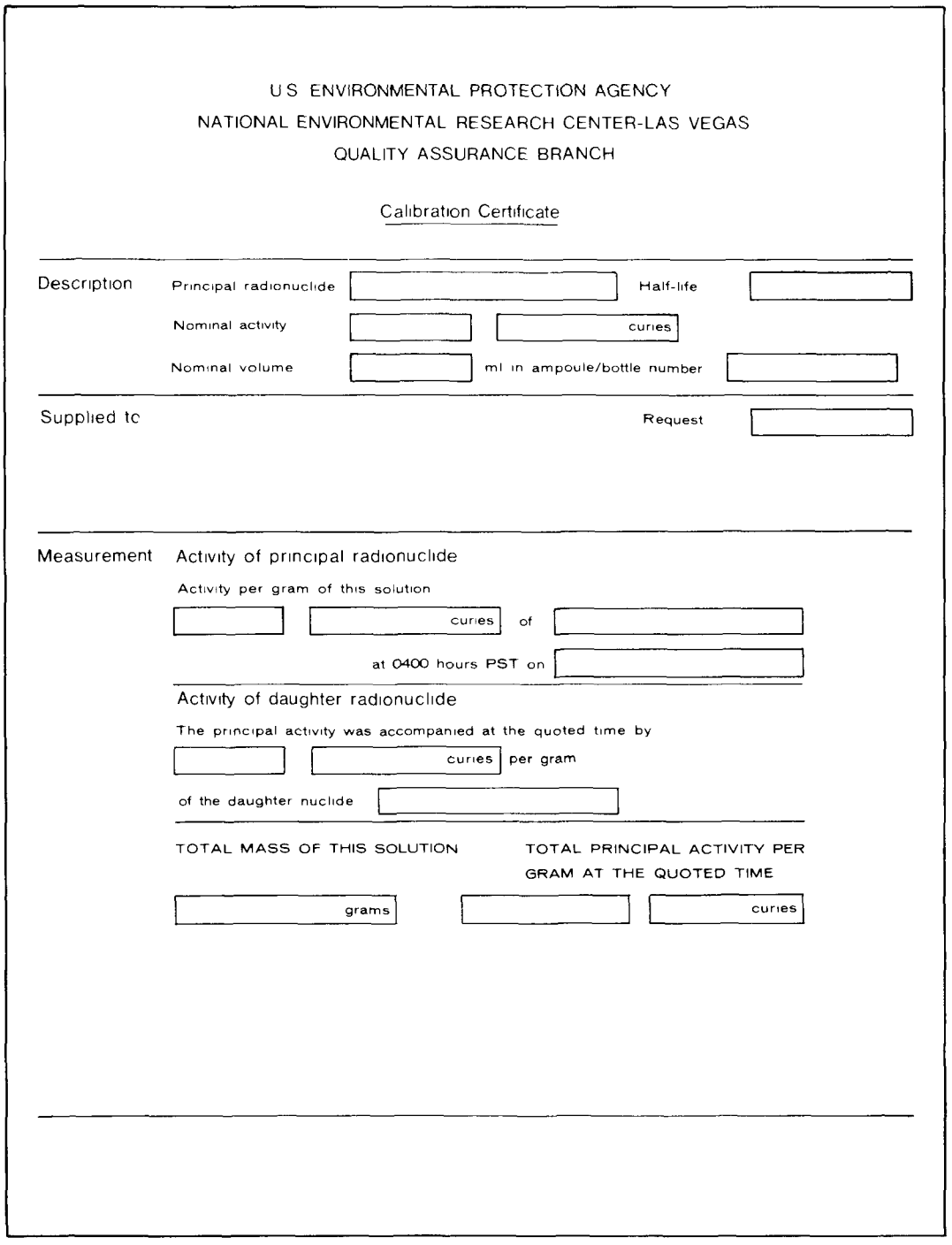
PREPARATION AND CALIBRATION OF SAMPLES

The radionuclides used in preparing calibrated samples are obtained from the National Bureau of Standards, the Laboratorie de Metrologie des Rayonnements Ionisants (France), or from reliable commercial sources. The uncertainty in the known activity of individual sources ranges from 0.5% to 5%. Activity of radionuclide impurities, excluding daughters, is documented and typically is less than 1% of the activity of the principal radionuclide.

Upon receipt, a radionuclide is checked for its activity and for the presence of radioactive contaminants. The sample is then diluted to the desired activity level (10,000-50,000 dpm/gm) with a carrier of the same chemical composition and concentration as used by the supplier. In certain cases the addition of a stabilizer is required. The accuracy of the dilution is carefully checked and the solution flame sealed in 5-ml ampuls.

Accompanying each calibrated sample is a certificate (Figure 1) listing pertinent information concerning the sample and its calibration including an estimate of the errors associated with the value of the activity. For gamma emitters, a net plot (Figure 2) of the pulse height spectrum is also included.

To further assure the precision and accuracy of the calibrated samples, the Quality Assurance Branch participates in on-going inter-comparison studies with the National Bureau of Standards. These studies involve the measurement of unknown samples supplied by the NBS, and the measurement by NBS of EPA-prepared samples.



U S ENVIRONMENTAL PROTECTION AGENCY
NATIONAL ENVIRONMENTAL RESEARCH CENTER-LAS VEGAS
QUALITY ASSURANCE BRANCH

Calibration Certificate

Description
Principal radionuclide
Half-life
Nominal activity
curies
Nominal volume
ml in ampoule/bottle number

Supplied to
Request

Measurement
Activity of principal radionuclide
Activity per gram of this solution
curies
of
at 0400 hours PST on

Activity of daughter radionuclide
The principal activity was accompanied at the quoted time by
curies
per gram
of the daughter nuclide

TOTAL MASS OF THIS SOLUTION
grams
TOTAL PRINCIPAL ACTIVITY PER GRAM AT THE QUOTED TIME
curies

Figure 1. Calibration Certificate

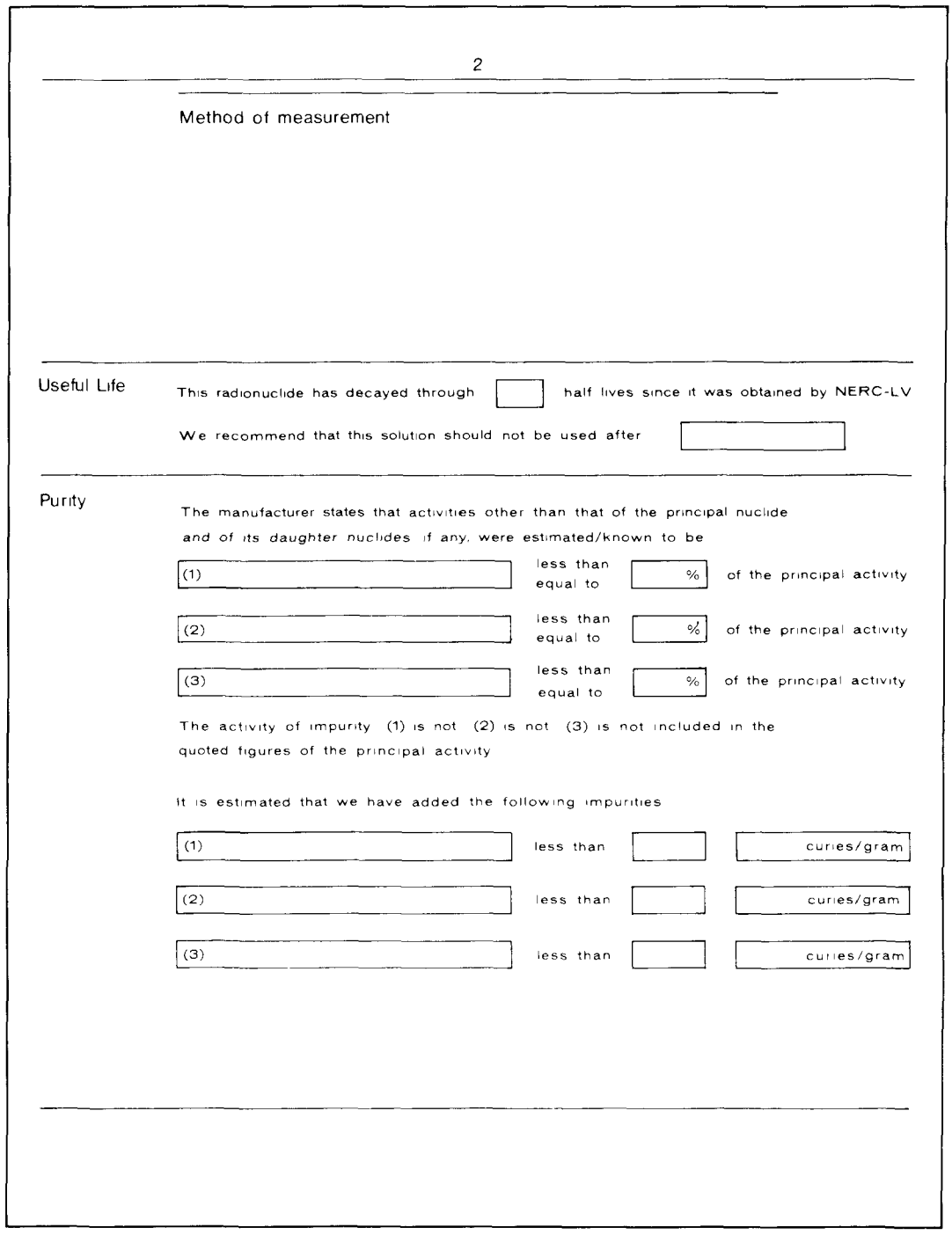


Figure 1 (continued). Calibration Certificate

3

Random Errors

The repeatability of this standardization (dilutions, source preparations, counting statistics, mass determinations, etc) was such that the certified value of the radioactive concentration of the principle activity had a standard error (σ) not greater than

$\pm$ [%] (The 99.7% confidence limits are given by $\pm 3\sigma$)

The total systematic error (sum of estimated maximum residual systematic errors due to dispensing, counting losses counting corrections known uncertainty of standard) of the certified radioactive concentrations of the principle activity has been estimated not to exceed [+ % (δ)] or [- % (δ')]

The overall limits of error calculated on the basis of $+(3\sigma + \delta)$ or $-(3\sigma + \delta')$ are

[+ %] or [- %] of the quoted radioactive concentration

The effective standard deviation is defined as 1/6th of the range between the overall limits $+(3\sigma + \delta)$ and $-(3\sigma + \delta')$ and is therefore [%]

Decay Schemes This standardization is based on the following assumptions of the principle nuclide its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above)

Chemical Composition of Solution

Carrier content per gram of solution

Other components

Preservative

Remarks

Date Certificate Prepared _____

Approval Signature _____

Figure 1 (continued). Calibration Certificate

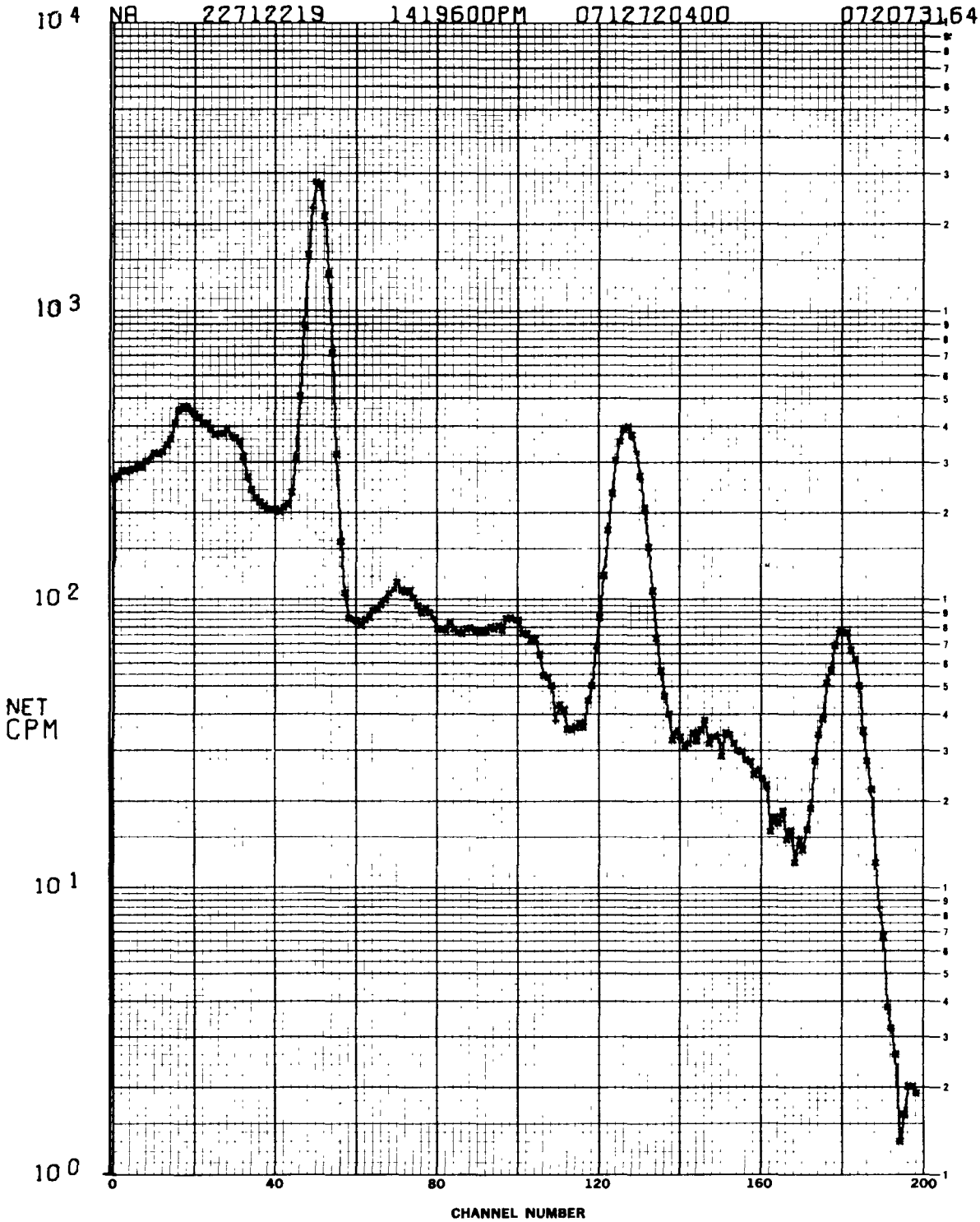


Figure 2. Net Pulse Height Spectrum of Sodium-22 Measured with 4-inch × 4-inch NaI(Tl) Crystal

AVAILABILITY OF CALIBRATED SAMPLES

The current inventory of calibrated samples consists of some forty different radionuclides. The table below lists the available radionuclides along with a schedule of their delivery dates. Radionuclides scheduled for delivery during a particular month will be prepared once during this year. They will be available after this month until the inventory is depleted, or until their decay negates the calibration.

CALIBRATED SAMPLE DISTRIBUTION SCHEDULE

Isotope	Type Emission	Half-Life*	Delivery
^{3}H	β^-	12.26 years	Stock
^{7}Be	γ	53.6 days	Feb
^{14}C	β^-	5730 years	Stock
^{22}Na	β^+,γ	2.62 years	Stock
^{46}Sc	β^-,γ	83.9 days	Oct, Jan
^{51}Cr	γ	27.8 days	Feb
^{54}Mn	γ	303 days	Stock
^{56}Co	β^+,γ	77.3 days	May
^{57}Co	γ	270 days	Stock
^{58}Co	β^+,γ	71.3 days	Apr
^{59}Fe	β^-,γ	45.6 days	Apr
^{60}Co	β^-,γ	5.26 years	Stock
^{65}Zn	β^+,γ	245 days	Stock
^{75}Se	γ	120.4 days	Stock
^{85}Kr	β^-,γ	10.8 years	May
^{85}Sr	γ	64 days	Stock

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* Lederer, C., et al., *Table of Isotopes*, sixth edition, John Wiley and Sons, New York 1967

CALIBRATED SAMPLE DISTRIBUTION SCHEDULE (continued)

Isotope	Type Emission	Half-Life*	Delivery
^{88}Y	β^+,γ	108 days	Jan
^{89}Sr	β^-	52 days	Stock
^{90}Sr	β^-	27.7 years	Stock
^{95}Zr-^{95}Nb	β^-,γ	65 days	Jun, Dec
^{103}Ru	β^-,γ	39 days	Mar, Nov
^{106}Ru	β^-,γ	368 days	Stock
^{109}Cd	γ	453 days	Stock
^{110m}Ag	β^-,γ	255 days	Stock
^{124}Sb	β^-,γ	60.4 days	Mar, Oct
^{125}Sb	β^-,γ	2.71 years	Stock
^{131}I	β^-,γ	8.06 days	Monthly
^{133}Ba	γ	7.2 years	Stock
^{134}Cs	β^-,γ	2.04 years	Stock
^{137}Cs	β^-,γ	30 years	Stock
^{139}Ce	γ	140 days	Feb
^{140}Ba	β^-,γ	12.8 days	Within 4 months
^{141}Ce	β^-,γ	32.5 days	Mar
^{144}Ce	β^-,γ	284 days	Stock
^{195}Au	γ	183 days	Stock
^{203}Hg	β^-,γ	46.9 days	Sep
$^{226}Ra^{\dagger}$	α,γ	1602 years	Stock
$^{230}Th^{\dagger\dagger}$	α	8×10^4 years	Jul
$^{232}Th^{\dagger}$	α	1.4×10^{10} years	Stock
$^{238}U^{\dagger}$	α	4.5×10^9 years	Stock
$^{239}Pu^{\dagger\dagger\dagger}$	α	2.4×10^4 years	Stock
$^{241}Am^{\dagger\dagger}$	α,γ	433 years**	Stock

* See footnote on page 8
** NBS Certificate Standard Reference Material 4904-D. α-part standard americium-241, April 1970
† Possible State license required
†† Byproducts license required
††† Special nuclear material license required

PARTICIPATION IN CALIBRATED SAMPLE DISTRIBUTION PROGRAM

Any Federal, State, local or private laboratory involved in, or concerned with, environmental radiation monitoring and surveillance may participate in the calibrated sample distribution program. To request samples, complete one of the request forms included in this publication and return it to:

U.S. Environmental Protection Agency
National Environmental Research Center
Quality Assurance Branch (TSQ)
P.O. Box 15027
Las Vegas, NV 89114

All requests for calibrated samples should be submitted at least three weeks in advance in order to insure delivery on the date required. Should additional forms be required, they may be requested from the same address.

RADIONUCLIDE REQUEST FORM

TO: U.S. Environmental Protection Agency
National Environmental Research Center
Quality Assurance Branch (TSQ)
P.O. Box 15027
Las Vegas, NV 89114

Please ship the calibrated samples listed below to:

Contact Person _____

Title _____

Laboratory _____

Address _____

_____

Telephone _____

AEC License and/or State License Type(s) _____

Number(s) _____

NOTE: If either byproducts (in quantities greater than exempt quantities) or special nuclear materials are requested, a copy of the AEC license(s) should accompany the first request.

Radionuclide Samples Desired:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

I certify that the calibrated sample(s) requested are to be used only in this laboratory by qualified personnel for the purpose of developing or checking analytical procedures and/or for the calibration of instrumentation.

I further certify that I am authorized to receive the above listed radionuclides under the license number(s) listed above or that this laboratory is exempt from licensing regulations.

Date _____ Signature _____

Title _____

RADIONUCLIDE REQUEST FORM

TO: U.S. Environmental Protection Agency
National Environmental Research Center
Quality Assurance Branch (TSQ)
P.O. Box 15027
Las Vegas, NV 89114

Please ship the calibrated samples listed below to:

Contact Person _____

Title _____

Laboratory _____

Address _____

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Telephone _____

AEC License and/or State License

Type(s) _____

Number(s) _____

NOTE: If either byproducts (in quantities greater than exempt quantities) or special nuclear materials are requested, a copy of the AEC license(s) should accompany the first request.

Radionuclide Samples Desired:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

I certify that the calibrated sample(s) requested are to be used only in this laboratory by qualified personnel for the purpose of developing or checking analytical procedures and/or for the calibration of instrumentation.

I further certify that I am authorized to receive the above listed radionuclides under the license number(s) listed above or that this laboratory is exempt from licensing regulations.

Date _____ Signature _____

Title _____

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1 REPORT NO	2.	3. RECIPIENT'S ACCESSION NO.
EPA-680/4-75-002a		

4 TITLE AND SUBTITLE	5. REPORT DATE
Radioactive Standards Distribution Program — 1975	April 1975
	6. PERFORMING ORGANIZATION CODE

7 AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Quality Assurance Branch Technical Support Laboratory	

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	11. CONTRACT/GRANT NO.

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Office of Research and Development U.S. Environmental Protection Agency Washington, D.C. 20460	Interim 1975
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

A program for the distribution of calibrated radioactive samples, as one function of EPA's quality assurance program for environmental radiation measurements, is described. Included is a discussion of the objectives of the distribution program and a description of the preparation, availability, and distribution of calibrated radioactive samples. Instructions and application forms are included for laboratories desiring to participate in the program.

This document is not a research report. It is designed for use by personnel of laboratories participating or desiring to participate in the Radioactivity Standards Distribution Program which is a part of the U.S. Environmental Protection Agency's quality assurance program.

17. KEY WORDS AND DOCUMENT ANALYSIS

a DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
quality assurance quality control radioactivity quantitative analysis calibrating standards		07 05/14 04

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO OF PAGES
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