NBL

December 2002

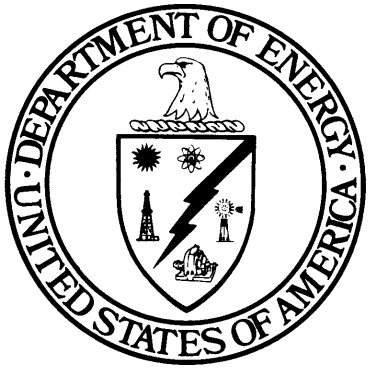
Certified

Reference

Materials

CATALOG

New Brunswick Laboratory



For ordering and shipping information:
Phone: (630) 252-CRMS (2767)
FAX: (630) 252-4146
E-mail: USDOE.NBL@CH.DOE.GOV
NBL Home Page: http://www.nbl.doe.gov

U.S. Department of Energy
New Brunswick Laboratory
Building 350
9800 South Cass Avenue
Argonne, Illinois 60439-4899

TABLE OF CONTENTS

ISOTOPIC CRM's - URANIUM

NONDESTRUCTIVE ASSAY CRM's - URANIUM

ORE CRM's - THORIUM

ORE CRM's - URANIUM

* The certified isotopic values for this CRM were removed as of August 2001 pending re-certification, expected to be completed early in FY 03.

CATALOG UPDATES

These sheets include changes made since the January 1999 edition. This version of the NBL CRM catalog is available on CD only, and includes a link to the FY 2003 NBL CRM Price List.

Page Reference	Section/CRM	Changes Made
Cover	Publication Date	December 2002
Cover	TWX/Telex	Deleted.
Cover	Internet:	Revised to E-mail address.
Foreword	Laboratory Director	December 2002 Forward updated. Forward signed by Acting Laboratory Director, Dr. Wanda Mitchell.
Foreword	Footnote 1	New Brunswick Laboratory is a technical extension of the U.S. Department of Energy, Office of Security, reporting through the Office of Plutonium, Uranium and Special Materials Inventory. [due to DOE organizational change November 2001]
Table of Contents Assay CRM's-Plutonium	Removed CRM 126	SOLD OUT. Replacement CRM 126A in process; available in FY03.
Table of Contents Assay CRM's-Uranium Table of Contents Isotopic CRM's-Uranium	Edited CRM 113-B	Assay value remains certified. Re-certification of isotopic values in process; available in FY 03.
Table of Contents Assay CRM's-Uranium	Added CRM 115	Replacement units available October 2002.
Table of Contents Assay CRM's-Uranium	Removed CRM 116	SOLD OUT. Replacement CRM 116 in process; available in FY 03.
Table of Contents Assay CRM's-Uranium	Removed CRM 129	SOLD OUT. Replacement CRM 129-A in process; available in FY 03.
Table of Contents Nondestructive Assay CRM's-Uranium	Added CRM 146	Available as of July 1999.
Table of Contents Nondestructive Assay CRM's-Uranium	Added CRM 42A	Available as of April 2001.
Table of Contents Nondestructive Assay CRM's-Uranium	Added CRM 149	Available as of November 1999.
1	Introduction	Foreign order approval revised to U.S. Department of Energy, National Nuclear Security Administration (NNSA).
3	Ordering Information for Buyers within U.S.	Added additional document prepared: Shipper's Declaration For Dangerous Goods.
3	"	Deleted "Most" in "Most shipments are shipped collect, for transportation charges."
3	"	Added hyperlink to FY 2003 Price List.
3	"	Deleted "and shipping containers," from inclusion on invoice.
3	"	Updated CH organizational title from Finance and Accounting Division to Office of the Chief Financial Officer.
4	CH F 540a	Reverse side of DOE-CH Form 540A contained Terms

Page Reference	Section/CRM	Changes Made
		and Conditions from DOE-CH Form 540B. Revised form, now CH F 540a, revised 09-02, now available as both a WORD document and an Adobe Acrobat file available as hyperlinked separate files.
5	Ordering Information For Buyers Outside the U.S.	Deleted paragraph on designation of freight forwarders.
6	"	Updated CH organizational title from Finance and Accounting Division to Office of the Chief Financial Officer.
6	"	Updated billing/collection process for foreign orders.
7	CH F 540b	Reverse side of DOE-CH Form 540 B contained Terms and Conditions from DOE-CH Form 540A. Revised form, now CH F 540b, revised 09-02, now available as both a WORD document and an Adobe Acrobat file available as hyperlinked separate files.
9, 18	CRM 113-B	Edited to show U assay certified value only. Removed isotopic certified values. Re-certification of isotopic values in process.
9	CRM 115	Replacement units available; U-235 isotope removed from certified values.
18	CRM 111-A	Corrected typo in properties certified: Uranium concentration = 2.06684 ± 0.00052 μmoles U/g solution.
19	CRM 135	Corrected typo in properties certified: Uranium concentration = 28.270 ± 0.051 μmoles U/gram solution.
21	CRM U010	Added missing note on the CRM containing SNM; .
40	NEW CRM's	CRM 146 and CRM 149 now available;
40	NEW CRM's	CRM 630, anticipated availability – March 2003.
41	Replacement/Repackaged CRM's	CRM 42-A now available.
41	"	CRM 113-B, anticipated availability – March 2003.
41	"	CRM 115 now available.
41	"	CRM 116, anticipated availability – July 2003.
41	"	CRM 126-A, anticipated availability – October 2003.
41	"	CRM U005-A now available.
41	"	CRM U045, anticipated availability – March 2003.
42	SPECIAL CUSTOMER REQUESTS	Updated fax form address to the attention of "Reference Materials Program Manager."
43	CUSTOMER SERVICE REQUEST FAX FORM	Updated name of NBL Program from Safeguards Assistance Program to Nuclear Safeguards and Nonproliferation Support Program.

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NEW BRUNSWICK LABORATORY
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FOREWORD

New Brunswick Laboratory[1] (NBL) takes great pride in its services to the nuclear community, particularly the safeguards measurement community which consists of both domestic and foreign customers. Among its services are the preparation, certification, and distribution of certified reference materials (CRM's), services that it has been providing since 1981. To facilitate appropriate selection of the desired CRM's by it customers, NBL prepares and updates its catalog, *NBL Certified Reference Materials Catalog,* on a regular basis. Pricing information on the NBL CRM's can be accessed on the Internet (http://www.nbl.doe.gov). With this edition, the catalog is available on CD for the first time.

Appropriate use of NBL CRM's can provide the users in the nuclear community with measurement quality and traceability to national and international standards, which are absolutely critical to measurement accuracy and valid inventory measurements. Most of NBL's CRM's were developed to meet the destructive assay (DA) needs of a production oriented nuclear community. With the changing foci of nuclear laboratories, especially those within the U.S. Department of Energy, there is much greater emphasis on environmental cleanup, reduction of inventories, and storage of excess nuclear materials. As NBL continues in its role as the U.S. Certifying Authority for Nuclear Reference Materials, it has placed more emphasis on the development of new CRM's to help meet those needs. For example, the need for non-destructive assay reference materials, as well as the need for smaller quantities of nuclear material per CRM unit, has led to the development of many new CRM projects. The status of these projects is presented in the catalog.

Customer inquiries and comments are appreciated. To facilitate these types of interactions, two Customer Service Fax Request Forms are included in the back of the catalog. The facsimile number and other pertinent information appear on the front cover of the catalog.

NBL staff members look forward to hearing from you.

Sincerely,

Wanda G. Mitchell, Ph.D.
Acting Laboratory Director

[1] New Brunswick Laboratory is a technical extension of the U.S. Department of Energy, Office of Security reporting through the Office of Plutonium, Uranium and Special Materials Inventory.

Introduction

The U.S. Department of Energy, New Brunswick Laboratory (NBL) provides Certified Reference Materials (CRM's) for use in nuclear and nuclear-related analytical measurement activities. This catalog lists and describes the CRM's currently available to both governmental and private organizations within the international nuclear community. All requests for nuclear standards are contingent upon existing U.S. regulations and international agreements regarding possession of such materials.

Those CRM's that contain plutonium, enriched uranium, or U-233 are defined by Title 10 CFR 110 as Special Nuclear Material (SNM), and are so noted in the catalog. These CRM's may be purchased domestically only under a valid DOE contractor or NRC license number. Foreign orders for these CRM's must receive individual approval by the U.S. Department of Energy, National Nuclear Security Administration (NNSA), prior to shipment.

Preparation and Availability of NBL CRM's

New and replacement NBL CRM's are prepared continually to meet changing measurement calibration or verification requirements and to replenish exhausted CRM supplies. As certification of each CRM is completed, the CRM is then listed in the next issue of this catalog. For a specific CRM update, contact us at addresses on the cover page.

Replacement CRM's are intended to be available before supplies of existing CRM's are exhausted. However, uninterrupted availability is not always possible and existing CRM's can go out of stock. When this occurs, users are informed and orders for the out-of-stock CRM's are canceled. Each replacement for a given CRM, although not identical to its predecessor, is sufficiently similar with regard to the certified property(ies) of interest to allow confidence in use as a replacement for the predecessor (or original CRM). Each replacement for a given CRM is identified by a capital letter which follows the CRM number. Thus, the "A" in NBL CRM 101-A means that the CRM is the first replacement for NBL CRM 101.

Certificate of Analysis

Each NBL CRM sold is accompanied by a ***Certificate of Analysis*** stating its certified value(s), date of issue and special conditions, if any, restricting its valid usage. Certificates for CRM's prepared since 1975 also contain the following information: statistical uncertainty ascribed to each certified value; the process(es) used to prepare the material; and the reference method(s) of analysis used to characterize each certified property of interest.

New certificates are issued when new or replacement NBL CRM's are prepared and when existing CRM's are recertified. In the latter case, the date of recertification is stated under the original issue date for the CRM.

CRM data provided in this catalog have been provided for informational purposes only. Although this catalog has been reviewed for accuracy, CRM certified values should be obtained directly from the associated Certificate of Analysis to preclude any possible error.

In accordance with OSHA regulations, Material Safety Data Sheets (MSDS's) have been prepared for all NBL CRM's. A copy of the MSDS is provided to the customer for each CRM type which is ordered. The MSDS is packaged in the actual shipping container(s) of the item(s) ordered. However, upon request, MSDS's are also available prior to purchase to those customers who require a copy to meet facility-specific purchasing requirements.

Ordering Information For Buyers Within the United States

Domestic orders should be submitted using the form: CH F 540a, U.S. Department of Energy/Chicago Operations Office/New Brunswick Laboratory ***Domestic Order Form For Certified Reference Materials***. A copy of this form, which may be reproduced for use, is provided with this catalog. CRM inquiries can be accepted; however, no telephone orders are accepted. Facsimiles may be sent to (630) 252-4146, provided a hard copy of the CHF 540a follows by mail. Acceptance of an order does not imply NBL acceptance of any buyer-imposed provisions set forth in the order that are contrary to the policy, practice, and regulations of the U.S. Department of Energy and the U.S. Government.

Orders for out-of-stock reference materials will be canceled if those are the only items requested. For orders consisting of available reference materials and out-of-stock reference materials, shipment will be made of the available items. That portion of the order which relates to out-of-stock reference materials will be canceled. If a replacement reference material is available, it will be substituted. The buyer will be notified of order cancellation or order changes before shipment is made.

A Certificate of Analysis for each CRM sold is sent in the shipping container(s). The NBL prepares the following documents for each domestic shipment:

1. NBL Shipping Form, which consists of a Straight Bill of Lading (2 copies) and a packing list.

2. Shipper's Declaration for Dangerous Goods

3. Emergency Response Form.

The NBL reserves the right to select, for all domestic orders, those approved shipping containers and modes of shipment which fully comply with Department of Transportation (DOT) and other Federal Regulations in effect at the time of shipment. The shipping point is free on board (FOB) Argonne, Illinois. Shipments are sent collect, for transportation charges. ***Immediately upon receipt of shipment, buyers must sign and return to the NBL Copy #4 of the Straight Bill of Lading.***

Prices are quoted in the NBL CRM Price List which is available separately and is subject to change without notice. The price list is updated at least annually at the beginning of the fiscal year (October). Orders will be invoiced with the prices in effect at the time of shipment. No discounts are given on purchases. See the reverse side of the CH F 540a order form for a complete explanation of **Terms and Conditions** for CRM services provided by the NBL. Signature in Block 7 of the CH F 540a order form signifies that the buyer has read and understood the **Terms and Conditions** of the order.

An invoice listing all CRM's ordered is issued by the Chicago Operations Office, Office of the Chief Financial Officer after shipment. Payment, payable to the U.S. Department of Energy, is due within 30 days and must be sent to: U.S. Department of Energy, Chicago Operations Office, Office of the Chief Financial Officer, 9800 South Cass Avenue, Argonne, Illinois 60439-4899.

CH F 540a

U.S. DEPARTMENT OF ENERGY
New Brunswick Laboratory

DOMESTIC ORDER FORM FOR CERTIFIED REFERENCE MATERIALS

Including Terms and Conditions

Available as separate WORD (.doc) file: Order Forms\CH F 540a.doc
Available as separate Adobe Acrobat (.pdf) file: Order Forms\CH F 540a.pdf

Ordering Information For Buyers Outside the United States

Foreign orders should be submitted using the form: CH F 540b, U.S. Department of Energy/Chicago Operations Office/New Brunswick Laboratory ***Order Form For Certified Reference Materials To Be Exported From The United States of America***. A copy of this form, which may be reproduced for use, is provided with this catalog. CRM inquiries can be accepted by telephone; however, no telephone orders are accepted. Facsimiles may be sent to (630) 252-4146, provided a hard copy of the CH F 540b follows by mail Orders shipped outside the United States must be approved by the U.S. Department of Energy, Washington, D.C. prior to shipment. The approval process may take several months to complete, so buyers should adjust delivery date requirements accordingly. The NBL recommends that buyers anticipate their CRM needs at least one year in advance to allow for shipment delays.

Acceptance of an order does not imply NBL acceptance of any buyer-imposed provisions set forth in the order that are contrary to the policy, practice, and regulations of the U.S. Department of Energy and the U.S. Government.

Orders for out-of-stock reference materials will be canceled if those are the only items requested. For orders consisting of available reference materials and out-of-stock reference materials, shipment will be made of the available items. That portion of the order which is related to out-of-stock reference materials will be canceled. If a replacement reference material is available, it will be substituted. The buyer will be notified of order cancellation or order changes before shipment is made.

A *Certificate of Analysis* for each CRM sold is sent in the shipping container(s). The NBL prepares the following documents for each foreign shipment:

1. NBL Shipping Form, which consists of a Straight Bill of Lading (2 copies) and a packing list.
2. Air Shipments Only: Shipper's Declaration For Dangerous Goods.
3. Emergency Response Form.
4. Export Declaration (6 copies).
5. Canada Only: Canada Customs Invoice.

Proforma invoices are not automatically provided but are available upon request.

The NBL reserves the right to select, for all foreign orders; those approved shipping containers and modes of shipment which fully comply with U.S. and International regulations in effect at the time of shipment. Most orders are shipped from free on board (FOB) Argonne, Illinois, by air freight collect. The only exceptions are specific plutonium CRM's which must be shipped sea collect. ***Immediately upon receipt of shipment, buyers must sign and return to the NBL Copy #4 of the Straight Bill of Lading.***

Prices are quoted in U.S. dollars in the NBL CRM Price List, which is available separately, and is subject to change without notice. Orders will be invoiced with the prices in effect at the time of shipment. No discounts are given on purchases. See the reverse side of the CH F 540b order form for a complete explanation of **Terms and Conditions** for CRM services provided by the NBL. Signature in Block 6 of the CH F 540b order form signifies that the buyer has read and understood the **Terms and Conditions** of the order.

The end user must complete the ***Required End-Use Statement*** in Block 8 of the CH F 540b.

An invoice listing all CRM's ordered and any shipping charges is issued by the Chicago Operations Office, Office of the Chief Financial Officer, after shipment. Payment is accepted by International Money Order payable in U.S. Dollars, to the U.S. Department of Energy, and is due within 30 days after shipment and must be sent to: U.S. Department of Energy, Chicago Operations Office, Office of the Chief Financial Officer, 9800 South Cass Avenue, Argonne, Illinois 60439-4899.

Any questions concerning billing information, please contact Paulette Hubbard, U.S. Department of Energy, DOE Chicago Operations Office, phone number (630) 252-2351 and facsimile number (630) 252-2048.

CH F 540b
U.S. DEPARTMENT OF ENERGY
New Brunswick Laboratory

ORDER FORM FOR CERTIFIED REFERENCE MATERIALS TO BE EXPORTED FROM THE UNITED STATES OF AMERICA

Including Terms and Conditions

Available as separate WORD (.doc) file: Order Forms\CH F 540b.doc
Available as separate Adobe Acrobat (.pdf) file: Order Forms\CH F 540b.pdf

CRM 122 Plutonium Oxide - PuO_2

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: 1 gram of PuO_2 (powder) packaged in a glass vial.

Certified Properties

Isotope	Atom %		
Pu-238	0.0521	±	0.0011
Pu-239	87.305	±	0.004
Pu-240	11.539	±	0.004
Pu-241	0.9248	±	0.0011
Pu-242	0.1790	±	0.0013

Pu Assay = 87.790 ± 0.039 Wt%
Relative Atomic Weight = 239.191

Certified values are for January 1, 1985.

Date of certificate: May, 1985
Reissued February, 1990

CRM 112-A Uranium Metal Assay Standard

This CRM was originally issued in 1972 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 960.

Unit Description: 4 grams of normal uranium, as a single metal rod, placed in a vial within a cardboard tube.

Properties certified: Uranium (etched metal basis) = 99.975 ± 0.006 Wt%
Relative Atomic Mass = 238.0289

Date of certificate: September, 1998
(Revision of NBL Certificate dated October, 1987)

*CRM 113-B Uranium (Enriched) Hexafluoride - (UF_6) In Solid Form, Assay and Isotopic Standard**

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: 1.7 kg of UF_6 (4.5% enriched) contained in 2-S cylinder.

Properties certified:

Uranium Assay (mass fraction) ……0.67578 ± 0.00022 kg/kg

* The certified isotopic values for this CRM were removed as of August 2001 pending re-certification, expected to be completed early in FY 03.

Date of certificate: December, 1998

CRM 115 Uranium (Depleted) Metal

CRM 115 is a reissue of CRM 115 issued originally in June 1978.

Unit Description: 75 g of depleted uranium metal. Primary packaging is a 28-mL polyethylene sample vial with a snap cap, packaged in a secondary cardboard container.

Properties certified: Uranium (etched metal basis).....$99.977_0 \pm 0.004_6$ Wt. %

Relative Atomic Weight..... 238.045

Date of certificate: July, 2002

CRM 125-A Uranium (Enriched) Oxide - (UO_2) Assay and Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: One solid pellet, 5.4 grams, contained in a snap-cap glass vial.

Properties certified: Uranium Assay = 88.129 ± 0.014 Wt%

	Atom Percent			Weight Percent
U-234	0.0374	±	0.0003	0.0368
U-235	4.0574	±	0.0028	4.0082
U-236	0.0003	±	0.0002	0.0003
U-238	95.9049	±	0.0029	95.9547

Relative Atomic Mass = 237.92727 ± 0.00008

Date of certificate: December, 1997

CRM 145 Uranium (Normal) Assay Solution Standard

Unit Description: Approximately 20 mL of uranyl nitrate solution (200 mg Uranium) in 1 M HNO_3, contained in a sealed 20-mL glass ampule.

Properties certified: Uranium Concentration = 10.1356 ± 0.0011 mg U/g solution
Relative Atomic Mass = 238.0289

Date of certificate: September, 1996

CRM 66(1-7) Thorium Oxide - ThO_2 (Impurity Standard)

This CRM was prepared at NBL by adding 22 selected impurities to a high-purity base material. Level 7 is the base material. Levels 1-6 have impurities added as follows (values are in parts per million on a metal basis):

Element	66-1	66-2	66-3	66-4	66-5	66-6
Ag	5	2	1	0.5	0.2	0.1
Al	500	200	100	50	20	10
B	5	2	1	0.5	0.2	0.1
Be	200	80	40	20	8	4
Bi	50	20	10	5	2	1
Ca	500	200	100	50	20	10
Cd	5	2	1	0.5	0.2	0.1
Cr	100	40	20	10	4	2
Cu	50	20	10	5	2	1
Fe	500	200	100	50	20	10
K	630	250	125	63	25	10
Mg	0	200	100	50	20	10
Mn	50	20	10	5	2	1
Mo	50	20	10	5	2	1
Na	400	160	80	40	15	8
Ni	200	80	40	20	8	4
P	500	200	100	50	20	10
Pb	50	20	10	5	2	1
Sn	50	20	10	5	2	1
Si	250	100	50	25	10	5
V	200	80	50	5	8	4
Zn	500	200	100	50	20	10

Unit Description: Set of 7 bottles, each of which contains 25 grams of ThO_2 (powder) of a given concentration level.

Properties certified: Concentration for 22 trace elements

Date of certificate: October, 1963

CRM 123(1-7) Uranium (Normal) Oxide - U_3O_8, 18 Element Impurity Standard

This CRM was prepared by adding 18 selected impurities to a high-purity base material (values are in µg Element / g Uranium). Level 7 is the base material. Levels 1-6 have impurities added and are certified as follows:

Element	123-1	123-2	123-3	123-4	123-5	123-6
Al	205	98	49	22	11	6
B	6	2	1	0.5	0.3	0.1
Ca	218	107	52	24	13	8
Cd	5	2	1	0.5	0.2	0.1
Cr	106	55	23	13	8	4
Cu	53	26	11	6	3	1
Fe	212	110	59	27	18	12
Mg	102	51	20	11	6	3
Mn	52	27	12	6	3	1
Mo	98	49	21	10	5	2
Na	391	174	80	42	24	14
Ni	200	100	52	21	11	6
Pb	44	23	10	5	3	1
Si	245	120	56	24	15	11
Sn	48	24	10	6	3	1
V	50	25	9	5	3	1
Zn	222	112	53	20	12	6
Zr	256	134	60	20	13	<10

Unit Description: Set of 7 bottles, each of which contains 25 grams of U_3O_8 (powder) of a given concentration level.

Properties certified: Concentration for 18 trace elements

Date of certificate: January, 1991

CRM 124(1-7) Uranium (Normal) Oxide - U_3O_8, 24 Element Impurity Standard

This CRM was prepared by adding 24 selected impurities to a high-purity base material (values are in µg Element / g Uranium). Level 7 is the base material. Levels 1-6 have impurities added as follows:

Element	124-1	124-2	124-3	124-4	124-5	124-6
Ag	4	2	1	0.4	<0.4	<0.4
Al	204	103	48	23	12	7
B	5	2	1	0.6	0.3	0.1
Be	24.4	11.6	4.1	2.4	1.3	0.5
Bi	50	25	10	5	2.5	1
Ca	206	104	55	29	16	10
Cd	6	3	1	0.6	0.3	0.1
Co	25	12.5	5	2.5	1.25	0.5
Cr	105	52	24	13	8	5
Cu	48	25	11	6	4	2
Fe	200	100	50	20	10	5
Mg	100	50	20	10	5	2
Mn	50	25	10	5	2.5	1
Mo	100	50	20	10	50	2
Na	400	200	100	40	20	10
Ni	200	100	50	20	10	5
Pb	50	25	10	5	2.5	1
Si	220	110	55	20	10	5
Sn	50	25	10	5	2.5	1
Ti	50	25	10	5	2.5	1
V	50	25	10	5	2.5	1
W	200	100	50	20	10	5
Zn	220	110	55	20	10	5
Zr	260	130	65	20	10	5

Unit Description: Set of 7 bottles, each of which contains 25 grams of U_3O_8 powder of a given concentration level.

Properties certified: Concentration for 24 trace elements (provisional)

Date of certificate: September, 1983

CRM 122 Plutonium Oxide - PuO_2

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: 1 gram of PuO_2 (powder) packaged in a glass vial.

Certified Properties

Isotope	Atom %		
Pu-238	0.0521	±	0.0011
Pu-239	87.305	±	0.004
Pu-240	11.539	±	0.004
Pu-241	0.9248	±	0.0011
Pu-242	0.1790	±	0.0013

Pu Assay = 87.790 ± 0.039 Wt%
Relative Atomic Weight = 239.191

Certified values are for January 1, 1985.

Date of certificate: May, 1985
Reissued February, 1990

CRM 128 Pu-239/Pu-242, 1:1 Atom Ratio

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

The CRM was prepared using plutonium materials obtained from the Oak Ridge National Laboratory Isotope Sales Group with the approval of the DOE Research Materials/Transplutonium Program Committee.

Unit Description: Approximately 1 milligram of a nominal 1:1 mixture of Pu-239 and Pu-242, as evaporated plutonium nitrate (solid) contained in a Teflon bottle. The packaging is designed for in-situ dissolution by the user.

Properties certified: Pu-239/Pu-242 Atom Ratio = 0.9993 ± 0.0002 as of October 1, 1984.

Date of certificate: October, 1985

CRM 130 Plutonium-242 in Nitrate Form

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

The CRM was prepared at the NBL using plutonium material which was obtained from the Oak Ridge National Laboratory Isotope Sales Group with the approval of the DOE Research Materials/ Transplutonium Program Committee.

Unit Description: Approximately 1 milligram of Pu-242 as evaporated plutonium nitrate (solid) in a Teflon bottle. The packaging is designed for in-situ dissolution by the user.

Properties certified: Total Pu content and isotopic composition. Each bottle contains a measured quantity of plutonium and is assigned a serial number for identification and reference.

Isotopic values as of January 1, 1987:

Pu-238	0.00419	±	0.00026	At%
Pu-239	0.00478	±	0.00012	At%
Pu-240	0.01974	±	0.00038	At%
Pu-241	0.02466	±	0.00034	At%
Pu-242	99.94623	±	0.00065	At%
Pu-244	0.00040	±	0.00010	At%

Relative Atomic Weight: 242.0578

Date of certificate: July, 1987

CRM 136 Plutonium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 946.

Unit Description: Approximately 0.25 grams of plutonium, in the form of solid plutonium sulfate tetrahydrate, contained in a glass bottle.

Properties certified: Isotopic values as of October 1, 1987:

	Atom Percent			Weight Percent
Pu-238	0.223	±	0.007	0.222
Pu-239	84.988	±	0.015	84.925
Pu-240	12.323	±	0.015	12.366
Pu-241	1.888	±	0.005	1.902
Pu-242	0.578	±	0.003	0.585

Date of certificate: October, 1987
(Revision of NBS Certificate dated August, 1982)

CRM 137 Plutonium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 947.

Unit Description: Approximately 0.25 grams of plutonium, in the form of solid plutonium sulfate tetrahydrate, contained in a glass bottle.

Properties certified: Isotopic values as of October 1, 1987:

	Atom Percent			Weight Percent
Pu-238	0.268	±	0.006	0.267
Pu-239	77.635	±	0.022	77.549
Pu-240	18.734	±	0.022	18.792
Pu-241	2.152	±	0.006	2.168
Pu-242	1.211	±	0.004	1.225

Date of certificate: October, 1987
(Revision of NBS Certificate dated August, 1982)

CRM 138 Plutonium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 948.

Unit Description: Approximately 0.25 grams of plutonium, in the form of solid plutonium sulfate tetrahydrate, contained in a glass bottle.

Properties certified: Isotopic values as of October 1, 1987:

	Atom Percent			Weight Percent
Pu-238	0.010	±	0.001	0.010
Pu-239	91.805	±	0.010	91.772
Pu-240	7.925	±	0.010	7.955
Pu-241	0.227	±	0.001	0.229
Pu-242	0.0330	±	0.0003	0.0334

Date of certificate: October, 1987
(Revision of NBS Certificate dated August, 1982)

CRM 111-A Uranium-233 in Nitrate Form

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: 5 milligrams of uranium dissolved in 10 g of 0.8 N nitric acid and sealed in a glass ampule.

Properties Certified: Uranium concentration = 2.06684 ± 0.00052 μmoles U/gram solution

U-233	99.4911	±	0.0006	At%
U-234	0.1847	±	0.0002	At%
U-235	0.0790	±	0.0002	At%
U-236	0.0166	±	0.0002	At%
U-238	0.2286	±	0.0004	At%

Date of certificate: January, 1990

*CRM 113-B Uranium (Enriched) Hexafluoride - (UF_6) In Solid Form, Assay and Isotopic Standard**

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: 1.7 kg of UF_6 (4.5% enriched) contained in 2-S cylinder.

Properties certified:

Uranium Assay (mass fraction) ……0.67578 ± 0.00022 kg/kg

* The certified isotopic values for this CRM were removed as of August 2001 pending re-certification, expected to be completed early in FY 03.

Date of certificate: December, 1998

CRM 125-A Uranium (Enriched) Oxide - (UO_2) Assay and Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: One solid pellet, 5.4 grams, contained in a snap-cap glass vial.

Properties certified: Uranium Assay = 88.129 ± 0.014 Wt%

	Atom Percent			Weight Percent
U-234	0.0374	±	0.0003	0.0368
U-235	4.0574	±	0.0028	4.0082
U-236	0.0003	±	0.0002	0.0003
U-238	95.9049	±	0.0029	95.9547

Relative Atomic Mass = 237.92727 ± 0.00008

Date of certificate: December, 1997

CRM 135 Uranium-235 Spike Assay and Isotopic Solution Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1975 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) 993.

Unit Description: 100 milligrams of uranium, dissolved in 0.8 M nitric acid and sealed in a glass ampule.

Properties Certified: Uranium concentration = 28.270 ± 0.051 μmoles U/gram solution

U-234	0.0442	±	0.0004	At%
U-235	99.8195	±	0.0013	At%
U-236	0.0574	±	0.0004	At%
U-238	0.0789	±	0.0004	At%

Date of certificate: October, 1987
(Revision of NBS Certificate dated June, 1975)

CRM U0002 Uranium Isotopic Standard

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-0002.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.00016	±	0.00001	0.00016
U-235	0.01755	±	0.00005	0.01733
U-236	<0.00001			<0.00001
U-238	99.9823	±	0.0001	99.9825

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U005-A Uranium Isotopic Standard

This CRM was originally issued in 1984 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-005a.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.00340	±	0.00007	0.00334
U-235	0.5064	±	0.0003	0.5000
U-236	0.00118	±	0.00001	0.00117
U-238	99.4890	±	0.0003	99.4955

Date of Certificate: October, 1987
(Revision of NBS Certificate dated July, 1984)

CRM U010 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-010.

Unit Description: 5 milligrams of U_3O_8 powder packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.00541	±	0.00005	0.00532
U-235	1.0037	±	0.0010	0.9911
U-236	0.00681	±	0.00007	0.00675
U-238	98.984	±	0.001	98.997

Date of Certificate: February, 1998
(Revision of NBL Certificate dated October 1, 1987)

CRM U015 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-015.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.00850	±	0.00009	0.00836
U-235	1.5323	±	0.0015	1.5132
U-236	0.0164	±	0.0001	0.0163
U-238	98.443	±	0.002	98.462

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U020-A Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1984 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-020a.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.01732	±	0.00003	0.01703
U-235	2.0262	±	0.0011	2.0011
U-236	0.01179	±	0.00007	0.01169
U-238	97.9447	±	0.0011	97.9702

Date of Certificate: October, 1987
(Revision of NBS Certificate dated July, 1984)

CRM U030-A Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1984 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-030a.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.02778	±	0.00006	0.02732
U-235	3.0404	±	0.0016	3.0032
U-236	0.000599	±	0.000005	0.000594
U-238	96.9312	±	0.0016	96.9689

Date of Certificate: October, 1987
(Revision of NBS Certificate dated July, 1984)

CRM U100 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-100.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.0676	±	0.0002	0.0666
U-235	10.190	±	0.010	10.075
U-236	0.0379	±	0.0001	0.0376
U-238	89.704	±	0.010	89.821

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U150 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-150.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.0993	±	0.0002	0.0978
U-235	15.307	±	0.015	15.143
U-236	0.0660	±	0.0002	0.0656
U-238	84.528	±	0.015	84.693

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U200 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-200.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.1246	±	0.0003	0.1229
U-235	20.013	±	0.020	19.811
U-236	0.2116	±	0.0006	0.2103
U-238	79.651	±	0.021	79.856

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U350 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-350.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.2498	±	0.0006	0.2467
U-235	35.190	±	0.035	34.903
U-236	0.1673	±	0.0005	0.1667
U-238	64.393	±	0.036	64.684

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U500 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-500.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.1581	±	0.0008	0.5126
U-235	49.696	±	0.050	49.383
U-236	0.0755	±	0.0003	0.0754
U-238	49.711	±	0.050	50.029

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U750 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-750.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.5923	±	0.0009	0.5880
U-235	75.357	±	0.025	75.129
U-236	0.2499	±	0.0008	0.2502
U-238	23.801	±	0.024	24.033

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U800 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-800.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.6563	±	0.0013	0.6519
U-235	80.279	±	0.021	80.088
U-236	0.2445	±	0.0007	0.2450
U-238	18.820	±	0.019	19.015

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U850 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-850.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.6437	±	0.0014	0.6399
U-235	85.137	±	0.017	84.988
U-236	0.3704	±	0.0011	0.3713
U-238	13.848	±	0.014	14.001

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U900 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-900.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	0.7777	±	0.0015	0.7735
U-235	90.196	±	0.011	90.098
U-236	0.3327	±	0.0010	0.3337
U-238	8.693	±	0.008	8.795

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM U930-D Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: Approximately 5 milligrams Uranium in 5-mL of a 1.0 M nitric acid solution, sealed in a borosilicate glass ampule.

Properties Certified:

	Atom Percent			Weight Percent
U-234	1.0291	±	0.0017	1.0241
U-235	93.2702	±	0.0049	93.2063
U-238	5.7007	±	0.0052	5.7696

Atom Ratio	
$^{234}U/^{235}U$	0.011034 ± 0.000018
$^{238}U/^{235}U$	0.061120 ± 0.000059

Relative Atomic Mass: 235.20501 ± 0.00016

Date of Certificate: September 30, 1997

CRM U970 Uranium Isotopic Standard

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1970 by the National Bureau of Standards (NBS) as Standard Reference Material (SRM) U-970.

Unit Description: 1 gram of Uranium, in the form of highly purified U_3O_8 powder, packed in a glass bottle.

Properties Certified:

	Atom Percent			Weight Percent
U-234	1.6653	±	0.0017	1.6582
U-235	97.663	±	0.003	97.663
U-236	0.1491	±	0.0005	0.1497
U-238	0.5229	±	0.0006	0.5296

Date of Certificate: October, 1987
(Revision of NBS Certificate dated April, 1981)

CRM 42A Uranium (Normal) Counting Standard

CRM 42A is a reissue of CRM 42 issued in August 1957. The CRM 42A was prepared from the same base materials that were used in the preparation of CRM 42.

Unit Description: Four glass bottles, each filled with about 100 grams of a mixture of pitchblende ore and dunite.

Properties certified: Uranium Content

Identification	CRM 42A-1	CRM 42A-2	CRM 42A-3	CRM 42A-4
Uranium (weight %)	4.058 ± 0.018	1.9555 ± 0.0034	1.0421 ± 0.0017	0.49055 ± 0.00084

Date of certificate: March, 2001

Each unit of CRM 42A, Uranium (Normal) Counting Standard, consists of four glass bottles, each bottle filled with about 100 grams of a mixture of pitchblende ore and dunite. CRM 42A is certified for uranium content with nominal uranium concentrations of 4%, 2%, 1% and 0.5%.

CRM 969 Uranium Isotopic Standard for Gamma Spectrometry

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

This CRM was originally issued in 1985 by the National Bureau of Standards (NBS), in cooperation with the Commission of the European Communities, Central Bureau for Nuclear Measurements, Geel, Belgium, and the New Brunswick Laboratory, as Standard Reference Material (SRM) 969.

Unit Description: Set of five sealed aluminum cans each containing 200 grams of compressed U_3O_8 powder of a given enrichment. An empty can is provided for use with samples. Also included is a fitted attaché case that may be used to carry the set. The case is shipped as a separate package.

Properties certified:

Material ID	U-235/U, Atom Percent	U-235/U, Mass Percent
031	0.3206 ± 0.0002	0.3166 ± 0.0002
071	0.7209 ± 0.0005	0.7119 ± 0.0005
194	1.9664 ± 0.0014	1.9420 ± 0.0014
295	2.9857 ± 0.0021	2.9492 ± 0.0021
446	4.5168 ± 0.0032	4.4623 ± 0.0032

Date of Certificate: October, 1985
(Revision of NBS Certificate dated June, 1985)

CRM 146 Uranium Isotopic Standard for Gamma Spectrometry Measurements

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: Set of three sealed aluminum cans each containing 230 grams of compressed U_3O_8 powder of a given enrichment. An empty can is provided for use with samples.

There are twenty sets of unique certified values for mass U_3O_8. These values are associated with Units identified as NBL 0001, NBL 0002 and NBL 0003 only.

Properties certified:

Can Identification	NBL 0001	NBL 0002	NBL 0003
^{235}U Atom Fraction (x 100)	20.311 ± 0.020	52.800 ± 0.042	93.2330 ± 0.0053
^{235}U Mass Fraction (x 100)	20.107 ± 0.020	52.488 ± 0.042	93.1703 ± 0.0052

See next page for CRM 146 Additional Certified Values

CRM 146
Additional Certified Values

Can Identification	NBL 0001	NBL 0002	NBL 0003
^{234}U Atom Fraction (x 100) ^{234}U Mass Fraction (x 100)	0.15076 ± 0.00037 0.14861 ± 0.00037	0.3756 ± 0.0011 0.3718 ± 0.0010	0.9849 ± 0.0029 0.9800 ± 0.0029
^{236}U Atom Fraction (x 100) ^{236}U Mass Fraction (x 100)	0.1985 ± 0.0013 0.1973 ± 0.0013	0.26495 ± 0.00060 0.26451 ± 0.00060	0.2927 ± 0.0022 0.2937 ± 0.0022
^{238}U Atom Fraction (x 100) ^{238}U Mass Fraction (x 100)	79.339 ± 0.020 79.547 ± 0.020	46.560 ± 0.043 46.876 ± 0.043	5.4895 ± 0.0053 5.5559 ± 0.0053
$^{234}U/^{238}U$ Atom Ratio	0.0019002 ± 0.0000050	0.008067 ± 0.000028	0.17942 ± 0.00058
$^{235}U/^{238}U$ Atom Ratio	0.25601 ± 0.00031	1.1340 ± 0.0020	16.984 ± 0.017
$^{236}U/^{238}U$ Atom Ratio	0.002501 ± 0.000016	0.005691 ± 0.000013	0.05332 ± 0.00038
Molar Mass of Uranium (g/mol)	237.43002 ± 0.00060	236.4428 ± 0.0012	235.20204 ± 0.00017
Uranium Mass Fraction (x 100)	84.553 ± 0.019	84.286 ± 0.030	84.519 ± 0.074
U_3O_8 Mass (grams)	229.99 ± 0.10	229.93 ± 0.10	230.04 ± 0.10
^{235}U Mass (grams)	39.10 ± 0.04	101.72 ± 0.10	181.15 ± 0.12

Date of Certificate: July, 1999

CRM 149 Uranium (93% Enriched) Oxide – U_3O_8 Standard for Neutron Counting Measurements

(NOTE: This CRM contains Special Nuclear Material. Buyers must hold a valid NRC License or qualify under a current DOE contract.)

Unit Description: Set of seven cans, one empty can and six other cans that contain U_3O_8 material with a nominal ^{235}U isotopic abundance of 93%. Each can is crimp sealed and engraved with a unique identification number. Each set is unique. These certified values are representative of one set.

Properties certified: Mass of U_3O_8, Uranium and Uranium-235; Isotopic Abundance, Molar Mass and uranium concentration.

Table I. Certified Values for Masses of U_3O_8, U, and ^{235}U

Can Identification	**U_3O_8 Mass (kg)**	**U Mass (kg)**	**^{235}U Mass (kg)**
1-93U3O8-0	0	0	0
1-93U3O8-500	0.50000 ± 0.00025	0.42172 ± 0.00022	0.39303 ± 0.00021
1-93U3O8-1000	0.99980 ± 0.00025	0.84328 ± 0.00024	0.78590 ± 0.00023
1-93U3O8-1500	1.49993 ± 0.00025	1.26512 ± 0.00027	1.17904 ± 0.00026
1-93U3O8-2000	2.00023 ± 0.00025	1.68710 ± 0.00031	1.57230 ± 0.00030
1-93U3O8-3000	3.00007 ± 0.00025	2.53041 ± 0.00041	2.35823 ± 0.00040
1-93U3O8-4000	3.99937 ± 0.00025	3.37326 ± 0.00052	3.14374 ± 0.00051

See next page for CRM 149 Additional Certified Values

CRM 149
Additional Certified Values

Isotopic Abundance	^{234}**U**	^{235}**U**	^{236}**U**	^{238}**U**
Atom Fraction (× 100)	1.0184 ± 0.0018	93.2570 ± 0.0049	0.3953 ± 0.0011	5.3294 ± 0.0051
Mass Fraction (× 100)	1.0134 ± 0.0018	93.1959 ± 0.0049	0.3967 ± 0.0011	5.3940 ± 0.0052

Molar Mass of Uranium (g/mol)	235.19792 ± 0.00016	Uranium Concentration (kg uranium/kg material)	0.84345 ± 0.00012

Date of Certificate: November, 1999

CRM 106-A Monazite Sand - Silica Mixture

This CRM was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7% ThO_2) with silica (99.9% SiO_2) to obtain a uniform mixture of desired thorium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Thorium Assay = 1.029 ± 0.003 Wt%

Date of Certificate: February, 1981

CRM 107-A Monazite Sand - Silica Mixture

This CRM was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7% ThO_2) with silica (99.9% SiO_2) to obtain a uniform mixture of desired thorium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Thorium Assay = 0.1028 ± 0.0002 Wt%

Date of Certificate: February, 1981

CRM 108-A Monazite Sand - Silica Mixture

This CRM was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7% ThO_2) with silica (99.9% SiO_2) to obtain a uniform mixture of desired thorium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Thorium Assay = 0.0515 ± 0.0002 Wt%

Date of Certificate: February, 1981

CRM 109-A Monazite Sand - Silica Mixture

This CRM was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7% ThO_2) with silica (99.9% SiO_2) to obtain a uniform mixture of desired thorium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Thorium Assay = 0.01052 ± 0.00009 Wt%

Date of Certificate: February, 1981

CRM 110-A Monazite Sand - Silica Mixture

This CRM was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7% ThO_2) with silica (99.9% SiO_2) to obtain a uniform mixture of desired thorium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Thorium Assay = 0.00104 ± 0.00001 Wt%

Date of Certificate: February, 1981

CRM 1-A Phosphate Rock - Uranium (Normal) Standard

This material was prepared from pebble phosphate rock from the Bone Valley Phosphate District in Central Florida.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 0.0153 ± 0.0002 Wt%

Date of Certificate: March, 1980

CRM 3-B Low Grade Pitchblende

This material was prepared from pitchblende ore diluted with dunite.

Unit Description: 100 grams of powder packed in a glass bottle.

Property Certified: U_3O_8 = 3.90 Wt%

Date of Certificate: June, 1969

CRM 4 Carnotite Ore

This material is made from carnotite, a potassium uranium vanadate ore, and provides a high benchmark on the Atomic Energy Commission schedule of minimum prices for uranium-bearing ores.[1]

Unit Description: 100 grams of powder packed in a glass bottle.

Property Certified: U_3O_8 = 0.18 Wt%

Date of Certificate: September, 1950

[1]AEC Circular No. 5, reprinted in Minerals for Atomic Energy by R. D. Nininger, Van Nostrand, 1954.

CRM 5 Carnotite Ore

This material is made from carnotite, a potassium uranium vanadate ore, and provides a low benchmark on the Atomic Energy Commission schedule of minimum prices for uranium-bearing ores.[2]

Unit Description: 100 grams of powder packed in a glass bottle.

Property Certified: U_3O_8 = 0.11 Wt%

Date of Certificate: September, 1950

CRM 101-A Pitchblende Ore - Silica Mixture

This reference material was prepared at NBL by milling and blending NBL CRM 6-A pitchblende ore (67.91 ± 0.05 Wt% U_3O_8) with silica (99.9% SiO_2) to obtain a uniform mixture of desired uranium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 1.007 ± 0.013 Wt%

Date of Certificate: February, 1981

CRM 102-A Pitchblende Ore - Silica Mixture

This reference material was prepared by milling and blending NBL CRM 6-A pitchblende ore (67.91 ± 0.05 Wt% U_3O_8) with silica (99.9% SiO_2) to obtain a uniform mixture of desired uranium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 0.1025 ± 0.0019 Wt%

Date of Certificate: February, 1981

[2]Ibid.

CRM 103-A Pitchblende Ore - Silica Mixture

This reference material was prepared by milling and blending NBL CRM 6-A pitchblende ore (67.91 ± 0.05 Wt% U_3O_8) with silica (99.9% SiO_2) to obtain a uniform mixture of desired uranium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 0.0499 ± 0.0007 Wt%

Date of Certificate: February, 1981

CRM 104-A Pitchblende Ore - Silica Mixture

This reference material was prepared by milling and blending NBL CRM 6-A pitchblende ore (67.91 ± 0.05 Wt% U_3O_8) with silica (99.9% SiO_2) to obtain a uniform mixture of desired uranium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 0.00988 ± 0.00020 Wt%

Date of Certificate: February, 1981

CRM 105-A Pitchblende Ore - Silica Mixture

This reference material was prepared by milling and blending NBL CRM 6-A pitchblende ore (67.91 ± 0.05 Wt% U_3O_8) with silica (99.9% SiO_2) to obtain a uniform mixture of desired uranium concentration.

Unit Description: 50 grams of powder packed in a glass bottle.

Property Certified: Uranium Assay = 0.00102 ± 0.00002 Wt%

Date of Certificate: February, 1981

NEW AND REPLACEMENT CRM's - CURRENT STATUS/INFORMATION

The following CRM's are in the proposal, planning, preparation or certification stages. A short description is provided here to keep you informed about the ongoing activities which may be of interest to you or to your organization.

NEW CRM's

[Available as of July 1999] CRM 146, Uranium (Enriched) Gamma Spectrometry Standard, consists of a set of three sealed aluminum cans, each containing approximately 230 grams of 20%, 52% and 93% enriched compressed U_3O_8 powder, respectively. An empty can is provided with each set. Twenty sets of this standard were fabricated. CRM 146 in conjunction with NBL CRM 969, will enable users to measure uranium enrichment spanning the range of 0.3 % to 93%.

CRM 147, Plutonium Nondestructive Assay Standard, or a Working Reference Material (WRM) is in the proposal stage. A unit of this reference material will be 3 kg of plutonium oxide or 4 kg of plutonium metal packaged in DOE-STD-3013-96 containers. Three to five units of this reference material will be produced. The planning and production will depend on the availability of funds.

CRM 148, Uranium U-233/U-236 Double Atom Spike Standard, is in the proposal stage. A unit will be 1 mg to 5 mg uranium. NBL is identifying and acquiring source materials, possibly pure isotopes, needed for the production of CRM units.

[Available as of November 1999] CRM 149, Uranium Nondestructive Assay Standard for Active Well Coincidence Counter is a 93% enriched U_3O_8 material, packaged into 37 individual units, ranging in weight from 0.5 kg to 4.0 kg. Twenty-eight units were available as CRM 149, and nine units are used in the NBL Safeguards Measurement Evaluation Program.

CRM (or WRM), Uranium Nondestructive Assay Standard for Californium Shuffler, is in the proposal stage. This reference material will consist of a set of 10 units of 93% enriched U_3O_8 material ranging in weights from 10 grams to 300 grams. The same batch of material used for CRM 149 production will be used for this standard.

[Estimated availability – March 2003] CRM U630, Uranium Isotopic Standard

REPLACEMENT OR REPACKAGED CRM's

CRM 17-B, Uranium (Normal) Tetrafluoride Assay Standard. All packaged units of this CRM are sold out. In FY 1997, a batch of the same material was packaged into a smaller unit size, approximately 50 g/unit. Since the original CRM 17-B was issued in 1961, NBL plans to recertify and issue a new Certificate of Analysis. This project has not yet been initiated.

CRM 18, Uranium (Normal) Oxide UO_3 Standard. All packaged units of this CRM are sold out. Packaging and recertification of CRM 18 is not planned. NBL has a characterized UO_3 (0.9% enrichment) material (WRM not a CRM) available that is in use by the NBL Safeguards Measurement Evaluation Program; this material is available as 10 g/unit.

[Available as of April 2001] CRM 42-A, Uranium (Normal) Counting Standard, was packaged in FY 1995. Since the original CRM 42 was issued in 1957, NBL certified and issued.

[Estimated availability of recertified isotopic values – March 2003] CRM 113-B. The isotopic values were recertified.

[Available as of October 2002] CRM 115, Uranium (Depleted) Metal Assay Standard. Repackaged units were verified for U assay. U-235 content did not verify and the isotopic data are given for information only pending future analyses.

[Estimated availability – July 2003] CRM 116, Uranium (Enriched) Metal Assay Standard. The inventory of this CRM has been exhausted. Repackaging and verification/certification are in the planning stage.

[Estimated availability – October 2003; SOLD OUT of CRM 126] CRM 126-A, Plutonium Metal Assay and Isotopic Standard. There is an immediate need for replacement. In FY 1997, NBL and Los Alamos National Laboratory (LANL) technical staff outlined the project scope for NBL CRM 126-A production and certification. The material was prepared and packaged at LANL in FY 2002. Certification of CRM 126-A is in process.

[Estimated availability – June 2003; SOLD OUT of CRM 129] CRM 129-A, Uranium Oxide (U_3O_8) Assay Standard has been packaged and its certification is in process.

[Available as of October 2002] CRM U005-A, Uranium Isotopic Standard. Repackaged and verified CRM U005-A units are now available for sale.

[Estimated availability of CRM U045 – March 2003] CRM 050, Uranium Isotopic Standard. The inventory of this CRM has been exhausted. CRM U050 will be replaced with CRM U045.

SPECIAL CUSTOMER REQUESTS

To better serve our customers, we have included several forms for your use in requesting additional information from the New Brunswick Laboratory. See the following pages to request information and/or to request New/Replacement CRM's.

Please FAX to: (630) 252-4146

or mail to:

U.S. Department of Energy
New Brunswick Laboratory
9800 S. Cass Avenue, Building 350
Argonne, IL 60439
ATTN: Reference Materials Program Manager

or e-mail your request to:

USDOE.NBL@CH.DOE.GOV

Please provide us as much information as possible to assist us in providing you with the information you need.

CUSTOMER SERVICE REQUEST FAX FORM FAX: (630) 252-4146

[ ] New Brunswick Laboratory Information Brochure

[ ] New Brunswick Laboratory CRM Catalog

[ ] New Brunswick Laboratory CRM Price List

[ ] Certificate(s) for CRM's:_____

[ ] Material Safety Data Sheet(s) for CRM's:_____

Information on Other NBL Business Lines

[ ] Nuclear Material Measurement Services

[ ] Measurement Development

[ ] Safeguards Measurement Evaluation Services

[ ] Nuclear Safeguards and Nonproliferation Support/Site-Specific Assistance

[ ] Other, please describe:_____

_____

_____

_____

Name: _____

Organization: _____

Address: _____

_____

_____

Phone/FAX: _____

E-mail address: _____

CUSTOMER SERVICE REQUEST FAX FORM FAX: (630) 252-4146

NEW AND REPLACEMENT CRM's - SPECIAL REQUESTS

NBL welcomes requests for CRM's that would address the measurement needs of the nuclear community. It will be useful to us if you can provide as much information as possible on your intended use/need, as requested below. We will evaluate all requests and determine the demand for new/replacements CRM's to meet user needs. We must give top priority to those requests for CRM's that will serve many users and those of utmost importance to non-proliferation and national security needs.

1. Title for the proposed CRM.

2. Intended use of the CRM.

3. Desired characteristics of the CRM.

4. Present and future demand for the CRM.

5. Other pertinent information.

Name: _____

Organization: _____

Address: _____

_____

_____

Phone/FAX: _____

E-mail address: _____