14 July 2010



Attn: Licensing Branch

Office of Federal & State Materials And Environmental Management Programs Division of Materials Safety and State Agreements U.S. Nuclear Regulatory Commission Washington, DC 20555-0001

Re: New License Application

To whom it may concern:

Please find enclosed Eckert & Ziegler Analytics (EZA) application for a new Exempt distribution license for byproduct material and license fee.

Contact Information:

Person:

Walter A. Levich: Plant Manager / RSO

Address:

Eckert & Ziegler Analytics, Inc. 1380 Seaboard Industrial Blvd. Atlanta, GA 30318

Phone/Fax: PH 404-425-5026 FX 404-352-2837 Email: walter.levich@ezag.com

Distribution Location: 1380 Seaboard Industrial Blvd., Atlanta, GA 30318

License: GA 742-1, Amendment 25

Eckert & Ziegler Analytics, founded over 25 years ago, specializes in the manufacture of radioactive calibration counting standards and cross check sources used for spectral measurements, analysis, and performance evaluation. Eckert & Ziegler Analytics is located in Atlanta, GA and operates under a specific license issued by the State of Geogia (RML No. GA 742-1, Amendment 25)

Our handling and processing of NRC exempt sources will be governed by EZA procedure ANA-HP-16; Processing of Exempt Quantity Distribution Products. This procedure outlines the departmental responsibilities for processing exempt sources,

573162

30-38320

Eckert & Ziegler

Atlanta, Georgia 30318

www.analyticsinc.com

Tel 404.352.8677

Fax 404.352.2837

1380 Seaboard Industrial Blvd.

Analytics

Page 1 of 2

ANA Form055 Rev. ---

labeling requirements, handling instructions, reporting requirements, and lists the exempt sources and quantity of radioactive material.

I have included catalog pages and/or source drawings and descriptions for each model listed in procedure ANA-HP-16.

A copy of EZA's RML, Quality Assurance Manual, product drawings, and our procedure for the processing of exempt quantity distribution products (in draft form) is included.

If you have any questions, please contact me at one of the following numbers or via email:

Main: 404-352-8677 Direct: 404-425-5026 Mobile: 770-401-4847 Email: <u>walter.levich@ezag.com</u>

Sincerely,

Walter A. Levich Plant Manager Radiation Safety Officer

Attachments:

- 1) NRC Form 313: Application for Material License
- 2) Attachment 1: Item 5 of application; Radioactive Material
- 3) Attachment 2: Item 6 of application; Purpose for which licensed material will be used
- 4) EZA RML (GA 742-1, Amendment 25)
- 5) EZA Procedure ANA-HP-16, Processing of Exempt Quantity Distribution products (draft)
- 6) Product drawings
- 7) Product Catalog/Catalog pages
- 8) EZA Quality Assurance Manual

NRC FORM 313 U.S. NUCLEAR REGULATORY COMMISS	ION APPROVED BLOMB: 40. 3150-0120 EXPIRES: 3/31/2012
(3-2009) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40	Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety Sade comparison burden estimate to the Records and FOU/Retwork Sade
APPLICATION FOR MATERIALS LICENSE	Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001 or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office o Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Managemen
	and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may no conduct or sponsor, and a person is not required to respond to, the information collection.
INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATIO	N GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION.
APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH	IF YOU ARE LOCATED IN:
OFFICE OF FEDERAL & STATE MATERIALS AND ENVIRONMENTAL MANAGEMENT PROGRAMS DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS U.S. NUCLEAR REGULATORY COMMISSION WASHINGTON, DC 20555-0001	ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:
ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:	MATERIALS DEUSING BOWGEN U.S. NUCLEAR REGULATORY COMMISSION, REGION III 2443 WARRENVILLE ROAD, SUITE 210 LISLE, IL 60532-4352
IF YOU ARE LOCATED IN:	
ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGI KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SO CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA SEND APPLICATIONS TO:	A, ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH UTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:
LICENSING ASSISTANCE TEAM DIVISION OF NUCLEAR MATERIALS SAFETY U.S. NUCLEAR REGULATORY COMMISSION, REGION I 475 ALLENDALE ROAD KING OF PRUSSIA, PA 19406-1415	NUCLEAR MATERIALS LICENSING BRANCH U.S. NUCLEAR REGULATORY COMMISSION, REGION IV 612 E. LAMAR BOULEVARD, SUITE 400 ARLINGTON, TX 76011-4125
PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUC MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURIS	LEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED SDICTIONS.
1. THIS IS AN APPLICATION FOR (Check appropriate item)	2. NAME AND MAILING ADDRESS OF APPLICANT (Include ZIP code)
A. NEW LICENSE	Eckert & Ziegler Analytics, Inc.
B. AMENDMENT TO LICENSE NUMBER	- Atlanta, GA 30318
C. RENEWAL OF LICENSE NUMBER	
3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED	4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION
1380 Seaboard Industrial Blvd. Atlanta GA 30318	Walter A. Levich
	TELEPHONE NUMBER
	(404) 425-5026
SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFO	I RMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.
5. RADIOACTIVE MATERIAL a. Element and mass number; b. chemical and/or physical form; and c. maiximum amount which will be possessed at any one time. See ang chement 4.	6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7. INDVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.	8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
). FACILITIES AND EQUIPMENT.	10. RADIATION SAFETY PROGRAM.
1. WASTE MANAGEMENT.	FEE CATEGORY 31 AMOUNT \$ 10,000.00
3. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS	THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING
THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33 CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF. WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62, STAT, 749 MAKES IT	OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN 3, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND
ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WIT	
Walter A. Levich, Plant Manager & RSO	<u>Uulta (1- 6- 07/14/2010</u>
YPE OF FEE FEE LOG FEE CATEGORY AMOUNT RECEIVED C	HECK NUMBER COMMENTS
PPROVED BY	ATE
	PRINTED ON RECYCLED PAPER

Eckert & Ziegler Analytics

### **APPLICANT NAME:**

ECKERT & ZIEGLER ANALYTICS 1380 Seaboard Industrial Blvd. Atlanta, GA 30318 License Number: GA 742-1 Amendment Number .25

### **ITEM 5, RADIOACTIVE MATERIAL**

We are requesting authorization to distribute calibration counting standards and check sources containing all isotopes listed in §30.71, Schedule B and not to exceed the activities listed in §30.71, Schedule B.

A list of the proposed Exempt Quantity Sources are listed in Appendix 10.2 of Eckert & Ziegler Analytics procedure ANA-HP-16; "Processing of Exempt Quantity Distribution Products". Appendix 10.2 includes the source model number, isotope, description and manufacturer.

See Attached List of 10 CFR 30.71 Schedule B Nuclides, Chemical/Physical Form, and upper activity limit exempted by the NRC.

### Eckert & Ziegler Analytics

Eckert & Ziegler Analytics

### 10 CFR 30.71 SCHEDULE B NUCLIDES AND UPPER ACTIVITY LIMITS EXEMPTED BY THE NRC

Byproduct Material	Chemical Form	Physical Form	Microcuries
Antimony 122 (Sb 122)	Any	Any (solid, liquid, gas)	100
Antimony 124 (Sb 124)	Any	Any (solid, liquid, gas)	10
Antimony 125 (Sb 125)	Any	Any (solid, liquid, gas)	10
Arsenic 73 (As 73)	Any	Any (solid, liquid, gas)	100
Arsenic 74 (As 74)	Any	Any (solid, liquid, gas)	10
Arsenic 76 (As 76)	Any	Any (solid, liquid, gas)	10
Arsenic 77 (as 77)	Any	Any (solid, liquid, gas)	100
Barium 131 (Ba 131)	Any	Any (solid, liquid, gas)	10
Barium 133 (Ba 133)	Any	Any (solid, liquid, gas)	10
Barium 140 (Ba 140)	Any	Any (solid, liquid, gas)	10
Bismuth 210 (Bi 210)	Any	Any (solid, liquid, gas)	1
Bromine 82 (Br 82)	Any	Any (solid, liquid, gas)	10
Cadmium 109 (Cd 109)	Any	Any (solid, liquid, gas)	10
Cadmium 115m (Cd 115m)	Any	Any (solid, liquid, gas)	. 10
Cadmium 115 (Cd 115)	Any	Any (solid, liquid, gas)	100
Calcium 45 (Ca 45)	Any	Any (solid, liquid, gas)	10
Calcium 47 (Ca 47)	Any	Any (solid, liquid, gas)	10
Carbon 14 (C 14)	Any	Any (solid, liquid, gas)	100
Cerium 141 (Ce 141)	Any	Any (solid, liquid, gas)	100
Cerium 143 (Ce 143)	Any	Any (solid, liquid, gas)	100
Cerium 144 (Ce 144)	Any	Any (solid, liquid, gas)	1
Cesium 129 (Cs 129)	Any	Any (solid, liquid, gas)	100
Cesium 131 (Cs 131)	Any	Any (solid, liquid, gas)	1,000
Cesium 134m (Cs 134m)	Any	Any (solid, liquid, gas)	100
Cesium 134 (Cs 134)	Any	Any (solid, liquid, gas)	1
Cesium 135 (Cs 135)	Any	Any (solid, liquid, gas)	10
Cesium 136 (Cs 136)	. Any	Any (solid, liquid, gas)	10
Cesium 137 (Cs 137)	Any	Any (solid, liquid, gas)	10
Chlorine 36 (Cl 36)	Any	Any (solid, liquid, gas)	10

Eckert & Ziegler Analytics

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Byproduct Material	Chemical Form	Physical Form	Microcuries
Chlorine 38 (Cl 38)	Any	Any (solid, liquid, gas)	10
Chromium 51 (Cr 51)	Any	Any (solid, liquid, gas)	1,000
Cobalt 57 (Co 57)	Any	Any (solid, liquid, gas)	100
Cobalt 58m (Co 58m)	Any	Any (solid, liquid, gas)	10
Cobalt 58 (Co 58)	Any	Any (solid, liquid, gas)	10
Cobalt 60 (Co 60)	Any	Any (solid, liquid, gas)	1
Copper 64 (Cu 64)	Any	Any (solid, liquid, gas)	100
Dysprosium 165 (Dy 165)	Any	Any (solid, liquid, gas)	10
Dysprosium 166 (Dy 166)	Any	Any (solid, liquid, gas)	100
Erbium 169 (Er 169)	Any	Any (solid, liquid, gas)	100
Erbium 171 (Er 171)	Any	Any (solid, liquid, gas)	100
Europium 152 9.2 h (Eu 152 9.2 h)	Any	Any (solid, liquid, gas)	100
Europium 152 13 yr (Eu 152 13 yr)	Any	Any (solid, liquid, gas)	1
Europium 154 (Eu 154)	Any .	Any (solid, liquid, gas)	] 1
Europium 155 (Eu 155)	Any	Any (solid, liquid, gas)	10
Fluorine 18 (F 18)	Any	Any (solid, liquid, gas)	1,000
Gadolinium 153 (Gd 153)	Any	, Any (solid, liquid, gas)	10
Gadolinium 159 (Gd 159)	Any	Any (solid, liquid, gas)	100
Gallium 67 (Ga 67)	Any	Any (solid, liquid, gas)	100
Gallium 72 (Ga 72)	Any	Any (solid, liquid, gas)	. 10
Germanium 68 (Ge 68)	Any	Any (solid, liquid, gas)	10
Germanium 71 (Ge 71)	Any	Any (solid, liquid, gas)	100
Gold 195 (Au 195)	Any	Any (solid, liquid, gas)	10
Gold 198 (Au 198)	Any	Any (solid, liquid, gas)	100
Gold 199 (Au 199)	Any	Any (solid, liquid, gas)	100
Hafnium 181 (Hf 181)	Any	Any (solid, liquid, gas)	10
Holmium 166 (Ho 166)	Any	Any (solid, liquid, gas)	100
Hydrogen 3 (H3)	Any	Any (solid, liquid, gas)	1,000
Indium 111 (In 111)	Any	Any (solid, liquid, gas)	100
Indium 113m (In 113m)	Any	Any (solid, liquid, gas)	100
Indium 114m (In 114m)	Any	Any (solid, liquid, gas)	10
Indium 115m (In 115m)	Any	Any (solid, liquid, gas)	100
Indium 115 (In 115)	Any	Any (solid, liquid, gas)	10
Iodine 123 (I 123)	Any	Any (solid, liquid, gas)	100
Iodine 125 (I 125)	Any	Any (solid, liquid, gas)	1
Iodine 126 (I 126)	Any	Any (solid, liquid, gas)	1

Eckert & Ziegler Analytics

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Analytics

Eckert & Ziegler

Byproduct Material	Chemical Form	Physical Form	Microcuries
Iodine 129 (I 129)	· Any	Any (solid, liquid, gas)	0,1
Iodine 131 (I 131)	Any	Any (solid, liquid, gas)	1
Iodine 132 (I 132)	Any	Any (solid, liquid, gas)	10
Iodine 133 (I 133)	Any	Any (solid, liquid, gas)	1
Iodine 134 (I 134)	Any	Any (solid, liquid, gas)	10
Iodine 135 (I 135)	Any	Any (solid, liquid, gas)	10
Iridium 192 (Ir 192)	Any	Any (solid, liquid, gas)	10
Iridium 194 (Ir 194)	Any .	Any (solid, liquid, gas)	100
Iron 52 (Fe 52)	Any	Any (solid, liquid, gas)	10
Iron 55 (Fe 55)	Any	Any (solid, liquid, gas)	100
Iron 59 (Fe 59)	Any	Any (solid, liquid, gas)	10
Krypton 85 (Kr 85)	Any	Any (solid, liquid, gas)	100
Krypton 87 (Kr 87)	Any	Any (solid, liquid, gas)	10
Lanthanum 140 (La 140)	Any	Any (solid, liquid, gas)	10
Lutetium 177 (Lu 177)	Any	Any (solid, liquid, gas)	100
Manganese 52 (Mn 52)	Any	Any (solid, liquid, gas)	10
Manganese 54 (Mn 54)	Any	Any (solid, liquid, gas)	. 10
Manganese 56 (Mn 56)	Any	Any (solid, liquid, gas)	10
Mercury 197m (Hg 197m)	Any	Any (solid, liquid, gas)	100
Mercury 197 (Hg 197)	Any	Any (solid, liquid, gas)	100
Mercury 203 (Hg 203)	Any	Any (solid, liquid, gas)	10
Molybdenum 99 (Mo 99)	Any	Any (solid, liquid, gas)	100
Neodymium 147 (Nd 147)	Any .	Any (solid, liquid, gas)	100
Neodymium 149 (Nd 149)	Any	Any (solid, liquid, gas)	100
Nickel 59 (Ni 59)	Any	Any (soliḍ, liquid, gas)	100
Nickel 63 (Ni 63)	Any	Any (solid, liquid, gas)	10
Nickel 65 (Ni 65)	Any	Any (solid, liquid, gas)	100
Niobium 93m (Nb 93m)	. Any	Any (solid, liquid, gas)	. 10
Niobium 95 (Nb 95)`	Any	Any (solid, liquid, gas)	10
Niobium 97 (Nb 97)	Any	Any (solid, liquid, gas)	10
Osmium 185 (Os 185)	Any	Any (solid, liquid, gas)	10
Osmium 191m (Os 191)	Any	Any (solid, liquid, gas)	. 100
Osmium 191 (Os 191)	Any	Any (solid, liquid, gas)	100
Osmium 193 (Os 193)	Any	Any (solid, liquid, gas)	100
Palladium 103 (Pd 103)	Any	Any (solid, liquid, gas)	100
Palladium 109 (Pd 109)	Any	Any (solid, liquid, gas)	100

Eckert & Ziegler Analytics

Analytics

Eckert & Ziegler

Byproduct Material	Chemical Form	Physical Form	Microcuries
Phosphorus 32 (P 32)	Any	Any (solid, liquid, gas)	10
Platinum 191 (Pt 191)	Any	Any (solid, liquid, gas)	100
Platinum 193m (Pt 193m)	Any	Any (solid, liquid, gas)	100
Platinum 193 (Pt 193)	Any	Any (solid, liquid, gas)	100
Platinum 197m (Pt 197m)	Any	Any (solid, liquid, gas)	100
Platinum 197 (Pt 197)	Any	Any (solid, liquid, gas)	100
Polonium 210 (Po 210)	Any	Any (solid, liquid, gas)	0.1
Potassium 42 (K 42)	Any	Any (solid, liquid, gas)	10
Potassium 43 (K 43)	Any	Any (solid, liquid, gas)	10
Praseodymium 142 (Pr 142)	Any	Any (solid, liquid, gas)	100
Praseodymium 143 (Pr 143)	Any	Any (solid, liquid, gas)	100
Promethium 147 (Pm 147)	Any	Any (solid, liquid, gas)	10
Promethium 149 (Pm 149)	Any	Any (solid, liquid, gas)	. 10
Rhenium 186 (Re 186)	Any	Any (solid, liquid, gas)	_100
Rhenium 188 (Re 188)	Any	Any (solid, liquid, gas)	100
Rhodium 103m (Rh 103m)	Any	Any (solid, liquid, gas)	100
Rhodium 105 (Rh 105)	Any	Any (solid, liquid, gas)	100
Rubidium 81 (Rb 81)	Any	Any (solid, liquid, gas)	10
Rubidium 86 (Rb 86)	Any	Any (solid, liquid, gas)	10
Rubidium 87 (Rb 87)	Any	Any (solid, liquid, gas)	10
Ruthenium 97 (Ru 97)	Any	Any (solid, liquid, gas)	100
Ruthenium 103 (Ru 103)	Any	Any (solid, liquid, gas)	10
Ruthenium 105 (Ru 105)	Any	Any (solid, liquid, gas)	10
Ruthenium 106 (Ru 106)	Any	Any (solid, liquid, gas)	. 1
Samarium 151 (Sm 151)	Any	Any (solid, liquid, gas)	10
Samarium 153 (Sm 153)	Any	Any (solid, liquid, gas)	100
Scandium 46 (Sc 46)	Any	Any (solid, liquid, gas)	10
Scandium 47 (Sc 47)	Any	Any (solid, liquid, gas)	100
Scandium 48 (Sc 48)	Any	Any (solid, liquid, gas)	10
Selenium 75 (Se 75)	Any	Any (solid, liquid, gas)	10
Silicon 31 (Si 31)	Any	Any (solid, liquid, gas)	100
Silver 105 (Ag 105)	Any	Any (solid, liquid, gas)	10
Silver 110m (Ag 110m)	Any	Any (solid, liquid, gas)	1
Silver 111 (Ag 111)	Any	Any (solid, liquid, gas)	100
Sodium 22 (Na 22)	Any	Any (solid, liquid, gas)	10
Sodium 24 (Na 24)	Any	Any (solid, liquid, gas)	10

Eckert & Ziegler Analytics



Byproduct Material	Chemical Form	Physical Form	Microcuries
Strontium 85 (Sr 85)	Any	Any (solid, liquid, gas)	10
Strontium 89 (Sr 89)	Any	Any (solid, liquid, gas)	1
Strontium 90 (Sr 90)	Any	Any (solid, liquid, gas)	0.1
Strontium 91 (Sr 91)	Any	Any (solid, liquid, gas)	10
Strontium 92 (Sr 92)	Any	Any (solid, liquid, gas)	10
Sulphur 35 (S 35)	Any	Any (solid, liquid, gas)	100
Tantalum 182 (Ta 182)	Any	Any (solid, liquid, gas)	10
Technetium 96 (Tc 96)	Any	Any (solid, liquid, gas)	10
Technetium 97m (Tc 97m)	Any	Any (solid, liquid, gas)	100
Technetium 97 (Tc 97)	Any	Any (solid, liquid, gas)	100
Technetium 99m (Tc 99m)	Any	Any (solid, liquid, gas)	100
Technetium 99 (Tc 99)	Any	Any (solid, liquid, gas)	10
Tellurium 125 m (Te 125 m)	Any	Any (solid, liquid, gas)	10
Tellurium 127m (Te 127m)	Any	Any (solid, liquid, gas)	10
Tellurium 127 (Te 127)	Any	Any (solid, liquid, gas)	100
Tellurium 129m (Te 129m)	Any	Any (solid, liquid, gas)	10
Tellurium 129 (Te 129)	Any	Any (solid, liquid, gas)	100
Tellurium 131m (Te 131m)	Any	Any (solid, liquid, gas)	10
Tellurium 132 (Te 132)	Any	Any (solid, liquid, gas)	10
Terbium 160 (Tb 160)	Any	Any (solid, liquid, gas)	10
Thallium 200 (Tl 200)	Any	Any (solid, liquid, gas)	100
Thallium 201 (Tl 201)	Any	Any (solid, liquid, gas)	100
Thallium 202 (TI 202)	Any	Any (solid, liquid, gas)	100
Thallium 204 (Tl 204)	Any	Any (solid, liquid, gas)	10
Thulium 170 (Tm 170)	Any	Any (solid, liquid, gas)	10
Thulium 171 (Tm 171)	Any	Any (solid, liquid, gas)	10
Tin 113 (Sn <sup>-</sup> 113)	Any	Any (solid, liquid, gas)	10
Tin 125 (Sn 125)	Any	Any (solid, liquid, gas)	10
Tungsten 181 (W 181)	Any	Any (solid, liquid, gas)	10
Tungsten 185 (W 185)	Any	Any (solid, liquid, gas)	10
Tungsten 187 (W 187)	Any .	Any (solid, liquid, gas)	100
Vanadium 48 (V 48)	Any	Any (solid, liquid, gas)	10
Xenon 131m (Xe 131m)	Any	Any (solid, liquid, gas)	1,000
Xenon 133 (Xe 133)	Any	Any (solid, liquid, gas)	100
Xenon 135 (Xe 135)	Any	Any (solid, liquid, gas)	100
Ytterbium 175 (Yb 175)	Any	Any (solid, liquid, gas)	100

Eckert & Ziegler Analytics

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Analytics

Eckert & Ziegler

Byproduct Material	Chemical Form	Physical Form	Microcuries
Yttrium 87 (Y 87)	Any	Any (solid, liquid, gas)	10
Yttrium 88 (Y 88)	Any	Any (solid, liquid, gas)	. 10
Yttrium 90 (Y 90)	Any	Any (solid, liquid, gas)	10
Yttrium 91 (Y91)	Any	Any (solid, liquid, gas)	10
Yttrium 92 (Y92)	Any	Any (solid, liquid, gas)	100
Yttrium 93 (Y93)	Any	Any (solid, liquid, gas)	100
Zinc 65 (Zn 65)	Any	Any (solid, liquid, gas)	10
Zinc 69m (Zn 69m)	Any	Any (solid, liquid, gas)	100
Zinc 69 (Zn 69)	Any	Any (solid, liquid, gas)	1,000
Zirconium 93 (Zr 93)	Any	Any (solid, liquid, gas)	. 10
Zirconium 95 (Zr 95)	Any	Any (solid, liquid, gas)	. 10
Zirconium 97 (Zr 97)	Any	Any (solid, liquid, gas)	10
Any byproduct material not listed above other than alpha emitting byproduct materials	Any	Any (solid, liquid, gas)	0.1





Application for Material License Item 6, Purpose For Which Licensed Matl. Will Be Used

Analytics

### **APPLICANT NAME:**

NRC Form 313 Attachment 2

ECKERT & ZIEGLER ANALYTICS 1380 Seaboard Industrial Blvd. Atlanta, GA 30318 License Number: GA 742-1 Amendment Number .25

### ITEM 6, PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED

The intended use of all §30.71, Schedule B nuclides are for their radioactive properties. Byproduct material will not be incorporated into any manufactured or assembled commodity, product, or device intended for commercial distribution.

§30.71, Schedule B nuclides will not be contained in any food, beverage, cosmetic, drug, or other commodity (product) designed for ingestion or inhalation by, or in an application to, a human being nor incorporated into any device.

### Eckert & Ziegler Analytics

Page 1 of 1

4220 International Parkway, Suite 100, Atlanta, Georgia 30354

Chris Clark, Commissioner Environmental Protection Division Carol A. Couch, Director 404-362-2675

# RADIOACTIVE MATERIALS PROGRAM GEORGIA RADIOACTIVE MATERIALS LICENSE

Pursuant to the Georgia Radiation Control Act O.C.G.A. 31-13 (H.B. 947) 1990 and the Georgia Department of Natural Resources Rules and Regulations, designated Chapter 391-3-17, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess, and use the radioactive material(s) designated below; and to use such radioactive materials for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules and regulations of the Georgia Department of Natural Resources and orders issued by the Department, now or hereafter in effect, and to any condition specified below.

Geor	gia Department of Natural Resources and c	orders	issued by the Departmen	nt, now o	r hereafter	in effect, and to any co	ondition specified below.
						Page 1 of License N Amendme	5 Pages umber GA 742-1 nt Number .25
Lic	ense (1. Name and 2. A	ddr	ess)	3.	In acco	ordance with lett	er dated April 14,
Ecl	cert & Ziegler Analytics, Inc.				ameno	led in its entirety	to read as follows:
Atla	anta, Georgia 30318	ara		4.	Expira	tion Date: Nov	ember 30, 2011
				5.	Telepi	one Number:	404-352-8677
6.	RADIOACTIVE MATERIAL (ELEMENT AND MASS NUMBER)	<b>7.</b>	CHEMICAL AN PHYSICAL FOR	D/OR RM	8.	MAXIMUM QU LICENSEE MA ANY ONE TIM	ANTITY NY POSSESS AT E
Α.	Any radioactive material with atomic number 3 through 83, inclusive	<b>A</b> .	Any		A.	2000 millicuries 50 millicuries atomic number inclusive	es, not to exceed per isotope with 3 through 83,
B.	Any radioactive material with atomic number 84 through 96, inclusive, <b>except special nuclear</b> <b>material</b>	В.	Any		В.	50 millicuries, millicuries per atomic number inclusive	not to exceed <b>5</b> isotope with 84 through 96,
C.	Hydrogen 3	C.	Any		С.	50 millicuries	
D.	Krypton 85	D.	Any		D.	5000 millicurie	es
E.	Polonium 210	Ε.	Any		Ε.	10 millicuries	
F.	Thorium 232	F.	Any		F.	2.2 millicuries	(20 kilograms)
G.	Uranium 234	G.	As an impurity in Uranium enriche isotope Uranium	n ed in th 1235	G. Ie	60 millicuries	
Н.	Uranium 238	H.	Any		Η.	2.9 millicuries	(5000 grams)
I.	Xenon 127	I.	Any		· <b>I.</b>	1000 millicurie	es in the second s
J.	Xenon 133	J.	Any		J.	5000 millicurie	Ś

Radioactive Materials License Supplementary Sheet

> Page 2 of 5 Pages License Number GA 742-1 Amendment Number .25

6. RADIOACTIVE MATERIAL 7. CHEMICAL AND/OR (ELEMENT AND MASS NUMBER)

# PHYSICAL FORM

### 8. MAXIMUM QUANTITY LICENSEE MAY POSSESS AT ANY ONE TIME

- K. lodine 125
- L. Special Nuclear Material (Uranium-233, Uranium-235, Plutonium)

- K. 600 millicuries
- H. Any

K. lotrex liquid

H. A total quantity insufficient to form 95% of a critical mass. See item 9.L. below

#### 9. **AUTHORIZED USE**

A. through J.

To receive, possess, use, transfer, and distribute radioactive materials for the purpose of preparation of custom instrument calibration standards, instrument calibration cross checks, spectral measurements, and analysis.

K.

To receive, possess, use, transfer, and distribute commercial calibration standards.

To receive, possess, use, transfer, and distribute radioactive materials for the purpose of preparation of custom instrument calibration standards, instrument calibration cross checks, spectral measurements, and analysis. The licensee shall restrict the possession of special nuclear material such that the following sum of ratios equation is met:

> grams U-235 \_ grams U-233 + grams Pu < 0.95 200 200 350

## CONDITIONS

- 10. Radioactive material shall be used only at the licensee's address stated in Item 2 above.
- 11. The licensee shall comply with the provisions of Georgia Department of Natural Resources Rule 391-3-17-.03, "Standards for Protection Against Radiation, Amended.", Rule 391-3-17-.06, "Transportation of Radioactive Material, Amended.", and Rule 391-3-17-.07, "Notices, Instructions and Reports to Workers: Inspections, Amended."

Radioactive Materials License Supplementary Sheet

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### Conditions (continued)

12. In accordance with DNR Board Policy adopted May 28, 2003, the fees associated with this license, fee category C.1, are:

Application fee	\$1300	Annual fee	\$2293
Amendment fee	\$ 550	Non-routine Inspection fee	\$2000

Checks for the fees should be made payable to the <u>Department of Natural Resources</u>, <u>Radioactive Materials Program</u>, and mailed to the following address:

Radioactive Materials Fees P.O. Box 101161 Atlanta, GA 30392

Mail license applications and amendment requests to the following address:

### Radioactive Materials Program 4220 International Parkway, Suite 100 Atlanta, GA 30354

All license applications, amendments and fee payments should be mailed the same day. Annual fees are billed by the Department at the beginning of each fiscal year.

- 13. The Radiation Safety Officer in this program shall be Walter Levich.
- 14. Radioactive material shall be used by or under the supervision of Daniel Montgomery, Evgeny Taskaev, Walter Levich, Margarita Taskaeva, **Natalie Kasate, or Wenlin Mao**.
- 15. The licensee shall conduct a physical inventory every 6 months to account for all licensed material received and possessed under this license. The records of inventories shall be maintained for inspection by the Department and shall include the quantities and kinds of radioactive material, the manufacturer, model and serial number, location of sealed sources, and the date and name of the individual performing the inventory.
- 16. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to use or transfer as a sealed source. If the inspection or test reveals any construction defects or 0.005 microcurie or greater of contamination, the source shall not be used or transferred as a sealed source until it has been repaired, decontaminated and retested.
- 17. The licensee is authorized to receive custom sources containing radioactive material for rework, recycle, and/or disposal. This authorization is limited to sources distributed under this license.

Radioactive Materials License Supplementary Sheet

> Page 4 of 5 Pages License Number GA 742-1 Amendment Number .25

### **Conditions** (continued)

- 18. This license does not authorize commercial distribution of licensed material to persons exempt from licensing pursuant to (3)(b) of Rule 391-3-17-.02. The distribution of byproduct material, source material, and special nuclear material (as defined in Rule 391-3-17-.01) to persons exempt from licensing pursuant to (3) of Rule 391-3-17-.02 requires a license issued by the U.S. Nuclear Regulatory Commission.
- 19. The licensee is authorized to hold radioactive material with a physical half-life of less than 120 days for decay-in-storage before disposal in ordinary trash provided:
  - A. Before disposal in ordinary trash, radioactive material shall be surveyed at the container surface with the appropriate survey meter set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.
  - B. A record of each disposal permitted under this License Condition shall be retained for three years. The record must include the date of disposal, the date on which the radioactive material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.
- 20. The licensee shall not transfer possession and/or control of materials or products containing radioactive material as a contaminant except:
  - A. By transfer of waste to an authorized recipient;
  - B. By transfer to a specifically licensed recipient; or
  - C. As provided otherwise by a specific condition of this license pursuant to the requirements of (13) of Rule 391-3-17-.03.
- 21. Except as provided in Rule 391-3-17-.06(16), no plutonium regardless of form shall be delivered to a carrier for shipment by air transport or transported in an aircraft by the licensee except in packages the design of which the U. S. Nuclear Regulatory Commission has specifically approved for transport of plutonium by air.
- 22. In accordance with Chapter 391-3-17-.02(8)(g), the licensee has filed a financial assurance mechanism as described in letter, with attachments, dated March 9, 2001, and as revised in renewal application dated October 27, 2006, as determined necessary by the Department to provide for the protection of the public health and safety. Expiration of a specific license shall not relieve the license of responsibility for decommissioning its facility and terminating the specific license.

Radioactive Materials License Supplementary Sheet

> Page 5 of 5 Pages License Number GA 742-1 Amendment Number .25

### Conditions (continued)

Date:

July 23, 2009

- 23. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with statements, representations, and procedures contained in the documents, including any enclosures listed below:
  - A. Application for renewal with attachments dated October 27, 2006, signed by Walter A Levich, Plant Manager and RSO.
  - B. Analytics Quality Assurance Manual, as described in the renewal application, as amended or revised.
  - C. Decommissioning Funding Plan, submitted under cover letter dated March 9, 2001, signed by Robert C. McFarland, Radiation Safety Officer, revised in renewal application dated October 27, 2006, as amended or revised.
  - D. Electronic correspondence from Walter Levich to Eric Jameson dated December 28, 2006, 15:24:29.
  - E. Letter with attachments dated April 14, 2009, signed by Walter A. Levich, Plant Manager and RSO.
  - F. Electronic correspondence from Walter Levich to Eric Jameson dated June 23, 2009, 12:35.

The Georgia Department of Natural Resources' regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the Regulations.

BY

FOR THE DEPARTMENT OF NATURAL RESOURCES

m mison

Eric T. Jameson







	LEGEN	D		
MODEL	DIM "A" MM	DIM "B" MM	ACTIVE MATERIAL DIM "C" MM	MATERIAL
F &J "B" LIP	64.3	25.4	5-20	CHARCOAL
F & J "C" LIPLESS	56.9	26.4	5-22	CHARCOAL
F & J LOW METAL	63.9	25.5	5-20	CHARCOAL
F & J TALL METAL	63.9	41.0	5-37	CHARCOAL
F & J LAPEL	41.6	19.2	5-15	CHARCOAL
BG-300	57.2	26.4	5-22	CHARCOAL
CP-100 PLASTIC	57.4	26.3	5-22	CHARCOAL
CP-100 METAL RING	57.3	26.4	5-22	CHARCOAL
CP-200	57.5	26.4	5-22	CHARCOAL
CESCO	58.1	24.5	5-20	CHARCOAL
SCOTT	62.0	25.6	5-20	CHARCOAL
HI-Q YELLOW PLASTIC	56.8	25.1	5-20	CHARCOAL
HI-Q LOW METAL	64.2	24.5	5-20	CHARCOAL
HI-Q TALL METAL	62.1	41.1	5-37	CHARCOAL
SAIC DE-500 LAPEL	41.4	19.3	5-15	CHARCOAL
RadecoRL-100	64.0	25.7	5-20	CHARCOAL
MSA METAL CARTRIDGE	84.1	30.3	5-26	CHARCOAL
SORRENTO	61.7	24.8	5-20	CHARCOAL
F &J "B" LIP	64.3	25.4	5-20	ZEOLITE
F & J "C" LIPLESS	56.9	26.4	5-22	ZEOLITE
F & J LOW METAL	63.9	25.5	5-20	ZEOLITE
F & J TALL METAL	63.9	41.0	5-37	ZEOLITE
F & J LAPEL	41.6	19.2	5-15	ZEOLITE
HI-Q YELLOW PLASTIC	56.8	25.1	5-20	ZEOLITE
HI-Q LOW METAL	64.2	24.5	5-20	ZEOLITE
HI-Q TALL METAL	62.1	41.1	5-37	ZEOLITE
GY-130	57.3	26.2	5-22	ZEOLITE

SIZE

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CAGE CODE DRAWING NO. DRAWN. CARTRIDGE SOURCE ASSEMBLY -

SHEET 2 OF 2

REV



DISK LEGEND					
DIM "A" (MM)	DIM "B" (MM)	MATERIAL (C)	MATERIAL (D)		
47	0.64	RED CAST ACRYLIC	TAPE		
47	0.64	RED CAST ACRYLIC	MYLAR		
25.4	0.64	RED CAST ACRYLIC	TAPE		
25.4	0.64	RED CAST ACRYLIC	MYLAR		
47.1	0.9	STAINLESS STEEL	TAPE		
47.1	0.9	STAINLESS STEEL	MYLAR		
47.1	0.9	ALUMINUM	TAPE		
47.1	0.9	ALUMINUM	MYLAR		

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				011555
DRAWN	CAGE CODE	DRAWING NO.	REV	SHEEL
	-	DISK SOURCE ASSEME	LY	2 OF 2

	· .			·				
	"C"			F	ACE	"A"	E	30TTOM
						"B"	; 	
5. SURFACE FINISH: SEE LEGEND			ELE	ECTRO		"B"	3 	
5. SURFACE FINISH: SEE LEGEND 4. PACKAGE AND IDENTIFY PART NUMBER THEREG 3 SURFACE ROUGHNESS: 16/NO SCRATCHES, D VOIDS OR MARKINGS	ON DIM DINGS (MM)	DIM "B" (MM)	ELE DIM "C" (MM)	ECTRO	DEPOSITE	"B"	s 	
<ul> <li>5. SURFACE FINISH: SEE LEGEND</li> <li>4. PACKAGE AND IDENTIFY PART NUMBER THEREO</li> <li>3 SURFACE ROUGHNESS: <sup>16</sup>/NO SCRATCHES, D</li> <li>VOIDS OR MARKINGS</li> <li>2. REMOVE BURRS AND BREAK EDGES 0.003 MAX</li> </ul>	ON DIM DINGS (MM) (47.1	DIM "B" (MM) 0.65	ELE DIM "C" (MM) 5-45	ECTRO	DDEPOSITE NLESS STEE	"B" ED SOURCE LEGEND MATERIAL EL MIRROR POLISHED	OR BEAD	BLASTED
<ul> <li>5. SURFACE FINISH: SEE LEGEND</li> <li>4. PACKAGE AND IDENTIFY PART NUMBER THEREO</li> <li>3 SURFACE ROUGHNESS: 16/NO SCRATCHES, D</li> <li>VOIDS OR MARKINGS</li> <li>2. REMOVE BURRS AND BREAK EDGES 0.003 MAX</li> <li>1. MATERIAL: N/A SEE LEGEND</li> <li>NOTES: UNLESS OTHERWISE SPECIFIED</li> </ul>	ON DIM "A" (MM) (47.1 24.1	DIM "B" (MM) 0.65 0.90	ELE DIM "C" (MM) 5-45 5-24.1	STA	DDEPOSITE NLESS STEE NLESS STEE	"B" ED SOURCE LEGEND MATERIAL EL MIRROR POLISHED EL MIRROR POLISHED	OR BEAD OR BEAD	BLASTED BLASTED
5. SURFACE FINISH: SEE LEGEND 4. PACKAGE AND IDENTIFY PART NUMBER THEREO 3. SURFACE ROUGHNESS: 16/NO SCRATCHES, D VOIDS OR MARKINGS 2. REMOVE BURRS AND BREAK EDGES 0.003 MAX 1. MATERIAL: N/A SEE LEGEND NOTES: UNLESS OTHERWISE SPECIFIED WILLESS OTHERWISE SPECIFIED WILLESS OTHERWISE SPECIFIED UNLESS OT	ON DINGS (MM) (MM) (A7.1 24.1 24.1 24.1 24.1 24.1 24.1 24.1 24	DIM "B" (MM) 0.65 0.90 NS ARE IN INCH- TERS. PECIFIED) LERANCE OF 0°±3 DIMENSIONS ± 1/2 JIMENSIONS () N/A ED DIMENSIONS	ELE DIM "C" (MM) 5-45 5-24.1 DRAWN 00 32" AAX ENGINE <>	STA STA WDJ ECKER	DDEPOSITE NLESS STEE NLESS STEE TITLE ELI SERIES TITLE	"B" ED SOURCE LEGEND MATERIAL EL MIRROR POLISHED EL MIRROR POLISHED ECTRODEPOSITED	OR BEAD OR BEAD	BLASTED



LEGEND								
MODEL FILTER IN	DIM "A" (MM)	DIM "B" (MM)	DIM "C" (MM)	DIM "D" (MM)	MATERIAL "E" BOTTOM	MATERIAL "F" TOP		
SNAP FALCON PETRI	45	45	47	48	TAPE	MYLAR		
SNAP FALCON PETRI	44	44	47	48	TAPE	TAPE		
TL FALCON PETRI	49	49	51	51	TAPE	MYLAR		
TL FALCON PETRI	47	47	51	51	TAPE	TAPE		
MILLIPORE PETRI	45	45	47	48	TAPE	MYLAR		
MILLIPORE PETRI	44	44	47	48	TAPE	TAPE		
PAUL GELMAN PETRI	45	45	47	47	TAPE	MYLAR		
PAUL GELMAN PETRI	44	44	47	47	TAPE	TAPE		
ALL PETRI SLIDES	45	45	47	48	TAPE	MYLAR		
ALL PETRI SLIDES	44	44	47	48	TAPE	TAPE		
TSB SS PLANCHET	47	47	49	49	TAPE	MYLAR		
TSB SS PLANCHET	45	45	49	49	<u>TAPE</u>	TAPE		
TRB SS PLANCHET	47	47	49	49	<u>TAPE</u>	<u>MYLAR</u>		
<u> </u>	45	45	49	49		MYLAR		
LSB SS PLANCHEI	4/	4/	49	49		MYLAR		
LSB SS PLANCHET	45	45	49	49	IAPE	IAPE		
LRB SS PLANCHET	47	47	49	49		MYLAR		
LRB SS PLANCHET	45	45	49	49	TAPE	TAPE		
TSB AL PLANCHET	47	47	49	49	TAPE	MYLAR		
TSB AL PLANCHET	45	45	49	49	TAPE	TAPE		
TRB AL PLANCHET	. 47	47	49	49		MYLAR		
TRB AL PLANCHET	45	45	49	49	TAPE	TAPE		
LSB AL PLANCHET	47	47	49	49	TAPE	MYLAR		
LSB AL PLANCHET	45	45	49	49	TAPE	TAPE		
FILTER IN TAPE	47	47	54	54	TAPE	TAPE		
FILTER IN TAPE	50	50	57	57	TAPE	TAPE		

REV SHEET 2 OF 2

			· · ·			
		· · ·				
	MOI	DEL	VOLUME, L	PRESSURE, PSI	PRESSU GA	
2. PACKAGE AND IDENTIFY PART NUMBER THEREON 1. MATERIAL: SEE LEGEND SHT 2	LECTURE BO 2.3L STEEL O	DTTLE CYLINDER	0.5 2.3	750 700	NITRO NITRO	GEN GEN
NOTES: UNLESS OTHERWISE SPECIFIED         UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN IN         SIZES. METRIC UNITS [mm] ARE IN MILLIMETERS.	ICH- DRAWN WDJ	TITLE	GAS CYLIN	IDER		
Image       TOLERANCES       (UNLESS OTHERWISE SPECIFIED)         XXXX       ± .002       INCH       ANGULAR TOLERANCE O         XXX       ± .005       INCH       FRACTIONAL DIMENSION         ATLANTA, . GEORGIA 30318       X.       ± .01       INCH       SURFACE ROUGHNESS µII         ALL DIMENSIONS ARE FINISHED DIMENSI       X.       ± .1       INCH       SURFACE ROUGHNESS µII	DF 0°±30' IS ± 1/32" () N/A NCH MAX IONS ME/CHEO SME/SME/SME/SME/SME/SME/SME/SME/SME/SME/	CKER SERIES TIT ER	LE			
THIS DRAWING IS THE PROPERTY OF ECKERT & ZIEGLER ANALYTICS AND MAY NOT BE USED, REPRODUCED, PUBLISHED OR DISCLOSED TO OTHER WITHOUT EXPRESS AUTHORIZATION BY ECKERT & ZIEGLER ANALYTICS	SCALE NONE	SIZE CAGE C	CODE DRAWING	NO. CYLINDER	REV	Sheet 1 Of 1

.



				GLASS REAGENT BUTTLE LEGEND							
			MODEL	D	IM "A (MM)	\" 	D (	IM ''B'' MM)	VOLUME (ML)	M	ATERIAL
			100		57			85	100		GLASS
2. PA	CKAGE AND IDENTIFY PART NUM	ABER THEREON	250		64			135	250		GLASS
1. M	ATERIAL: GLASS		500	90				120	500		GLASS
		1000	110.				165	1000		<u>GLASS</u>	
NOTES: UNLESS OTHERWISE SPECIFIED		<u> </u>	,						······		
	Eckert & Ziealer	UNLESS OTHERWISE SPECIFIED DI SIZES. METRIC UNITS [mm] ARE IN	MENSIONS ARE IN INCH- MILLIMETERS.	DRAWN WD	DRAWN TITLE WDJ CLASS REAGENT BOTTLE						
and the second second	9	TOLERANCES (UNLESS OTH	ICES (UNLESS OTHERWISE SPECIFIED)		ME/CHECKER						
	ANALYTICS	XXXX ± .002 INCH ANG	ULAR TOLERANCE OF 0°±30'	<>	GRER						
	/ (I () (E I II (C))	X.X ± .03 INCH REFER	RENCE DIMENSIONS () N/A	FNGINE	FR	SERIES II	IILC				
	ATLANTA, , GEORGIA 30318	X. ± .} INCH SURF, ALL DIMENSIONS AF	ace roughness µinch max Re finished dimensions	<>							
THIS DRA	WING IS THE PROPERTY OF ECKERT & ZEIGLER ANALYTICS	THIRD ANGLE PRO	DJECTION	SCALE	SIZE	CAGEC	CODE	DRAWING NO.		REV	SHEET
AND MAY WITHO	NOT BE USED, REPRODUCED, PUBLISHED OR DISCLOSED TO OTHERS UT EXPRESS AUTHORIZATION BY ECKERT & ZEIGLER ANALYTICS.			NONE	A	***	(	GLASS REAC	ENT BOTTLE		1 OF 1 .









# SEE MARINELLI BEAKER SIZE CONFIGURATION TABLE



MARINELLI BEAKER SIZE CONFIGURATION TABLE           MODEL         DETECTOR "ENDCAP" DIA mm (IN)         DIM A mm (IN)         DIM B mm (IN)         DIM C mm (IN)         DIM C mm (IN)         DIM D mm (IN)         FREE VOL           1         443016 250 mL         Ø 76 (3.00)         65 (2.6)         Ø 116 (4.6)         38 (1.5)         Ø 78 (3.1)         0.23.           2         523N-E 500 mL         Ø 70 (2.75)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 71 (2.80)         0.50           4         530G-E 500 mL         Ø 76 (3.00)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 71 (2.80)         0.50           4         530G-E 500 mL         Ø 76 (3.00)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 71 (2.80)         0.50           4         530G-E 500 mL         Ø 76 (3.00)         101 (4.0)         Ø 1127 (5.0)         75 (2.9)         Ø 84 (3.30)         0.40           5         533N 500 mL         Ø 82 (3.25)         152 (6.0)         Ø 127 (5.0)         76 (3.0)         Ø 71 (2.78)         0.97           7         127G 1 LITER         Ø 76 (3.00)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 74 (3.05)         0.95           9         130G 1 LITER									
MODEL         DETECTOR "ENDCAP" DIA mm (IN)         DIM A mm (IN)         DIM B mm (IN)         DIM C mm (IN)         DIM D mm (IN)         PREE VOL           1         443016 250 mL         Ø 76 (3.00)         65 (2.6)         Ø 116 (4.6)         38 (1.5)         Ø 78 (3.1)         0.23.           2         523N-E 500 mL         Ø 57 (2.25         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 71 (2.80)         0.50           4         530G-E 500 mL         Ø 76 (3.00)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 77 (3.03)         0.40           5         533N 500 mL         Ø 82 (3.25)         117 (4.6)         Ø 127 (5.0)         75 (2.9)         Ø 84 (3.30)         0.54           6         125G 1 LITER         Ø 65 (2.56)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 74 (3.05)         0.95           7         127G 1 LITER         Ø 76 (3.00)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 74 (3.05)         0.95           9         130G 1 LITER         Ø 76 (3.00)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 74 (3.05)         0.97           12         230G 2 LITER         Ø 76 (3.00)         152 (6.5)         Ø 157 (6.2)         76 (3.0)         Ø 74 (3.0) <th colspan="9">MARINELLI BEAKER SIZE CONFIGURATION TABLE</th>	MARINELLI BEAKER SIZE CONFIGURATION TABLE								
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	BOARD IME (L)								
2523N-E 500 mL $\emptyset$ 57 (2.25101 (4.0) $\emptyset$ 114 (4.5)68 (2.7) $\emptyset$ 58 (2.30)3527G-E 500 mL $\emptyset$ 70 (2.75)101 (4.0) $\emptyset$ 114 (4.5)68 (2.7) $\emptyset$ 71 (2.80)0.504530G-E 500 mL $\emptyset$ 76 (3.00)101 (4.0) $\emptyset$ 114 (4.5)68 (2.7) $\emptyset$ 77 (3.03)0.405533N 500 mL $\emptyset$ 82 (3.25)117 (4.6) $\emptyset$ 127 (5.0)75 (2.9) $\emptyset$ 84 (3.30)0.546125G 1 LITER $\emptyset$ 65 (2.56)152 (6.0) $\emptyset$ 127 (5.0)76 (3.0) $\emptyset$ 65 (2.55)1.027127G 1 LITER $\emptyset$ 65 (2.56)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 76 (3.05)0.978130G 1 LITER $\emptyset$ 76 (3.00)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 76 (3.05)0.959133N 1 LITER $\emptyset$ 82 (3.25)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 74 (3.05)0.9510138G 1 LITER $\emptyset$ 95 (3.75)165 (6.5) $\emptyset$ 157 (6.2)101 (4.0) $\emptyset$ 96 (3.78)1.6011227G 2 LITER $\emptyset$ 76 (3.00)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 77 (3.05)3.7612230G 2 LITER $\emptyset$ 76 (3.00)178 (7.0) $\emptyset$ 200 (7.9)76 (3.0) $\emptyset$ 77 (3.05)3.7612230G 2 LITER $\emptyset$ 76 (3.00)178 (7.0) $\emptyset$ 200 (7.9)76 (3.0) $\emptyset$ 77 (3.05)3.7613233N 2 LITER $\emptyset$ 82 (3.25)165 (6.5) $\emptyset$ 150 (6.1)76 (3.0) $\emptyset$ 84 (3.33)3.6814430G 4 LIT									
3         527G-E 500 mL         Ø 70 (2.75)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 71 (2.80)         0.50           4         530G-E 500 mL         Ø 76 (3.00)         101 (4.0)         Ø 114 (4.5)         68 (2.7)         Ø 77 (3.03)         0.40           5         533N 500 mL         Ø 82 (3.25)         117 (4.6)         Ø 127 (5.0)         75 (2.9)         Ø 84 (3.30)         0.54           6         125G 1 LITER         Ø 65 (2.56)         152 (6.0)         Ø 127 (5.0)         76 (3.0)         Ø 65 (2.55)         1.02           7         127G 1 LITER         Ø 70 (2.75)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 76 (3.05)         0.97           8         130G 1 LITER         Ø 76 (3.00)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 76 (3.05)         0.95           9         133N 1 LITER         Ø 82 (3.25)         152 (6.0)         Ø 129 (5.1)         76 (3.0)         Ø 76 (3.05)         0.95           9         133N 1 LITER         Ø 95 (3.75)         165 (6.5)         Ø 157 (6.2)         101 (4.0)         Ø 96 (3.78)         1.60           11         227G 2 LITER         Ø 76 (3.00)         165 (6.5)         Ø 157 (6.2)         76 (3.0)         Ø 77 (3.05)									
4530G-E 500 mL $\emptyset$ 76 (3.00)101 (4.0) $\emptyset$ 114 (4.5)68 (2.7) $\emptyset$ 77 (3.03)0.405533N 500 mL $\emptyset$ 82 (3.25)117 (4.6) $\emptyset$ 127 (5.0)75 (2.9) $\emptyset$ 84 (3.30)0.546125G 1 LITER $\emptyset$ 65 (2.56)152 (6.0) $\emptyset$ 127 (5.0)76 (3.0) $\emptyset$ 65 (2.55)1.027127G 1 LITER $\emptyset$ 70 (2.75)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 77 (3.05)0.978130G 1 LITER $\emptyset$ 76 (3.00)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 76 (3.05)0.959133N 1 LITER $\emptyset$ 82 (3.25)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 84 (3.33)0.8510138G 1 LITER $\emptyset$ 95 (3.75)165 (6.5) $\emptyset$ 157 (6.2)101 (4.0) $\emptyset$ 96 (3.78)1.6011227G 2 LITER $\emptyset$ 76 (3.00)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 77 (3.05)3.7612230G 2 LITER $\emptyset$ 76 (3.00)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 84 (3.30)1.6814430G 4 LITER $\emptyset$ 82 (3.25)165 (6.5) $\emptyset$ 150 (6.1)76 (3.0) $\emptyset$ 84 (3.30)1.6814430G 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 2000 (7.9)76 (3.0) $\emptyset$ 84 (3.33)3.6916438G 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 2000 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3616438G 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 2000 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3617445									
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$									
6 $125G 1 \text{ LITER}$ $\emptyset 65 (2.56)$ $152 (6.0)$ $\emptyset 127 (5.0)$ $76 (3.0)$ $\emptyset 65 (2.55)$ $1.02$ 7 $127G 1 \text{ LITER}$ $\emptyset 70 (2.75)$ $152 (6.0)$ $\emptyset 129 (5.1)$ $76 (3.0)$ $\emptyset 71 (2.78)$ $0.97$ 8 $130G 1 \text{ LITER}$ $\emptyset 76 (3.00)$ $152 (6.0)$ $\emptyset 129 (5.1)$ $76 (3.0)$ $\emptyset 76 (3.05)$ $0.95$ 9 $133N 1 \text{ LITER}$ $\emptyset 82 (3.25)$ $152 (6.0)$ $\emptyset 129 (5.1)$ $76 (3.0)$ $\emptyset 84 (3.33)$ $0.85$ 10 $138G 1 \text{ LITER}$ $\emptyset 95 (3.75)$ $165 (6.5)$ $\emptyset 157 (6.2)$ $101 (4.0)$ $\emptyset 96 (3.78)$ $1.60$ 11 $227G 2 \text{ LITER}$ $\emptyset 70 (2.75)$ $165 (6.5)$ $\emptyset 157 (6.2)$ $76 (3.0)$ $\emptyset 77 (3.12)$ $1.74$ 13 $233N 2 \text{ LITER}$ $\emptyset 76 (3.00)$ $165 (6.5)$ $\emptyset 157 (6.2)$ $76 (3.0)$ $\emptyset 77 (3.05)$ $3.76$ 14 $430G 4 \text{ LITER}$ $\emptyset 76 (3.00)$ $178 (7.0)$ $\emptyset 200 (7.9)$ $76 (3.0)$ $\emptyset 84 (3.33)$ $3.69$ 16 $438G 4 \text{ LITER}$ $\emptyset 95 (3.75)$ $178 (7.0)$ $\emptyset 200 (7.9)$ $101 (4.0)$ $\emptyset 96 (3.78)$ $3.36$ 17 $445N 4 \text{ LITER}$ $\emptyset 112 (4.40)$ $175 (6.9)$ $\emptyset 200 (7.9)$ $104 (4.1)$ $\emptyset 113 (4.44)$ $3.06$ 18 $132G 1 \text{ LITER}$ $\emptyset 83 (3.25)$ $130 (5.1)$ $\emptyset 170 (6.7)$ $71 (2.8)$ $\emptyset 84 (3.32)$ $1.10$ 19 $141G 1 \text{ LITER}$ $\emptyset 102 (4.00)$ $165 (6.5)$ $\emptyset 157 (6.2)$ $102 (4.0)$ $\emptyset 103 (4.08)$ $1.46$ 20 $190G 1 $									
7127G 1 LITER $\emptyset$ 70 (2.75)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 71 (2.78)0.978130G 1 LITER $\emptyset$ 76 (3.00)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 76 (3.05)0.959133N 1 LITER $\emptyset$ 82 (3.25)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 84 (3.33)0.8510138G 1 LITER $\emptyset$ 95 (3.75)165 (6.5) $\emptyset$ 157 (6.2)101 (4.0) $\emptyset$ 96 (3.78)1.6011227G 2 LITER $\emptyset$ 70 (2.75)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 71 (2.78)1.8012230G 2 LITER $\emptyset$ 76 (3.00)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 77 (3.12)1.7413233N 2 LITER $\emptyset$ 82 (3.25)165 (6.5) $\emptyset$ 150 (6.1)76 (3.0) $\emptyset$ 84 (3.30)1.6814430G 4 LITER $\emptyset$ 76 (3.00)178 (7.0) $\emptyset$ 200 (7.9)76 (3.0) $\emptyset$ 77 (3.05)3.7615433N 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3616438G 4 LITER $\emptyset$ 95 (3.75)178 (7.0) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3617445N 4 LITER $\emptyset$ 112 (4.40)175 (6.9) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3617445N 4 LITER $\emptyset$ 102 (4.00)165 (6.5) $\emptyset$ 157 (6.2)102 (4.0) $\emptyset$ 133 (4.08)1.4620190G 1 LITER $\emptyset$ 102 (4.00)165 (6.5) $\emptyset$ 157 (6.2)102 (4.0) $\emptyset$ 103 (4.08)1.4620 <td></td>									
8130G 1 LITER									
9133N 1 LITER $\emptyset$ 82 (3.25)152 (6.0) $\emptyset$ 129 (5.1)76 (3.0) $\emptyset$ 84 (3.33)0.8510138G 1 LITER $\emptyset$ 95 (3.75)165 (6.5) $\emptyset$ 157 (6.2)101 (4.0) $\emptyset$ 96 (3.78)1.6011227G 2 LITER $\emptyset$ 70 (2.75)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 71 (2.78)1.8012230G 2 LITER $\emptyset$ 76 (3.00)165 (6.5) $\emptyset$ 157 (6.2)76 (3.0) $\emptyset$ 79 (3.12)1.7413233N 2 LITER $\emptyset$ 82 (3.25)165 (6.5) $\emptyset$ 150 (6.1)76 (3.0) $\emptyset$ 84 (3.30)1.6814430G 4 LITER $\emptyset$ 76 (3.00)178 (7.0) $\emptyset$ 200 (7.9)76 (3.0) $\emptyset$ 77 (3.05)3.7615433N 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 84 (3.33)3.6916438G 4 LITER $\emptyset$ 95 (3.75)178 (7.0) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3617445N 4 LITER $\emptyset$ 112 (4.40)175 (6.9) $\emptyset$ 200 (7.9)104 (4.1) $\emptyset$ 113 (4.44)3.0618132G 1 LITER $\emptyset$ 83 (3.25)130 (5.1) $\emptyset$ 170 (6.7)71 (2.8) $\emptyset$ 84 (3.32)1.1019141G 1 LITER $\emptyset$ 102 (4.00)165 (6.5) $\emptyset$ 157 (6.2)102 (4.0) $\emptyset$ 91 (3.54)1.4620190G 1 LITER $\emptyset$ 90 (3.54)130 (5.1) $\emptyset$ 170 (6.7)102 (4.0) $\emptyset$ 91 (3.58)1.00									
10       138G 1 LITER       Ø 95 (3.75)       165 (6.5)       Ø 157 (6.2)       101 (4.0)       Ø 96 (3.78)       1.60         11       227G 2 LITER       Ø 70 (2.75)       165 (6.5)       Ø 157 (6.2)       76 (3.0)       Ø 71 (2.78)       1.80         12       230G 2 LITER       Ø 76 (3.00)       165 (6.5)       Ø 157 (6.2)       76 (3.0)       Ø 79 (3.12)       1.74         13       233N 2 LITER       Ø 82 (3.25)       165 (6.5)       Ø 150 (6.1)       76 (3.0)       Ø 84 (3.30)       1.68         14       430G 4 LITER       Ø 76 (3.00)       178 (7.0)       Ø 200 (7.9)       76 (3.0)       Ø 77 (3.05)       3.76         15       433N 4 LITER       Ø 82 (3.25)       178 (7.0)       Ø 200 (7.9)       76 (3.0)       Ø 84 (3.33)       3.69         16       438G 4 LITER       Ø 95 (3.75)       178 (7.0)       Ø 200 (7.9)       101 (4.0)       Ø 96 (3.78)       3.36         17       445N 4 LITER       Ø 83 (3.25)       130 (5.1)       Ø 107 (6.7)       71 (2.8)       Ø 84 (3.32)       1.10         19       141G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 157 (6.2)       102 (4.0)       Ø 103 (4.08)       1.46         20       190G 1 LITER       Ø 102 (4.00)       1									
11       227G 2 LITER       Ø 70 (2.75)       165 (6.5)       Ø 157 (6.2)       76 (3.0)       Ø 71 (2.78)       1.80         12       230G 2 LITER       Ø 76 (3.00)       165 (6.5)       Ø 157 (6.2)       76 (3.0)       Ø 79 (3.12)       1.74         13       233N 2 LITER       Ø 82 (3.25)       165 (6.5)       Ø 150 (6.1)       76 (3.0)       Ø 84 (3.30)       1.68         14       430G 4 LITER       Ø 76 (3.00)       178 (7.0)       Ø 200 (7.9)       76 (3.0)       Ø 77 (3.05)       3.76         15       433N 4 LITER       Ø 82 (3.25)       178 (7.0)       Ø 196 (7.7)       76 (3.0)       Ø 84 (3.33)       3.69         16       438G 4 LITER       Ø 95 (3.75)       178 (7.0)       Ø 200 (7.9)       101 (4.0)       Ø 96 (3.78)       3.36         17       445N 4 LITER       Ø 112 (4.40)       175 (6.9)       Ø 200 (7.9)       104 (4.1)       Ø 113 (4.44)       3.06         18       132G 1 LITER       Ø 83 (3.25)       130 (5.1)       Ø 170 (6.7)       71 (2.8)       Ø 84 (3.32)       1.10         19       141G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 157 (6.2)       102 (4.0)       Ø 103 (4.08)       1.46         20       190G 1 LITER       Ø 102 (4.00) <td< td=""><td></td></td<>									
12       230G 2 LITER       Ø 76 (3.00)       165 (6.5)       Ø 157 (6.2)       76 (3.0)       Ø 79 (3.12)       1.74         13       233N 2 LITER       Ø 82 (3.25)       165 (6.5)       Ø 150 (6.1)       76 (3.0)       Ø 84 (3.30)       1.68         14       430G 4 LITER       Ø 76 (3.00)       178 (7.0)       Ø 200 (7.9)       76 (3.0)       Ø 77 (3.05)       3.76         15       433N 4 LITER       Ø 82 (3.25)       178 (7.0)       Ø 196 (7.7)       76 (3.0)       Ø 84 (3.33)       3.69         16       438G 4 LITER       Ø 95 (3.75)       178 (7.0)       Ø 200 (7.9)       101 (4.0)       Ø 96 (3.78)       3.36         17       445N 4 LITER       Ø 112 (4.40)       175 (6.9)       Ø 200 (7.9)       104 (4.1)       Ø 113 (4.44)       3.06         18       132G 1 LITER       Ø 83 (3.25)       130 (5.1)       Ø 170 (6.7)       71 (2.8)       Ø 84 (3.32)       1.10         19       141G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 157 (6.2)       102 (4.0)       Ø 103 (4.08)       1.46         20       190G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 170 (6.7)       102 (4.0)       Ø 91 (3.58)       1.00         20       190G 1 LITER       Ø 90 (3.54) <t< td=""><td></td></t<>									
13       233N 2 LITER       Ø 82 (3.25)       165 (6.5)       Ø 150 (6.1)       76 (3.0)       Ø 84 (3.30)       1.68         14       430G 4 LITER       Ø 76 (3.00)       178 (7.0)       Ø 200 (7.9)       76 (3.0)       Ø 77 (3.05)       3.76         15       433N 4 LITER       Ø 82 (3.25)       178 (7.0)       Ø 196 (7.7)       76 (3.0)       Ø 84 (3.33)       3.69         16       438G 4 LITER       Ø 95 (3.75)       178 (7.0)       Ø 200 (7.9)       101 (4.0)       Ø 96 (3.78)       3.36         17       445N 4 LITER       Ø 112 (4.40)       175 (6.9)       Ø 200 (7.9)       104 (4.1)       Ø 113 (4.44)       3.06         18       132G 1 LITER       Ø 83 (3.25)       130 (5.1)       Ø 170 (6.7)       71 (2.8)       Ø 84 (3.32)       1.10         19       141G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 157 (6.2)       102 (4.0)       Ø 103 (4.08)       1.46         20       190G 1 LITER       Ø 90 (3.54)       130 (5.1)       Ø 170 (6.7)       102 (4.0)       Ø 91 (3.58)       1.00         21       90G 1 LITER       Ø 90 (3.54)       130 (5.1)       Ø 170 (6.7)       102 (4.0)       Ø 91 (3.58)       1.00									
14430G 4 LITER $\emptyset$ 76 (3.00)178 (7.0) $\emptyset$ 200 (7.9)76 (3.0) $\emptyset$ 77 (3.05)3.7615433N 4 LITER $\emptyset$ 82 (3.25)178 (7.0) $\emptyset$ 196 (7.7)76 (3.0) $\emptyset$ 84 (3.33)3.6916438G 4 LITER $\emptyset$ 95 (3.75)178 (7.0) $\emptyset$ 200 (7.9)101 (4.0) $\emptyset$ 96 (3.78)3.3617445N 4 LITER $\emptyset$ 112 (4.40)175 (6.9) $\emptyset$ 200 (7.9)104 (4.1) $\emptyset$ 113 (4.44)3.0618132G 1 LITER $\emptyset$ 83 (3.25)130 (5.1) $\emptyset$ 170 (6.7)71 (2.8) $\emptyset$ 84 (3.32)1.1019141G 1 LITER $\emptyset$ 102 (4.00)165 (6.5) $\emptyset$ 157 (6.2)102 (4.0) $\emptyset$ 91 (3.58)1.0020190G 1 LITER $\emptyset$ 90 (3.54)130 (5.1) $\emptyset$ 170 (6.7)102 (4.0) $\emptyset$ 91 (3.58)1.00									
15       433N 4 LITER       Ø 82 (3.25)       178 (7.0)       Ø 196 (7.7)       76 (3.0)       Ø 84 (3.33)       3.69         16       438G 4 LITER       Ø 95 (3.75)       178 (7.0)       Ø 200 (7.9)       101 (4.0)       Ø 96 (3.78)       3.36         17       445N 4 LITER       Ø 112 (4.40)       175 (6.9)       Ø 200 (7.9)       104 (4.1)       Ø 113 (4.44)       3.06         18       132G 1 LITER       Ø 83 (3.25)       130 (5.1)       Ø 170 (6.7)       71 (2.8)       Ø 84 (3.32)       1.10         19       141G 1 LITER       Ø 102 (4.00)       165 (6.5)       Ø 157 (6.2)       102 (4.0)       Ø 103 (4.08)       1.46         20       190G 1 LITER       Ø 90 (3.54)       130 (5.1)       Ø 170 (6.7)       102 (4.0)       Ø 91 (3.58)       1.00									
16438G 4 LITER $0 95 (3.75)$ $1/8 (7.0)$ $0 200 (7.9)$ $101 (4.0)$ $0 96 (3.78)$ $3.36$ 17445N 4 LITER $0 112 (4.40)$ $175 (6.9)$ $0 200 (7.9)$ $104 (4.1)$ $0 113 (4.44)$ $3.06$ 18132G 1 LITER $0 83 (3.25)$ $130 (5.1)$ $0 170 (6.7)$ $71 (2.8)$ $0 84 (3.32)$ $1.10$ 19141G 1 LITER $0 102 (4.00)$ $165 (6.5)$ $0 157 (6.2)$ $102 (4.0)$ $0 103 (4.08)$ $1.46$ 20190G 1 LITER $0 90 (3.54)$ $130 (5.1)$ $0 170 (6.7)$ $102 (4.0)$ $0 91 (3.58)$ $1.00$									
17       445N 4 LITER $0$ 112 (4.40)       175 (6.9) $0$ 200 (7.9)       104 (4.1) $0$ 113 (4.44)       3.06         18       132G 1 LITER $0$ 83 (3.25)       130 (5.1) $0$ 170 (6.7)       71 (2.8) $0$ 84 (3.32)       1.10         19       141G 1 LITER $0$ 102 (4.00)       165 (6.5) $0$ 157 (6.2)       102 (4.0) $0$ 103 (4.08)       1.46         20       190G 1 LITER $0$ 90 (3.54)       130 (5.1) $0$ 170 (6.7)       102 (4.0) $0$ 91 (3.58)       1.00									
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$\frac{24}{25} \frac{3005}{500} \frac{300}{500} \frac{11}{50} \frac{117}{400} \frac{117}{400} \frac{117}{400} \frac{117}{500} \frac{117}{$									
$\frac{25}{26} \frac{5700500}{541} \frac{102}{400} \frac{102}{400} \frac{117}{400} \frac{117}{400} \frac{130}{510} \frac{130}{51} \frac{100}{84} \frac{102}{400} \frac{102}{400} \frac{100}{400} 10$									
$\frac{20}{27} \frac{143316}{43316} \frac{10}{250} \frac{10}{250} \frac{10}{43} \frac{10}{43} \frac{11}{43} \frac{11}$									

SIZE

# SHEET 2 OF 3

REV

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SOURCE MATRIX CONFIGURATION TABLE							
DENSITY	DESCRIPTION	MATRIX					
0.13 g/cc	VERMICULITE	SIEVED ZONDITE VERMICULITE					
0.44 g/cc	CORN COBB GRIT	CORN COBB GRIT					
0.6 G/cc	COFFEE GROUNDS	GROUNDED COFFEE BEANS					
1.0 g/cc	PULVERIZED SOIL	COSTUM PULVERIZED SOIL					
1.15 g/cc	REGULAR RESIN	RESIN, MR-11109. CATALYST METHYL ETHYL KETONE PEROXIDE, MA					
1.6 g/cc	SAND	ROLLO SILIA SAND. WASHED DRIED SIZED -40 MESH					
1.6 g/cc	SIEVED GRIFFIN SOIL	SIEVED GRIFFIN SOIL					
1.2 - 2.0 g/cc	RESIN MIX WITH MARBLE	MARBLEND MARBLE POWDER AND RESIN					

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WDJ

REV

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LEGEND	
MODEL SIMULATED EVAPORATED LIQUID	DIM "A" (MM)
TSB SS PLANCHET	49
TPB SS PLANCHET	49
TRB SS PLANCHET	47
LSB SS PLANCHET	49
LSB SS PLANCHET	49
LRB SS PLANCHET	49
LRB SS PLANCHET	49
TSB AL PLANCHET	49
TSB AL PLANCHET	49
TRB AL PLANCHET	49
TRB AL PLANCHET	49
LSB AL PLANCHET	49
LSB AL PLANCHET	49

THIS DRAWING IS THE PROPERTY OF ISOTOPE PRODUCTS LABORATORIE AND MAY NOT BE USED, REPRODUCED, PUBLISHED OR DISCLOSED TO OTHER WITHOUT EXPRESS AUTHORIZATION BY ISOTOPE PRODUCTS LABORATORIES CAGE CODE REV SHEET DRAWN DRAWING NO. SIZE 2 ÓF 2 SIMULATED EVAPORATED LIQUID -




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BOTTLES LEGEND							
DASH NO.	MOUTH SIZE	A-DIA MM/INCH	B-SIZE MM/INCH		. '		
<u>]</u> .	30ml NARROW	34.9 (1.375)	63.5 (2.50)				
2	60 ml NARROW	38.1 (1.5)	82.55 (3.25)				
3	125 ml NARROW	50.8 (2.0)	101.6 (4.0)				
4	250 ml NARROW	84.14 (3.312)	127 (5.0)				
5	500 ml NARROW	69.85 (2.75)	171.45 (6.75	)			
6	1000 ml NARROW	88.9 (3.50)	203.2 (8.0)	<b></b>			
7	2000 ml NARROW	120.65 (4.75)	241.3 (9.50)				
8	4000 ml NARROW	152.4 (6.00)	285.75 (11.25	5)			
9	125 ml WIDE	50.8 (2.00)	101.6 (4.0)	-1			
10	250 ml WIDE	84.137 (3.3125)	127 (5.0)				
	500 ml WIDE	69.85 (2.75)	171.45 (6.75				
12	<u>1000 ml WIDE</u>	88.9 (3.50)	203.2 (8.0)				
13		120.65 (4.75)	241.3(9.5)				
14		152.4 (6.00)	285.75 (11.23	2			
	· · ·		<u></u>				
<ul> <li>5. IDENTIFY PART NUMBER</li> <li>4. PACKAGE AND IDENTIFY PART NUMBER THEREON</li> <li>3. SUGGESTED SUPPLIER: SCIENTIFIC PRODUCTS DIVISION</li> </ul>							
2. SEE TABLE FOR DIMENSIONS							
1. MATERIAL: NALGENE" HIGH-DENSITY POLYETHYLENE, OR EQUIVALENT							
WIDE MOUTH BOTTLE (HDPE)							
NOTES: UNLESS OTHERWISE SPECIFIED							
F.	ckert & 7iealer	UNLESS OTHERWISE SPECIFIED DIME SIZES. METRIC UNITS [mm] ARE IN M	NSIONS ARE IN INCH- ILLIMETERS.		ור ו		
	ekerr & ziegier	TOLERANCES (UNLESS OTHERV	WISE SPECIFIED)				
		X.XXX ± .002 INCH ANGUL					
		X.X ± .03 INCH REFEREN	VCE DIMENSIONS () N/A	ENGINE	ER		
	ATLANTA, , GEORGIA 30318	X. ± .1 INCH SURFAC	E ROUGHNESS HINCH MAX	<>	 T		
THIS DRAWING I	STHE PROPERTY OF ECKERT & ZEIGLER ANALYTICS	THIRD ANGLE PROJ	ECTION	SCALE	SIZE		
AND MAY NOT BE U	SED, KERKODUCED, PUBLISHED OR DISCLOSED TO OTHERS		<del>(O)</del>	NONE	A		



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DRAWING NO. PLASTIC BOTTLE

SOURCE MATRIX CONFIGURATION TABLE							
DENSITY	DESCRIPTION	MATRIX					
0.02 g/cc	STYROFOAM BEADS	STYROFOAM BEADS					
0.15 g/cc	VERMICULITE	SIEVED ZONDITE VERMICULITE					
0.44 g/cc	CORN COBB GRIT	CORN COBB GRIT					
0.6 g/cc	COFFEE GROUNDS	COFFEE GROUNDS					
1.0 g/cc	PULVERIZED SOIL	CUSTOM PULVERIZED SOIL					
1.15 g/cc	REGULAR RESIN	RESIN, MR-11109 CATALYST METHYL ETHYL KEYTONE					
1.55(or 1.6)g/cc	SIEVED GRITTIN SOIL	SIEVED GRITTEN SOIL					
1.6 g/cc	Sand	ROLLO SILIA SAND, WASHED, DRIED SIZED ~ 40 MESH					
1.2-2.0 g/cc	RESIN MIX WITH MARBLE	MARBLEND MARBLE POWDER					





		MARINELLI GAS BEAKER CONFIGURATION TABLE								
		DASH No. (X) MC		DEL SIZE	Ę	DETECTOR ENDCAP''	DÍM A	DIM B (DIA)	DIM C	DIM D (DIA)
	1	G-127	7G 1 LITER	२ ४	ó 2.75 [70]	6.1 [155]	Ø 5.2 [132]	3.1 [79]	Ø 2.82 [72]	
	2	G-130	g 1 liter	<b>२</b>	3.00 [76]	6.2 [157]	Ø 5.25 [133]	3.0 [76]	Ø 3.07 [78]	
	. 3	G-13	3N 1 LITER	2 9	5 3.25 [82]	6.1 [155]	Ø 5.2 [132]	3.01 [76]	Ø 3.37 [85]	
3. PACKAGE AND IDENTIFY PART NUM	4	G-430	)g 4 liter	<b>२</b>	3.00 [76]	7.1 [180]	Ø 8.1 [206]	3.0 [76]	Ø 3.05 [77]	
1. MATERIAL: HIGH-IMPACT POLYSTYRI	ENE, SEAMLESS	5	G-43	3N 4 LITER	<u> </u>	3.25 [82]	7.1 [180]	Ø 8.1 [206]	3.02 [77]	Ø 3.35 [85]
(RECOMMENDED VENDOR GA-MA	ivaleni & Associates. inc)	6	G-438	3g 4 liter	<b>२</b>	3.75 [96]	7.1 [180]	Ø 8.1 [206]	4.0 [101]	Ø 3.80 [96]
NOTES: UNLESS OTHERWISE SPECIFIED	7	G-44	5N 4 LITER	₹ Ø	4.40 [112]	7.1 [180]	Ø 8.1 [206]	4.23 [107]	Ø 4.50 [114]	
Eckert & Ziegler	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCH- SIZES. METRIC UNITS [mm] ARE IN MILLIMETERS. TOLERANCES (UNLESS OTHERWISE SPECIFIED)			DRAWN WD ME/CHE	J CKER	TITLE	GAS GA	AMMA STAN	NDARD	
ATLANTA, GEORGIA 30318	CTIONAL DIMENSION RENCE DIMENSIONS ACE ROUGHNESS µII RE FINISHED DIMENSI	S ± 1/32" () N/A NCH MAX ONS	- ENGINEI -	ER	SERIES TITLE					
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		MARINELLI GAS BEAKER	
item NO.	PART NUMBER	DESCRIPTION	QT
1		MATRIX, DENSITY 0.02 g/cc POLYSTYRENE BEADS	. 1
-	-	-	1

•				GAS
	•			
		•		

ISOTOPE ACTIVITY SERIAL NAME REF. DATE

		GAS BEAKER	• .	
NO.	PART NUMBER	DESCRIPTION	<u>د</u>	QTY
1		MATRIX, DENSITY 0.02 g/cc POLYSTYRENE BEADS		1
-	-	-	•	1

































Z 5:1

anodized aluminium foil thickness of the activated anodized layer approx. 5µm



					50 0700	Surface	Scale	1:2				
2	various nu	uclide		fme	50 2 766					aluminium		
					Date	Name	L V			EEDENCE	-	
				Drawn	17.06.2009	DStagper	V	VIDE	AREA RE	FERENCE	-	
				Appr.		P.t. N			SOURCE			
В	firm logo	17.06.2009	DST		Eckort &	7 Jogler					Pag	e
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	name; logo	19.04.2007	DSłappe		Nuclitec			020			1 p	pag
lssue	Change	Date	Name	EDV No	o. \\Aean	t6\CAD Zeict	nungen\	0501-075	50\VerkaufsZeichn	ung\VZ628C.dwg		
The c made	The contents of this drawing and its enclosures are our property. The drawing and its enclosures may not be duplicated without our written approval nor be made accessible to any third party. Any unauthorised usage is unlawful and will be prosecuted.											





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#### 2. Instrument check sources

#### 2.5 Sources for particular applications Sec.

Calibrated robust Cs-137 gamma point sources



Each source is supplied with a Eckert & Ziegler Nuclitec certificate of measurement.

Ordering information	
<b>n</b> . 1:	
Kadionuciide	[kBq]
Cc 127	27 CDDB8953
Cs-137 Cs-137	370. CDRb5352 370. CDRB5953
Cs-137	3700 CDRB5954

#### Calibrated robust Cs-137 point sources with thread

#### Construction

Cs-137 in the form of a ceramic disc is welded into an inner stainless steel capsule. The inner capsule is mounted into an outer stainless steel capsule which has an M4 thread on the top of the source. The overall dimensions are 6.4mm diameter x 17.6mm.

#### **ISO classification**

Activity C.66646

Drawing: VZ-2733

Ordering information

Radionuclide	Nominal activity	Product code
	[kBq]	
Cs-137	37	CDRB5950
Cs-137	370	CDRB3542
CS-13/	3700	CDKD3231



VZ-1508/2

#### Certification

Each source is supplied with a Eckert & Ziegler Nuclitec certificate of measurement.















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Approval Signatures and Dates:			
Initiator of Document/Changes:	Manager Responsible Department:	Quality Assurance:	
WL	WL	ND	

#### 1.0 Purpose:

The purpose of this procedure is to outline the processing of exempt quantity distribution products.

#### 2.0 Scope:

This procedure entails the license to manufacture, process, produce, package, repackage, or transfer quantities of radioactive material for commercial transfer or distribution to persons exempt from licensing requirements (general public) in accordance with a license issued by the Nuclear Regulatory Commission (NRC).

#### 3.0 Safety:

Not Applicable

#### 4.0 Definitions/Acronyms:

Not Applicable

5.0 Equipment/Materials:

Not Applicable

## 6.0 Flow Chart:

Not Applicable

## 7.0 Procedure:

- 7.1. General Information:
  - 7.1.1. Eckert & Ziegler Analytics (EZA) is licensed to manufacture, process, produce, package, repackage, dispose, or transfer quantities of radioactive material for commercial transfer or distribution to persons <u>exempt from licensing requirements</u> (general public) in accordance with a license issued by the NRC (referred to as an E-license).
  - 7.1.2. All exempt distributions must be in accordance with this E-license. In general, the NRC licenses byproduct material as defined in the Energy Policy Act of 2005 (EPAct). This expanded definition of byproduct material includes naturally occurring and accelerator produced radioactive material (NARM). Appendix 10.1 shows the nuclides and upper limits of activities that are exempted by the NRC exempt quantity regulations (10 CFR 30.71 Schedule B).

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- 7.1.3. State variations with the new definition of byproduct material, the NRC regulates all exempt distribution sources, so State variations will not be encountered.
- 7.1.4. Appendix 10.2 shows the list of EZA products whose distribution and possession is exempted from licensing requirements in accordance with EZA's Exempt Quantity Distribution License.

#### 7.2. Sales:

- 7.2.1. The nuclide, activity, and model number for each order must be checked by a member of the Customer Service Department to verify that:
  - 7.2.1.1. The article is an NRC approved EZA Model Number series (Appendix 10.2 lists the NRC approved Sources) that meets the requirements shown in Appendix 10.1 under the column labeled 'NRC Quantity.'
  - 7.2.1.2. The total activity to ship to the customer in a single shipment does not exceed 10 times the exempt quantity limit.
- 7.2.2. If the material is exempt, Customer Service (the person who performs the verification) stamps or writes "EXEMPTED QUANTITIES" on the work order and notes the following information in the Exempt Quantity Order Log (which may exist in data base form):

#### NOTE:

During order entry either select the Exempt Quantity model number, feature option, or make sure that the words "Exempt Quantity" are present in the item description or other section of the Order.

7.2.2.1. Date

7.2.2.2. Company and Address

- 7.2.2.3. Nuclide
- 7.2.2.4. Activity
- 7.2.2.5. EZA Model and/or Catalog Number
- 7.2.2.6. Number of Items
- 7.2.2.7. NRC (exempt source)
- 7.2.3. If the order is for the maximum exempt amount of a nuclide, Sales also must note on the work Order that this "maximum activity MUST NOT be exceeded" and/or indicate the accepted activity range e.g. +0%, -15%.

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- 7.2.4. All sales orders containing exempt quantity sources must be reviewed and countersigned by either QO or HP qualified personnel. This approval is documented on the EZA Purchase order review form.
- 7.3. Inventory Control (Labeling):
  - 7.3.1. Each Exempt Quantity Source must be marked or labeled with the words, "Radioactive Material". In addition, the following must also appear on the source in a legible and durable fashion:
    - 7.3.1.1. Nuclide
    - 7.3.1.2. Activity (in microcuries)
    - 7.3.1.3. Serial/Source number or lot number
    - 7.3.1.4. Calibration or Reference date
  - 7.3.2. The order processing paperwork, procedures, drawings, and/or engraving/marking instructions shall state that the source must be marked with "Radioactive Material", nuclide, activity, serial/source or lot number, and calibration or reference date.

#### 7.4. Quality Control:

- 7.4.1. Each Exempt Quantity Source must undergo and pass the following Quality Control inspections:
  - 7.4.1.1 Visual inspection of required labeling. The words "Radioactive Material" must be visible on the source. The nuclide, activity, serial/source number or lot number, and calibration or reference date must be visible on the source.
  - 7.4.1.2 Review the contained activity per the Quality Control Review Form or lab notebook page to verify that activity is below exempt quantity limits as listed on Appendices 10.1 and 10.2 of this procedure.
  - 7.4.1.3 Verify that Form ANA-HP-16-01 "Important Instructions for Exempt Material" is included with the order.
  - 7.4.1.4 Standard Quality Control checks as required by contract, work order, and/or product Quality Control procedures.
- 7.5. Preparation for Shipping:
  - 7.5.1. Each quantity of exempt material listed in Appendix 10.1 must be separately and individually packaged.

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- 7.5.1.1. No more than 10 Exempt Quantity Sources may be placed in any outer package.
- 7.5.1.2. The dose rate of any external surface of the outer package must not exceed 0.5 mR/h.
- 7.5.1.3. Each Exempt Quantity Source must be marked in accordance to section 7.3.1 of this procedure.
- 7.5.1.4. Each order must include instructions for possession, use, and disposal of exempt radioactive material, Form ANA-HP-16-01.

7.5.1.6. Multiple packages each containing up to 10 sources as described in 7.5.1.1 may be shipped to any single customer on any given day as long as the total activity of all the sources doesn't exceed 10 times the exempt quantity.

#### NOTE:

For example, for a nuclide with an Exempt Quantity of 10 uCi, the customer could receive 10 sources that were each 10 uCi in one box

Or

The customer could receive 100 sources that were 1 uCi = ach - 10 boxes with 10 sources in each box would be required for this order.

#### 7.6. Reports:

7.6.1. There are two reports that are generated:

- 7.6.1.1. NRC Exempt Quantity Report per 10 CFR 32.16 and 10 CFR 32.20.
  - 7.6.1.1.1. Report should include: Nuclide, Physical Form (liquid, solid, gas), and Quantity.
- 7.6.1.2. Summary Report when filing a renewal or when notifying the NRC of discontinuation of activities under the E-license
- 7.6.1.3. NRC notification per 10 CFR 21.21 (as referred).
- 7.6.2. Records of transfers shall be retained for one year after inclusion in a summary report.

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<sup>7.5.1.5.</sup> When transferring sources containing fractional amounts of Exempt Quantity Limits, the sum of the activities in one shipment must not exceed 10 exempt quantity limits for the nuclide involved.

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## 8.0 Reference(s):

- 8.1. US NRC exempt distribution license XX-XXXXX-XXX
- 8.2. 10 CFR 21 Reporting of defects and non-compliance
- 8.3. 10 CFR 30 Rules Of General Applicability To Domestic Licensing Of Byproduct Material
- 8.4. 10 CFR 32 Specific domestic licenses to manufacture and transfer certain items containing byproduct materials.

#### 9.0 Revision History:

Revision:	Effective Date:	Description of Change:	Submitted/ Approved By:

#### 10.0 Appendices:

- 10.1. NRC Exempt Quantities
- 10.2. Exempt Quantity Sources
- 10.3. Instructions for Possession, Use, and Disposal
- 10.4. Description of Mixed Gamma Standard Options

#### 11.0 Forms:

11.1. Form ANA-HP-16-01 "Important Instructions for Possession, Use, Storage, and Disposal of Exempt Radioactive Material.

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# Appendix 10.1: NRC Exempt Quantities (10 CFR 30.71 Schedule B)

Radionuclide	(Microcuries)	
Antimony-122 (Sb-122)	100	
Antimony-124 (Sb-124)	10	
Antimony-125 (Sb-125)	10	
Arsenic-73 (As-73)	100	
Arsenic-74 (As-74)	10	
Arsenic-76 (As-76)	10	
Arsenic-77 (As-77)	100	
Barium-131 (Ba-131)	10	
Barium-133 (Ba-133)	10	
Barium-140 (Ba-140)	10	
Beryllium-7 (Be-7)	Not Allowed	
Bismuth-210 (Bi-210)	1	
Bromine-82 (Br-82)	10	
Cadmium-109 (Cd-109)	10	
Cadmium-115m (Cd-115m)	10	
Cadmium-115 (Cd-115)	100	
Calcium-45 (Ca-45)	10	
Calcium-47 (Ca-47)	10	
Carbon-14 (C-14)	100	
Cerium-141 (Ce-141)	100	
Cerium-143 (Ce-143)	100	
Cerium-144 (Ce-144)	1	
Cesium-129 (Cs-129)	100	
Cesium-131 (Cs-131)	1,000	
Cesium-134m (Cs-134m)	100	
Cesium-134 (Cs-134)	1	
Cesium-135 (Cs-135)	10	

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Radionuclide	NRC Quantity (Microcuries)
Cesium-136 (Cs-136)	10
Cesium-137 (Cs-137)	10
Chlorine-36 (Cl-36)	10
Chlorine-38 (Cl-38)	10
Chromium-51 (Cr-51)	1,000
Cobalt-57 (Co-57)	100
Cobalt-58m (Co-58m)	10
Cobalt-58 (Co-58)	10
Cobalt-60 (Co-60)	1
Copper-64 (Cu-64)	100
Dysprosium-165 (Dy-165)	10
Dysprosium-166 (Dy-166)	100
Erbium-169 (Er-169)	100
Erbium-171 (Er-171)	100
Europium-152 9.2 h (Eu-152 9.2 h)	100
Europium-152 13 yr (Eu-152 13 yr)	1
Europium-154 (Eu-154)	1
Europium-155 (Eu-155)	10
Fluorine-18 (F-18)	1,000
Gadolinium-153 (Gd-153)	10
Gadolinium-159 (Gd-159)	100
Gallium-67 (Ga-67)	100
Gallium-72 (Ga-72)	10
Germanium-68 (Ge-68)	10
Germanium-71 (Ge-71)	100
Gold-195 (Au-195)	10
Gold-198 (Au-198)	100
Gold-199 (Au-199)	100
Hafnium-181 (Hf-181)	10

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Dedienvelide	NRC Quantity
Kadionuciide	(Microcuries)
Holmium-166 (Ho-166)	100
Hydrogen-3 (H-3)	1,000
Indium-111 (In-111)	100
Indium-113m (In-113m)	100
Indium-114m (In-114m)	10
Indium-115m (In-115m)	100
Indium-115 (In-115)	10
Iodine-123 (I-123)	100
Iodine-125 (I-125)	1
Iodine-126 (I-126)	1
lodine-129 (I-129)	0.1
lodine-131 (l-131)	1
lodine-132 (l-132)	10
lodine-133 (l-133)	1
lodine-134 (I-134)	10
lodine-135 (I-135)	10
Iridium-192 (Ir-192)	10
Iridium-194 (Ir-194)	100
Iron-52 (Fe-52)	10
Iron-55 (Fe-55)	100
Iron-59 (Fe-59)	10
Krypton-85 (Kr-85)	100
Krypton-87 (Kr-87)	10
Lanthanum-140 (La-140)	10
Lead-210 (Pb-210)	Not Allowed
Lutetium-177 (Lu-177)	100
Manganese-52 (Mn-52)	10
Manganese-54 (Mn-54)	10
Manganese-56 (Mn-56)	10

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Radionuclide	NRC Quantity
	(Microcuries)
Mercury-197m (Hg-197m)	100
Mercury-197 (Hg-197)	100
Mercury-203 (Hg-203)	10
Molbdenum-99 (Mo-99)	100
Neodymium-147 (Nd-147)	100
Neodymium-149 (Nd-149)	100
Nickel-59 (Ni-59)	100
Nickel-63 (Ni-63)	10
Nickel-65 (Ni-65)	100
Niobium-93m (Nb-93m)	10
Niobium-95 (Nb-95)	10
Niobium-97 (Nb-97)	10
Osmium-185 (Os-185)	10
Osmium-191m (Os-191m)	100
Osmium-191 (Os-191)	100
Osmium-193 (Os-193)	100
Palladium-103 (Pd-103)	100
Palladium-109 (Pd-109)	100
Phosphorus-32 (P-32)	10
Platinum-191 (Pt-191)	100
Platinum-193m (Pt-193m)	100
Platinum-193 (Pt-193)	100
Platinum-197m (Pt-197m)	100
Platinum-197 (Pt-197)	100
Polonium-210 (Po-210)	0.1
Potasium-42 (K-42)	10
Potasium-43 (K-43)	10
Praseodymium-142 (Pr-142)	100
Praseodymium-143 (Pr-143)	100

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Padianualida	NRC Quantity	
Kaulonuciue	(Microcuries)	
Promethium-147 (Pm-147)	10	
Promethium-149 (Pm-149)	10	
Rhenium-186 (Re-186)	100	
Rhenium-188 (Re-188)	100	
Rhodium-103m (Rh-103m)	100	
Rhodium-105 (Rh-105)	100	
Rubidium-81 (Rb-81)	10	
Rubidium-86 (Rb-86)	10	
Rubidium-87 (Rb-87)	10	
Ruthenium-97 (Ru-97)	100	
Ruthenium-103 (Ru-103)	10	
Ruthenium-105 (Ru-105)	10	
Ruthenium-106 (Ru-106)	1	
Samarium-151 (Sm-151)	10	
Samarium-153 (Sm-153)	100	
Scandium-46 (Sc-46)	10	
Scandium-47 (Sc-47)	100	
Scandium-48 (Sc-48)	10	
Selenium-75 (Se-75)	10	
Silicon-31 (Si-31)	100	
Silver-105 (Ag-105)	10	
Silver-110m (Ag-110m)	1	
Silver-111 (Ag-111)	100	
Sodium-22 (Na-22)	10	
Sodium-24 (Na-24)	10	
Strontium-85 (Sr-85)	10	
Strontium-89 (Sr-89)	1	
Strontium-90 (Sr-90)	0.1	
Strontium-91 (Sr-91)	10	

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Radionuclide	NRC Quantity
Strontium-92 (Sr-92)	10
Sulphur-35 (S-35)	100
Tantalum-182 (Ta-182)	10
Technetium-96 (Tc-96)	10
Technetium-97m (Tc-97m)	100
Technetium-97 (Tc-97)	100
Technetium-99m (Tc-99m)	100
Technetium-99 (Tc-99)	10
Tellerium-125m (Te-125m)	10
Tellerium-127m (Te-127m)	10
Tellerium-127 (Te-127)	100
Tellerium-129m (Te-129m)	10
Tellerium-129 (Te-129)	100
Tellerium-131m (Te-131m)	10
Tellerium-132 (Te-132)	10
Terbium-160 (Tb-160)	10
Thallium-200 (TI-200)	- 100
Thallium-201 (TI-201)	100
Thallium-202 (TI-202)	100
Thallium-204 (TI-204)	10
Thulium-170 (Tm-170)	10
Thulium-171 (Tm-171)	10
Tin-113 (Sn-113)	10
Tin-125 (Sn-125)	10
Tungsten-181 (W-181)	10
Tungsten-185 (W-185)	10
Tungsten-187 (W-187)	100
Vanadium-48 (V-48)	10
Xenon-131m (Xe-131m)	1,000

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Radionuclide	NRC Quantity (Microcuries)
Xenon-133 (Xe-133)	100
Xenon-135 (Xe-135)	100
Ytterbium-175 (Yb-175)	100
Yttrium-87 (Y-87)	10
Yttrium-88 (Y-88)	10
Yttrium-90 (Y-90)	10
Yttrium-91 (Y-91)	10
Yttrium-92 (Y-92)	100
Yttrium-93 (Y-93)	100
Zinc-65 (Zn-65)	10
Zinc-69m (Zn-69m)	100
Zinc-69 (Zn-69)	1,000
Zirconium-93 (Zr-93)	10
Zirconium-95 (Zr-95)	10
Zirconium-97 (Zr-97)	10
Any radionuclide not listed above other than alpha emitting radionuclides	0.1

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## Appendix 10.2: Exempt Quantity Sources

The following Eckert & Ziegler Analytics products are exempt quantity sources:

	,	Description: BUTTON	
		Overall Diameter: 1 x 1/4 Inch, 1 x 1/8	
Model No	Nuclida	Inch	Mariufaaturar
woder no.	Nuclide	2 x 1/4 Inch or 2 x 1/8 Inch	Manufacturer
		Active Diameter: 5 mm	
		Drawing E-XXX-BUT	
E-XXX-BUT	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-BUT	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-BUT	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- BUT	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BIO- BUT	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14- BUT	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- BUT	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- BUT	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE1- BUT	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- BUT	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CE9-BUT	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CL6- BUT	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- BUT	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- BUT	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- BUT	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- BUT	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- BUT	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- BUT	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- BUT	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- BUT	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-BUT	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- BUT	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- BUT	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-BUT	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-BUT	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-BUT	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-BUT	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GE8-BUT	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GRS-BUT	Multinuclide (no Am- 241)	Not exceeding 2.5 uCi Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-HG3- BUT	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- BUT	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125- BUT	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- BUT	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- BUT	I-131	less than 1 uCi	Eckert & Zieger Analytics

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Model No.NuclideOverall Diameter: 1 x 1/4 Inch, 1 x 1/8 Inch 2 x 1/4 Inch or 2 x 1/8 Inch Active Diameter: 5 mm Drawing E-XXX-BUTManufacture	alytics alytics alytics alytics alytics
Model No.   Nuclide   Inch 2 x 1/4 Inch or 2 x 1/8 Inch   Manufacture     Active Diameter: 5 mm   Drawing E-XXX-BUT   Manufacture	alytics alytics alytics alytics alytics
Model No.   Nuclide   11011   Manufactur     2 x 1/4 Inch or 2 x 1/8 Inch   Active Diameter: 5 mm   Manufactur     Drawing E-XXX-BUT   Drawing E-XXX-BUT   Drawing E-XXX-BUT	alytics alytics alytics alytics alytics
Active Diameter: 5 mm Drawing E-XXX-BUT	alytics alytics alytics alytics
Drawing E-XXX-BUT	alytics alytics alytics alytics
	alytics alytics alytics alytics
E-IN1-BUT In-111 I less than 100 uCi Eckert & Zieger Ar	alytics alytics alytics
E-IR2-BUT Ir-192 less than 10 uCi Eckert & Zieger Ar	alytics alytics
E-IR4-BUT Ir-194 less than 100 uCi Eckert & Zieger Ar	alytics
E-LU7-BUT Lu-177 less than 100 uCi Eckert & Zieger Ar	
E-MGS- BUT Multinuclide (no Am- Not exceeding uCi Ref.: Appendix 10.4 = to to a to	
241) Eckert & Zieger An	alytics
E-MN2- BUT Mn-52 less than 10 uCi Eckert & Zieger An	alytics
E-MN4- BUT Mn-54 less than 10 uCi Eckert & Zieger Ar	alytics
E-MO9- BUT Mo-99 less than 100 uCi Eckert & Zieger An	alytics
E-NA2- BUT Na-22 less than 10 uCi Eckert & Zieger An	alytics
E-NI3- BUT Ni-63 less than 10 uCi Eckert & Zieger Ar	alytics
E-NI9- BUT Ni-59 less than 100 uCi Eckert & Zieger Ar	alytics
E-P32- BUT P-32 less than 10 uCi Eckert & Zieger Ar	alytics
E-PD3- BUT Pd-103 less than 100 uCi Eckert & Zieger Ar	alytics
E-PD9- BUT Pd-109 less than 100 uCi Eckert & Zieger Ar	alytics
E-PM7- BUT Pm-147 less than 10 uCi Eckert & Zieger Ar	alytics
E-PO0- BUT Po-210 less than 0.1 uCi Eckert & Zieger Ar	alytics
E-RU3- BUT Ru-103 less than 10 uCi Eckert & Zieger Ar	alytics
E-RU6- BUT Ru-106 less than 1 uCi Eckert & Zieger Ar	alytics
E-S35- BUT S-35 less than 100 uCi Eckert & Zieger Ar	alytics
E-SB2- BUT Sb-122 less than 100 uCi Eckert & Zieger Ar	alytics
E-SB4- BUT Sb-124 less than 10 uCi Eckert & Zieger Ar	alytics
E-SB5- BUT Sb-125 less than 10 uCi Eckert & Zieger Ar	alytics
E-SE5-BUT Se-75 less than 10 uCi Eckert & Zieger Ar	alytics
E-SI2-BUT Si-32 less than 0.1 uCi Eckert & Zieger Ar	alytics
E-SM1- BUT Sm-151 less than 10 uCi Eckert & Zieger Ar	alytics
E-SM3- BUT Sm-153 less than 100 uCi Eckert & Zieger Ar	alytics
E-SN3- BUT Sn-113 less than 10 uCi Eckert & Zieger Ar	alytics
E-SR5- BUT Sr-85 less than 10 uCi Eckert & Zieger Ar	alytics
E-SR9- BUT Sr-89 less than 1 uCi Eckert & Zieger Ar	alytics
E-SR0- BUT Sr-90 less than 0.1 uCi Eckert & Zieger Ar	alytics
E-TA2-BUT Ta-182 less than 10 uCi Eckert & Zieger Ar	alytics
E-TC9- BUT Tc-99 less than 10 uCi Eckert & Zieger Ar	alytics
E-TL4- BUT TI-204 less than 10 uCi Eckert & Zieger Ar	alytics
E-Y88- BUT Y-88 less than 10 uCi Eckert & Zieger Ar	alytics
E-Y90- BUT Y-90 less than 10 uCi Eckert & Zieger Ar	alytics
E-ZN5- BUT Zn-65 less than 10 uCi Eckert & Zieger Ar	alytics
E-ZR3-BUT Zr-93 less than 10 uCi Eckert & Zieger Ar	alytics
E-ZR5-BUT Zr-95 less than 10 uCi Eckert & Zieger Ar	alytics
E-ZR7-BUT Zr-97 Less than 10 uCi Eckert & Zieger Ar	alytics

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## Appendix 10.2: Exempt Quantity Sources

		Description: CARTRIDGE	
Model No.	Nuclide	Plastic or Metal	Manufacturer
		Drawing E-XXX-CAR	
E-XXX-CAR	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
	~		
E-AG0-CAR	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3- CAR	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- CAR	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0- CAR	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14- CAR	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- CAR	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- CAR	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE1- CAR	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- CAR	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CE9-CAR	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CL6- CAR	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- CAR	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- CAR	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- CAR	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- CAR	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- CAR	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- CAR	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- CAR	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- CAR	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-CAR	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- CAR	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- CAR	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-CAR	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-CAR	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-CAR	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-CAR	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-CAR	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-CAR	Multinuclide (no Am- 241)	Not exceeding 2.5 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
E-HG3- CAR	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- CAR	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125- CAR	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- CAR	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-131- CAR	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- CAR	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-CAR	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-CAR	Ir-194	less than 100 uCi	Eckert & Zieger Analytics
E-LU7-CAR	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- CAR	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics

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		Description: CARTRIDGE	
Model No.	Nuclide	Plastic or Metal	Manufacturer
		Drawing E-XXX-CAR	
E-MN4- CAR	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-CAR	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- CAR	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- CAR	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- CAR	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-CAR	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-CAR	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-CAR	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7- CAR	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0- CAR	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3- CAR	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- CAR	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- CAR	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5- CAR	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-CAR	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-CAR	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-CAR	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-CAR	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- CAR	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- CAR	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- CAR	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- CAR	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-CAR	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- CAR	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-CAR	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- CAR	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- CAR	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- CAR	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- CAR	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-CAR	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-CAR	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-CAR	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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		Description: DISK	
		Overall Diameter: 1 x 1/4 Inch. 1 x 1/8	
		Inch	
Model No.	Nuclide	2 x 1/4 Inch or 2 x 1/8 Inch	Manufacturer
		Active Diameter: 5 mm – 47 mm	
		Drawing F-XXX-dis	
F-XXX-DIS	XXX=Nuclide	Refer to nuclide in Appendix 10.1 NRC Quantity	Eckert & Zieger Analytics
		There is nating in Appendix 10.1, the edunity	Eckert & Zieger Analytics
F-AG0-DIS	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3- DIS	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- DIS	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-C14-DIS	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- DIS	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- DIS	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE1- DIS	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- DIS	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CE9-DIS	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CL6- DIS	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-DIS	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- DIS	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- DIS	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-DIS	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- DIS	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- DIS	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- DIS	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- DIS	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-DIS	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- DIS	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- DIS	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-DIS	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-DIS	Ga- <u>71</u>	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-DIS	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-DIS	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-DIS	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-DIS	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
E-HG3- DIS	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- DIS	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25- DIS	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- DIS	I-12 <u>9</u>	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- DIS	I-13 <u>1</u>	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- DIS	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-DIS	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-DIS	Ir-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- DIS	Multinuclide (no Am-	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics

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		Description: DISK	
		Overall Diameter: 1 x 1/4 Inch, 1 x 1/8	
		Inch	
Wodel No.	Nuclide	2 x 1/4 Inch or 2 x 1/8 Inch	Manufacturer
•	-	Active Diameter: 5 mm – 47 mm	
		Drawing E-XXX-dis	
	241)		
E-MN4-DIS	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-DIS	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- DIS	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-DIS	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-DIS	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-DIS	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- DIS	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9- DIS	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-DIS	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-DIS	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3- DIS	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- DIS	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-DIS	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- DIS	Sb-122	less than 10 uCi	Eckert & Zieger Analytics
E-SB4- DIS	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- DIS	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-DIS	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-DIS	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-DIS	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-DIS	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- DIS	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- DIS	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-DIS	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- DIS	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-DIS	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- DIS	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-DIS	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- DIS	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-DIS	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-DIS	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- DIS	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-DIS	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-DIS	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-DIS	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: ELECTRODEPOSITED 24.1 mm Diameter x 0.65 mm Thick Stainless Steel Disk 47.1 mm Diameter x 0.9 or 0.77 mm Thick Stainless Steel Disk Drawing E-XXX-ELE	Manufacturer
E-XXX- ELE	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-TC9- ELE	Tc-99	less than 10 uCi	Eckert & Zieger Analytics

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		Description: FILTER	
		47-50 mm (2 Inch) Diameter Filter in Tape	
Model No.	Nuclide	or in Planchet	Manufacturer
		0.5, 0.8, 1.7 or 10.8 mg/cm2 tape cover	
		Drawing E-XXX-FIL	
E-XXX-FIL	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	Eckert & Zieger Analytics
			Eckert & Zieger Analytics
E-AG0-FIL	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3- FIL	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- FIL	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-C14- FIL	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- FIL	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- FIL	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-FIL	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1- FIL	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- FIL	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6- FIL	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- FIL	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- FIL	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- FIL	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- FIL	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- FIL	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- FIL	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- FIL	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- FIL	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-FIL	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- FIL	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- FIL	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-FIL	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-FIL	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-FIL	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-FIL	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-FIL	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-FIL	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
E-HG3- FIL	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- FIL	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125- FIL	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- FIL	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- FIL	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- FIL	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-FIL	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-FIL	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- FIL	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics

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		Description: FILTER	
		47-50 mm (2 Inch) Diameter Filter in Tape	
Model No.	Nuclide	or in Planchet	Manufacturer
		0.5. 0.8. 1.7 or 10.8 mg/cm2 tape cover	
		Drawing E-XXX-FIL	
E-MN4- FIL	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9- FIL	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- FIL	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- FIL	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- FIL	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-FIL	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- FIL	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-FIL	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-FIL	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-FIL	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-FILS	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- FIL	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- FIL	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- FIL	Sb-122	less than 10 uCi	Eckert & Zieger Analytics
E-SB4- FIL	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- FIL	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-FIL	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-FIL	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1- FIL	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- FIL	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- FIL	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- FIL	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- FIL	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- FIL	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-FIL	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- FIL	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-FIL	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- FIL	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- FIL	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- FIL	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- FIL	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-FIL	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-FIL	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-FIL	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: GAS 33 mL Glass Gas Sphere; Pressurized Lecture Bottle; Pressurized Stainless Steel Cylinder Drawing E-XXX-GAS	Manufacturer
E-XXX-GAS	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-KR5-GAS	Kr-85	less than 100 uCi	Eckert & Zieger Analytics
E-Xe1-GAS	Xe-131m	less than 1000 uCi	Eckert & Zieger Analytics
E-Xe3-GAS	Xe-133	less than 100 uCi	Eckert & Zieger Analytics

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		Description: LIQUIDS	
		5 - 50 mL Liquid Flame Sealed Vial	. '
Model No.	Nuclide	100 – 1000 mL Liquid in Flame Sealed	Manufacturer
		Bottle	
		Drawing E-XXX-LIQ	
E-XXX-LIQ	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
			· · · · ·
E-AG0-LIQ	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-LIQ	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7-LIQ	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0-LIQ	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14-LIQ	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5-LIQ	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9-LIQ	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-LIQ	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-LIQ	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-LIQ	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-LIQ	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-LIQ	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-LIQ	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-LIQ	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-LIQ	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-LIQ	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-LIQ	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-LIQ	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-LIQ	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-LIQ	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-LIQ	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-LIQ	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-LIQ	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-LIQ	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-LIQ	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-LIQ	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-LIQ	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E GPS LIO	Multinuclide (no Am-	Not exceeding 2.5 uCi (Flame Sealed	Eckort & Zieger Analytics
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-H-3-LIQ	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-LIQ	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-LIQ	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25-LIQ	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129-LIQ	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-LIQ	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-LIQ	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-LIQ	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-LIQ	Ir-194	less than 100 uCi	Eckert & Zieger Analytics

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	·	Description: LIQUIDS	
		5 - 50 mL Liquid Flame Sealed Vial	
Model No.	Nuclide	100 – 1000 mL Liquid in Flame Sealed	Manufacturer
		Bottle	
		Drawing E-XXX-LIQ	
E-LU7-LIQ	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS-LIQ	Multinuclide (no Am-	Not exceeding 3.0 uCi (Flame Sealed	
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-MN4-LIQ	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-LIQ	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-LIQ	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-LIQ	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-LIQ	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-LIQ	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-LIQ	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-LIQ	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-LIQ	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-LIQ	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-LIQ	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-LIQ	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-LIQ	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-LIQ	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-LIQ	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-LIQ	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-LIQ	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-LIQ	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-LIQ	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-LIQ	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-LIQ	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-LIQ	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-LIQ	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC5-LIQ	Tc-95m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TC9-LIQ	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-LIQ	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-LIQ	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-LIQ	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-LIQ	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-LIQ	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-LIQ	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-LIQ	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-LIQ	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: Plate 12 cm x 12 cm Plate, 10 cm x 10 cm Active Area with 1 cm wide x 3 mm Thick Frame and a 3 mm thick backing plate, tape, 0.5 or 0.8 mg/cm2 mylar cover Drawing E-XXX-PLT	Manufacturer
E-XXX-PLT	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-PLT	Aq-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3- PLT	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- PI T	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-C14- PLT	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- PLT	Ca-45	less than 10 µCi	Eckert & Zieger Analytics
E-CD9- PLT	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-PLT	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1- PLT	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- PLT	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6- PLT	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- PLT	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- PLT	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- PLT	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- PLT	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- PLT	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- PLT	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- PLT	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- PLT	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-PLT	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- PLT	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- PLT	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-PLT	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-PLT	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-PLT	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-PLT	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-PLT	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-PLT	Multinuclide (no Am-	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
E-HG3- PLT	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- PLT	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25- PLT	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- PLT	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- PLT	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- PLT	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-PLT	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-PLT	Ir-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- PLT	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics

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		Description: Plate	
		12 cm x 12 cm Plate, 10 cm x 10 cm	
		Active Area with 1 cm wide x 3 mm Thick	Manufacture
	Nuclide	Frame and a 3 mm thick backing plate,	wanutacturer
		tape, 0.5 or 0.8 mg/cm2 mylar cover	-
		Drawing E-XXX-PLT	
E-MN4- PLT	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9- PLT	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- PLT	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- PLT	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- PLT	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-PLT	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- PLT	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-PLT	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-PLT	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-PLT	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-PLT	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- PLT	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-PLT	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- PLT	Sb-122	less than 10 uCi	Eckert & Zieger Analytics
E-SB4- PLT	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- PLT	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-PLT	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-PLT	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-PLT	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- PLT	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- PLT	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- PLT	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- PLT	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- PLT	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-PLT	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- PLT	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-PLT	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- PLT	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- PLT	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- PLT	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- PLT	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-PLT	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-PLT	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-PLT	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: PLANCHET Simulated Evaporated Liquid in Smooth Bottom or Ringed Bottom Stainless Steel or Aluminum Planchet with 0.5, 0.8 or 1.7	Manufacturer
		mg/cm2 mylar cover Drawing E-XXX-PLN	
E-XXX-PLN	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
	A 110		
E-AG0-PLN	Ag-110m		Eckert & Zieger Analytics
E-BA3- PLN	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI/- PLN	BI-207		Eckert & Zieger Analytics
E-C14- PLN	C-14		Eckert & Zieger Analytics
E-CA5- PLN	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- PLN	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-PLN	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1- PLN	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- PLN	Ce-144		Eckert & Zieger Analytics
E-CL6- PLN	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- PLN	<u>Co-57</u>	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- PLN	<u>Co-58</u>	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- PLN	<u>Co-60</u>	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-PLN	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- PLN	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- PLN	<u>Cs-137</u>	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- PLN	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- PLN	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-PLN	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- PLN	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- PLN	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-PLN	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-PLN	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-PLN	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-PLN	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-PLN	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-PLN	Multinuclide (no Am- 241)	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
E-HG3-PLN	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- PLN	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125- PLN	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- PLN	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- PLN	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- PLN	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-PLN	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-PLN	Ir-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- PLN	Multinuclide (no Am-	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics

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		Description: PLANCHET	
		Simulated Evaporated Liquid in Smooth	
		Bottom or Ringed Bottom Stainless Steel	
Model No.	Nuclide	or Aluminum Planchet with 0.5. 0.8 or 1.7	Manufacturer
		mg/cm2 mvlar cover	
		Drawing F-XXX-PI N	
	241)		
E-MN4- PLN	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9- PLN	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- PLN	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- PLN	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- PLN	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-PLN	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- PLN	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-PLN	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-PLN	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-PLN	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-PLN	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- PLN	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- PLN	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- PLN	Sb-122	less than 10 uCi	Eckert & Zieger Analytics
E-SB4- PLN	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- PLN	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-PLN	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-PLN	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-PLN	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- PLN	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- PLN	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- PLN	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- PLN	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- PLN	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-PLN	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- PLN	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-PLN	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- PLN	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- PLN	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- PLN	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- PLN	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-PLN	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-PLN	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-PLN	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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•		Description: POINT	
		Point Source in Tape on 2 Inch Aluminum	
Model No.	Nuclide	Ring	Manufacturer
		Drawing E-XXX-PNT	
E-XXX-PNT	XXX = nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-PNT	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3- PNT	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- PNT	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-C14- PNT	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- PNT	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- PNT	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-PNT	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1- PNT	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- PNT	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6- PNT	CI-36	less than 10 uCi	Eckert & Zieger Analytics
F-CO7- PNT	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- PNT	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- PNT	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- PNT	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- PNT	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- PNT	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- PNT	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-FU4- PNT	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-PNT	 Fu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- PNT	 Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FF9- PNT	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-PNT	Ga-67	less than 100 µCi	Eckert & Zieger Analytics
E-GA1-PNT	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD8-PNT	Gd-148	less than 0.1 uCi	Eckert & Zieger Analytics
E-GD3-PNT	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-PNT	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-PNT	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-PNT	Multinuclide (no Am-	Not exceeding 3.0 uCi (Ref : Appendix 10.4)	
	241)		Eckert & Zieger Analytics
E-HG3- PNT	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- PNT	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125- PNT	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129- PNT	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- PNT	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1- PNT	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-PNT	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-PNT	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- PNT	Multinuclide (no Am-	Not exceeding 3.0 uCi (Ref.: Appendix 10.4)	Eckert & Zieger Analytics
F-MN4- PNT	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
			Lonor & Llogor / marytos

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-	· · · · · · · · · · · · · · · · · · ·	Description: POINT	
Model No	Nuclido	Point Source in Tape on 2 Inch Aluminum	Manufacturor
Wouer No.	Nacinae	Ring	Manuacturei
		Drawing E-XXX-PNT	
E-MO9- PNT	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- PNT	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- PNT	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- PNT	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-PNT	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- PNT	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-PNT	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-PNT	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-PNT	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-PNT	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- PNT	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- PNT	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- PNT	Sb-122	less than 10 uCi	Eckert & Zieger Analytics
E-SB4- PNT	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- PNT	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-PNT	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-PNT	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1- PNT	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- PNT	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- PNT	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- PNT	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- PNT	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- PNT	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-PNT	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- PNT	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-PNT	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4- PNT	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- PNT	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- PNT	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- PNT	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-PNT	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-PNT	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-PNT	Zr-97	less than 10 uCi	Eckert & Zieger Analytics

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	· ·	Description: QUENCH	
	•	15 mL Liquid in 20 mL Flame Sealed	
		Liquid Scintillation Vial or 5 ml Liquid in	
Model No.	Nuclide	7 ml Flame Sealed Liquid Scintillation	Manufacturer
		Vial	
·		Drowing E XXX OUE	
	XXX-Nuolido	Befor to publide in Appendix 10.1 NBC Questitu	
E-XXX-QUE		Refer to fluctide in Appendix T0.1, NRC Qualitity	
	Ag 110m	loss than 1 uCi	Eckort & Zioger Apolytics
	Ro 133	less than 10 uCi	Eckert & Zieger Analytics
	Bi 207		Eckert & Zieger Analytics
	Bi 210		Eckert & Zieger Analytics
	DI-210		Eckert & Zieger Analytics
E-C14-QUE	0-14		Eckert & Zieger Analytics
E-CAS-QUE	Ca-45		Eckert & Zieger Analytics
E-CD9-QUE		less than 10 uCi	Eckert & Zieger Analytics
E-CE9-QUE	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-QUE	<u>Ce-141</u>	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-QUE	<u>Ce-144</u>	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-QUE	Cl-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-QUE	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-QUE	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-QUE	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-QUE	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-QUE	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-QUE	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-QUE	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-QUE	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-QUE	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-QUE	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-QUE	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-QUE	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-QUE	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-QUE	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-QUE	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-QUE	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
	Multinuclide (no Am-	Not exceeding 2.5 uCi (Flame Sealed	
E-GRS-QUE	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-H-3-QUE	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-QUE	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-QUE	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125-QUE	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-I29-QUE	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-QUE	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-QUE	In-111	less than 100 uCi	Eckert & Zieger Analytics
F-IR2-QUE	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-QUE	Ir-194	less than 100 uCi	Eckert & Zieger Analytics

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		Description: QUENCH	
		15 mL Liquid in 20 mL Flame Sealed	
		Liguid Scintillation Vial or 5 mL Liguid in	
Model No.	Nuclide	7 mL Flame Sealed Liquid Scintillation	Manufacturer
		Vial	
		Drawing E-XXX-QUE	
E-LU7-QUE	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
	Multinuclide (no Am-	Not exceeding 3.0 uCi (Flame Sealed	
E-MGS-QUE	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-MN4-QUE	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-QUE	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-QUE	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-QUE	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-QUE	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-QUE	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-QUE	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-QUE	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-QUE	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-QUE	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-QUE	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-QUE	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-QUE	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-QUE	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-QUE	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-QUE	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-QUE	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-QUE	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-QUE	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-QUE	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-QUE	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-QUE	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-QUE	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9-QUE	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-QUE	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-QUE	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-QUE	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-QUE	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-QUE	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-QUE	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-QUE	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-QUE	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: UNQUENCHED 15 mL Liquid in 20 mL Flame Sealed Liquid Scintillation Vial or 5 mL Liquid in 7 mL Flame Sealed Liquid Scintillation Vial Drawing E-XXX-UNQ	Manufacturer
E-XXX-UNQ	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
	·	· · · · ·	
E-C14-UNQ	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-H-3-UNQ	H-3	less than 1 mCi	Eckert & Zieger Analytics

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Model No.Nuclide0.625 Inch Diameter x 5 Inch Long, active area <5 mm 0.5 Inch Diameter x 5 Inch Long, active area <5 mm 0.5 Inch Diameter x 2.95 Inch Long, active area <5 mm Drawing E-XXX-ROD	Manufacturer
E-XXX-ROD XXX=Nuclide Refer to nuclide in Appendix 10.1, NRC Quantity	· · · · · · · · · · · · · · · · · · ·
E-AG0- ROD Ag-110m less than 1 uCi	Eckert & Zieger Analytics
E-BA3- ROD Ba-133 less than 10 uCi	Eckert & Zieger Analytics
E-BI7- ROD Bi-207 less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0- ROD Bi-210 less than 1 uCi	Eckert & Zieger Analytics
E-C14- ROD C-14 less than 100 uCi	Eckert & Zieger Analytics
E-CA5- ROD Ca-45 less than 10 uCi	Eckert & Zieger Analytics
E-CD9- ROD Cd-109 · less than 10 uCi	Eckert & Zieger Analytics
E-CE1- ROD Ce-141 less than 100 uCi	Eckert & Zieger Analytics
E-CE4- ROD Ce-144 less than 1 uCi	Eckert & Zieger Analytics
E-CE9- ROD Ce-139 less than 0.1 uCi	Eckert & Zieger Analytics
E-CL6- ROD CI-36 less than 10 uCi	Eckert & Zieger Analytics
E-CO7- ROD Co-57 less than 100 uCi	Eckert & Zieger Analytics
E-CO8- ROD Co-58 less than 10 uCi	Eckert & Zieger Analytics
E-CO0- ROD Co-60 less than 1 uCi	Eckert & Zieger Analytics
E-CR1- ROD Cr-51 less than 1 mCi	Eckert & Zieger Analytics
E-CS4- ROD Cs-134 less than 1 uCi	Eckert & Zieger Analytics
E-CS7- ROD Cs-137 less than 10 uCi	Eckert & Zieger Analytics
E-EU2- ROD Eu-152 less than 1 uCi	Eckert & Zieger Analytics
E-EU4- ROD Eu-154 less than 1 uCi	Eckert & Zieger Analytics
E-EU5- ROD Eu-155 less than 10 uCi	Eckert & Zieger Analytics
E-FE5- ROD Fe-55 less than 100 uCi	Eckert & Zieger Analytics
E-FE9- ROD Fe-59 less than 10 uCi	Eckert & Zieger Analytics
E-GA7- ROD Ga-67 less than 100 uCi	Eckert & Zieger Analytics
E-GA1- ROD Ga-71 less than 10 uCi	Eckert & Zieger Analytics
E-GD3- ROD Gd-153 less than 10 uCi	Eckert & Zieger Analytics
E-GE1- ROD Ge-71 less than 100 uCi	Eckert & Zieger Analytics
E-GE8- ROD Ge-68 less than 10 uCi	Eckert & Zieger Analytics
E-GRS- ROD Multinuclide (no Am- 241) Not exceeding 2.5 uCi Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-HG3- ROD Hg-203 less than 10 uCi	Eckert & Zieger Analytics
E-HO6- ROD Ho-166m less than 0.1 uCi	Eckert & Zieger Analytics
E-I25- ROD I-125 less than 1 uCi	Eckert & Zieger Analytics
E-I29- ROD I-129 less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- ROD I-131 less than 1 uCi	Eckert & Zieger Analytics
E-IN1- ROD In-111 less than 100 uCi	Eckert & Zieger Analytics
E-IR2- ROD Ir-192 less than 10 uCi	Eckert & Zieger Analytics

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		Description: ROD	
		0.625 Inch Diameter x 5 Inch Long, active	
		area <5 mm	
Madal Na	Nuclida	0.5 Inch Diameter x 5 Inch Long, active area	Manufacturen
wodel No.	Nucilae	<5 mm	Wanutacturer
		0.5 Inch Diameter x 2.95 Inch Long, active	
		area <5 mm	
		Drawing E-XXX-ROD	
E-IR4- ROD	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-LU7- ROD	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS-	Multinuclide (no Am-	Not exceeding 3 uCi Ref.: Appendix 10.4	Eckort & Ziggor Applytics
ROD	241)		Eckert & Zieger Analytics
E-MN2- ROD	Mn-52	less than 10 uCi	Eckert & Zieger Analytics
E-MN4- ROD	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9- ROD	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- ROD	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- ROD	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- ROD	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32- ROD	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- ROD	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9- ROD	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7- ROD	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0- ROD	Po-210	less than 0.1 uCi	*Eckert & Zieger Analytics
E-RU3- ROD	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- ROD	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- ROD	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- ROD	Sb-122	less than 100 uCi	Eckert & Zieger Analytics
E-SB4- ROD	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- ROD	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5- ROD	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2- ROD	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1- ROD	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- ROD	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- ROD	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- ROD	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- ROD	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- ROD	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2- ROD	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- ROD	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TL4- ROD	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- ROD	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- ROD	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- ROD	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3- ROD	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5- ROD	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7- ROD	Zr-97	Less than 10 uCi	Eckert & Zieger Analytics

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		Description: SAND	
	-	500 mL Sand in 500 Marinelli Beaker	
Model No.	Nuclide	1.0 Liter Sand in 130G GA-MA Beaker	Manufacturer
		4.0 Liter Sand in 430G GA-MA Beaker	· · · · ·
		Drawing E-XXX-SAN	
E-XXX-SAN	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-SAN	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-SAN	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7-SAN	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0-SAN	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14-SAN	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5-SAN	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9-SAN	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-SAN	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-SAN	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-SAN	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-SAN	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-SAN	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-SAN	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-SAN	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-SAN	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-SAN	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-SAN	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-SAN	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-SAN	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-SAN	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-SAN	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-SAN	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-SAN	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-SAN	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-SAN	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-SAN	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-SAN	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-SAN	Multinuclide (no Am-	Not exceeding 2.5 uCi (Flame Sealed	
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-H-3-SAN	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-SAN	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-SAN	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25-SAN	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129-SAN	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-SAN	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-SAN	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-SAN	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-SAN	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-LU7-SAN	Lu-177	less than 100 uCi	Eckert & Zieger Analytics

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		Description: SAND	
	· ·	500 mL Sand in 500 Marinelli Beaker	
Model No.	Nuclide	1.0 Liter Sand in 130G GA-MA Beaker	Manufacturer
		4.0 Liter Sand in 430G GA-MA Beaker	
		Drawing E-XXX-SAN	
E-MGS-SAN	Multinuclide (no Am-	Not exceeding 3.0 uCi (Flame Sealed	Eckert & Zieger Analytics
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	
E-MN4-SAN	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-SAN	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-SAN	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-SAN	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-SAN	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-SAN	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-SAN	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-SAN	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-SAN	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-SAN	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-SAN	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-SAN	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-SAN	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-SAN	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-SAN	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-SAN	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-SAN	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-SAN	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-SAN	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-SAN	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-SAN	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-SAN	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-SAN	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9-SAN	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-SAN	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-SAN	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-SAN	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-SAN	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-SAN	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-SAN	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-SAN	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-SAN	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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		Description: SIMULATED GAS	
	-	In 15 ml. Off Cap Vial	
		In 15 mL Off Gas viai	
		100 mL GA-MA Gas Beaker	-
Model No.	Nuclide	500 mL Marinelli Beaker	Manufacturer
		130G GA-MA Gas Beaker	
		430G GA-MA Gas Beaker	• · ·
		Drawing E-XXX-SIM	_
E-XXX-SIM	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-SIM	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-SIM	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7-SIM	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0-SIM	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14-SIM	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5-SIM	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9-SIM	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-SIM	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-SIM	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-SIM	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-SIM	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-SIM	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-SIM	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-SIM	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-SIM	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-SIM	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-SIM	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-SIM	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-SIM	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-SIM	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-SIM	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-SIM	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-SIM	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-SIM	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-SIM	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-SIM	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-SIM	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-SIM	Multinuclide (no Am-	Not exceeding 2.5 uCi (Flame Sealed	Eckert & Zieger Analytics
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	
E-H-3-SIM	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-SIM	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-SIM	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25-SIM	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-I29-SIM	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-SIM	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-SIM	In-111	less than 100 uCi	Eckert & Zieger Analytics

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		Description: SIMULATED GAS	
		In 15 mL Off Gas Vial	·
		100 mL GA-MA Gas Beaker	
Model No	Nuclide	500 ml Marinelli Beaker	Manufacturer
incuci no.		130G GA-MA Gas Beaker	manufacturor
		A30G GA-MA Gas Beaker	
		Drawing E XXX SIM	
	lr 102		Eakort & Ziggor Applytics
	Ir 104		Eckert & Zieger Analytics
			Eckert & Zieger Analytics
	Lu-177 Multipuolido (po Am	Not expending 2.0 uCi. (Eleme Socied	Eckert & Zieger Analytics
E-10103-31101		Ampoulo/Rottle) Ref : Appendix 10.4	Eckert & Zieger Analytics
	241) Mp 54	Ampoule/Bollie/ Rel.: Appendix 10.4	Eakort & Ziogor Apolytics
	Mo 99		Eckert & Zieger Analytics
	No. 22		Eckert & Zieger Analytics
	Ni 62		Eckert & Zieger Analytics
	NI EO		Eckert & Zieger Analytics
	D 22		Eckert & Zieger Analytics
E-P32-511VI	P-32		Eckert & Zieger Analytics
E-PD3-SIM	Pd-103		Eckert & Zieger Analytics
E-PD9-SIM	P0-109		Eckert & Zieger Analytics
E-PM7-SIM	Pm-147	less than 10 uCr	Eckert & Zieger Analytics
E-PO0-SIM	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-SIM	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-SIM	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-SIM	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-SIM	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-SIM	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-SIM	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-SIM	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-SIM	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-SIM	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-SIM	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-SIM	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-SIM	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-SIM	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9-SIM	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-SIM	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-SIM	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-SIM	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-SIM	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-SIM	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-SIM	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-SIM	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-SIM	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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Or-WiA BeakerDrawing E-XXX-SVEE-XXX-SVEE-XXX-SVEE-AG0-SVEAq-110mless than 1 uCiE-AG0-SVEBa-133less than 1 uCiE-BA3-SVEBa-133less than 1 uCiE-BA3-SVEBa-133less than 1 uCiE-BA3-SVEBi-207less than 1 uCiE-BA1-SVEBi-207less than 1 uCiE-CA1-SVEC-14less than 10 uCiE-CA1-SVEC-14less than 10 uCiE-CA5-SVEC-45less than 10 uCiE-CA5-SVEC-141less than 10 uCiE-CE1-SVEC-141less than 10 uCiE-CE4-SVEC-141less than 10 uCiE-CE4-SVEC-141less than 10 uCiE-CE4-SVEC-6-141less than 10 uCiE-CA5-SVEC-6-57less than 10 uCiE-CA6-SVEC-6-58less than 10 uCiE-CA6-SVEC-6-58less than 1 uCiE-CA7-SVEC-6-51less than 1 uCiE-CA7-SVEC-51less than 1 uCiE-CA7-SVEC-51less than 1 uCiE-CA7-SVEC-51less than 1 uCiE-CA7-SVEC-55less than 1 uCiE-CA7-SVEC-55	Model No.	Nuclide	Description: SIMULATED VEGETATION Denisty of 500 mL Simulated Vegetation in 500 Marinelli Beaker 1.0 Liter Simulated Vegetation in 130G GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G	Manufacturer
E-XXX-SVEXXX=NuclideRefer to nuclide in Appendix 10.1, NRC QuantityEckert & Zieger AnalyticsE-AG0-SVEAg-110mless than 1 uCiEckert & Zieger AnalyticsE-BA3-SVEBa-133less than 1 uCiEckert & Zieger AnalyticsE-BID-SVEBi-207less than 0.1 uCiEckert & Zieger AnalyticsE-CAI-SVEC-14less than 1 uCiEckert & Zieger AnalyticsE-CAI-SVEC-14less than 10 uCiEckert & Zieger AnalyticsE-CAI-SVEC-45less than 10 uCiEckert & Zieger AnalyticsE-CD9-SVEC-45less than 10 uCiEckert & Zieger AnalyticsE-CEI-SVEC-141less than 10 uCiEckert & Zieger AnalyticsE-COF-SVEC-6-139less than 10 uCiEckert & Zieger AnalyticsE-COF-SVEC-6-57less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-6-57less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-6-51less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-6-51less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-51less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-51less than 10 uCiEckert & Zieger AnalyticsE-COS-SVEC-51less than 10 uCiEckert & Zieger Analytics		· ·	GA-MA Beaker Drawing E-XXX-SVE	
E-AG0-SVEAg-110mless than 1 uCiEckert & Zieger AnalyticsE-AG-SVEBa-133less than 10 uCiEckert & Zieger AnalyticsE-BA3-SVEBi-207less than 0 uCiEckert & Zieger AnalyticsE-BI0-SVEBi-210less than 10 uCiEckert & Zieger AnalyticsE-C14-SVEC-14less than 10 uCiEckert & Zieger AnalyticsE-C44-SVEC-14less than 10 uCiEckert & Zieger AnalyticsE-C45-SVECa-45less than 10 uCiEckert & Zieger AnalyticsE-C45-SVECd-109less than 0 uCiEckert & Zieger AnalyticsE-C45-SVECe-139less than 0 uCiEckert & Zieger AnalyticsE-C45-SVECe-139less than 10 uCiEckert & Zieger AnalyticsE-C45-SVECe-141less than 10 uCiEckert & Zieger AnalyticsE-C45-SVECe-144less than 10 uCiEckert & Zieger AnalyticsE-C65-SVECo-57less than 10 uCiEckert & Zieger AnalyticsE-C07-SVECo-57less than 10 uCiEckert & Zieger AnalyticsE-C08-SVECo-58less than 10 uCiEckert & Zieger AnalyticsE-C34-SVECo-51less than 1 uCiEckert & Zieger AnalyticsE-C34-SVECo-513less than 1 uCiEckert & Zieger AnalyticsE-C34-SVECo-514 <t< td=""><td>E-XXX-SVE</td><td>XXX=Nuclide</td><td>Refer to nuclide in Appendix 10.1, NRC Quantity</td><td>Eckert &amp; Zieger Analytics</td></t<>	E-XXX-SVE	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	Eckert & Zieger Analytics
E-AG0-SVE     Ag-110m     less than 1 uCi     Eckert & Zieger Analytics       E-BA3-SVE     Ba-133     less than 0 uCi     Eckert & Zieger Analytics       E-BI7-SVE     Bi-207     less than 0 uCi     Eckert & Zieger Analytics       E-BI7-SVE     Bi-210     less than 10 uCi     Eckert & Zieger Analytics       E-CA5-SVE     Ca-45     less than 10 uCi     Eckert & Zieger Analytics       E-CA5-SVE     Ca-45     less than 10 uCi     Eckert & Zieger Analytics       E-CD9-SVE     Cd-109     less than 10 uCi     Eckert & Zieger Analytics       E-CE1-SVE     Ce-139     less than 10 uCi     Eckert & Zieger Analytics       E-CE4-SVE     Ce-144     less than 10 uCi     Eckert & Zieger Analytics       E-CC1-SVE     Co-57     less than 10 uCi     Eckert & Zieger Analytics       E-CO8-SVE     Co-58     less than 10 uCi     Eckert & Zieger Analytics       E-CO8-SVE     Co-57     less than 10 uCi     Eckert & Zieger Analytics       E-CO8-SVE     Co-58     less than 10 uCi     Eckert & Zieger Analytics       E-CS4-SVE     Cr-51     less than 10 uCi     Eckert & Zieger Analytics <				Eckert & Zieger Analytics
E-BA3-SVE     Ba-133     less than 10 uCi     Eckert & Zieger Analytics       E-BI7-SVE     Bi-200     less than 1.0 uCi     Eckert & Zieger Analytics       E-BI0-SVE     Bi-210     less than 1.0 uCi     Eckert & Zieger Analytics       E-C14-SVE     C-14     less than 10 uCi     Eckert & Zieger Analytics       E-CA5-SVE     Cd-109     less than 10 uCi     Eckert & Zieger Analytics       E-CE9-SVE     Cd-109     less than 10 uCi     Eckert & Zieger Analytics       E-CE4-SVE     Ce-139     less than 10 uCi     Eckert & Zieger Analytics       E-CE4-SVE     Ce-144     less than 10 uCi     Eckert & Zieger Analytics       E-CE4-SVE     Ce-144     less than 10 uCi     Eckert & Zieger Analytics       E-CA5-SVE     Co-144     less than 10 uCi     Eckert & Zieger Analytics       E-CO4-SVE     Co-58     less than 10 uCi     Eckert & Zieger Analytics       E-CO4-SVE     Co-58     less than 10 uCi     Eckert & Zieger Analytics       E-CO4-SVE     Co-57     less than 10 uCi     Eckert & Zieger Analytics       E-CO4-SVE     Co-58     less than 10 uCi     Eckert & Zieger Analytics	E-AG0-SVE	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
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E-CO7-SVECo-57less than 100 uCiEckert & Zieger AnalyticsE-CO8-SVECo-58less than 10 uCiEckert & Zieger AnalyticsE-CO0-SVECo-60less than 1 uCiEckert & Zieger AnalyticsE-CR1-SVECr-51less than 1 mCiEckert & Zieger AnalyticsE-CS4-SVECs-134less than 1 uCiEckert & Zieger AnalyticsE-CS7-SVECs-134less than 1 uCiEckert & Zieger AnalyticsE-CS7-SVECs-137less than 1 uCiEckert & Zieger AnalyticsE-EU2-SVEEu-152less than 1 uCiEckert & Zieger AnalyticsE-EU4-SVEEu-154less than 1 uCiEckert & Zieger AnalyticsE-EU5-SVEEu-155less than 10 uCiEckert & Zieger AnalyticsE-FE5-SVEFe-55less than 10 uCiEckert & Zieger AnalyticsE-FE9-SVEFe-59less than 100 uCiEckert & Zieger AnalyticsE-GAT-SVEGa-67less than 100 uCiEckert & Zieger AnalyticsE-GB3-SVEGd-153less than 10 uCiEckert & Zieger AnalyticsE-GB3-SVEGe-71less than 10 uCiEckert & Zieger AnalyticsE-GRS-SVEMultinuclide (no Am- 241)Not exceeding 2.5 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-H-3-SVEH-3less than 10 uCiEckert & Zieger AnalyticsE-HG3-SVEH9-203less than 10 uCiEckert & Zieger AnalyticsE-HG3-SVEH-3less than 10 uCiEckert & Zieger AnalyticsE-HG3-SVEH-3less than 10 uCi<	E-CL6-SVE	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-C08-SVECo-58less than 10 uCiEckert & Zieger AnalyticsE-C00-SVECo-60less than 1 uCiEckert & Zieger AnalyticsE-CR1-SVECr-51less than 1 mCiEckert & Zieger AnalyticsE-CS4-SVECs-134less than 1 uCiEckert & Zieger AnalyticsE-CS7-SVECs-137less than 1 uCiEckert & Zieger AnalyticsE-CU2-SVEEu-152less than 1 uCiEckert & Zieger AnalyticsE-EU2-SVEEu-152less than 1 uCiEckert & Zieger AnalyticsE-EU2-SVEEu-154less than 1 uCiEckert & Zieger AnalyticsE-EU5-SVEEu-155less than 10 uCiEckert & Zieger AnalyticsE-FE5-SVEFe-55less than 100 uCiEckert & Zieger AnalyticsE-FE9-SVEFe-59less than 100 uCiEckert & Zieger AnalyticsE-GA7-SVEGa-67less than 100 uCiEckert & Zieger AnalyticsE-GA7-SVEGa-71less than 100 uCiEckert & Zieger AnalyticsE-GB8-SVEGe-68less than 100 uCiEckert & Zieger AnalyticsE-GRS-SVEGe-71less than 100 uCiEckert & Zieger AnalyticsE-GRS-SVEH-3less than 100 uCiEckert & Zieger AnalyticsE-GRS-SVEHo-166mless than 100 uCiEckert & Zieger AnalyticsE-HO6-SVEHo	E-CO7-SVE	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO0-SVECo-60less than 1 uCiEckert & Zieger AnalyticsE-CR1-SVECr-51less than 1 mCiEckert & Zieger AnalyticsE-CS4-SVECs-134less than 1 uCiEckert & Zieger AnalyticsE-CS7-SVECs-137less than 10 uCiEckert & Zieger AnalyticsE-EU2-SVECs-137less than 1 uCiEckert & Zieger AnalyticsE-EU2-SVEEu-152less than 1 uCiEckert & Zieger AnalyticsE-EU5-SVEEu-154less than 1 uCiEckert & Zieger AnalyticsE-EU5-SVEEu-155less than 10 uCiEckert & Zieger AnalyticsE-FE5-SVEFe-55less than 10 uCiEckert & Zieger AnalyticsE-FE9-SVEFe-59less than 10 uCiEckert & Zieger AnalyticsE-GA7-SVEGa-67less than 10 uCiEckert & Zieger AnalyticsE-GB3-SVEGa-71less than 10 uCiEckert & Zieger AnalyticsE-GB3-SVEGe-71less than 10 uCiEckert & Zieger AnalyticsE-GB3-SVEGe-71less than 10 uCiEckert & Zieger AnalyticsE-GRS-SVEMultinuclide (no Am- 241)Not exceeding 2.5 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-H-3-SVEH-3less than 1 mCiEckert & Zieger AnalyticsE-H3-SVEH-3less than 1 mCiEckert &	E-CO8-SVE	Co-58	less than 10 uCi	Eckert & Zieger Analytics
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E-HO6-SVEHo-166mless than 0.1 uCiEckert & Zieger AnalyticsE-I25-SVEI-125less than 1 uCiEckert & Zieger AnalyticsE-I29-SVEI-129less than 0.1 uCiEckert & Zieger Analytics	E-HG3-SVE	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-I25-SVE I-125 less than 1 uCi Eckert & Zieger Analytics   E-I29-SVE I-129 less than 0.1 uCi Eckert & Zieger Analytics	E-HO6-SVE	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I29-SVE I-129 less than 0.1 uCi Eckert & Zieger Analytics	E-I25-SVE	I-125	less than 1 uCi	Eckert & Zieger Analytics
	E-129-SVE	I-129	less than 0.1 uCi	Eckert & Zieger Analytics

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Model No.NuclideDenisty of 500 mL Simulated Vegetation in 500 Marinelli Beaker 1.0 Liter Simulated Vegetation in 130G GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVEManufacturerE-I31-SVEI-131less than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-LU7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics			Description: SIMULATED VEGETATION	
Model No.Nuclide500 mL Simulated Vegetation in 500 Marinelli Beaker 1.0 Liter Simulated Vegetation in 130G GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVEManufacturerE-I31-SVEI-131less than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 100 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-U7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics			Denisty of	
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Model No.Nuclide1.0 Liter Simulated Vegetation in 130G GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVEManufacturerE-I31-SVEI-131less than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 100 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics		N I 12 - 12	Marinelli Beaker	
GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVEE-I31-SVEI-131E-IN1-SVEIn-111Iess than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111Iss than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192Ir-194Iess than 100 uCiE-LU7-SVELu-177Iess than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54Iess than 10 uCiE-MO9-SVEMo-99Iess than 100 uCiE-MO9-SVEMo-99Iess than 100 uCi	Model No.	NUCIIde	1.0 Liter Simulated Vegetation in 130G	Manufacturer
4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVEE-I31-SVEI-131Iess than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111Iess than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192Ir-192Iess than 100 uCiE-IR4-SVEIr-194Iess than 100 uCiEckert & Zieger AnalyticsE-U7-SVELu-177Iess than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54Iess than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99Iess than 100 uCiEckert & Zieger Analytics			GA-MA Beaker	
E-I31-SVEI-131less than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 100 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-LU7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics			4.0 Liter Simulated Vegetation in 430G	
E-I31-SVEI-131less than 1 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 100 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-LU7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics			Drowing E XXX SVE	
L-IST-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IN1-SVEIn-111less than 100 uCiEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 10 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-LU7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics		L131		Eckert & Zieger Analytics
E-IR1-SVEIn TheTote doinEckert & Zieger AnalyticsE-IR2-SVEIr-192less than 10 uCiEckert & Zieger AnalyticsE-IR4-SVEIr-194less than 100 uCiEckert & Zieger AnalyticsE-LU7-SVELu-177less than 100 uCiEckert & Zieger AnalyticsE-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 100 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics	E-IN1-SVE	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR4-SVE   Ir-194   less than 100 uCi   Eckert & Zieger Analytics     E-IU7-SVE   Lu-177   less than 100 uCi   Eckert & Zieger Analytics     E-MGS-SVE   Multinuclide (no Am- 241)   Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4   Eckert & Zieger Analytics     E-MN4-SVE   Mn-54   less than 100 uCi   Eckert & Zieger Analytics     E-MO9-SVE   Mo-99   less than 100 uCi   Eckert & Zieger Analytics	E-IR2-SVE	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-LU7-SVE   Lu-177   less than 100 uCi   Eckert & Zieger Analytics     E-MGS-SVE   Multinuclide (no Am- 241)   Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4   Eckert & Zieger Analytics     E-MN4-SVE   Mn-54   less than 10 uCi   Eckert & Zieger Analytics     E-MO9-SVE   Mo-99   less than 100 uCi   Eckert & Zieger Analytics	E-IR4-SVE	Ir-194	less than 100 uCi	Eckert & Zieger Analytics
E-MGS-SVEMultinuclide (no Am- 241)Not exceeding 3.0 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 10 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics	E-LU7-SVE	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
241)Ampoule/Bottle) Ref.: Appendix 10.4Eckert & Zieger AnalyticsE-MN4-SVEMn-54less than 10 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics	E-MGS-SVE	Multinuclide (no Am-	Not exceeding 3.0 uCi (Flame Sealed	
E-MN4-SVEMn-54less than 10 uCiEckert & Zieger AnalyticsE-MO9-SVEMo-99less than 100 uCiEckert & Zieger Analytics		241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-MO9-SVE Mo-99 less than 100 uCi Eckert & Zieger Analytics	E-MN4-SVE	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
	E-MO9-SVE	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-SVE Na-22 less than 10 uCi Eckert & Zieger Analytics	E-NA2-SVE	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-SVE Ni-63 less than 10 uCi Eckert & Zieger Analytics	E-NI3-SVE	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-SVE Ni-59 less than 100 uCi Eckert & Zieger Analytics	E-NI9-SVE	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-SVE P-32 less than 10 uCi Eckert & Zieger Analytics	E-P32-SVE	P-32		Eckert & Zieger Analytics
E-PD3-SVE Pd-103 less than 100 uCi Eckert & Zieger Analytics	E-PD3-SVE	Pd-103		Eckert & Zieger Analytics
E-PD9-SVE P0-109 less than 100 UCI Eckert & Zieger Analytics	E-PD9-SVE	Pd-109		Eckert & Zieger Analytics
E-PIVI7-SVE PIII-147 less than 0.1 uCi Eckert & Zieger Analytics		Po-210		Eckert & Zieger Analytics
E-PU3-SVE PU-210 less than 10 uCi Eckert & Zieger Analytics	E-RU3-SVE	Ru-103	less than 10 µCi	Eckert & Zieger Analytics
E-RU6-SVE Ru-106 less than 1 uCi Eckert & Zieger Analytics	E-RU6-SVE	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
F-S35-SVE S-35 less than 100 uCi Eckert & Zieger Analytics	E-S35-SVE	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-SVE Sb-125 less than 10 uCi Eckert & Zieger Analytics	E-SB5-SVE	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-SVE Se-75 less than 10 uCi Eckert & Zieger Analytics	E-SE5-SVE	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-SVE Si-32 less than 0.1 uCi Eckert & Zieger Analytics	E-SI2-SVE	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-SVE Sm-151 less than 10 uCi Eckert & Zieger Analytics	E-SM1-SVE	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-SVE Sm-153 less than 100 uCi Eckert & Zieger Analytics	E-SM3-SVE	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-SVE Sn-113 less than 10 uCi Eckert & Zieger Analytics	E-SN3-SVE	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-SVE Sr-85 less than 10 uCi Eckert & Zieger Analytics	E-SR5-SVE	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-SVE Sr-89 less than 1 uCi Eckert & Zieger Analytics	E-SR9-SVE	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-SVE Sr-90 less than 0.1 uCi Eckert & Zieger Analytics	E-SR0-SVE	Sr-90		Eckert & Zieger Analytics
E-TA2-SVE Ta-182 less than 10 uCi Eckert & Zieger Analytics	E-TA2-SVE	1 a-182		Eckert & Zieger Analytics
E-TC9-SVE TC-99 less than 10 UCI Eckert & Zieger Analytics	E-IC9-SVE	To 122m		Eckert & Zieger Analytics
E-TEO-OVE TE-TEOTONE TECKET & Zieger Analytics	E-1E3-3VE	TL204		Eckert & Zieger Analytics
E-Y88-SVE Y-88 less than 10 uCi Eckert & Zieger Analytics	E-V88-SVE	V-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y00-SVE Y-90 less than 10 uCi Eckert & Zieger Analytics	E-Y90_SVE	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-SVE Zn-65 less than 10 uCi Eckert & Zieger Analytics	E-ZN5-SVE	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-SVE Zr-93 less than 10 uCi Eckert & Zieger Analytics	E-ZR3-SVE	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-SVE Zr-95 less than 10 uCi Eckert & Zieger Analytics	E-ZR5-SVE	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: SIMULATED VEGETATION Denisty of 500 mL Simulated Vegetation in 500 Marinelli Beaker 1.0 Liter Simulated Vegetation in 130G GA-MA Beaker 4.0 Liter Simulated Vegetation in 430G GA-MA Beaker Drawing E-XXX-SVE	Manufacturer
E-ZR7-SVE	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: SOLID Solid in Liquid Scintillation Vial 500 mL Solid in 500 mL Marinelli Beaker 1.0 Liter Solid in 130G GA-MA Beaker 4.0 Liter Solid in 430G GA-MA Beaker	Manufacturer
	<u>.</u>	Drawing E-XXX-SOL	
E-XXX-SOL	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AGO-SOL	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-SOL	Ba-133		Eckert & Zieger Analytics
E-BI7-SOL	BI-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BIO-SOL	BI-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14-SOL	<u>C-14</u>		Eckert & Zieger Analytics
E-CA5-SOL	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9-SOL	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-SOL	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-SOL	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-SOL	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-SOL	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-SOL	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-SOL	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-SOL	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-SOL	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-SOL	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-SOL	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-SOL	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-SOL	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-SOL	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-SOL	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-SOL	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-SOL	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-SOL	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-SOL	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-SOL	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-SOL	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-SOL	Multinuclide (no Am- 241)	Not exceeding 2.5 uCi (Flame Sealed Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-H-3-SOL	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-SOL	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-SOL	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-125-SOL	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-129-SOL	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-SOL	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-SOL	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-SOL	Ir-192	less than 10 uCi	Eckert & Zieger Analytics

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		Description: SOLID	
		Solid in Liquid Scintillation Vial	
		500 mL Solid in 500 mL Marinelli Beaker	
Model No.	Nuclide	1.0 Liter Solid in 130G GA-MA Beaker	Manufacturer
		4.0 Liter Solid in 430G GA-MA Beaker	
		Drawing E-XXX-SOL	
E-IR4-SOL	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-LU7-SOL	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS-SOL	Multinuclide (no Am-	Not exceeding 3.0 uCi (Flame Sealed	
	241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-MN4-SOL	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-SOL	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-SOL	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-SOL	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-SOL	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-SOL	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-SOL	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-SOL	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-SOL	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-SOL	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-SOL	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-SOL	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-\$35-SOL	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-SOL	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-SOL	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-SOL	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-SOL	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-SOL	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-SOL	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-SOL	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-SOL	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-SOL	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-SOL	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9-SOL	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-SOL	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-SOL	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-SOL	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-SOL	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-SOL	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-SOL	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-SOL	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-SOL	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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## Standard and Radionuclide Button Check Source

	× · · · · · · · · · · · · · · · · · · ·	Description: Button	·
Model Ne	Nualida	1 Inch Diameter x ¼ Inch Thick Nominal	Manufacturer
model no.	Nuchue	Source	Wanutacturer
		Drawing E-XXX-CKS-BUT	
E-XXX-CKS-BUT	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
,			
E-AG0-CKS-BUT	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-CKS-BUT	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7- CKS-BUT	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0- CKS-BUT	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14- CKS-BUT	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5- CKS-BUT	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9- CKS-BUT	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE1- CKS-BUT	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4- CKS-BUT	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6- CKS-BUT	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7- CKS-BUT	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8- CKS-BUT	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0- CKS-BUT	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1- CKS-BUT	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4- CKS-BUT	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7- CKS-BUT	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2- CKS-BUT	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4- CKS-BUT	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-CKS-BUT	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5- CKS-BUT	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9- CKS-BUT	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-CKS-BUT	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-CKS-BUT	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD3-CKS-BUT	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-CKS-BUT	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GE8-CKS-BUT	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GRS-CKS-BUT	Multinuclide (no Am-241)	Not exceeding 2.5 uCi Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-HG3- CKS-BUT	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6- CKS-BUT	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25- CKS-BUT	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-I29- CKS-BUT	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31- CKS-BUT	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-CKS-BUT	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-CKS-BUT	lr-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-CKS-BUT	lr-194	less than 100 uCi	Eckert & Zieger Analytics
E-LU7-CKS-BUT	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS- CKS-BUT	Multinuclide (no Am-241)	Not exceeding 3.0 uCi Ref.: Appendix 10.4	Eckert & Zieger Analytics

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Model No.	Nuclide	<b>Description:</b> Button 1 Inch Diameter x ¼ Inch Thick Nominal Source Drawing E-XXX-CKS-BUT	Manufacturer
E-MN2- CKS-BUT	Mn-52	less than 10 uCi	Eckert & Zieger Analytics
E-MN4- CKS-BUT	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9- CKS-BUT	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2- CKS-BUT	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3- CKS-BUT	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9- CKS-BUT	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32- CKS-BUT	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3- CKS-BUT	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9- CKS-BUT	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7- CKS-BUT	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0- CKS-BUT	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3- CKS-BUT	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6- CKS-BUT	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35- CKS-BUT	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB2- CKS-BUT	Sb-122	less than 100 uCi	Eckert & Zieger Analytics
E-SB4- CKS-BUT	Sb-124	less than 10 uCi	Eckert & Zieger Analytics
E-SB5- CKS-BUT	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-CKS-BUT	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-CKS-BUT	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1- CKS-BUT	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3- CKS-BUT	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3- CKS-BUT	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5- CKS-BUT	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9- CKS-BUT	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0- CKS-BUT	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-CKS-BUT	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9- CKS-BUT	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TL4- CKS-BUT	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88- CKS-BUT	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90- CKS-BUT	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5- CKS-BUT	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-CKS-BUT	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-CKS-BUT	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-CKS-BUT	Zr-97	Less than 10 uCi	Eckert & Zieger Analytics

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Model No.	Nuclide	Description: GAS 3.75 mL Vial with Septum 33 mL Glass Gas Sphere; Pressurized Lecture Bottle; Pressurized Stainless Steel Cylinder Drawing E-XXX-CKS-GAS	Manufacturer
E-XXX-CKS-GAS	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-KR5-CKS-GAS	Kr-85	less than 100 uCi	Eckert & Zieger Analytics
E-XE1 <u>-CKS-GAS</u>	Xe-131m	less than 1000 uCi	Eckert & Zieger Analytics
E-XE3-CKS-GAS	Xe-133	less than 100 uCi	Eckert & Zieger Analytics

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		Description: Liquids	· · · · · · · · · · · · · · · · · · ·
		5 - 50 mL Liquid Flame Sealed Vial	
Model No.	Nuclide	100 – 1000 mL Liquid in Flame Sealed	Manufacturer
		Bottle	
		Drawing E-XXX-CKS-LIQ	
E-XXX-CKS-LIQ	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-CKS-LIQ	Ag-110m	less than 1 uCi	Eckert & Zieger Analytics
E-BA3-CKS-LIQ	Ba-133	less than 10 uCi	Eckert & Zieger Analytics
E-BI7-CKS-LIQ	Bi-207	less than 0.1 uCi	Eckert & Zieger Analytics
E-BI0-CKS-LIQ	Bi-210	less than 1 uCi	Eckert & Zieger Analytics
E-C14-CKS-LIQ	C-14	less than 100 uCi	Eckert & Zieger Analytics
E-CA5-CKS-LIQ	Ca-45	less than 10 uCi	Eckert & Zieger Analytics
E-CD9-CKS-LIQ	Cd-109	less than 10 uCi	Eckert & Zieger Analytics
E-CE9-CKS-LIQ	Ce-139	less than 0.1 uCi	Eckert & Zieger Analytics
E-CE1-CKS-LIQ	Ce-141	less than 100 uCi	Eckert & Zieger Analytics
E-CE4-CKS-LIQ	Ce-144	less than 1 uCi	Eckert & Zieger Analytics
E-CL6-CKS-LIQ	CI-36	less than 10 uCi	Eckert & Zieger Analytics
E-CO7-CKS-LIQ	Co-57	less than 100 uCi	Eckert & Zieger Analytics
E-CO8-CKS-LIQ	Co-58	less than 10 uCi	Eckert & Zieger Analytics
E-CO0-CKS-LIQ	Co-60	less than 1 uCi	Eckert & Zieger Analytics
E-CR1-CKS-LIQ	Cr-51	less than 1 mCi	Eckert & Zieger Analytics
E-CS4-CKS-LIQ	Cs-134	less than 1 uCi	Eckert & Zieger Analytics
E-CS7-CKS-LIQ	Cs-137	less than 10 uCi	Eckert & Zieger Analytics
E-EU2-CKS-LIQ	Eu-152	less than 1 uCi	Eckert & Zieger Analytics
E-EU4-CKS-LIQ	Eu-154	less than 1 uCi	Eckert & Zieger Analytics
E-EU5-CKS-LIQ	Eu-155	less than 10 uCi	Eckert & Zieger Analytics
E-FE5-CKS-LIQ	Fe-55	less than 100 uCi	Eckert & Zieger Analytics
E-FE9-CKS-LIQ	Fe-59	less than 10 uCi	Eckert & Zieger Analytics
E-GA7-CKS-LIQ	Ga-67	less than 100 uCi	Eckert & Zieger Analytics
E-GA1-CKS-LIQ	Ga-71	less than 10 uCi	Eckert & Zieger Analytics
E-GD8-CKS-LIQ	Gd-148	less than 0.1 uCi	Eckert & Zieger Analytics
E-GD3-CKS-LIQ	Gd-153	less than 10 uCi	Eckert & Zieger Analytics
E-GE8-CKS-LIQ	Ge-68	less than 10 uCi	Eckert & Zieger Analytics
E-GE1-CKS-LIQ	Ge-71	less than 100 uCi	Eckert & Zieger Analytics
E-GRS-CKS-LIQ	Multinuclide (no	Not exceeding 2.5 uCi (Flame Sealed	Eckert & Zieger Analytics
	Am-241)	Ampoule/Bottle) Ref.: Appendix 10.4	
E-H-3-CKS-LIQ	H-3	less than 1 mCi	Eckert & Zieger Analytics
E-HG3-CKS-LIQ	Hg-203	less than 10 uCi	Eckert & Zieger Analytics
E-HO6-CKS-LIQ	Ho-166m	less than 0.1 uCi	Eckert & Zieger Analytics
E-I25-CKS-LIQ	I-125	less than 1 uCi	Eckert & Zieger Analytics
E-I29-CKS-LIQ	I-129	less than 0.1 uCi	Eckert & Zieger Analytics
E-I31-CKS-LIQ	I-131	less than 1 uCi	Eckert & Zieger Analytics
E-IN1-CKS-LIQ	In-111	less than 100 uCi	Eckert & Zieger Analytics
E-IR2-CKS-LIQ	Ir-192	less than 10 uCi	Eckert & Zieger Analytics
E-IR4-CKS-LIQ	lr-194	less than 100 uCi	Eckert & Zieger Analytics

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		Description: Liquids	
		5 - 50 mL Liquid Flame Sealed Vial	
Model No.	Nuclide	100 – 1000 mL Liquid in Flame Sealed	Manufacturer
		Bottle	
		Drawing E-XXX-CKS-LIQ	
E-LU7-CKS-LIQ	Lu-177	less than 100 uCi	Eckert & Zieger Analytics
E-MGS-CKS-LIQ	Multinuclide (no	Not exceeding 3.0 uCi (Flame Sealed	
•	Am-241)	Ampoule/Bottle) Ref.: Appendix 10.4	Eckert & Zieger Analytics
E-MN4-CKS-LIQ	Mn-54	less than 10 uCi	Eckert & Zieger Analytics
E-MO9-CKS-LIQ	Mo-99	less than 100 uCi	Eckert & Zieger Analytics
E-NA2-CKS-LIQ	Na-22	less than 10 uCi	Eckert & Zieger Analytics
E-NI3-CKS-LIQ	Ni-63	less than 10 uCi	Eckert & Zieger Analytics
E-NI9-CKS-LIQ	Ni-59	less than 100 uCi	Eckert & Zieger Analytics
E-P32-CKS-LIQ	P-32	less than 10 uCi	Eckert & Zieger Analytics
E-PD3-CKS-LIQ	Pd-103	less than 100 uCi	Eckert & Zieger Analytics
E-PD9-CKS-LIQ	Pd-109	less than 100 uCi	Eckert & Zieger Analytics
E-PM7-CKS-LIQ	Pm-147	less than 10 uCi	Eckert & Zieger Analytics
E-PO0-CKS-LIQ	Po-210	less than 0.1 uCi	Eckert & Zieger Analytics
E-RU3-CKS-LIQ	Ru-103	less than 10 uCi	Eckert & Zieger Analytics
E-RU6-CKS-LIQ	Ru-106	less than 1 uCi	Eckert & Zieger Analytics
E-S35-CKS-LIQ	S-35	less than 100 uCi	Eckert & Zieger Analytics
E-SB5-CKS-LIQ	Sb-125	less than 10 uCi	Eckert & Zieger Analytics
E-SE5-CKS-LIQ	Se-75	less than 10 uCi	Eckert & Zieger Analytics
E-SI2-CKS-LIQ	Si-32	less than 0.1 uCi	Eckert & Zieger Analytics
E-SM1-CKS-LIQ	Sm-151	less than 10 uCi	Eckert & Zieger Analytics
E-SM3-CKS-LIQ	Sm-153	less than 100 uCi	Eckert & Zieger Analytics
E-SN3-CKS-LIQ	Sn-113	less than 10 uCi	Eckert & Zieger Analytics
E-SR5-CKS-LIQ	Sr-85	less than 10 uCi	Eckert & Zieger Analytics
E-SR9-CKS-LIQ	Sr-89	less than 1 uCi	Eckert & Zieger Analytics
E-SR0-CKS-LIQ	Sr-90	less than 0.1 uCi	Eckert & Zieger Analytics
E-TA2-CKS-LIQ	Ta-182	less than 10 uCi	Eckert & Zieger Analytics
E-TC9-CKS-LIQ	Tc-99	less than 10 uCi	Eckert & Zieger Analytics
E-TE3-CKS-LIQ	Te-123m	less than 0.1 uCi	Eckert & Zieger Analytics
E-TL4-CKS-LIQ	TI-204	less than 10 uCi	Eckert & Zieger Analytics
E-Y88-CKS-LIQ	Y-88	less than 10 uCi	Eckert & Zieger Analytics
E-Y90-CKS-LIQ	Y-90	less than 10 uCi	Eckert & Zieger Analytics
E-ZN5-CKS-LIQ	Zn-65	less than 10 uCi	Eckert & Zieger Analytics
E-ZR3-CKS-LIQ	Zr-93	less than 10 uCi	Eckert & Zieger Analytics
E-ZR5-CKS-LIQ	Zr-95	less than 10 uCi	Eckert & Zieger Analytics
E-ZR7-CKS-LIQ	Zr-95	less than 10 uCi	Eckert & Zieger Analytics

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The following Eckert & Ziegler Nuclitec products are exempt quantity sources:

		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 25 mm x 3 mm	Manufacturer
·	,	Active Diameter 16 mm	
		Drawing VZ-1366	
E-XXX-VZ1366	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC	
		Quantity	
E-AG0-VZ1366	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1366	_Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1366	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1366	_C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1366	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1366	_Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1366	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1366	_Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1366	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1366	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1366	_Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1366	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1366	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1366	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1366	_Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1366	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1366	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1366	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1366	_ Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1366	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1366	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1366	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1366	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1366	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1366	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1366	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1366	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1366	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1366	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1366	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-129-VZ1366	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-131-VZ1366	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1366	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1366	lr-192 .	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1366	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1366	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1366	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 25 mm x 3 mm	Manufacturer
		Active Diameter 16 mm	
		Drawing VZ-1366	
E-NA2-VZ1366	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ1366	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1366	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1366	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1366	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1366	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1366	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1366	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1366S	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1366	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1366	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1366	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1366	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1366	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1366	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1366	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1366	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1366	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1366	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1366	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1366	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1366	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1366	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1366	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1366	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1366	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1366	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1366	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1366	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1366	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1366	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1366	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 30 mm x 3 mm	Manufacturer
		Active Diameter 25 mm	
		Drawing VZ-1367	
E-XXX-VZ1367	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC	
		Quantity	· · · · · · · · · · · · · · · · · · ·
E-AG0-VZ1367	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1367	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1367	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1367	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1367	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1367	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1367	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1367	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1367	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1367	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1367	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1367	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1367	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1367	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1367	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1367	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1367	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1367	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1367	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1367	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1367	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1367	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1367	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1367	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1367	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1367	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1367	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1367	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1367	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1367	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1367	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1367	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1367	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1367	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1367	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1367	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1367	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 30 mm x 3 mm	Manufacturer
		Active Diameter 25 mm	
		Drawing VZ-1367	
E-NA2-VZ1367	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ1367	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1367	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1367	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1367	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1367	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1367	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1367	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1367S	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1367	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1367	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1367	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1367	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1367	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1367	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1367	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1367	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1367	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1367	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1367	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1367	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1367	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1367	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1367	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1367	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1367	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1367	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1367	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1367	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1367	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1367	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1367	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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	· .	Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 3 mm	Manufacturer
	-	Active Diameter 36 mm	
		Drawing VZ-1369	
E-XXX-VZ1369	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	Eckert & Ziegler Nuclitec
			Eckert & Ziegler Nuclitec
E-AG0-VZ1369	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1369	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1369	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1369	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1369	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1369	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1369	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1369	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1369	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1369	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1369	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1369	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1369	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1369	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1369	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1369	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1369	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1369	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1369	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1369	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1369	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1369	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1369	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1369	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1369	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1369	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1369	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1369	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1369	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1369	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1369	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1369	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1369	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1369	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1369	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1369	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1369	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1369	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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· · · · · · · · · · · · · · · · · · ·		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 3 mm	Manufacturer
• •		Active Diameter 36 mm	
		Drawing VZ-1369	
E-NI3-VZ1369	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1369	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1369	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1369	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1369	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1369	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1369	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1369	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1369	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1369	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1369	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1369	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1369	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1369	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1369	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1369	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1369	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1369	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1369	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1369	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1369	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1369	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1369	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1369	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1369	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1369	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1369	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1369	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1369	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1369	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1369	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 60 mm x 3 mm	Manufacturer
		Active Diameter 50 mm	
		Drawing VZ-1370	
E-XXX-VZ1370	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
· · ·			·
E-AG0-VZ1370	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1370	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1370	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1370	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1370	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1370	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1370	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1370- '	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1370	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1370	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1370	Co-57 -	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1370	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1370	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1370	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1370	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1370	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1370	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
<u>E-EU4-VZ1370</u>	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1370	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1370	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1370	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1370	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1370	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1370	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1370	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1370	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
<u>E-H-3-VZ1370</u>	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1370	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1370	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-125-VZ1370	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1370	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1370	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1370	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1370	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1370	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1370	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1370	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1370	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 60 mm x 3 mm	Manufacturer
		Active Diameter 50 mm	·
		Drawing VZ-1370	
E-NI3-VZ1370	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1370	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1370	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1370	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1370	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1370	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1370	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1370	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1370	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1370	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1370	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1370	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1370	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1370	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1370	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1370	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1370	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1370	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1370	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1370	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1370	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1370	Ta- <u>182</u>	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1370	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1370	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1370	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1370	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1370	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1370	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1370	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1370	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1370	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Alunimum	
		Planchet Source	
Model No.	Nuclide	Overall Diameter 194 mm x 3 mm	Manufacturer
•		Active Diameter 190 mm	
	· /	Drawing VZ-615	
E-XXX-VZ615	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
	· · · · · · · · · · · · · · · · · · ·		
E-AG0-VZ615	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ615	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ615	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ615	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ615	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ615	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ615	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ615	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ615	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ615	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ615	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ615	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ615	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ615	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ615	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ615	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ615	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ615	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ615	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ615	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ615	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ615	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ615	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ615	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ615	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ615	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ615	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ615	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ615	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ615	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ615	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ615	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ615	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ615	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ615	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ615	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ615	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ615	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Alunimum	
		Planchet Source	·
Model No.	Nuclide	Overall Diameter 194 mm x 3 mm	Manufacturer
		Active Diameter 190 mm	
		Drawing VZ-615	
E-NI3-VZ615	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ615	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ615	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ615	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ615	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ615	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ615	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ615	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ615	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ615	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ615	Sb-122	less than 10 úCi	Eckert & Ziegler Nuclitec
E-SB4-VZ615	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ615	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ615	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ615	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ615	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ615	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ615	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ615	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ615	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ615	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ615	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ615	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ615	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ615	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ615	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ615	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ615	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ615	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ615	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ615	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Alunimum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 0.8 mm	Manufacturer
		Active Diameter 40.6 mm	
		Drawing VZ-1688	
E-XXX-VZ1688	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	· · ·
· · ·			
E-AG0-VZ1688	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1688	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1688	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1688	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1688	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1688	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1688	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1688	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1688	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1688	Cl-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1688	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1688	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1688	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1688	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1688	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1688	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1688	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1688	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1688	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1688	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1688	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1688	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1688	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1688	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1688	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1688	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1688	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1688	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1688	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1688	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1688	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1688	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1688	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1688	Ir-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1688	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1688	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1688	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1688	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Alunimum Disk	· · ·
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 0.8 mm	Manufacturer
		Active Diameter 40.6 mm	
		Drawing VZ-1688	
E-NI3-VZ1688	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1688	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1688	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1688	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1688	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1688	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1688	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1688	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1688	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1688	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1688	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1688	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1688	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1688	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1688	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1688	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1688	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1688	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1688	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1688	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1688	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1688	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1688	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1688	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1688	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1688	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1688	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1688	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1688	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1688	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1688	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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•		Description: Anodized Alunimum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 47 mm x 0.8 mm	Manufacturer
		Active Diameter 40 mm	
		Drawing VZ-1964	
E-XXX-VZ1964	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-VZ1964	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1964	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1964	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclited
E-C14-VZ1964	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1964	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1964	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1964	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1964	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1964	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1964	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1964	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1964	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1964	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1964	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1964	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1964	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1964	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1964	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1964	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1964	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1964	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1964	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1964	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1964	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1964	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1964	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1964	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1964	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1964	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-125-VZ1964	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1964	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1964	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1964	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1964	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1964	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1964	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1964	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1964	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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	· · ·	Description: Anodized Alunimum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 47 mm x 0.8 mm	Manufacturer
		Active Diameter 40 mm	
		Drawing VZ-1964	
E-NI3-VZ1964	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1964	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1964	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1964	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1964	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1964	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1964	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1964	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1964	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1964	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1964	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1964	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1964	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1964	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1964	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1964	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1964	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1964	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1964	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1964	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1964	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1964	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1964	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1964	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1964	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1964	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1964	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1964	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1964	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1964	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1964	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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······		Description: Anodized Stainless Steel	
		Planchet Source	· · ·
Model No.	Nuclide	Overall Diameter 50 mm x 3 mm	Manufacturer
		Active Diameter 49 mm	
		Drawing VZ-1430	
E-XXX-VZ1430	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-VZ1430	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1430	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1430	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1430	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1430	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1430	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1430	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1430	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1430	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1430	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1430	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1430	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1430	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1430	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1430	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1430	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1430	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1430	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1430	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1430	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1430	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1430	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1430	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1430	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1430	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1430	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
<u>E-H-3-VZ1430</u>	<u>H-3</u>	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1430	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1430	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1430	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1430	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1430	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1430	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1430	Ir-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1430	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1430	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1430	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1430	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Stainless Steel	
		Planchet Source	
Model No.	Nuclide	Overall Diameter 50 mm x 3 mm	Manufacturer
		Active Diameter 49 mm	
		Drawing VZ-1430	
E-NI3-VZ1430	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1430	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1430	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1430	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1430	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1430	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1430	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1430	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1430	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1430	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1430	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1430	Sb-124 ·	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1430	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1430	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1430	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1430	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1430	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1430	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1430	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1430	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1430	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1430	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1430	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1430	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1430	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1430	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1430	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1430	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1430	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1430	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1430	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Stainless Steel Planchet Source Overall Diameter 60 mm x 3 mm Active Diameter 58 mm Drawing VZ-1431	Manufacturer
F-XXX-V/71431	XXX=Nuclide	Refer to nuclide in Appendix 10.1 NRC Quantity	· · · · · · · · · · · · · · · · · · ·
27000 021101			
E-AG0-VZ1431	Aq-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1431	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1431	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1431	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1431	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1431	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1431	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1431	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1431	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1431	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1431	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1431	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1431	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1431	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1431	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1431	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1431	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1431	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1431	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1431	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1431	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1431	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1431	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1431	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1431	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1431	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1431	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1431	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1431	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1431	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1431	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1431	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1431	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1431	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1431	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1431	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1431	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1431	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Stainless Steel Planchet Source Overall Diameter 60 mm x 3 mm	Manufacturer
	· ·	Active Diameter 58 mm	
		Drawing VZ-1431	· · ·
E-NI3-VZ1431	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1431	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1431	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1431	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1431	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1431	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1431	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1431	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1431	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1431	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1431	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1431	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1431	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1431	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1431	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1431	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1431	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1431	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1431	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1431	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1431	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1431	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1431	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1431	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1431	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1431	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1431	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1431	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1431	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1431	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1431	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Stainless Steel Planchet Source Overall Diameter 216 mm x 12 mm Active Diameter 197 mm Drawing VZ-339	Manufacturer
E-XXX-VZ339	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	· · · · · · · · · · · · · · · · · · ·
E-AG0-VZ339	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ339	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ339	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ339	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ339	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ339	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ339	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ339	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ339	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ339	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ339	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ339	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ339	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ339	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ339	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ339	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ339	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ339	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ339	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ339	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ339	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ339	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ339	.Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ339	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ339	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ339	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ339	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ339	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ339	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-125-VZ339	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-129-VZ339	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-l31-VZ339	<u>l-131</u>	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ339	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ339	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ339	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ339	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ339	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ339	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		<b>Description: Anodized Stainless Steel</b>	
		Planchet Source	
Model No.	Nuclide	Overall Diameter 216 mm x 12 mm	Manufacturer
		Active Diameter 197 mm	<i>.</i>
		Drawing VZ-339	
E-NI3-VZ339	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ339	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ339	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ339	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ339	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ339	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ339	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ339	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ339	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ339	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ339	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ339	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ339	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ339	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ339	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ339	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ339	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ339	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ339	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ339	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ339	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ339	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ339	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ339	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ339	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ339	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ339	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ339	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ339	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ339	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ339	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No	Nuclide	Description: Anodized Stainless Steel Planchet Source Overall Diameter 60 mm x 8 mm	Manufacturer
model ne.	Indonatio	Active Diameter 58 mm	
		Drawing VZ-1392	
E-XXX-VZ1392	XXX=Nuclide	Refer to nuclide in Appendix 10.1. NRC Quantity	
E-AG0-VZ1392	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1392	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1392	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1392	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1392	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1392	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1392	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1392	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1392	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1392	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1392	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1392	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1392	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1392	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1392	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1392	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1392	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1392	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1392	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1392	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1392	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1392	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1392	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1392	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1392	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1392	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1392	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1392	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1392	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1392	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1392	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1392	-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1392	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1392	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1392	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1392	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1392	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1392	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Stainless Steel	
		Planchet Source	
Model No.	Nuclide	Overall Diameter 60 mm x 8 mm	Manufacturer
		Active Diameter 58 mm	
		Drawing VZ-1392	
E-NI3-VZ1392	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1392	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1392	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1392	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1392	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1392	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1392	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1392	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1392	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1392	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1392	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1392	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1392	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1392	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1392	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1392	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1392	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1392	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1392	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1392	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1392	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1392	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1392	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1392	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1392	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1392	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1392	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1392	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1392	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1392	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1392	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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	Τ	Description: Anodized Aluminum Plate	
		Source	· ·
Madal Na	Nevellala	Overall Diameter 120 mm x 120 mm x 3	BA - mufa - fuman
	NUCIIde	mm	Manufacturer
		Active Diameter 100 mm x 100 mm	
		Drawing VZ-626	
E-XXX-VZ626	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AGU-VZ626	Ag-110m		Eckert & Ziegler Nuclitec
E-BA3-VZ626	Ba-133		Eckert & Ziegler Nuclitec
E-DI/-VZ020	BI-207		Eckert & Ziegler Nuclitec
E-C14-VZ626	0-14		Eckert & Ziegler Nuclitec
E-CA5-VZ626	Ca-45		Eckert & Ziegler Nuclitec
E-CD9-VZ626			Eckert & Ziegler Nuclitec
E-CE9-VZ626	Ce-139		Eckert & Ziegler Nuclitec
E-CE1-VZ626	Ce-141		Eckert & Ziegler Nuclitec
E-CE4-V2626	Ce-144		Eckert & Ziegler Nuclitec
E-CL6-VZ626			Eckert & Ziegler Nuclitec
E-CO7-VZ626	0.57		Eckert & Ziegler Nuclitec
E-CO8-V2626	0.00		Eckert & Ziegler Nuclitec
E-CO0-V2626	Co-60	less than 1 uCl	Eckert & Ziegier Nuclitec
E-CR1-VZ626	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ626	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ626	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ626	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ626	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ626	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ626	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ626	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ626	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ626	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ626	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ626	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ626	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ626	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ626	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ626	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ626	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-129-VZ626	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ626	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ626	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ626	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ626	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ626	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ626	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Plate	
		Source	
		Overall Diameter 120 mm x 120 mm x 3	
Model No.	Nuclide	mm	Manufacturer
		Active Diameter 100 mm x 100 mm	
	۰ ۱	Drawing VZ-626	
E-NA2-VZ626	Na-22	less than 10 uCi	Eckert & Ziealer Nuclitec
E-NI3-VZ626	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ626	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ626	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ626	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ626	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ626	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ626	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ626	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ626	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ626	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ626	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ626	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ626	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ626	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ626	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ626	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ626	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ626	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ626	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ626	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ626	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ626	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ626	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ626	<u>Te-123m</u>	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ626	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ626	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ626	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ626	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ626	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ626	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ626	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Aluminum Plate Source Overall Diameter 120 mm x 170 mm x 3 mm Active Diameter 100 mm x 150 mm Drawing VZ-628	Manufacturer
E-XXX-VZ628	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-VZ628	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ628	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ628	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ628	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ628	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ628	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ628	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ628	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ628	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ628	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ628	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ628	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ628	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ628	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ628	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ628	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ628	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ628	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ628	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ628	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ628	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ628	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ628	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ628	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ628	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ628	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ628	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ628	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ628	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-125-VZ628	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-129-VZ628	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ628	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ628	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ628	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ628	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ628	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ628	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Plate	×.
		Source	
Madel No	Nuclida	Overall Diameter 120 mm x 170 mm x 3	Manufactures
wodel No.	Nucilae	mm	wanutacturer
		Active Diameter 100 mm x 150 mm	
-		Drawing VZ-628	· .
E-NA2-VZ628	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ628	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ628	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ628	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ628	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ628	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ628	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ628	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ628	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ628	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ628	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ628	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ628	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ628	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ628	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ628	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ628	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ628	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ628	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ628	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ628	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ628	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ628	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ628	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ628	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ628	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ628	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ628	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ628	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ628	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ628	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ628	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Aluminum Photon Source Overall Diameter 150 mm x 150 mm x 3 mm Active Diameter 100 mm x 100 mm Drawing VZ-1658	Manufacturer
E-XXX-VZ1658	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-FE5-VZ1658	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec

Nuclide	Description: Photon Source Overall Diameter 150 mm x 150 mm x 3 mm Active Diameter 100 mm x 100 mm 200 mg/cm2 Stainless Steel Drawing VZ-1776	Manufacturer
XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	· · ·
Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
	Nuclide XXX=Nuclide Co-57	Nuclide Description: Photon Source Overall Diameter 150 mm x 150 mm x 3 mm Active Diameter 100 mm x 100 mm 200 mg/cm2 Stainless Steel Drawing VZ-1776   XXX=Nuclide Refer to nuclide in Appendix 10.1, NRC Quantity   Co-57 less than 100 uCi

Model No.	Nuclide	Description: Photon Source Overall Diameter 150 mm x 150 mm x 3 mm Active Diameter 100 mm x 100 mm 800 mg/cm2 Stainless Steel Drawing VZ-2162	Manufacturer
E-XXX-VZ2162	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ2162	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Photon Source Overall Diameter 150 mm x 150 mm x 3 mm Active Diameter 100 mm x 100 mm 81 mg/cm2 Aluminum Drawing VZ-1898	Manufacturer
E-XXX-VZ1898	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CO0-VZ1898	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Gamma Reference Source Overall Diameter 50 mm x 3 mm Active Diameter 32 mm Drawing VZ-2130	Manufacturer
E-XXX-VZ2130	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-I29-VZ2130	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Photon Source Overall Diameter 120 mm x 170 mm x 5 mm Active Diameter 100 mm x 150 mm Drawing VZ-1958	Manufacturer
E-XXX-VZ1958	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-I29-VZ1958	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec

Nuclide	Description: Anodized Aluminum LadderSource Overall Diameter 2020 mm x 267 mm Active Diameter 100 mm x 100 mm each source (6) Drawing VZ-1634	Manufacturer
XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
	Nuclide XXX=Nuclide Co-60 Cs-137	Nuclide Description: Anodized Aluminum LadderSource   Nuclide Overall Diameter 2020 mm x 267 mm Active Diameter 100 mm x 100 mm each source (6) Drawing VZ-1634   XXX=Nuclide Refer to nuclide in Appendix 10.1, NRC Quantity   Co-60 less than 1 uCi   Cs-137 less than 10 uCi

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Model No.	Nuclide	Description: Anodized Beta Stainless Steel Source Overall Diameter 87 mm x 50 mm x 1 mm Active Diameter 19 mm Drawing VZ-2020	Manufacturer
E-XXX-VZ2020	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CL6-VZ2020	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ2020	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ2020	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ2020	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Stainless Steel Beta Reference Source Overall Diameter 87 mm x 50 mm x 1 mm Active Diameter 19 mm Drawing VZ-2029	Manufacturer
E-XXX-VZ2029	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	· · · · · · · · · · · · · · · · · · ·
E-SR0-VZ2029	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Plate	
	,	Source	
		Overall Diameter 113 mm x 310 mm x 50	
Model No.	Nuclide	mm	Manufacturer
		Active Diameter 100 mm x 100 mm	
		Drawing V7-1614-001	
F-XXX-\/71614	XXX=Nuclide	Refer to nuclide in Appendix 10.1 NRC Quantity	
2700( 121014		There is hadine in Appendix 10.1, Mile Quantity	·····
E-AG0-VZ1614	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1614	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1614	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1614	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1614	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1614	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1614	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1614	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1614	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1614	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1614	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1614	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1614	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1614	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1614	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1614	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1614	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1614	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1614	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1614	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1614	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1614	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1614	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1614	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1614	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1614	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1614	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1614	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1614	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1614	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1614	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1614	<u>I-131</u>	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1614	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1614	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1614	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1614	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1614	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Plate	
		Source	
	NI 17 1	Overall Diameter 113 mm x 310 mm x 50	Maria Cartanan
wodel No.	Nuclide	mm	wanutacturer
		Active Diameter 100 mm x 100 mm	
		Drawing VZ-1614-001	
E-NA2-VZ1614	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ1614	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1614	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1614	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1614	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1614	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1614	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1614	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1614	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1614	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1614	S-35	less than 100 uCi	Eckert & Ziegler Nuclitéc
E-SB2-VZ1614	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1614	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1614	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1614	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1614	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1614	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1614	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1614	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1614	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1614	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1614	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1614	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1614	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1614	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1614	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1614	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1614	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1614	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1614	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1614	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1614	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Aluminum Plate Source Overall Diameter 113 mm x 310 mm x 50 mm Active Diameter 150 mm x 100 mm Drawing VZ-1684-001	Manufacturer
E-XXX-VZ1684	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-VZ1684	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ1684	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ1684	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1684	<u>C-14</u>	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1684	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1684	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1684	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1684	<u>Ce-141</u>	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1684	<u>Ce-144</u>	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1684	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1684	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1684	<u>Co-58</u>	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ1684	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ1684	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ1684	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ1684	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ1684	Eu- <u>152</u>	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1684	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1684	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1684	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1684	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1684	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1684	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1684	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1684	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1684	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1684	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1684	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ1684	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ1684	1-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ1684	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ1684	I-13 <u>1</u>	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1684	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1684	Ir-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1684	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1684	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1684	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec

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		<b>Description: Anodized Aluminum Plate</b>	
		Source	
BR a shall be	<b></b>	Overall Diameter 113 mm x 310 mm x 50	
wodel No.	Nuclide	mm	Manufacturer
		Active Diameter 150 mm x 100 mm	
		Drawing VZ-1684-001	
E-NA2-VZ1684	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ1684	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1684	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ1684	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1684	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1684	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1684	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1684	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1684	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1684	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ1684	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1684	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ1684	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ1684	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1684	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1684	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1684	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1684	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1684	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1684	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1684	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1684	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1684	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1684	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1684	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1684	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1684	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1684	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1684	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1684	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1684	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1684	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
		Source	
Model No.	Nuclide	Overall Diameter 25 mm x 3 mm	Manufacturer
	· .	Active Diameter 16 mm & 7 mm	-
		Drawing VZ-599	
E-XXX-VZ599	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-AG0-VZ599	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ599	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ599	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ599	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ599	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ599	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ599	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ599	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ599	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ599	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ599	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ599	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ599	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ599	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ599	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ599	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ599	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ599	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ599	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ599	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ599	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ599	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ599	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ599	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ599	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ599	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ599	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ599	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ599	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ599	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ599	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ599	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ599	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ599	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ599	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ599	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ599	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ599	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	
•		Source	
Model No.	Nuclide	Overall Diameter 25 mm x 3 mm	Manufacturer
		Active Diameter 16 mm & 7 mm	· .
		Drawing VZ-599	
E-NI3-VZ599	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ599	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ599	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ599	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ599	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ599	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ599	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ599	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ599	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ599	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ599	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ599	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ599	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ599	, Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ599	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ599	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ599	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ599	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ599	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ599	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ599	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ599	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ599	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ599	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ599	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ599	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ599	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ599	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ599	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ599	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ599	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	=
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 4 mm	Manufacturer
. ,	· · · ·	Active Diameter 36 mm & 7 mm	
		Drawing VZ-605	
E-XXX-VZ605	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	•
	······································	······································	
E-AG0-VZ605	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ605	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ605	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ605	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ605	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ605	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ605	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ605	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ605	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ605	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ605	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ605	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ605	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ605	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ605	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ605	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ605	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ605	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ605	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ605	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ605	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ605	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ605	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ605	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ605	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ605	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ605	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ605	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ605	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I25-VZ605	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ605	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ605	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ605	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ605	Ir-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ605	lr-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ605	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ605	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ605	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Anodized Aluminum Disk	· · ·
		Source	
Model No.	Nuclide	Overall Diameter 50 mm x 4 mm	Manufacturer
		Active Diameter 36 mm & 7 mm	
		Drawing VZ-605	
E-NI3-VZ605	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ605	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ605	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ605	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ605	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ605	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ605	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ605	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ605	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ605	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ605	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ605	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ605	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ605	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ605	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ605	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ605	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ605	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ605	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ605	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ605	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ605	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ605	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ605	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ605	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ605	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ605	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ605	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ605	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ605	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ605	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Anodized Aluminum Source Overall Diameter 134 mm x 210 mm Active Diameter 10 mm x 75 mm Drawing VZ-1610	Manufacturer
E-XXX-VZ1610	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-H-3-VZ1610	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Anodized Aluminum Plate Source Overall Diameter 86 mm x 226 mm Active Diameter 15 mm x 152 mm Drawing VZ-1516	Manufacturer
E-XXX-VZ1516	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-H-3-VZ1516	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Ceramic Pellet Source Mounted in Brass Capsule Drawing VZ-269	Manufacturer
E-XXX-VZ269	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ269	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Ion Exchange Resin Bead Source Mounted in Stainless Steel Capsulre Drawing VZ-296 and VZ-297	Manufacturer
E-XXX-VZ296	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ296	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Plastic Foil Source Mounted on Aluminum Backing Plate Placed in a Teflon Jig Active Diameter 32 mm Drawing VZ-2044 and JIG Z-2012	Manufacturer
E-XXX-VZ2044	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-FE5-VZ2044	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Glass Disk Source Sealed in Stainless Steel Capsule Active Diameter 5.8 mm Drawing VZ-2134	Manufacturer
E-XXX-VZ2134	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ2134	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Ceramic Disk Source Fixed on Bronze spring and welded in Stainless Steel Capsule Drawing VZ-542	Manufacturer
E-XXX-VZ542	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ542	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
<u> </u>			Eckert & Ziegier Huentee

Model No.	Nuclide	Description: Ceramic Disk Source Fixed on Bronze spring and welded in Stainless Steel Capsule Drawing VZ-543	Manufacturer
E-XXX-VZ543	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ543 E-CS7-VZ543	Cs-137 Co-60	less than 10 uCi less than 1 uCi	Eckert & Ziegler Nuclitec Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Ceramic Pellet Source Welded in Stainless Steel Capsule Drawing VZ-2936-001	Manufacturer
E-XXX-VZ2936	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ2936	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Ceramic Disk Source Welded in Stainless Steel Capsule Drawing VZ-130	Manufacturer
E-XXX-VZ130	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	-
E-CS7-V7130	Ce-137	less than 10 uCi	
L-037-V2130	03-137		

Model No.	Nuclide	Description: Ceramic Pellet Source Welded in Stainless Steel Capsule Drawing VZ-1145	Manufacturer
E-XXX-VZ1145	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
	· · ·		
E-CS7-VZ1145	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
· .			

Model No.	Nuclide	Description: Ceramic Disk Source Welded in Stainless Steel Capsule Drawing VZ-2733	Manufacturer
E-XXX-VZ2733	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
		× .	
E-CS7-VZ2733	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: C-14 Salt Deposited on Aluminum or Aluminized Plastic Mounted in Aluminum Capsule Drawing VZ-623	Manufacturer
E-XXX-VZ623	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ623	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: C-14 Salt Deposited on Aluminum or Aluminized Plastic Mounted in Aluminum Capsule Drawing VZ-3686	Manufacturer
E-XXX-VZ3686	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ3686	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description: Sodium Salt Laminated and Sealed Between Plastic Foils Drawing VZ-3549	Manufacturer
E-XXX-VZ3549	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-NA2-VZ3549	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Ion Exchange Bead in Plastic Holder Overall Diameter 23.5 mm x 11 mm x 2 mm	Manufacturer
		Drawing VZ-1240	
E-XXX-VZ1240	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E AG0 1/71240	Δq-110m	loss than 1 uCi	Eckort & Ziegler Nuclited
E-RG0-V21240	Ba-133	less than 10 µCi	Eckert & Ziegler Nuclitec
E-BI7-V71240	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ1240	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ1240	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ1240	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ1240	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ1240	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ1240	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ1240	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ1240	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ1240	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-COU-VZ1240	Co-60		Eckert & Ziegler Nuclitec
E - CR I - VZ I 240	Ce-134		Eckert & Ziegler Nuclitec
$E_{CS7}/71240$	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-V71240	Fu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ1240	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ1240	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ1240	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ1240	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ1240	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ1240	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ1240	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ1240	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ1240	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ1240	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ1240	Hg-203		Eckert & Ziegler Nuclitec
E-00-VZ1240			Eckert & Ziegler Nuclitec
E-129-VZ1240	I-120	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-129-V21240	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ1240	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ1240	lr-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ1240	Ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ1240	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ1240	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ1240	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ1240	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI9-VZ1240	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec

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		Description: Ion Exchange Bead in	
		Plastic Holder	
Model No.	Nuclide	Overall Diameter 23.5 mm x 11 mm x 2	Manufacturer
	-	mm	
		Drawing VZ-1240	
E-P32-VZ1240	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ1240	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ1240	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ1240	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ1240	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ1240	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ1240	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-\$35-VZ1240	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ1240	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-\$B4-VZ1240	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-\$B5-VZ1240	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ1240	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ1240	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ1240	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ1240	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ1240	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ1240	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ1240	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ1240	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ1240	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ1240	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ1240	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ1240	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ1240	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ1240	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ1240	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ1240	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ1240	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ1240	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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		Description: Ion Exchange Bead in	
	Mara Bala	Plastic Holder	<b>N A A A A A A A A A A</b>
Wodel No.	NUCIIde	Overall Diameter 25 mm x 3 mm	Manufacturer
		Drawing VZ-477	
E-XXX-VZ477	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	Eckert & Ziegler Nuclitec
			Eckert & Ziegler Nuclitec
E-AG0-VZ477	Ag-110m	less than 1 uCi	Eckert & Ziegler Nuclitec
E-BA3-VZ477	Ba-133	less than 10 uCi	Eckert & Ziegler Nuclitec
E-BI7-VZ477	Bi-207	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-C14-VZ477	C-14	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CA5-VZ477	Ca-45	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CD9-VZ477	Cd-109	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CE9-VZ477	Ce-139	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-CE1-VZ477	Ce-141	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CE4-VZ477	Ce-144	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CL6-VZ477	CI-36	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO7-VZ477	Co-57	less than 100 uCi	Eckert & Ziegler Nuclitec
E-CO8-VZ477	Co-58	less than 10 uCi	Eckert & Ziegler Nuclitec
E-CO0-VZ477	Co-60	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CR1-VZ477	Cr-51	less than 1 mCi	Eckert & Ziegler Nuclitec
E-CS4-VZ477	Cs-134	less than 1 uCi	Eckert & Ziegler Nuclitec
E-CS7-VZ477	Cs-137	less than 10 uCi	Eckert & Ziegler Nuclitec
E-EU2-VZ477	Eu-152	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU4-VZ477	Eu-154	less than 1 uCi	Eckert & Ziegler Nuclitec
E-EU5-VZ477	Eu-155	less than 10 uCi	Eckert & Ziegler Nuclitec
E-FE5-VZ477	Fe-55	less than 100 uCi	Eckert & Ziegler Nuclitec
E-FE9-VZ477	Fe-59	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GA7-VZ477	Ga-67	less than 100 uCi	Eckert & Ziegler Nuclitec
E-GA1-VZ477	Ga-71	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GD3-VZ477	Gd-153	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE8-VZ477	Ge-68	less than 10 uCi	Eckert & Ziegler Nuclitec
E-GE1-VZ477	Ge-71	less than 100 uCi	Eckert & Ziegler Nuclitec
E-H-3-VZ477	H-3	less than 1 mCi	Eckert & Ziegler Nuclitec
E-HG3-VZ477	Hg-203	less than 10 uCi	Eckert & Ziegler Nuclitec
E-HO6-VZ477	Ho-166m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-125-VZ477	I-125	less than 1 uCi	Eckert & Ziegler Nuclitec
E-I29-VZ477	I-129	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-I31-VZ477	I-131	less than 1 uCi	Eckert & Ziegler Nuclitec
E-IN1-VZ477	In-111	less than 100 uCi	Eckert & Ziegler Nuclitec
E-IR2-VZ477	Ir-192	less than 10 uCi	Eckert & Ziegler Nuclitec
E-IR4-VZ477	ir-194	less than 100 uCi	Eckert & Ziegler Nuclitec
E-MN4-VZ477	Mn-54	less than 10 uCi	Eckert & Ziegler Nuclitec
E-MO9-VZ477	Mo-99	less than 100 uCi	Eckert & Ziegler Nuclitec
E-NA2-VZ477	Na-22	less than 10 uCi	Eckert & Ziegler Nuclitec
E-NI3-VZ477	Ni-63	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No	Nuclide	Plastic Holder	Manufacturer
moder no.	Nuchue	Overall Diameter 25 mm x 3 mm	Manufacturer
		Drawing VZ-477	
E-NI9-VZ477	Ni-59	less than 100 uCi	Eckert & Ziegler Nuclitec
E-P32-VZ477	P-32	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PD3-VZ477	Pd-103	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PD9-VZ477	Pd-109	less than 100 uCi	Eckert & Ziegler Nuclitec
E-PM7-VZ477	Pm-147	less than 10 uCi	Eckert & Ziegler Nuclitec
E-PO0-VZ477	Po-210	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-RU3-VZ477	Ru-103	less than 10 uCi	Eckert & Ziegler Nuclitec
E-RU6-VZ477	Ru-106	less than 1 uCi	Eckert & Ziegler Nuclitec
E-S35-VZ477	S-35	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SB2-VZ477	Sb-122	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB4-VZ477	Sb-124	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SB5-VZ477	Sb-125	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SE5-VZ477	Se-75	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SI2-VZ477	Si-32	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-SM1-VZ477	Sm-151	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SM3-VZ477	Sm-153	less than 100 uCi	Eckert & Ziegler Nuclitec
E-SN3-VZ477	Sn-113	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR5-VZ477	Sr-85	less than 10 uCi	Eckert & Ziegler Nuclitec
E-SR9-VZ477	Sr-89	less than 1 uCi	Eckert & Ziegler Nuclitec
E-SR0-VZ477	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TA2-VZ477	Ta-182	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TC9-VZ477	Tc-99	less than 10 uCi	Eckert & Ziegler Nuclitec
E-TE3-VZ477	Te-123m	less than 0.1 uCi	Eckert & Ziegler Nuclitec
E-TL4-VZ477	TI-204	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y88-VZ477	Y-88	less than 10 uCi	Eckert & Ziegler Nuclitec
E-Y90-VZ477	Y-90	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZN5-VZ477	Zn-65	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR3-VZ477	Zr-93	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR5-VZ477	Zr-95	less than 10 uCi	Eckert & Ziegler Nuclitec
E-ZR7-VZ477	Zr-97	less than 10 uCi	Eckert & Ziegler Nuclitec

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Model No.	Nuclide	Description: Sr-90 Beta Source Overall Diameter 25 mm x 0.8 mm Active Diameter 24 mm Drawing VZ-3493	Manufacturer
E-XXX-VZ3493	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ3493	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec

Model No.	Nuclide	Description Sr-90 Beta Source Overall Diameter 50 mm x 5 mm Active Diameter 44.45 mm Drawing VZ-3494	Manufacturer
E-XXX-VZ3494	XXX=Nuclide	Refer to nuclide in Appendix 10.1, NRC Quantity	
E-CS7-VZ3494	Sr-90	less than 0.1 uCi	Eckert & Ziegler Nuclitec

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# Appendix 10.3: Instructions for Possession, Use, and Disposal

### (Suggested text for FORM ANA-HP-16-01: "Important Instructions for Exempt Material")

# IMPORTANT

#### INSTRUCTIONS FOR POSSESSION, USE, AND DISPOSAL OF EXEMPT RADIOACTIVE MATERIAL

The enclosed contents of Radioactive Material are exempt from NRC or Agreement State licensing requirements.

These contents are Radioactive Material - Not for Human Use -

# HANDLING

- Although the quantities of radioactive material contained in these products is extremely small, the basic radiation principals of time, distance, and shielding should be practiced as effective methods for minimizing exposure.
- Use of radioactive material should be only by responsible persons in authorized areas.
- Introduction into foods, beverages, cosmetics, drugs, or medicinals, or into products manufactured for commercial distribution is prohibited.
- Gloves, safety glasses, and laboratory coats should be worn when working with liquid radioactive material.

### USE

- Disk sources should be held by the metal or plastic sides or back. Be careful not to damage any foil used to cover the radioactive material.
- Liquid sources should be handled in such a way as to minimize spillage of the liquid on fingers or unprepared surfaces.
- Exempt quantities should not be combined.

### Eckert & Ziegler Analytics 1380 Seaboard Industrial Blvd Atlanta, GA 30318 Tel 404-352-8677 Fax 404-352-2837

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# IMPORTANT

#### INSTRUCTIONS FOR POSSESSION, USE, AND DISPOSAL OF EXEMPT RADIOACTIVE MATERIAL

## CONTAMINATION

• Loose radioactive material may be cleaned up with small quantities of detergent in water and absorbent materials.

# STORAGE

• Store all sources in a secured container with visible identification when not in use.

# DISPOSAL

• This product may be disposed of without regard to its radioactive content provided all radiation symbols have been removed or defaced.

These instructions apply only to the exempt material shipped by Eckert & Ziegler Analytics and are meant as guidelines for your safe handling of the sources. Radioactive material possessed under a specific license from the NRC or an Agreement State must be handled in accordance with those specific license requirements.

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# Appendix 10.4: Description of Mixed Gamma Standard Options

Mixed Gamma Series - maximum activity for an Exempt Quantity source is 3.5 uCi total

	Exempt	Activity in a 3.5
Nuclides	Qty Limit	uCi source
<sup>109</sup> Cd	10 uCi	2.590 uCi
<sup>57</sup> Co	100 uCi	0.057 uCi
<sup>139</sup> Ce	0.1 uCi	0.085 uCi
<sup>203</sup> Hg	10 uCi	0.189 uCi
<sup>113</sup> Sn	10 uCi	0.148 uCi
<sup>137</sup> Cs	10 uCi	0.071 uCi
<sup>60</sup> Co	1 uCi	0.113 uCi
<sup>88</sup> Y	10 uCi	0.247 uCi

Mixed Gamma-Ray Series - maximum activity for an Exempt Quantity source is 6.0 uCi total

	Exempt	Activity in a 6.0
Nuclides	Qty Limit	uCi source
<sup>109</sup> Cd	10 uCi	2.530 uCi
<sup>57</sup> Co	100 uCi	0.060 uCi
<sup>139</sup> Ce	0.1 uCi	0.085 uCi
<sup>51</sup> Cr	10 uCi	2.540 uCi
<sup>113</sup> Sn	10 uCi	0.140 uCi
<sup>85</sup> Sr	10 uCi	0.200 uCi
<sup>137</sup> Cs	10 uCi	0.075 uCi
<sup>60</sup> Co	1 uCi	0.120 uCi
<sup>88</sup> Y	10 uCi	0.250 uCi

Tri-Nuclide Series - maximum activity for an Exempt Quantity source is 2.1 uCi total

Nuclides	Exempt Qty Limit	Activity in a 2.1 uCi source
<sup>154</sup> Eu	1 uCi	0.84 uCi
<sup>155</sup> Eu	10 uCi	0.42 uCi
<sup>125</sup> Sb	10 uCi	0.84 uCi

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Mixed Gamma -TCC Series - maximum activity for an Exempt Quantity source is 4.1 uCi total

	Exempt	Activity in a 4.1
Nuclides	Qty Limit	uCi source
<sup>109</sup> Cd	10 uCi	2.450 uCi
<sup>57</sup> Co	100 uCi	0.070 uCi
<sup>139</sup> Ce	0.1 uCi	0.080 uCi
<sup>203</sup> Hg	10 uCi	0.180 uCi
<sup>113</sup> Sn	10 uCi	0.120 uCi
<sup>134</sup> Cs	1 uCi	0.280 uCi
<sup>137</sup> Cs	10 uCi	0.070 uCi
<sup>54</sup> Mn	10 uCi	0.150 uCi
<sup>88</sup> Y	10 uCi	0.290 uCi
<sup>65</sup> Zn	10 uCi	0.410 uCi

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# **Analytics**

# QUALITY ASSURANCE MANUAL

Revision 17

May 15, 2009

Eckert & Ziegler Analytics • 1380 Seaboard Industrial Boulevard • Atlanta, GA 30318 • USA Telephone: 404.352.8677 • Fax: 404.352.2837 • Web Site: analyticsinc.com

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# **Quality Assurance Manual**

Revision 17 May 15, 2009

Eckert & Ziegler Analytics 1380 Seaboard Industrial Boulevard Atlanta, Georgia 30318 U.S.A.

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	Date 05-18-09	
Walter 1	evich, Plant Manager/Radiation Safety Officer	
	Signature Willia A.	
	Date 05-18-69	

#### The effective date for this manual is May 15, 2009

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## 1. Organization and Quality Assurance Program

#### 1.1. Policy Statement

Eckert & Ziegler Analytics (EZA), a wholly-owned subsidiary of Eckert and Ziegler Isotope Products, is incorporated in the State of Georgia and has operated continuously since 1980. EZA is located at 1380 Seaboard Industrial Boulevard, Atlanta, GA, and all source production is at this address. The parent company, Eckert and Ziegler Isotope Products, is located at 24937 Avenue Tibbitts, Valencia, CA.

The primary goal of EZA's Quality Assurance Program is to ensure the production of radioactive standards of the highest quality and accuracy. This goal is attained by the commitment of management and employees to conscientiously implement the policies and procedures in this manual. The quality of radioactive standards is assured through a quality control program based on 100% testing of our products and participation in a Measurements Assurance Program with the United States National Institute of Standards and Technology (NIST). The Quality Assurance Manual includes requirements of the Health Physics Society for accreditation of EZA as a producer of NIST-traceable standards. The scope of accreditation may be found in EZA's application for accreditation by the Health Physics Society's Laboratory Accreditation Program. It is the responsibility of all employees to ensure the quality of EZA's products. The Quality Assurance Manual (QAM) and Operations Manual are available and accessible by all EZA employees. Customers and other business associates may request a copy of the QAM. The Quality Assurance Manager (QA Manager) has sufficient authority, organizational freedom, and independence to carry out the responsibilities of EZA's Quality Assurance Program.

All employees have access to the QA Manager and higher management regarding any issues affecting quality. Each employee at EZA is aware of the extent and limitations of his or her responsibilities. Upon training and assignment to a particular department, the employee is provided with a job description and training in procedures which outline the specifications of the qualifications, training, and experience necessary to fulfill the job.

Managers and technical personnel have the authority and resources necessary to carry out their duties, identify the occurrence of departures from the quality system or from the procedures for performing their work including tests and/or calibrations, and initiate actions to prevent or minimize such departures.

Organizational arrangements are set so that departments having conflicting interests (such as customer service, production, or quality assurance) do not adversely influence EZA's compliance to regulatory and ISO standards.

EZA's organizational structure and commitment to quality and professional standards ensure that its management and personnel are free from any undue internal and external commercial, financial, and other pressures and influences that may adversely affect the quality of their work.

The management of EZA ensures communication processes are established within the organization and that communication takes place regarding the effectiveness and improvement of the quality system.

The processes which make up the quality system of EZA and the documentation of the interactions among those processes by such means as employee orientation, documented training, and procedures ensure communication between the various functions and levels regarding the processes of the system and their effectiveness.

Communication within EZA is accomplished by such means as:

- Availability of the appropriate documentation as and where needed to assure effective operation of the quality system.
- An orientation process for new employees (temporary and regular) which covers these topics.
- Quarterly employee meetings, periodic management meetings, and other unscheduled meetings.
- Use of corrective action and preventive action processes.
- Use of the results of data analysis.
- Transfer of information and/or materials among the various functions of the organization.
- Use of the results of the internal audit process.

Quality assurance has been our number one priority at EZA since its inception. Our commitment to quality has been demonstrated by our development of a Measurements Assurance Program with the National Institute of Standards and Technology (NIST) in 1980. EZA's Quality Assurance Program is detailed in our QAM. All radioactive standards and performance evaluation samples are produced in accordance with this quality program.

EZA's management is committed to the production of quality standards with a goal of zero defects. Our employees are committed to providing the nuclear industry with accurate NIST-traceable standards that reflect the counting geometries in use. Our review process includes an evaluation of all requested sources to determine if they can be produced as NIST-traceable sources. If source geometry, activity, or other factors preclude the production of a NIST-traceable source, the item will not be accepted for production as a NIST-traceable source. This does not preclude the production of check sources for which there is no certified activity.

This manual provides EZA's procedures and policies for: (1) producing radionuclide standards and quality control samples which satisfy USNRC Regulatory Guide 4.15, Revision 1, February 1979 or the current version and ANSI N42.22-1995, "Traceability of Radioactive Sources to the National Institute of Standards and Technology and Associated Instrument Quality Control" or the current version. Guidance for this manual is provided in the documents listed in Section 1.3, "References". The QAM covers all activities at the EZA facility at 1380 Seaboard Industrial Boulevard, Atlanta, GA.

#### **1.2.** Organization and Quality System

EZA's organization is divided into customer service, production, and quality assurance. These three independent groups report separately to the Plant Manager. The Review Committee has the responsibility to assess the effectiveness of the quality program. The Review Committee includes the Plant Manager, the QA Manager, the Production Manager, and the Customer Service Manager. Responsibility for the establishment and implementation of the Quality Assurance Program belongs to the QA Manager.

EZA's quality system is defined in the QAM. Procedures for implementing the quality system are in the Operations Manual. The production of radioactivity standards is conducted in accordance with this system which is designed to ensure the quality and traceability of all certified standards. The objective of the quality system is to ensure the quality and integrity of all products. All employees are required to be familiar with the QAM and the applicable operating procedures. Management is committed to maintaining NIST-traceability by meeting ANSI-N42.22-1995, ISO/IEC 17025 and the HPS Laboratory Accreditation Program. EZA's management is committed to continually improving the effectiveness of the management system. Top management shall ensure that the integrity of the management system is maintained when changes to the management system are planned and implemented. This shall be documented in Review Committee minutes or Management Review minutes.

EZA's executive management assigns its own management personnel the authority and responsibility to define, document, and maintain procedures that assure successful implementation of this manual. Policies and procedures are implemented to avoid involvement in any activities that would diminish confidence in EZA's competence, impartiality, judgment, or operational integrity.

#### 1.3. References

- USNRC Regulatory Guide 4.15, Rev. 1, February 1979, "Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) -- Effluent Streams and the Environment",
- ANSI N45.2, 1977, "Quality Assurance Program Requirements for Nuclear Facilities"
- ANSI N45.22, 1995, "Traceability of Radioactive Sources to NIST and Associated Instrument Quality Control"
- 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"
- ASME NQA-1-1994, "Quality Assurance Program Requirements for Nuclear Facility Applications"
- ISO/IEC 17025, 2005, "General Requirements for the Competence of Testing and Calibration Laboratories"
- ICRU Report 12, 1968, "Certification of Standardized Radioactive Sources"
- HPS Laboratory Accreditation Manual, Revision 3.1, 2/6/08, Available from HPS Secretariat



#### 1.5. Duties of the Plant Manager

#### 1.5.1. Purpose

To specify the duties and responsibilities of the Plant Manager

#### 1.5.2. Authority

1.5.2.1. The authority for management of the company is vested in the Plant Manager.

#### 1.5.3. Responsibilities

- 1.5.3.1. Establishes company policy with respect to fiscal, personnel matters, product quality, and production
- 1.5.3.2. Ensures that adequate resources, space, and equipment are available to ensure the quality of products and services
- 1.5.3.3. Provides oversight of all company operations and supervises the Customer Service Manager, Production Manager, QA Manager, and Radiation Safety Officer
- 1.5.3.4. Defines the scope of operations and the products to be produced and distributed
- 1.5.3.5. Serves as a member of the Review Committee
- 1.5.3.6. Maintains job descriptions for all managers

#### 1.5.4. Qualifications of the Plant Manager

- 1.5.4.1. The Plant Manager shall have a general knowledge of radiochemistry and radionuclide metrology from previous academic training or on-the-job experience.
- 1.5.4.2. The Plant Manager shall have a thorough understanding of EZA's quality control objectives and procedures.
- 1.5.4.3. The Plant Manager shall be familiar with appropriate regulations dealing with the possession, use, and distribution of radioactive materials.

#### 1.5.5. Alternate to the Plant Manager

When unavailable, the Plant Manager will designate a department manager as the Alternate to the Plant Manager. The Alternate to the Plant Manager may perform those functions authorized by the Plant Manager.

#### 1.6. Duties of the Quality Assurance Manager

#### 1.6.1. Purpose

To specify the duties and responsibilities of the QA Manager

#### 1.6.2. Authority

- 1.6.2.1. The QA Manager reports directly to the Plant Manager.
- 1.6.2.2. The QA Manager shall chair the Review Committee.
- 1.6.2.3. The QA Manager must approve all shipments/transfers to customers.
- 1.6.2.4. The QA Manager may issue stop work orders if the quality of standards is in question and, after corrective action, authorize resumption of work.

#### 1.6.3. Responsibilities

- 1.6.3.1. Maintains the Quality Assurance Manual and ensures that it is current and meets ISO 17025 and HPS Accreditation Manual
- 1.6.3.2. Identifies problem areas in product quality
- 1.6.3.3. Reviews and approves corrective actions for conditions which adversely affect quality
- 1.6.3.4. Verifies that established procedures are being followed and that approved changes have been implemented
- 1.6.3.5. Verifies that non-conforming items are properly identified and corrected
- 1.6.3.6. Verifies that employees involved in production, quality assurance, and counting room operations are qualified
- 1.6.3.7. Trains all employees in EZA's policies and procedures for reporting defects under 10 CFR 21
- 1.6.3.8. Trains all employees in EZA's Quality Assurance procedures and operating procedures related to quality
- 1.6.3.9. Budgets for necessary resources to maintain and improve the quality of standards
- 1.6.3.10. Performs internal audits of Production
- 1.6.3.11. Maintains job descriptions for all Quality Assurance employees
- 1.6.3.12. Ensures the quality program and technical managers comply with ISO/IEC 17025

#### 1.6.4. Qualifications of the Quality Assurance Manager

The QA Manager shall be qualified per Section 8.2, "Qualifications for Quality Assurance Personnel".

#### 1.6.5. Quality Assurance Manager Alternate

- 1.6.5.1. When the QA Manager is not available, the Counting Room Supervisor or any person qualified in QA management functions per Section 8.2 may act as QA Manager Alternate and perform functions designated by the QA Manager.
- 1.6.5.2. QA Manager Alternates may not approve standards that they have produced.

#### 1.7. Duties of the Production Manager

1.7.1. Purpose

To specify the duties and responsibilities of the Production Manager

#### 1.7.2. Authority

The Production Manager reports directly to the Plant Manager.

#### 1.7.3. Responsibilities

- 1.7.3.1. Serves as a member of the Review Committee
- 1.7.3.2. Supervises members of the production staff
- 1.7.3.3. Ensures that standards are produced in accordance with the QAM and Operations Manual procedures
- 1.7.3.4. Makes changes to production processes and changes to procedures as required

- 1.7.3.5. Provides training and guidance to production staff to ensure all are familiar with procedures and methods for production of sources
- 1.7.3.6. Prepares procedures for calibration of radionuclides and production of radioactivity sources
- 1.7.3.7. Performs internal audits of the Quality Assurance Program
- 1.7.3.8. Budgets for necessary resources to maintain and improve the quality of production processes
- 1.7.3.9. Maintains job descriptions for all Production employees

#### 1.7.4. Qualifications of the Production Manager

1.7.4.1. The Production Manager shall be qualified per Section 8.4, "Qualifications for Production Personnel".

#### 1.7.5. Production Manager Alternate

When unavailable, the Production Manager will assign duties to a qualified member of the Production staff or the QA Manager.

#### **1.8.** Duties of the Customer Service Manager

#### 1.8.1. Purpose

To specify the duties and responsibilities of the Customer Service Manager

#### 1.8.2. Authority

The Customer Service Manager reports directly to the Plant Manager.

#### 1.8.3. Responsibilities

- 1.8.3.1. Serves as a member of the Review Committee
- 1.8.3.2. Supervises the administrative staff in performing the following duties:
  - 1.8.3.2.1. Processes orders and maintains customers' records
  - 1.8.3.2.2. Coordinates the review of customers' orders prior to acceptance for production
  - 1.8.3.2.3. Ensures that customers' containers are available
  - 1.8.3.2.4. Reviews and identifies customers' quality assurance requirements
  - 1.8.3.2.5. Assigns serial numbers
  - 1.8.3.2.6. Prepares documentation for shipments including Certificates of Calibration
  - 1.8.3.2.7. Maintains Quality Assurance records in accordance with requirements
  - 1.8.3.2.8. Budgets for necessary resources to maintain and improve the quality of customer service
  - 1.8.3.2.9. Provides training and guidance to administrative staff

1.8.3.3. Responsible for Human Resource functions at EZA

1.8.3.3.1. Interfaces with Isotope Products Human Relations Department with issues related to payroll, benefits, training, and employment policies

#### 1.8.3.4. Maintains current job descriptions for customer service employees

#### 1.8.4. Qualifications of the Customer Service Manager

The Customer Service Manager shall be knowledgeable of the processes for accepting, scheduling, and processing orders for radioactive standards and technical services. The Customer Service Manager shall be familiar with the Quality Assurance Program and Operations Manual procedures as they relate to the responsibilities of the Customer Service Department.

#### 1.8.5. Customer Service Manager Alternate

When unavailable, the Customer Service Manager will assign duties to members of the Customer Service staff or a member of the Review Committee.

#### 1.9. Duties of the Radiation Safety Officer

#### 1.9.1. Purpose

To specify the duties and responsibilities of the Radiation Safety Officer (RSO)

#### 1.9.2. Authority

The RSO reports directly to the Plant Manager.

#### 1.9.3. Responsibilities

- 1.9.3.1. Maintains EZA's radioactive materials license with the State of Georgia or other regulatory agencies
- 1.9.3.2. Trains and approves individuals to work with radioactive material
- 1.9.3.3. Ensures that EZA's radioactive materials inventory is in compliance with license conditions
- 1.9.3.4. Supervises the review of the customer licenses to determine the acceptability of their license conditions for the material ordered
- 1.9.3.5. Sets policies relating to the use of radioactive material
- 1.9.3.6. Ensures that radiation surveys are conducted in accordance with license conditions

#### 1.9.4. Qualifications of the Radiation Safety Officer

The RSO shall have a broad knowledge of health physics principles, radiation safety, and the safe use of radioactive materials. Generally, the RSO will have at least five years experience working with radioactive material.

#### 1.9.5. Radiation Safety Officer Alternate

When unavailable, a Technical Manager will serve as the acting RSO.

#### 1.10. Review Committee

#### 1.10.1. Purpose

To describe the membership and function of the Review Committee

#### 1.10.2. Membership

The Review Committee shall consist of the Plant Manager, the Customer Service Manager, the Production Manager, and the QA Manager.

#### 1.10.3. Frequency of Meetings

The Review Committee will meet as necessary but at least annually. Official meetings of the Review Committee will be documented in the Review Committee Minutes.

#### 1.10.4. Function

- 1.10.4.1. The QA Manager shall chair the Review Committee and shall be responsible for implementing requirements described in this section.
- 1.10.4.2. A quorum for official meetings of the Review Committee shall be three members.
- 1.10.4.3. The Review Committee will review internal audits and document that the audits have been conducted as required in the Review Committee Minutes.
- 1.10.4.4. The Review Committee will conduct annual reviews of the Operations and the Quality Assurance Manuals. These reviews will be documented in the Review Committee Minutes.

#### 1.10.5. Management Review

- 1.10.5.1. The Review Committee will perform an annual Management Review that will address, as a minimum, the following areas:
  - 1.10.5.1.1. Changes to the management system to ensure the integrity of the system is maintained
  - 1.10.5.1.2. Suitability of policies and procedures
  - 1.10.5.1.3. Objectives and effectiveness of the management system and quality system
  - 1.10.5.1.4. Reports from managerial and supervisory personnel
  - 1.10.5.1.5. Outcome of recent internal audits
  - 1.10.5.1.6. Corrective and preventive actions
  - 1.10.5.1.7. Assessments by external bodies
  - 1.10.5.1.8. Results of proficiency testing
  - 1.10.5.1.9. Changes in volume and type of work
  - 1.10.5.1.10. Customer feedback
  - 1.10.5.1.11. Complaints
  - 1.10.5.1.12. Recommendations for improvement of management system
  - 1.10.5.1.13. Other relevant factors such as quality control activities, resources, and effectiveness of staff training

## 1.10.6. Documentation of Management Review

A summary of the Management Review shall be documented in the Review Committee Minutes. Action items resulting from the review shall be recorded and completed upon an agreed date. Any deviations from quality shall be identified and tracked on Form QA-13-01, "Corrective Action/Preventive Action (CAPA) Request".

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Audits

### 2. Quality Assurance Manual

#### 2.1. Requirements for Quality Assurance Program

The EZA Quality Assurance Program shall be documented in a Quality Assurance Manual (QAM) that addresses all elements of the program. The QAM shall as a minimum address the following elements:

- Organizational Structure
  Quality Assurance Manual
  Design Control
  Control of Purchased Material, Equipment, and Services
   Dread Structure
   Document Control
   Records
   Personnel Qualifications
   Quality Control of Instruments
   Product Quality Control
  - Procedures and Instructions
- 2.2. Control and Distribution

The manual shall be controlled and distributed to all EZA employees and customers requesting an electronic or hard copy. Distribution of uncontrolled copies of the QAM is permitted with authorization by the QA Manager. The QAM shall include the revision number and the effective date of implementation. All employees and holders of controlled copies will be informed when the QAM is revised and will be instructed to destroy outdated copies or mark them as obsolete.

#### 2.3. Review

The QAM is reviewed at least yearly by the Review Committee and amendments or revisions will be made as necessary. This review will include a discussion of overall program effectiveness. Results of the review will be documented in the Review Committee Minutes.

#### 2.4. Revisions

All revisions to the QAM must be approved by the Review Committee.

#### 2.4.1. Temporary Revisions

Temporary revisions (amendments) to the QAM are permitted. Amendments shall be identified with the QAM revision number and an amendment number. The effective date of the amendment must also be noted. Amendments shall be provided to all employees and recipients on the Controlled Distribution List (Section 6.2.2, "Distribution of Quality Assurance Manual to Outside Organizations").

#### 2.4.2. Full Revisions

A full revision to the QAM would be identified by changing the revision number and the effective date of the QAM. Revisions will incorporate all amendments issued after the previous revision of the QAM. Revisions shall be provided to all employees and recipients on the Controlled Distribution List (Section 6.2.2).

### 3. Design Control

#### 3.1. Processes for Controlling the Design of Sources

#### 3.1.1. Purpose

To specify the control of processes used to produce NIST-traceable and non-traceable radioactive sources

#### 3.1.2. Requirements

The fabrication of custom sources requires the review of each purchase order to ensure that sources requested by the customer can be fabricated in such a manner to meet the customer's specifications and are NIST-traceable if required.

#### 3.1.3. Actions

The following steps shall be followed to ensure the quality of the radioactivity sources:

- 3.1.3.1. Purchase orders shall be reviewed to determine if the requested items can be produced as NIST-traceable sources. The review is conducted in accordance with Section 3.2, "Approval for Production of NIST-Traceable Sources" and documented on Form QA-03, "Purchase Order Review Form".
- 3.1.3.2. Standards shall be produced in accordance with approved procedures for controlling the fabrication process (See Section 12.1, "Requirements for Processing Radionuclide Standards" in the Operations Manual).
- 3.1.3.3. Quality control testing shall be performed in accordance with Section 11.3, "Quality Control Testing of Radionuclide Standards" to ensure that the final source meets customers' requirements with respect to activity, geometry, and specifications.
- 3.1.3.4. Production and quality assurance representatives shall review and approve certificates of calibration.

#### 3.2. Approval for Production of NIST-Traceable Sources

#### 3.2.1. Purpose

To specify the review cycle and approval for the production of NIST-traceable sources

#### 3.2.2. Procedure

- 3.2.2.1. Prior to production of any NIST-traceable source, the following review cycle shall be followed and documented on Form QA-03.
- 3.2.2.2. A Customer Service Representative will review the customer order to verify that sufficient information has been provided to produce the sources. This should include the radionuclide(s), quantity, and specific geometry (volume, area of source, container type, etc.). If a customer requests standards that have been previously produced, information from a previous order may be used. The Customer Service Review section of Form QA-03 shall be completed and forwarded to a Quality Assurance Specialist for review.
- 3.2.2.3. The Quality Assurance Specialist will review the specific quality assurance and shipping requirements and note any special requirements on Form QA-03. This review shall include verification that the customer has the necessary radioactive materials license and

a copy of the license or other suitable documentation is on file. The QA Review section of Form QA-03 shall be completed and forwarded to the Production Manager or alternate for review.

- 3.2.2.4. The Production Manager will review the customer order to determine if the requested sources can be produced as NIST-traceable standards in accordance with the customer's specifications. Specific instructions for production shall be noted or attached to Form QA-03. The production review and approval shall include a review of both the Customer Service and QA sections and constitutes the necessary authorization for production. If there are any questions regarding quality control testing of the final product, Form QA-03 will be forwarded to the QA Manager for review and approval.
- 3.2.2.5. Any necessary changes (deviations) to a customer's order shall be discussed with the client prior to approval and documented on Form QA-03 prior to submission of the order for production. Documentation shall include the identity of the customer's representative, date contacted, and initials of the EZA representative.
- 3.2.2.6. If a client issues a change order, all changes shall be subject to the review process and documented on Form QA-03.

#### 3.3. Approval for Production of Non-Traceable Sources

#### 3.3.1. Purpose

To specify the review cycle and approval for the production of non-traceable sources

#### 3.3.2. Procedure

- 3.3.2.1. Prior to production of any non-traceable source, the following review cycle shall be followed and documented on Form QA-03.
- 3.3.2.2. A Customer Service Representative will review the customer order and verify that sufficient information has been provided to produce the sources. This should include the radionuclide(s), quantity, and specific geometry (volume, area of source, container type, etc.). If a customer requests sources that have been previously produced, information from a previous order may be used. The Customer Service Review section of Form QA-03 shall be completed and forwarded to a Quality Assurance Specialist for review.
- 3.3.2.3. The Quality Assurance Specialist will review the specific quality assurance and shipping requirements and note any special requirements on Form QA-03. This review shall include verification that the customer has the necessary radioactive materials license and a copy of the license or other suitable documentation is on file. The QA Review section of Form QA-03 shall be completed and forwarded to the Production Manager or alternate for review.
- 3.3.2.4. The Production Manager will review the purchase order to determine if the requested sources can be produced in accordance with the customer's specifications. Specific instructions for production shall be noted or attached to Form QA-03. The production review and approval shall include a review of both the Customer Service and QA Review sections and constitutes the necessary authorization for production.
# Form QA-03-01. Customer Order Review Form

# Sample Only. See Operations Manual for controlled copy.

Site	EZA Order Number
Company	Date received
P.O. Number	Release
Customer Service Review	Date and Initials of Reviewer
A. Is requested ship date acceptable?	Yes No Advise
B. Are previous orders attached?	Yes INO
C. Have geometries and quantities been specified?	Yes No
D. Are customer containers on-site? We provide?	Yes No Requested? Yes No
E. Are prices correct on the order?	Yes No
F. Are terms acceptable? (Check if yes, X if not.)	FOB Net 30 Ship Via Ship Charges
	Federal Express Acct #
G. If blanket release, is the release valid?	Yes No
Notes	
QA Review	Date and Initials of Reviewer
A. Are the QA Requirements acceptable?	Yes No
B. Are the terms and conditions compatible?	Yes No   Warranty Exception Yes   No Advise Warranty   Yes No
C. What documentation is requested/required?	
D. Is an acceptable radioactive materials license on file?	□ Yes □ No Lic. No.: Exp.:
Notes	
Production Review	Date and Initials of Reviewer
A. Can we meet traceability on isotopes at levels requested?	Yes No
B. Are specified geometries acceptable?	Yes No
C. Are there any production questions?	Yes No
D. Any QC questions?	Yes INo - If yes, forward to Quality Assurance Manager, for review.
Notes:	
Quality Assurance Manager Review	Date and Initials of Reviewer
A. Any QC problems or recommendations for this order?	Yes No
Notes	•

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# 4. Procurement and Control of Purchased Materials, Equipment and Services

Suppliers of critical consumables, supplies, and services that affect the quality of testing and calibration shall be evaluated and placed on an Approved Suppliers List (Form ANA-QA-09). The process for evaluation and maintenance of an Approved Suppliers List is maintained in the Operations Manual (Procedure ANA-QA-09, "Approved Suppliers Program". EZA does not utilize contractors for the production or calibration of radioactive sources.

#### 4.1. Purchasing Radioisotopes

#### 4.1.1. Purpose

To specify requirements for purchasing radioisotopes used for the preparation of master solutions and controlling the receipt of radioactive material

#### 4.1.2. Policy

EZA does not impose any specific quality requirements on the suppliers of radioisotopes. Radioisotopes are qualified by commercial dedication with respect to the isotope, quantity, and purity during the calibration process. The policy is to request the highest radiochemical purity available subject to cost considerations. Procedure(s) used to qualify radioisotopes are documented in the Operations Manual. EZA's certification of the isotopes in the preparation and calibration of master solutions constitutes a very strict test of the ingredients and assures their quality. This certification process includes 100% of all radioisotopes received from outside sources and is not a statistical sampling. The only certifications from outside suppliers that can be passed are provided by the national standardizing laboratories (NSL) listed in Section 4.1.4. However, NSL certified values shall be verified and the documentation retained with the original certificate.

#### 4.1.3. Purchasing Procedure

- 4.1.3.1. To purchase radioactive material, the Production Manager or alternate shall fill out Form QA-04-01, "Procurement of Radioactive Material" and issue a written purchase order.
- 4.1.3.2. After receipt of any radioactive material, receiving personnel shall fill out Form QA-04-02, "Receipt of Radioactive Material Log", columns 1-8, and verify that material is in conformance with the material ordered. Final qualification of radioactive isotopes is documented during the calibration of the material as specified in the Operations Manual, and documented by the Production Manager in columns 9-10.
- 4.1.3.3. If the radioactive material is not acceptable or purchase order requirements are not met, Form QA-13-01 shall be initiated.

#### 4.1.4. National Standardizing Laboratories

- 4.1.4.1. National Institute of Standards and Technology, Gaithersburg, MD, United States
- 4.1.4.2. National Physical Laboratory, Teddington, United Kingdom
- 4.1.4.3. Departement des Applications et de la Metrologie des Rayonnements Ionisants / Laboratoire de Mesure des Rayonnements Ionisante, Cedex, France
- 4.1.4.4. Physikalisch-Technische Bundesanstalt, Braunschweig and Berlin, Germany

Form QA-04-01. Procurement of Radioactive Material

Sample only. See Operations Manual for controlled copy.

Order #\_\_

Item #	Date Ordered	Expected Delivery Date	lsotope	Physical & Chemical Form (ie. Nal, 1 M NaOH)	Activity Ordered MBq	License Limit MBq	Estimated Inventory MBq	Vendor
		· · ·						
								· · · · · · · · · · · · · · · · · · ·

The individual ordering radioisotope(s) acknowledges that EZA's Possession Limit for radioactive materials will not be exceeded.

Signature of Person Ordering Radioisotopes:

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# Form QA-04-02. Receipt of Radioactive Material Log

	Sample of	only.	See C	perations	Manual	for	controlled	copy
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log#	Date	Isotope	Vendor	Order#	Activity Ordered (MBq)	Activity Rec. (Vendor Assay) (MBq)	PO Requirements Met? Yes or No & initial	EZA Production Assay, (MBq)	Production (initials)
			· · · · · · · · · · · · · · · · · · ·						
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### 4.2. Purchasing Supplies

#### 4.2.1. Purpose

To specify the requirements for purchasing laboratory supplies and chemical reagents

#### 4.2.2. Suppliers

Laboratory supplies and chemicals can be obtained from any commercial supplier of laboratory supplies and equipment.

#### 4.2.3. Requirements

- 4.2.3.1. Chemical reagents used in the production of liquid standards shall be ACS Reagent grade when available.
- 4.2.3.2. Solvents or other chemicals that are not used in the production of standards may be technical grade.
- 4.2.3.3. Polyester resins used for production of water-equivalent standards may be of technical grade. The acceptability of this material is determined during the production process.
- 4.2.3.4. Stable gases used for counting instrumentation may be of technical grade since the performance of instrumentation verifies the acceptability of the gases used.

#### 4.2.4. Purchasing Procedure

- 4.2.4.1. Laboratory supplies and chemicals are normally purchased verbally under a blanket purchase order.
- 4.2.4.2. Procurements shall be documented on Form QA-04-03, "Purchase Order Log" with a description of each item and a catalog number, if available.
- 4.2.4.3. Standing orders for supplies such as liquid nitrogen are not required to be logged on Form QA-04-03.
- 4.2.5. Receipt Inspection
  - 4.2.5.1. Shipments shall be inspected by the Shipping and Receiving Department to verify conformance with the order. Acceptance and conformance with specifications shall be noted by initialing the item on Form QA-04-03.
  - 4.2.5.2. The items shall be transferred to the appropriate department which will determine the acceptability of the items. If unacceptable, the item(s) shall be returned to the supplier and a Form QA-13-01 shall be submitted to the QA Manager.
  - 4.2.5.3. Chemical reagents will be stored in the laboratories. Bulk chemicals will be stored in the warehouse.

# Form QA-04-03. Purchase Order Log

# Sample only. See Operations Manual for controlled copy.

Date Ordered	P.O. #	Catalog Number	Chemical Name	ACS	Quantity	Date Received	Lot #	Initials <sup>.</sup>
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# 4.3. Purchasing Equipment and Instrumentation

### 4.3.1. Purpose

To specify the procedure for purchase of equipment and instrumentation

#### 4.3.2. Policy

The acceptability of equipment and instrumentation is ultimately determined by its intended use and performance in the laboratory. Laboratory equipment that is not quality-related may be purchased from any supplier and no specific procurement controls are necessary. Qualityrelated equipment shall be purchased from 10 CFR 50 Appendix B qualified suppliers or qualified as commercial grade in accordance with Operations Manual procedures. Purchase orders will only be issued to companies on the Approved Suppliers List (Form ANA-QA-09). The purchase order shall include technical specifications and requirements. Proposals from manufacturers on the Approved Suppliers List will be evaluated prior to issuance of a purchase order. The QA Manager shall approve the final purchase order. Receipt inspection for such equipment will be performed and, if appropriate, tests will be performed to demonstrate compliance with technical specifications. The acceptability of the equipment will be demonstrated by means of the Quality Control Program for instrumentation.

#### 4.4. Purchasing Services

#### 4.4.1. Purpose

To specify requirements for contracted services for maintenance of instrumentation and laboratory equipment

#### 4.4.2. Policy

Services such as maintenance of counting room instrumentation and laboratory equipment may be contracted to any authorized service representative or distributor of the manufacturer on the Approved Suppliers List. Other representatives may be used for contract services provided their capabilities are evaluated and they are placed on the Approved Suppliers List. The purchase of services that are used for maintenance of quality-related equipment would be accomplished by issuance of a purchase order to a company on the Approved Suppliers List. The purchase order shall include, as appropriate, technical specifications and requirements. The responsibility for demonstrating the acceptability and operability of the equipment after service is maintained by EZA through the Quality Control Program.

# 5. Procedures and Instructions

### 5.1. Requirements for Issuance of Procedures

#### 5.1.1. Purpose

To specify EZA's policy for issuance of procedures

#### 5.1.2. Policy

The QA Manager shall determine the activities associated with the calibration, production, and testing of radionuclide sources for which operating procedures are required. In contrast to analytical radiochemistry laboratories where detailed operating procedures are necessary to ensure the quality of the final product, the production of custom radionuclide standards can only be procedurally controlled in a very general manner since specific details will be dependent on the particular source being produced. The final testing of the source will demonstrate the acceptability of the production process and the methods used to produce the source.

#### 5.1.3. Actions

- 5.1.3.1. Guidance for issuing and controlling operating procedures is provided in Operations Manual Procedure ANA-QA-11, "Guidance for Issuance and Control of Operations Procedures and Quality Related Forms".
- 5.1.3.2. The Review Committee will annually review the procedures to determine the need for additions or revisions.

#### 5.1.4. Temporary Changes to Procedures

Temporary changes to procedures can be made as follows:

Temporary changes in effect until the procedure is revised shall be marked on the procedure, dated, and signed by the department manager and the QA Manager. Copies of the temporary revisions shall be distributed to all holders of the procedure.

#### 5.1.5. Revisions to Procedures

- 5.1.5.1. Revisions to procedures shall be initiated by the department manager for the function being controlled. Revisions are made in accordance with guidance in the Operations Manual.
- 5.1.5.2. Changes and/or additions to procedures shall be identified with suitable markings.

# 6. Document Control

#### 6.1. Document Control

#### 6.1.1. Purpose

To describe the control and distribution of the Quality Assurance Manual (QAM), Operations Manual, and Software Manual

#### 6.2. Quality Assurance Manual

#### 6.2.1. Internal Distribution

- 6.2.1.1. Each EZA employee shall have access to EZA's QAM via a copy maintained in Document Control or the electronic copy on the EZA server.
- 6.2.1.2. It shall be the duty of the QA Manager to see that the QAM is updated with all revisions and all employees are notified of such revisions.
- 6.2.1.3. The EZA's QAM shall be reviewed by the Review Committee at least once per twelve (12) months.

#### 6.2.2. Distribution of Quality Assurance Manual to Outside Organizations

The Quality Assurance Manual Distribution List (Form QA-06-01) shall be maintained.

#### 6.2.3. Forms

Forms specified in the QAM are sample forms and are controlled in accordance with Operations Manual Procedure ANA-QA-11. Controlled copies of forms maintained by computer shall be "read only" to maintain the integrity of the forms.

#### 6.3. Operations Manual

- 6.3.1. The Operations Manual contains all procedures that implement the requirements of the QAM. This includes the processing of orders, calibration of radionuclides, production and testing of sources, preparation of certificates, and shipping.
- 6.3.2. Each EZA employee shall have access to EZA's Operations Manual via a copy maintained in Document Control or the electronic copy on the EZA server.
- 6.3.3. The QA Manager is responsible for ensuring that the Operations Manual is up to date.
- 6.3.4. Once revised procedures are issued, obsolete copies of procedures shall be collected and destroyed or otherwise marked as obsolete if maintained for historical purposes
- 6.3.5. The Operations Manual shall be reviewed at least once per twelve (12) months.
- 6.3.6. The Operations Manual or any procedure in the manual shall not be distributed to outside organizations without approval of the QA Manager.

# 6.4. Software Manual

- 6.4.1. The Software Manual contains documentation of software used in the production and certification of standards. A copy of the manual shall be maintained in triplicate one copy with the QA Manager, one with Document Control, and one in the Quality Assurance Records.
- 6.4.2. The Software Manual shall be reviewed at least once per twelve (12) months.

# Form QA-06-01. Quality Assurance Manual Distribution List

# Sample Only. See Operations Manual for controlled copy.

Copy Number	Assigned To	Comments
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# 7. Quality Assurance Records

# 7.1. Requirements for Maintenance and Storage of Quality Assurance Records

#### 7.1.1. Purpose

To describe the process for maintenance and storage of Quality Assurance records

#### 7.1.2. Responsibilities

7.1.2.1. It is the responsibility of the QA Manager to ensure that quality records are up to date, and properly maintained and stored.

#### 7.1.3. Recording Data and Observations

- 7.1.3.1. All data recorded by hand shall be entered in a legible form.
- 7.1.3.2. Mistakes shall be corrected by lining through each mistake and the corrected value placed alongside. The person making the correction shall initial and date the correction.

#### 7.1.4. Storage of Quality Records

The following records will be maintained for 10 years in accordance with ASME NQA-1, Supplement 17S-1.

7.1.4.1. Review Committee Notebook

7.1.4.1.1. The Review Committee Notebook(s) will be stored indefinitely and contain the following records:

- Minutes/memos relating to Review Committee business
- Employee qualification and training records
- Internal audit checklists and reports
- Corrective action/preventive action reports
- 7.1.4.2. Counting and Test Data Log Books
  - 7.1.4.2.1. All counting and test data collected manually shall be recorded in logbooks at the time of observation with the initials of the person performing the testing.

7.1.4.3. Data for National Standardizing Laboratories' Products

- 7.1.4.4. Production Notebooks
  - 7.1.4.4.1. The Production Manager shall oversee the timely and accurate entry of all production data in a current production notebook. Each entry shall be recorded with the date and initials of the person performing the task.
- 7.1.4.5. Mixed Gamma Standards

The QA Manager shall ensure that an example of a Certificate of Calibration for each mixed gamma batch is maintained.

- 7.1.4.6. Standards, Hot Cross Check, and Environmental Cross Check Logs
  - 7.1.4.6.1. All traceable standard numbers shall be recorded in the Standards Log.
  - 7.1.4.6.2. Environmental cross check sample numbers shall be recorded in the Environmental Cross Check Order Log.

- 7.1.4.6.3. All other radiochemistry cross check sample numbers shall be recorded in the Hot Cross Check Order Log.
- 7.1.4.7. Quality Assurance Manual, Operations Manual, and Software Manual

The QA Manager shall ensure that a current copy of EZA's QAM, Operations Manual, and Software Manual are maintained. Quality Assurance Records shall be on the Controlled Distribution List for each manual to ensure that the current revision is maintained.

- 7.1.4.8. Traceability Log
- 7.1.4.9. Traceability Results
- 7.1.4.10. Purchase Orders and Receipt Inspections for Quality-Related Equipment
- 7.1.4.11. Instrument Qualification Log
- 7.1.4.12. Balance Quality Assurance Records
- 7.1.4.13. Radionuclide Calibration Summaries
- 7.1.4.14. Calibration Certificates for Purchased Standards
- 7.1.5. Storage of Other Quality-Related Records

The following records will be maintained for at least ten years:

- 7.1.5.1. Customer Purchase Orders
- 7.1.5.2. Counting Room Data
- 7.1.6. Security of Records
  - 7.1.6.1. Copies of all records necessary to reconstruct certificates are stored as quality records.
  - 7.1.6.2. There is no off-site storage. EZA is located in a secure building with controlled access requiring all visitors to be escorted.

# 8. Personnel Qualifications and Training

# 8.1. Job Descriptions

- 8.1.1. Job descriptions shall be developed and maintained for all EZA employees who manage, perform, or verify work affecting the quality of tests and calibrations.
- 8.1.2. Job descriptions shall provide minimum qualifications, duties, responsibilities, and interaction with other individuals or departments.

# 8.2. Qualifications for Quality Assurance Personnel

#### 8.2.1. Purpose

To state qualifications for Quality Assurance personnel

#### 8.2.2. Definition of Quality Assurance Personnel

Quality personnel include individuals responsible for any of the following activities: reviewing quality requirements in customer purchase orders, preparing Certificates of Calibration, reviewing and approving quality control data, and signing Certificates of Calibration for the QA Manager. Production personnel, excluding Production Assistants, may perform quality assurance functions if they have been qualified on Form QA-08-01, "Employee's Qualification for Quality Assurance Functions".

#### 8.2.3. Qualifications

- 8.2.3.1. All Quality Assurance personnel shall demonstrate detailed knowledge of the EZA Quality Program through training and on-the-job experience.
- 8.2.3.2. Personnel shall be knowledgeable of EZA's quality control objectives and procedures.
- 8.2.3.3. Employees involved in the review and approval of quality control data shall have experience in nuclear counting techniques and preparation of radionuclide standards from academic or on-the-job training.

#### 8.2.4. Approval

The department manager and QA Manager or designee shall approve all quality assurance personnel using Form QA-08-01.

# Form QA-08-01. Employee's Qualification for Quality Assurance Functions

# Sample only. See Operations Manual for controlled copy.

Certification

activities:

has been certified, on \_\_\_\_/ \_\_\_, for the following

Review and approval of customer purchase orders quality requirements

Review and approval of quality control data for standards

Preparation of certificates for radioactive standards and shipping documentation

QA Manager Alternate

Only these so specified:

#### Certification is based on (check box as appropriate)

1. Education, on-the-job, experience, and previous training are considered valid for this position and are summarized here:

2. Radiological Safety Indoctrination (including laboratory safety).

3. Quality Assurance Program indoctrination.

Approval		
Date of qualification: / /		
Department Manager	Date	1 1
QA Manager (or designee)	Date	

# 8.3. Qualifications for Production Assistants

#### 8.3.1. Purpose

Production assistants are qualified to produce standards and to perform specific production tasks ONLY under the direct supervision of a production chemist (any personnel qualified to produce standards). All notebook entries by production assistants shall be reviewed and initialed by the supervising production chemist or any production qualified individual. Certificates for standards shall be signed by the supervising production chemist or another production qualified individual as the person preparing the standard.

#### 8.3.2. Qualification

- 8.3.2.1. The QA Manager shall ensure that the applicant demonstrates a thorough knowledge of EZA's quality control objectives and procedures that relate to the production of standards.
- 8.3.2.2. The RSO shall ensure that the applicant demonstrates safe and proper handling of radioactive material.
- 8.3.2.3. The applicant shall successfully prepare at least two (2) internal standards for each geometry type or production task being qualified as noted in the Production Assistant section on Form QA-08-03. Production tasks include liquid dilutions and quality control sample preparation. If dilutions were performed in the process of preparing any of the internal standards, the applicant is also qualified to perform dilutions under supervision. The data demonstrating successful preparation of internal standards shall be maintained in the employee's qualification file.

#### 8.3.3. Approval

The Production Manager and the QA Manager or designee shall give approval for qualification of production assistants using Form QA-08-02 "Employee's Qualification for Production".

#### 8.3.4. Training

Technical training of production assistants is accomplished by on-the-job training and is the responsibility of the Production Manager. The need for additional formalized training is determined and approved by the Production Manager.

#### 8.4. Qualifications for Production Personnel

#### 8.4.1. Purpose

To state the qualifications for personnel responsible for radionuclide standard preparation and quality assurance functions

#### 8.4.2. Qualification

- 8.4.2.1. Production personnel must complete training as a production assistant prior to certification for production.
- 8.4.2.2. An applicant shall demonstrate a broad knowledge of chemistry and nuclear counting techniques from previous academic or on-the-job training.
- 8.4.2.3. The applicant shall demonstrate a thorough knowledge of EZA's quality control objectives and procedures.

- 8.4.2.4. The RSO shall determine that the applicant demonstrates safe and proper handling of radioactive material.
- 8.4.2.5. The applicant shall successfully produce a standard of each type listed in the Standard Preparation section of Form QA-08-03, "Employee's Qualification Form for Production Personnel and Production Assistants".
- 8.4.2.6. To document qualification, Form QA-08-02, "Employee's Qualification for Production" shall be maintained indefinitely for each qualified employee and production assistant.

### 8.4.3. Approval

The Production Manager and the QA Manager or designee shall give final approval to production and quality assurance personnel.

# Form QA-08-02. Employee's Qualification for Production

# Sample only. See Operations Manual for controlled copy.

#### Certification

activities:

has been certified on /\_\_/, for the following

All production activities

Production Assistant

Only these so specified:

#### Certification is based on (check box as appropriate)

1. The production of standards listed in Form QA-08-03

2. Education, experience, and previous training are considered valid for this position and are summarized here:

3. Radiological Safety Indoctrination (including laboratory safety)

4. Quality Assurance Program indoctrination

Approval		<u>.</u>
Date of qualification: / /		
Department Manager	Date	
QA Manager (or designee)	Date	1 1

Eckert & Ziegler Analytics Quality Assurance Manual, Revision 17

# Form QA-08-03. Employee's Qualification Form for Production Personnel and Production Assistants

# Sample only. See Operations Manual for controlled copy.

\_\_\_\_ is qualified to produce standards and perform production tasks as specified

below,

Standard Preparation (add other categories as necessary)

Type of Standard	Liquid	Point Source	Filters	Solids	Simulated Gas	Plate Sources	Electrodeposited Sources	Gas Standards
Date Internal Standard Prepared			·					•
Production Manager Approval (Date & Initial)								
QA Manager Approval (Date & Initial)								

Production Tasks for Production Assistants only (add tasks as necessary)

Internal Standards									
Task	Liquid Dilutions	Gas Dilutions	Liquid Scintillation	Mixed Gamma	Single Isotope	Filters	Large Area Sources	Gas Standards	
Date Internal Standards Prepared		1							
Production Manager Approval (Date & Initial)									
QA Manager Approval (Date & Initial)									

# 8.5. Qualifications for Counting Room Personnel

#### 8.5.1. Purpose

To specify qualifications for personnel responsible for operation of radiation detection instrumentation for calibrating or verifying radionuclide sources. Only qualified individuals are authorized to use counting room instrumentation.

#### 8.5.2. Qualifications

- 8.5.2.1. Individuals shall demonstrate knowledge of radiation detection instrumentation and nuclear counting techniques from previous on-the-job training, academic training, or on-the-job training at EZA.
- 8.5.2.2. The employee shall demonstrate a thorough knowledge of EZA's Quality Assurance Program and quality control procedures.
- 8.5.2.3. The RSO shall determine that an applicant is trained in the safe and proper handling of radioactive material.
- 8.5.2.4. An employee's qualifications and training for operation of counting room equipment shall be documented and maintained on Form QA-08-04, "Employee's Qualification for Counting Room Operations".

#### 8.5.3. Approval

The responsible department manager or the QA Manager or designee shall give final approval to counting room personnel.

# Form QA-08-04. Employee's Qualification for Counting Room Operations

, for the following

# Sample only. See Operations Manual for controlled copy.

~		
( or	titics	ation
CCI	unce	auon

activities:

\_\_\_\_ has been certified on

Operation of all radiation counting room equipment for product verification

Operation of all counting room equipment for calibrations

Review and approval of product verification results

All of the above

Only these so specified:

#### Certification is based on (check box as appropriate)

1. Previous education, experience, and training are considered valid for this position and are summarized here:

2. On-the-job training at EZA has been completed and is considered adequate for the employee's responsibilities.

3. Radiological Safety Indoctrination.

4. Quality Assurance Program indoctrination

			-
Approval			
Date of qualification: / /			
Department Manager	Date	1 1	-
QA Manager (or designee)	Date	1 1	

### 8.6. Training

#### 8.6.1. Purpose

To specify required training for EZA's employees

#### 8.6.2. Required Training

- 8.6.2.1. General employee training for all new employees will be completed within 30 working days from the initial date of employment. General employee training consists of all items in Form ANA-QA-10-01, "General Employee Training Checklist", including the following topics:
  - 8.6.2.1.1. Personnel Policy
  - 8.6.2.1.2. Quality Assurance Program

8.6.2.1.3. Radiation Safety

- 8.6.2.2. All employees will receive training for revisions to the QAM within 30 working days from issuance of a revision.
- 8.6.2.3. Technical training, including familiarization with the Operations Manual, is to be provided by the responsible supervisor. Training sessions shall be summarized and documented by memo to the training files for each employee. Informal or on-the-job training is not formally documented.
- **8.6.2.4.** Specific training needs shall be identified by the supervisor and a training request submitted to the Plant Manager.
- 8.6.2.5. All EZA employees who are involved in the transport of hazardous materials, including radioactive materials, will be trained in accordance with 49 CFR 172, Subpart H.

# 9. Quality Control of Instruments and Software

This section provides requirements for the quality control of instruments and software used for calibration of radioactivity standards. A procedure in the Operations Manual provides a master list of measuring and test equipment along with details regarding the identity of each item and software, manufacturer and serial number, location, manufacturers' instructions, data related to calibrations, and maintenance records.

#### 9.1. Quality Control of Gamma-Ray Spectrometers

#### 9.1.1. Purpose

To establish a procedure for maintaining calibration of gamma-ray spectrometers used for calibrating and testing radionuclide standards

#### 9.1.2. Quality Control for Calibrations

- 9.1.2.1. Batch calibrations on gamma-ray spectrometers shall be verified at least once a year by exchanging a standard with a national standardizing laboratory.
- 9.1.2.2. EZA's standards prepared and sent to a national standardizing laboratory as part of a measurement assurance program constitute a calibration verification of the instruments used in preparation. The report sent to the national standardizing laboratory shall identify the systems used in the test.
- 9.1.2.3. The blind analysis of standards received from a national standardizing laboratory and analyzed by EZA may be used for calibration verification.
- 9.1.2.4. Samples sent to or obtained from a national standardizing laboratory shall be measured on the system being calibrated and the results should not differ by more than 5% from results obtained from any other EZA gamma spectroscopy system.
- 9.1.2.5. If the results obtained on the gamma-ray spectrometer in question do not differ from NIST or other national standardizing laboratory results by more than the stated uncertainty (k = 3), the system is calibrated.
- 9.1.2.6. If the results differ from the national standardizing laboratory results by an amount greater than the expanded uncertainty (k = 3), the samples must be reanalyzed to determine the cause of the observed differences.
- 9.1.2.7. The calibration of the gamma-ray spectrometer system shall be checked using a traceable standard before calibrating any gamma-ray emitting source.
- 9.1.2.8. If significant efficiency changes (> 3%) are detected in the calibration check, the cause shall be investigated and, if necessary, the gamma-ray spectrometers shall be recalibrated using traceable standards.

#### 9.1.3. Quality Control Testing of Standards

- 9.1.3.1. Gamma-ray spectrometer systems may be used for quality control tests without having exchanged samples with a national standardizing laboratory if the tests involve a direct comparison with a traceable standard, or if results are compared to an internal standard which is prepared in the same geometry and the same radionuclides.
- 9.1.3.2. If significant differences in efficiencies are detected in counting any standard in the routine Quality Assurance Program and the differences cannot be attributed to the standard being counted, the system calibration shall be checked using a traceable standard.

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#### 9.1.4. Routine Quality Control

Performance checks shall be performed on the gamma-ray spectrometer systems weekly or prior to use, whichever is greater. These checks will include resolution, efficiency (count rate) tests, and energy calibration. Acceptance criteria shall be established for the efficiency check. If results are outside of the control limits, the test shall be repeated. If test results are still outside of control limits, an investigation shall be conducted to determine the cause. If the equipment is found to be out of tolerance and has been used for testing standards since the previous successful check, test results subsequent to the last successful check shall be evaluated and out of tolerance systems shall be recalibrated prior to use.

# 9.2. Quality Control of Liquid Scintillation Counting Systems

#### 9.2.1. Purpose

To maintain traceability of calibrations performed by liquid scintillation counting

#### 9.2.2. Routine Quality Control

- 9.2.2.1. Performance checks shall be conducted daily when in use by counting a quality control sample. Acceptance criteria shall be established and used to determine if the instrument is performing within control limits. If test results are outside the control limits, the count shall be repeated. If results are still outside of control limits, an investigation shall be conducted to determine the cause.
- 9.2.2.2. If the instrument is out of tolerance and has been used for testing standards since the previous successful quality control check, test results subsequent to the last successful check shall be evaluated and corrected if necessary.

#### 9.2.3. Quality Control for Calibrations

- 9.2.3.1. The liquid scintillation counter(s) shall be tested by performing measurement assurance tests for alpha and beta calibrations in accordance with Section 10.1.4, "Measurements Assurance Program".
- 9.2.3.2. The system operation shall be checked before the instrument is used to calibrate any radioactive source by the method below in Section 9.2.2.3.
- 9.2.3.3. Counter operation and calibration methodology shall be checked by the analysis of a traceable standard calibrated by the same methodology (such as efficiency tracing). The results should agree to within expanded uncertainty (k = 3) of the traceable solution or within expanded uncertainty (k = 3) of the measurement, whichever is larger. If the check is in disagreement, the cause shall be investigated and corrected if necessary.

#### 9.3. Quality Control of Ionization Chamber Radionuclide Calibrator

#### 9.3.1. Purpose

To maintain traceability of measurements performed with an ionization chamber radionuclide calibrator

#### 9.3.2. Quality Control for Calibrations

9.3.2.1. The ionization chamber shall be used to perform at least one measurement assurance test per year with a national standardizing laboratory in accordance with Section 10.1.4.

- 9.3.2.2. The ionization chamber operability shall be checked before it is used to calibrate any radionuclide.
- 9.3.2.3. The system operability may be checked by measuring a check source that was measured after a measurement assurance test. The current activity determined should agree to within twice the random uncertainty of the measurement.
- 9.3.2.4. The system operation may also be checked by measuring a traceable source. The results should agree to within the expanded uncertainty (k = 3) of the source or within the expanded uncertainty (k = 3) of the measurement, whichever is larger.
- 9.3.2.5. If measurements in Sections 9.3.2.3 or 9.3.2.4 above are outside of acceptance criteria, the instrument shall be recalibrated prior to use.

#### 9.4. Quality Control of Alpha and Beta Counters

#### 9.4.1. Purpose

To maintain the operability of alpha and beta counting systems including gas flow and scintillation counters

#### 9.4.2. Routine Quality Control

- 9.4.2.1. Daily (when in use), count an appropriate check source and record results in alpha/beta log book.
- 9.4.2.2. Compare results with acceptance criteria using a control chart or numerical acceptance criteria. If results are outside of the control limits, recount. If results are still outside of control limits, perform an investigation to determine the cause and make corrections as necessary.
- 9.4.2.3. If equipment is out of tolerance and has been used for testing standards since the previous successful quality control check, test results subsequent to the last successful check shall be evaluated.

#### 9.4.3. Quality Control for Calibrations

- 9.4.3.1. Alpha and beta counters used for calibrations (such as plastic scintillation or ZnS) shall be used to perform measurement assurance tests in accordance with Section 10.1.4.
- 9.4.3.2. Counter operation and calibration methodology shall be checked by the analysis of a traceable standard calibrated by the same methodology (such as alpha activity). The results should agree to within expanded uncertainty (k = 3) of the traceable solution or within expanded uncertainty (k = 3) of the measurement, whichever is larger. If the check is in disagreement, the cause shall be investigated and corrected if necessary.

#### 9.5. Quality Control for Analytical Balances

#### 9.5.1. Purpose

To establish a procedure for maintaining the accuracy and precision of analytical balances

#### 9.5.2. Procedure for Five-Place Analytical Balances

9.5.2.1. Each balance shall be serviced and checked for accuracy before initial use and on a yearly basis thereafter. A sticker on the balance will verify the calibration date and state the next calibration due date. After service, the calibration status of each

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balance as found and after service shall be reviewed in accordance with a procedure in the Operations Manual.

- 9.5.2.2. Each balance shall be checked with NIST-traceable weights at least monthly when in use. Testing and acceptance requirements are specified in the Operations Manual. NIST-traceable weight sets shall be re-certified every five years.
- 9.5.2.3. If a balance does not pass the test in Section 9.5.2.2 above, it shall be serviced and the calibration checked before further use. Standards prepared with this balance since the previous successful check will be investigated for the potential impact on the accuracy of these standards by initiating Form QA-13-01.

#### 9.5.3. Procedure for Other Balances

- 9.5.3.1. Each balance shall be checked for accuracy using NIST-traceable weights before initial use and on a yearly basis thereafter. A sticker on the balance will verify the calibration date and the next calibration due date.
- 9.5.3.2. Each balance shall be checked with a stable weight either monthly or before each use, whichever is later. Testing and acceptance requirements are specified in the Operations Manual.
- 9.5.3.3. If the balance does not pass the test in Section 9.5.3.2 above, it shall be serviced and calibrated before further use.

#### 9.5.4. Control of Analytical Balance Calibrations

- 9.5.4.1. EZA will review and approve the Quality Assurance Program for the vendor performing calibration services.
- 9.5.4.2. The vendor shall submit a certificate of conformance stating that balance calibrations were performed in accordance with their EZA-approved Quality Assurance Program.

#### 9.6. Quality Control of Computer Software

#### 9.6.1. Purpose

To provide controls for computer software utilized in the calibration of radioactive standards

#### 9.6.2. References

USNRC Regulatory Guide 4.15, Revision 1, February 1979.

#### 9.6.3. Procedure

- 9.6.3.1. This procedure applies to all software utilized in the production, testing, and certification of NIST-traceable radioactive standards. This shall include spreadsheet software such as Microsoft Excel as specified in Section 9.6.4, "Control of Spreadsheet Calculations".
- 9.6.3.2. All software meeting the criteria of Section 9.6.3.1 shall be identified in the Software Manual with Form QA-09-01, "Documentation of Software" (or equivalent) along with a listing of the source code if available. The current revision number and/or revision date shall be included in a program data statement.
- 9.6.3.3. All quality related software developed and/or revised shall be verified by appropriate tests which may include one or more of the following techniques: comparison of results with manual calculations, comparison of results/output to results from earlier versions of the software, and comparison of results with values verified by the NIST

traceability program. Testing shall verify the accuracy of software and the system as built and configured.

- 9.6.3.4. Software calibration programs that are part of a system with multiple components are ultimately tested with the entire system. Additionally, measurement assurance tests with NIST validate the accuracy of the software used for calibration.
- 9.6.3.5. For newly designed/procured software, the software documentation will include the software requirements, source code for in-house designed software, verification and validation, system/configuration identification, and problem/error evaluation and reporting. For procured software, errors reported by suppliers or discovered by EZA will be evaluated for impact on quality, and errors identified by EZA will be reported to the supplier. Approval of revisions (or configuration changes) to existing software will include verification and validation, identification of system/configuration changes, problem/error evaluation and reporting.
- 9.6.3.6. Software errors and failures shall be reviewed and evaluated. Errors and problems shall be documented on Form QA-13-01 and entered in the corrective action system as necessary.
- 9.6.3.7. The QA Manager will review and approve all new computer programs and revisions thereto.

#### 9.6.4. Control of Spreadsheet Calculations

- 9.6.4.1. Spreadsheet software used for final calculations of certified values or issuance of Certificates of Calibration shall be controlled. Spreadsheet software shall also be controlled if it is used for calculations that impact directly on the calibration of standards (i.e. calculation of detector efficiencies from equations).
- 9.6.4.2. Spreadsheets shall be controlled in accordance with Sections 9.6.3.2 through 9.6.3.4.
- 9.6.4.3. Simple spreadsheet calculations such as averages or standard deviations performed using functions included in the software are not controlled, but shall be initialed by the user as having been verified for the calculation performed.

# Form QA-09-01. Documentation of Software

# Sample only. See Operations Manual for controlled copy.

1. Title	2. Load Command ,
3. Revision No. and Date	4. Programmer
5. Language/Version	
6. Purpose and Description of Program. (Attach Additional Sheets as Necessary)	
	~
7. Program Operation	
8. Verification Data (Attach Additional Sheets as Necessary)	
<b>پ</b> ۱	
. *	
9. Problem/Error Evaluation (attach additional sheets as necessary)	
· · · · · · · · · · · · · · · · · · ·	
Signature and date of reviewer	Date
Approval	Date
QA Manager	Date

# **10.** Traceability and Calibration Certificates

### 10.1. Traceability to NIST and Other National Standardizing Laboratories

#### 10.1.1. Purpose

To define the process for establishing traceability of EZA's radionuclide standards to national standards and to describe the Measurements Assurance Program with NIST and other national standardizing laboratories

#### 10.1.2. References

- 10.1.2.1. USNRC Regulatory Guide 4.15, Revision 1, February 1979 or revisions thereof
- 10.1.2.2. ANSI N42.22-1995, "Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control"
- 10.1.2.3. NCRP Report 58, 1978, "A Handbook of Radioactivity Measurements Procedures".

#### 10.1.3. Definitions

- 10.1.3.1. National Standardizing Laboratory: A laboratory that participates in the IAEA/BIPM international inter-comparison program and is on EZA's national standardizing laboratories list in Section 4.1.4, "National Standardizing Laboratories".
- 10.1.3.2. Measurements Assurance Program: A program for verifying the accuracy of measurements through exchange and measurement of samples with a national standardizing laboratory. This involves EZA's analysis of blind samples sent by the national standardizing laboratory or the analysis by the national standardizing laboratory of sources certified by EZA.
- 10.1.3.3. Traceability: The process of relating the accuracy of radionuclide sources to national physical standards. Traceability is achieved by demonstrating the capability to produce accurate standardized sources. Traceability of EZA's sources to national standardizing laboratories including NIST is achieved by participation in Measurements Assurance Programs with linkage to national standardizing laboratories and production of certified material in accordance with EZA's Quality Assurance Program. While ANSI N42.22-1995 does not define levels or "types" of traceability, the terms "direct traceability" and "indirect traceability" are used in EZA's program.
- 10.1.3.4. Direct Traceability: A standard is directly traceable to a national standardizing laboratory if at least one standard from the master solution or from a dilution of the master solution was sent to that national standardizing laboratory for comparison and the results met the criteria in Section 10.1.5, "Evaluation of Measurements Assurance Program Data". Direct traceability also exists if the master solution or dilution was calibrated by a national standardizing laboratory. Standards calibrated by a national standardizing laboratory are traceable to NIST if EZA verifies the standards with techniques that have been demonstrated to produce results traceable to NIST or the calibration method has tested through the NIST program and meets the criteria in ANSI N42.22-1995.
- 10.1.3.5. Indirect Traceability: A standard is indirectly traceable to national standards if the standard was produced by the methodology and instrumentation type used to calibrate a standard which has been demonstrated to be traceable by participation in a national standardizing laboratory's Measurements Assurance Program.

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- 10.1.3.6. Derived Traceable Standards: Sources prepared or derived from certified sources that are traceable to a national standardizing laboratory. Derived traceable sources are traceable if the following conditions are met:
  - 10.1.3.6.1. The derived sources are prepared from material that is traceable.
  - 10.1.3.6.2. Tests are conducted to demonstrate that the preparation process has not adversely affected the accuracy of the original calibration.
  - 10.1.3.6.3. A test of derived sources produced in lots includes representative sampling of the lot to ensure the integrity of the production process.

#### 10.1.4. Measurements Assurance Program

The requirements that follow apply to the radionuclides and the specific national standardizing laboratory for which traceability is stated. The minimum requirements for participation in a Measurements Assurance Program for purposes of traceability to a national standardizing laboratory are as follows:

- 10.1.4.1. Verifications with a national standardizing laboratory shall be performed at least annually for each calibration technique and instrument type involving relative calibrations. Absolute calibration techniques shall be verified with a national standardizing laboratory every three years or prior to use if used less often than three years.
- 10.1.4.2. For calibrations utilizing the same instrument and technique over an energy range, verifications shall also include the following:
  - 10.1.4.2.1. Separate tests for gamma-ray or photon emitters with primary energies less than 250 keV and those with primary energies greater than 250 keV.
  - 10.1.4.2.2. Separate tests for beta-particle emitters with average beta energies less than 100 keV and those with average beta energies greater than 100 keV.
  - 10.1.4.2.3. Separate tests for alpha-particle sources used for high-resolution alpha spectroscopy and alpha sources used for measuring total alpha activity.
- 10.1.4.3. At least one (1) standard from an EZA eight-isotope mixed gamma-ray batch shall be sent to a national standardizing laboratory annually for verification.

#### 10.1.5. Evaluation of Measurements Assurance Program Data

10.1.5.1. Successful verification requires that the difference between the national standardizing laboratory's and EZA's values be less than the propagated uncertainty of the difference. The propagated uncertainty of the difference shall be determined by combining the expanded uncertainty of each measurement using the root-sum-of-the-squares method with a coverage factor of three (k = 3). In equation form, this requirement is as follows:

$$\left|V_{A}-V_{N}\right| \leq 3\sqrt{\mu_{A}^{2}+\mu_{N}^{2}}$$

Where  $V_A = EZA$  value  $\mu_A$  is the expanded uncertainty of  $V_A$   $V_N = NIST$  value, and  $\mu_N$  is the expanded uncertainty of  $V_N$ 

10.1.5.2. If the results of a verification test do not meet the criterion in Section 10.1.5.1, then the cause shall be investigated. If the difference with the national standardizing laboratory cannot be resolved within 90 days or a time interval agreed to by the national standardizing laboratory and EZA, the radionuclide in question and all

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sources calibrated by the same instrument type and technique shall not be considered traceable until a successful verification test has been performed.

10.1.5.3. If the disagreement with the national standardizing laboratory cannot be resolved, customers who have received standards from the material in question shall be notified of the disagreement.

# 10.2. Calibration Certificates

#### 10.2.1. Purpose

To prescribe requirements for Certificates of Calibration for NIST-traceable radioactivity standards

### 10.2.2. References

- 10.2.2.1. ANSI N42.22-1995, "Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control"
- 10.2.2.2. ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories, 1999
- 10.2.2.3. ICRU Report 12, "Certification of Standardized Radioactive Sources", 1968

#### 10.2.3. Format of Certificates

10.2.3.1. Certificates shall as a minimum contain the following information:

- 10.2.3.1.1. EZA's Name and Address
- 10.2.3.1.2. Title: Certificate of Calibration
- 10.2.3.1.3. SRS Number of the source or another unique identification that is traceable to the source
- 10.2.3.1.4. Title which provides a short description of source (i.e. <sup>133</sup>Ba 5-ml Liquid in Flame Sealed Vial)
- 10.2.3.1.5. Description of source preparation
- 10.2.3.1.6. Calibration method
- 10.2.3.1.7. Technique for verification of certified value and impurities
- 10.2.3.1.8. Statement of traceability including reference to HPS Accreditation Program
- 10.2.3.1.9. Nuclear data

10.2.3.1.9.1.	Radionuclide(s)
10.2.3.1.9.2.	Activity or emission rate with uncertainty statement with coverage factor
10.2.3.1.9.3.	Half-life(s) of radionuclides
10.2.3.1.9.4.	Reference date
10.2.3.1.9.5.	Impurity statement
10.2.3.1.9.6.	Relevant physical or chemical information as appropriate for the type of source
10.2.3.1.9.7.	Volume, mass, and density of the source as appropriate
10.2.3.1.9.8.	Chemical properties such as carrier concentration and solution composition

- 10.2.3.1.10. Source dimensions and active area and description of any material covering the source
- 10.2.3.1.11. Customer name and purchase order number

10.2.3.1.12. Other pertinent remarks that may be useful for the user

10.2.3.1.13. Expiration date as appropriate or required by customer

10.2.3.1.14. Signature of the person making the standard and the QA Manager

#### 10.2.4. Supplemental Information

10.2.4.1. Additional or supplemental information from clients may be included in the Certificate of Calibration in the Comments section or as an addendum to the Certificate. The addendum shall include the words "Addendum to Calibration Certificate for SRS 99999-999" with the issue date.

#### 10.2.5. Issuing Replacement Certificates

10.2.5.1. If a replacement certificate is issued, the new certificate shall be signed with the reissue date and shall identify the original it replaces by specifying the date of the original certificate. The reason for replacement shall be included as supplemental information in the replacement certificate.

# **11. Product Quality Control**

# 11.1. Radionuclide Standard and Master Solution Calibration

#### 11.1.1. Purpose

To establish a procedure for calibrating individual radionuclide standards and master radionuclide solutions that maintains traceability to national standards

#### 11.1.2. Calibration by Gamma-Ray Spectroscopy

- 11.1.2.1. The standard or an aliquot of a master solution shall be counted on a calibrated system in a geometry and position that has been calibrated with traceable sources or that has been used to perform a successful measurements assurance test.
- 11.1.2.2. An instrument qualification log shall be kept for each system showing the calibrated geometries and positions that can be used. The approved efficiency tables for each system shall be included in the instrument log.
- 11.1.2.3. System operability shall be demonstrated before performing calibrations using check sources or traceable standards.
- 11.1.2.4. If the results of the operability check differ by more than twice the counting uncertainty for check sources or by more than the expanded uncertainty (k = 3) for traceable standards, the cause shall be investigated and corrected if necessary.
- 11.1.2.5. Uncertainties shall be calculated by Operations Manual Procedure ANA-QA-06, "Calculation of Uncertainties for Standards".

#### 11.1.3. Calibration by an Ionization Chamber Measurement

- 11.1.3.1. The standard or an aliquot of a master solution shall be measured in a geometry or a related geometry which has been calibrated by a national standardizing laboratory or which has been calibrated by EZA using traceable standards.
- 11.1.3.2. The calibration factor for the radionuclide being calibrated shall have been determined by a national standardizing laboratory or determined by EZA and verified by a measurement assurance test.
- 11.1.3.3. An instrument qualification log shall be kept showing accepted radionuclide calibration factors, geometries, and geometry correction factors.
- 11.1.3.4. Before calibrating any source, system operability shall be checked by the procedure in Section 9.3.2 for the ionization chamber calibrator.
- 11.1.3.5. Uncertainties shall be calculated by the procedure in Section 11.4, "Calculation of Uncertainties".

#### 11.1.4. Calibration by Liquid Scintillation Counting

- 11.1.4.1. Calibration by liquid scintillation counting may be performed by any method that has been used to perform a measurement assurance test.
- 11.1.4.2. An instrument qualification log shall be kept showing accepted methods and accepted energy ranges for beta standards per Section 10.1.4.2.2. For methods requiring efficiencies, a list of approved factors shall be maintained in the log.
- 11.1.4.3. The instrument shall be maintained in accordance with Section 9.2, "Quality Control of Liquid Scintillation Counting Systems".
- 11.1.4.4. Uncertainties shall be calculated by the procedure in Section 11.4.

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#### 11.1.5. Calibration by ZnS and Plastic Scintillation Detectors

- 11.1.5.1. Alpha and beta calibrations may be performed by any method that has been used to perform a Measurement Assurance Test.
- 11.1.5.2. An instrument qualification log shall be kept showing accepted methods and accepted energy ranges for alpha and beta standards as per Section 10.1.4.1.2.
- 11.1.5.3. The instrument shall be maintained in accordance with Section 9.2.
- 11.1.5.4. Uncertainties shall be calculated by the procedure in Section 11.4.

#### 11.1.6. Calibration by Alternative Means

- 11.1.6.1. Calibration of radionuclides by methods not specified above shall be qualified by a Measurement Assurance Test with a national standards laboratory (preferably NIST) prior to distribution of such radionuclides.
- 11.1.6.2. The results shall be entered in the instrumentation qualification log.
- 11.1.6.3. If a new instrument is utilized, an appropriate quality control procedure shall be implemented for this instrument.

### **11.2.** Production of Traceable Radionuclide Standards

#### 11.2.1. Purpose

To describe the methodology for production of radionuclide calibration standards and for demonstrating traceability

# 11.2.2. Methods of Production that Demonstrate Traceability

11.2.2.1. Master solution method for liquid or solid standards

Standards may be prepared from master solutions or dilutions of master solutions if the final standard can be gravimetrically related to the traceable master solution. The master solution must be traceable to a national standardizing laboratory by either the direct or the indirect methods described in Section 10.1.3.4 or 10.1.3.5. Master solutions shall be identified by radionuclide and page/volume.

#### 11.2.2.2. Direct calibration for all forms of standards

Any standard may be directly calibrated on an instrument calibrated by the procedures specified in this manual if traceability can be demonstrated by one of the methods described in Section 10.1, "Traceability to NIST and Other National Standardizing Laboratories".

#### 11.2.2.3. Master source method for gas standards

Individual gas standards may be prepared volumetrically from master sources calibrated in emission rate per cubic centimeter or in activity per cubic centimeter. The transfer syringe shall be gravimetrically calibrated.

### 11.3. Quality Control Testing of Radionuclide Standards

#### 11.3.1. Purpose

To describe quality control tests for radionuclide calibration standards

#### 11.3.2. General Requirements for Testing

- 11.3.2.1. The results for quality control tests shall be recorded and attached to a Quality Control Form, QA-12-#, where # refers to the form number related to specific types of standards.
- 11.3.2.2. The QA Manager shall review the test results and approve or reject the standard.
- 11.3.2.3. If a standard is rejected, the cause shall be noted on the appropriate Form QA-12, "Quality Control Review". The standard, Form QA-12, and test data shall be returned to Production. The Production Manager shall review the results and determine if corrective action is necessary prior to remake of the standard. If corrective action is necessary, Form QA-13-01, "Corrective Action/Preventive Action Request (CAPA)" shall be initiated by Production.

#### 11.3.3. Testing of Gamma-Ray Emitting Standards

11.3.3.1. Quality Control Test of Eight-Radionuclide Mixed Gamma Standards

- 11.3.3.1.1. Count the standard on a germanium gamma-ray spectrometer system in a position that keeps the system dead time below 10% (< 20% if pile-up rejection amplifier is used). Count until at least 10,000 net counts are accumulated for each gamma-ray energy that is certified.
- 11.3.3.1.2. Use an approved software program that calculates gamma-ray efficiencies for mixed gamma standards and input the following information: serial number, geometry, counting position, operator's initials, and length of count.
- 11.3.3.1.3. Use the efficiency data for the following energies for analysis: 88 keV, 122 keV, 166 keV, 279 keV, 392 keV, 662 keV, 898 keV, 1173 keV, 1332 keV, and 1836 keV.
- 11.3.3.1.4. Compare absolute efficiencies to previous standards where possible. If the efficiencies of the sources used for comparison do not match within the stated expanded uncertainty (k = 3) of the standard, the QA Manager shall be responsible for deciding the outcome of the test based on data or internal standards.
- 11.3.3.1.5. The GCOUNT computer program developed by EZA (documented in the Software Manual) tests for homogeneity of radionuclides in the standard. If the test parameters for the <sup>88</sup>Y, <sup>203</sup>Hg, or <sup>139</sup>Ce test have an absolute magnitude exceeding 0.080, the overall spectrum test will determine whether or not the standard is passed. If the <sup>88</sup>Y test parameters (1) and (2) and the <sup>139</sup>Ce parameter are all positive and greater than 0.050, the overall spectrum test parameters shall be used to determine the quality of the standard. In the overall spectrum test, the difference between parameter (3) and parameter (4) should not exceed 0.10. Overall spectrum test parameters (5) through (10) should not exceed 0.060 in absolute magnitude.
- 11.3.3.2. Other Mixed Gamma-Ray Standards
  - 11.3.3.2.1. Count the source on a germanium gamma-ray spectrometer system in a position to allow comparison with other standards of similar geometry and record the data listed in Section 11.3.2.1.
  - 11.3.3.2.2. The measured efficiencies shall agree with the extrapolated efficiencies from the comparison standard within the stated expanded uncertainty (k = 3) of the source being tested.

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- 11.3.3.2.3. If the geometries of the sources used for comparison do not match exactly, the QA Manager shall be responsible for deciding the outcome of the test based on previous experience and data.
- 11.3.3.3. Single Radionuclide Gamma-Ray Standards
  - 11.3.3.3.1. Single radionuclide gamma-ray standards may be tested by the procedure in Section 11.3.3 using an approved gamma-ray analysis program or,
  - 11.3.3.3.2. Single liquid radionuclide gamma-ray standards may be tested using an ionization chamber.
- 11.3.3.4. Alpha-gamma and beta-gamma standards
  - 11.3.3.4.1. Alpha-gamma and beta-gamma standards may also be tested by any of the procedures in Section 11.3.3, "Testing of Gamma-Ray Emitting Standards".

#### 11.3.4. Alpha or Beta Particle Emitting Standards

- 11.3.4.1. Solid or Liquid Standard
  - 11.3.4.1.1. Standards shall be counted using a gas counter system, a liquid scintillation counter, or solid scintillation counters.
  - 11.3.4.1.2. The activities or counting efficiencies determined in the test shall be compared to other standards and agree with the standard used for comparison within the stated expanded uncertainty (k = 3) for the source being tested.

#### 11.3.5. Disposition of Standards Failing Quality Control Test

- 11.3.5.1. The Counting Room Supervisor shall be responsible for identifying non-confirming standards. Standards that fail quality control test shall be marked with an "X" and segregated from other standards. These standards shall be stored in the radioactive storage cave in an area reserved for waste or non-conforming solutions.
- 11.3.5.2. Solutions that fail QC testing shall be marked with an "X" and placed in the radioactive storage area for disposal or recalibration. Notations shall be made in the master calibration book for solutions that are retested and fail to meet acceptance criteria. Notations shall identify the date of test and reason for failure.

#### **11.4.** Calculation of Uncertainties

The methodology for calculating and reporting uncertainties of radionuclide standards are documented in Operations Manual Procedure ANA-QA-06. This methodology shall be consistent with good industry practice and/or published NIST practice.

### 11.5. Inter-laboratory Cross Check Programs

#### 11.5.1. Purpose

To control the production of radioactive samples used in the inter-laboratory cross check programs

11.5.2. Radiochemistry and Environmental Cross Check Programs

11.5.2.1. Cross check samples are used for testing instrument calibration, sample preparation procedures, radiochemical procedures, laboratory technique, and computer software. Inter-laboratory cross check samples are not to be used by the customer for
instrument calibration due to their low activity levels and the addition of interferences for testing purposes.

- 11.5.2.2. Samples shall be prepared gravimetrically from solutions calibrated by EZA or by a national standardizing laboratory whenever possible.
- 11.5.2.3. Cross check samples shall, when possible, be prepared from radionuclides calibrated by a different method than used for the same radionuclides supplied to the customer for calibrations.
- 11.5.2.4. Cross check samples shall be verified by counting, when possible, and should agree with gravimetric preparation data within the expanded uncertainty of the measurement (k = 3).
- 11.5.2.5. Gas samples shall be prepared volumetrically from EZA's calibrated sources or individually counted on EZA's equipment.

### 12. Identification, Handling, Storage, and Shipment

### 12.1. Requirements for Processing Radionuclide Standards

### 12.1.1. Purpose

To document the requirements for the testing, tracking, storage, and shipping of radionuclide standards

### 12.1.2. References

12.1.2.1. EZA's Radioactive Material License

12.1.2.2. 49 CFR 173, "Shippers--General Requirements for Shipments and Packaging"

12.1.2.3. International Air Transport Association (IATA) Dangerous Goods Regulations

### 12.1.3. Tracking of Standards During Production

- 12.1.3.1. Prior to production, each source shall be assigned a five-digit serial number followed by a hyphen with the customer number. The serial number or an identification number will follow the source through production and QA.
- 12.1.3.2. All sources will have their assigned serial number attached to the container by a temporary tag during production or shall have the serial number written on the container.
- 12.1.3.3. If a source fails any Quality Assurance test at any time during production, the replacement standard shall be identified by amending the original five-digit serial number by adding a letter starting with "A". Successive rejections would be indicated by "B", "C", etc. For example, the first remake of 99999-999 would be labeled as 99999A-999.

### 12.1.4. Transfer of Sources from Production

- 12.1.4.1. Sources shall be wiped clean to remove possible loose radioactive contamination.
- 12.1.4.2. Standards shall be forwarded to the counting room for quality control testing with a completed copy of the appropriate quality control review form from the QA-12 series of forms. Different variations of these forms are provided in the Operations Manual for specific type of standards. They are numbered as QA-12-# where the # refers to the form for a specific type of standard.

### 12.1.5. Processing of Standards

- 12.1.5.1. Standards shall be counted using applicable quality control test procedures for each particular type of source (See Section 11.3), and reviewed by the Quality Assurance department. Direct calibrations shall be reviewed and approved by an individual other than the person performing the calibration. If calibration results are calculated manually, then the reviewer of the calibration shall record calculations on the quality control review form or an attachment to the form.
- 12.1.5.2. If a source fails the QC test, it will not receive an EZA label and shall be handled as described in Section 11.3.5, "Disposition of Standards Failing Quality Control Test" and Section 13.2, "Control of Non-Conforming Items". If a source passes the QC test but is rejected for other reasons such as appearance or activity, it may be used as an in-house test source if it is so identified by markings on the source.

- 12.1.5.3. Sources which pass the Quality Assurance test shall become Standard Radionuclide Sources (SRS) will have their assigned serial number attached, and will receive an EZA label.
- 12.1.5.4. The label attached to the standard shall state the SRS number, the type and quantity of radioactive material, the reference date, the expiration date if applicable, and the initials of the QA Manager or alternate.
- 12.1.5.5. A calibration certificate signed by the person making the standard with his or her title will accompany each item. In the absence of the individual making the source, an individual qualified to make radioactive standards may review the production data and sign the certificate. The QA Manager or an individual authorized to sign calibration certificates shall also sign the calibration certificate.

### 12.1.6. Disposition of Standards Failing QC Testing

- 12.1.6.1. If a standard is rejected, the reason for failure shall be noted on the appropriate quality control review form from the QA-12 series of forms.
- 12.1.6.2. The failed standard(s) and the filled-out quality review form shall be returned to production. The Production Manager will review the results and determine if corrective action (using Form QA-13-01) is necessary prior to remaking the standard. Production is responsible for disposal of non-conforming items.

### 12.1.7. Storage of Standards During QC Testing

Standards shall be stored in approved areas of the building per EZA's license.

### 12.1.8. Shipment of Standards

All shipments are required to meet applicable U.S. Department of Transportation regulations. Detailed requirements for shipping are provided in Operations Manual Procedure ANA-ADM-02, "Shipping Procedures".

### 12.2. Requirements for Processing Radioactive Check Sources

### 12.2.1. Purpose

To document the requirement for testing, tracking, storage and shipping of radioactive check sources which are not certified as standards

### 12.2.2. References

12.2.2.1. EZA's Radioactive Material License

12.2.2.2. 49 CFR 173, "Shippers' General Requirements for Shipment Packaging"

12.2.2.3. International Air Transport Association (IATA) Dangerous Goods Regulations

### 12.2.3. Tracking of Check Sources During Production

12.2.3.1. Each check source will be assigned a sequential three-digit identification number followed by a hyphen with the customer number that will follow it through production. Check sources produced in lots can use one identification number for the entire lot.

### 12.2.4. Transfer of Check Sources from Production

12.2.4.1. Sources will be wiped clean to remove loose radioactive contamination.

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12.2.4.2. Check sources will be counted to determine if activity is within  $\pm$  20% of requested activity. If this condition is not met, the QA Manager will determine if the source is acceptable. If the source is rejected, it may be retained for future use or transferred to radioactive waste. The original check source identification may be retained.

### 12.2.5. Storage of Check Sources during Production and QC Testing

Check sources will be stored in approved areas of the building per EZA license.

### 12.2.6. Shipment of Check Sources

- 12.2.6.1. All shipments are required to meet applicable U.S. Department of Transportation regulations. Detailed requirements for shipping are provided in Operations Manual Procedure ANA-ADM-02.
- 12.2.6.2. A Report of Activity will be provided for each check source or lot. The Report of Activity will contain, as a minimum, the following information.
  - 12.2.6.2.1. Check Source Number
  - 12.2.6.2.2. Description
  - 12.2.6.2.3. Customer Name
  - 12.2.6.2.4. Purchase Order Number
  - 12.2.6.2.5. Reference Date
  - 12.2.6.2.6. Isotope
  - 12.2.6.2.7. Activity
  - 12.2.6.2.8. For check sources made as lots, the average activity can be reported with the standard deviation and range of values.

### Form QA-12-#. Quality Control Review

### Sample only. See Operations Manual for controlled copy.

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### **13.** Corrective Actions

### 13.1. Identification, Evaluation, Corrections, and Prevention of Conditions Adverse to Quality

### 13.1.1. Purpose

EZA has a system to identify, evaluate, and correct conditions adverse to quality. Conditions adverse to quality are defined as any condition that, if not corrected, could have an impact on the quality of standards. This also includes needed improvements to the quality system or operating procedures to prevent possible non-conformances. Examples of such conditions are listed below.

### 13.1.2. Conditions Adverse to Quality

- 13.1.2.1. Failure to follow the QAM or Operations Manual with respect to production of standards
- 13.1.2.2. Calibration of standards with an instrument that has not been qualified
- 13.1.2.3. Computer software problems that may introduce uncertainties in the calibration or testing of radionuclide standards
- 13.1.2.4. Production of standards by unqualified individuals
- 13.1.2.5. Process problems for the manufacture or calibration of standards

### 13.1.3. Identification of Potentially Adverse Conditions

The procedure for reporting and correcting potential conditions adverse to quality is Operations Manual Procedure ANA-QA-07, "Corrective Action/Preventive Action Procedure". All employees have a responsibility to identify any condition that may have an adverse impact on quality. Such conditions shall be identified immediately (verbally) to the QA Manager and then documented on Form QA-13-01. Form QA-13-01 shall be initiated as soon as practical but no later than the end of the next working day. Results from internal and external audits and customer complaints may also be identified as potential deviations from quality and would be processed on Form QA-13-01.

### 13.1.4. Evaluation and Corrective Action

13.1.4.1. Immediate action may be necessary for the following issues:

- 13.1.4.1.1. If the reported condition would compromise the integrity or quality of standards, the QA Manager may issue a stop work order for the activities in question. A stop work order will be transmitted to all employees by written communication. Work will not resume until corrective actions have been completed and the QA Manager has rescinded the stop work order by written communication to all employees.
- 13.1.4.1.2. If the reported condition has compromised the quality system, a special investigation of this area will be conducted if deemed necessary by the QA Manager. The results of the investigation shall be summarized by the QA Manager and transmitted to the Review Committee using Form QA-13-01.
- 13.1.4.1.3. If the reported condition would have resulted in the certified activity of previously supplied standards to be outside of the stated expanded uncertainty (k = 3) of the standards, the client shall be notified as soon as possible with

details regarding the standard(s) in question and requested to return the standards. If EZA is accredited through an external body, HPS Laboratory Accreditation Program, the accrediting body shall be notified and provided the details associated with the adverse condition.

- 13.1.4.1.4. If the reported condition does not require immediate attention, it shall be assigned to an individual for investigation. This individual will provide a report within the assigned date that includes a determination of the cause and recommendations to correct and prevent recurrences of this condition.
- 13.1.4.2. Preventive action is also implemented in Operations Manual Procedure ANA-QA-07 and is designed to prevent problems before they occur or prevent recurrence of a problem. This procedure provides a tool to:
  - 13.1.4.2.1. Determine potential nonconformities and their causes
  - 13.1.4.2.2. Evaluate the need for action to prevent occurrence of nonconformities
  - 13.1.4.2.3. Determine and implement necessary action
  - 13.1.4.2.4. Record results of any investigations and actions taken
  - 13.1.4.2.5. Review the preventive action taken and its effectiveness

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Quality Assurance Manager (Sign):	<u>_</u>	Date:

### 13.2. Control of Non-Conforming Items

### 13.2.1. Purpose

To describe the methods for controlling non-conforming items

### 13.2.2. Definition of Non-conforming Items

"Non-conforming items" refer to products that are manufactured by EZA in accordance with the Quality Assurance Program and do not meet the acceptance criteria for accuracy. In addition, products that do not meet customer's specifications with respect to appearance, activity, or geometry are considered non-conforming items.

### 13.2.3. Procedure for Handling Non-conforming Items

- 13.2.3.1. Sources that fail to pass the final Quality Assurance test shall be marked as unacceptable by marking through the serial number or by marking the source with a large "X" and disposed of as radioactive waste.
- 13.2.3.2. Sources rejected for reasons that do not affect accuracy such as physical appearance or the activity may be retained as in-house test sources and shall be labeled as such.
- 13.2.3.3. In accordance with Section 12.1.3, "Tracking of Standards During Production", remakes shall be identified by amending the original five-digit serial number by adding a letter starting with "A". Successive rejections would be indicated by "B", "C", etc. For example, the first remake of 99999-999 would be labeled as 99999A-999.

### 13.3. Reporting Defects in Accordance with 10 CFR Part 21

#### 13.3.1. Purpose

To describe the criteria and procedure for reporting defects required by 10 CFR Part 21 (10 CFR 21)

### 13.3.2. References

- 13.3.2.1. 10 CFR 21, "Reporting of Defects and Noncompliance"
- 13.3.2.2. Regulatory Guide, 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environmental Conditions During and Following an Accident"

### 13.3.3. Procedure

- 13.3.3.1. Section 206 of the Atomic Energy Act shall be posted on the company bulletin board and in the main counting room with a notice describing the regulations/procedures, including the name of the individual to whom reports may be made, and states where reports may be examined
- 13.3.3.2. 10 CFR 21 requires that defects in basic components supplied to nuclear power reactors that could create a substantial safety hazard be reported in accordance with 10 CFR 21.21. A substantial safety hazard is defined as the loss of safety function to the extent that there is a major reduction in the degree of protection provided to public health and safety.

EZA does not provide equipment or hardware that is considered to be safety-related. Radioactive standards are provided to commercial power reactors for the calibration of radiation detection equipment, radiation monitors, and post-accident monitoring systems. It does not appear that any products supplied by EZA are covered by 10 CFR 21 since calibration standards are not considered to be a basic component as defined in Part 21. EZA will however, apply Part 21 to all radioactive standards supplied to nuclear power plants as follows:

- 13.3.3.3. The basis for determining if a defective standard is to be reported can be found in NRC Regulatory Guide 1.97 which requires accuracy within a factor of two for post-accident radioactivity measurements. EZA will issue a notification of a defect if the following conditions are met:
  - 13.3.3.3.1. The accuracy or design of the standard would introduce an uncertainty greater than a factor of two (2) compared to the certified value of the standard.
  - 13.3.3.2. Since EZA may not have information regarding the intended use of radioactive standards by customers, any standard supplied to nuclear power plants will be reported if the condition in Section 13.3.3.3.1 is met.
- 13.3.3.4. Any defects in radioactive standards supplied by EZA that meet the criteria in Sections 13.3.3.3.1 and 13.3.3.2 shall be reported by the Plant Manager in accordance with 10 CFR 21.21 and Operations Manual Procedure ANA-QA-12, "Instructions for Submitting 10 CFR Part 21 Reports".

### 13.3.4. Posting Requirements

A current copy of Section 206 of the Energy Reorganization Act of 1974 shall be posted on the company bulletin board and other places as directed by the Plant Manager. In lieu of posting 10 CFR 21, a notice shall be posted describing the regulations and procedures (including the name of the individual to whom reports may be made) and stating where they may be examined.

### 13.4. Evaluating Customer Quality Concerns

### 13.4.1. Policy

It is EZA's policy to address customer concerns regarding the quality of products manufactured by EZA. The procedure for processing customer concerns is provided in Operations Manual Procedure ANA-ADM-07, "Handling Customer Quality Concerns".

### 13.4.2. EZA's Warranty

The standard EZA Limited Warranty is as follows:

Eckert & Ziegler Analytics (EZA) warrants that at the time of shipment the products sold by it are free from defects in material and workmanship and conform to specifications which accompany the product. EZA makes no other warranty, expressed or implied, with respect to the products, including any warranty of merchantability or fitness for any particular purpose. Complaints of breach of warranty on radioactive products must be received in writing by EZA within two half-lives of the radioactive material or 30 days, whichever first occurs. The maximum liability for any breach of warranty shall be replacement of the product or refund of the invoice price of the product. EZA shall in no case be liable for special, incidental, or consequential damages of any kind.

### 14. Audits and Inspections

### 14.1. Internal Quality Assurance Audits

### 14.1.1. Internal Audits

EZA performs a comprehensive audit of the Quality Assurance Program every year in accordance with Operations Manual Procedure ANA-QA-03, "Internal Audits of Eckert & Ziegler Analytics QA Program".

### 14.1.2. Qualifications of Internal Auditors

Internal auditors are qualified by Operations Manual Procedure ANA-QA-05, "Qualification of Internal Auditors". This procedure provides requirements and the mechanism for approval by the Review Committee.

### 14.1.3. Audits and Inspections by Clients

- 14.1.3.1. Audits of EZA's Quality Assurance Program by clients can be arranged with the QA Manager subject to the client's assurance that the confidentiality of EZA's Program will be maintained. The length (number of days) of audits shall be negotiated with the QA Manager and shall be limited to normal industry practice for the size and scope of operation.
- 14.1.3.2. Clients will be afforded access to EZA's production and calibration facilities to observe the preparation and calibration of standards. It is generally not possible for a client to observe their orders being filled since such inspections would interfere with production schedules. If there is a purchase order requirement to observe production of a client's order, there will be a fee to compensate EZA for disruption of the production schedule. Clients must agree to maintain the confidentiality of all operations observed during laboratory visits.

# Eckert & Ziegler Analytics Product Information





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### Introduction

The sole focus at Eckert & Ziegler Analytics is the preparation of quality radioactive calibration standards and calibrationrelated products. Our in-depth understanding of the intricacies of custom-standard preparation and the preparation of inter-laboratory cross-check samples makes us the premier supplier of custommade radionuclide calibration standards and inter-laboratory cross-check products. Eckert & Ziegler Analytics' experienced, professional staff ensures that you are able to purchase the appropriate standards for your calibration needs. Our continuing technical support after the sale guarantees that you meet those calibration needs.



### Traceability

Eckert & Ziegler Analytics is committed to ensuring the traceability of its radionuclide calibration standards. For more than twenty-five years Eckert & Ziegler Analytics has participated in Measurements Assurance Programs (MAPs) with the National Institute of Standards and Technology (NIST) and has successfully completed over 1800 individual measurements on 40 different radionuclides. Eckert & Ziegler Analytics' participation in the NIST/ Nuclear Energy Institute (NIST/NEI) Measurements Assurance Program for the Nuclear Power Industry satisfies the requirements of the United States' Nuclear Regulatory Commission's Regulatory Guide 4.15, Revision 1, 1979, and ANSI N42,22-1995 American National Standard -Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.

Eckert & Ziegler Analytics is an active participant with the American National Standards Institute (ANSI) subcommittee on radioactivity measurements. Eckert & Ziegler Analytics' personnel have assisted in the writing of the standard on traceability (ANSI N42.22) and are assisting in the development of an accreditation program for standards suppliers.

### Quality

Eckert & Ziegler Analytics has one of the best quality-assurance programs in the custom-standard preparation industry. From 1980 to the present Eckert & Ziegler Analytics has delivered quality standards whose calibrations are accurate and completely supported by quality-assurance documentation. Each of our standards must pass a rigorous quality-control testing process.

For the quality-control testing of custom-geometry gammaray standards, Eckert & Ziegler Analytics maintains a current database including efficiencies from more than 40,000 individual standards in over 600 geometries. This data collection also allows Eckert & Ziegler Analytics to assist its customers in making informed decisions when choosing geometries and optimum activities for calibrating detectors.

These services are included as part of the package when purchasing Eckert & Ziegler Analytics standards. All of our resources are available to assist you with your purchase. These are the reasons we say "Our Universe is Calibration" and why we believe it makes a difference to our customers. We invite you to visit our universe and investigate how we can meet your calibration needs.

# **Gamma-Ray Standards**



Analytics' Mixed-Gamma-Ray Standards provide efficiency calibrations for germanium gamma-ray-spectrometer systems over a wide energy range. These radionuclide mixtures provide the most accurate calibrations available for modern, high-efficiency germanium detectors.

All custom-made, gammaray calibration standards must pass Analytics' quality-control requirements as follows:

Calibrations utilizing Analytics' standards demonstrate traceability to NIST. Analytics' participation in the NIST/ Nuclear Energy Institute (NIST/NEI) Measurements Assurance Program for the Nuclear Power Industry satisfies the requirements of the United States' Nuclear Regulatory Commission's Regulatory Guide 4.15, Revision 1, 1979, and ANSI N42.22-1995 American National Standard -Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.

Each standard is prepared gravimetrically with a calibrated balance.

After preparation, each standard is counted with a calibrated, germanium spectrometer system. The counting efficiencies at each primary energy are compared to the counting efficiency of at least one independent standard and agreement must be within Analytics' stated uncertainty. For the quality-control testing of custom-geometry gamma-ray standards, Analytics maintains a current database including efficiencies from more than 40,000 individual standards in over 600 geometries.

### Mixed Gamma Standard (Basic 8-isotope mixture): Advantages

The Mixed Gamma Standard contains carefully selected radionuclides for minimum spectral interference.

The use of multiple gammaray-emitting radionuclides with simple spectra (single or at most twin gamma-ray emissions) allows the activities of each component to be adjusted to give approximately equal counting statistics across the entire energy range. The result is that all regions of the energyversus-efficiency curve will have equal precision.

This mixture minimizes coincident summing effects, which is particularly important when counting close to large, high-efficiency, germanium detectors. For more information on problems with coincidence summing consult "The Counting Room: Special Edition," Radioact. Radiochem., McFarland, T., Ed; Caretaker Communications, 1994; pp 67-86. The calibration is performed by germanium spectrometry on the final mixture. This procedure provides verifiable final calibrations and uncertainty values for each component. Typical uncertainties are in the range of 3 - 4%, relative expanded uncertainty (k=2).

### **Gamma-Ray Standards**

### Matrices

Over the past twenty-five years Analytics has prepared custom-made standards in hundreds of different geometries utilizing many different matrices.

- Water-equivalent solid standards are prepared in hundreds of different geometries. These standards are individually traceable and much safer to handle in the counting room than liquid standards. There is no possibility of leakage, spillage or plate-out of the radioactive material. Matrix density is 1.15 g/cc.
- Air filter standards are uniformly deposited to your specifications and sealed in customer supplied counting configurations.
- Charcoal and silver zeolite cartridge standards are prepared in customer supplied cartridges loaded to your specifications.
- Soil or sand standards are prepared in customer supplied counting containers. Matrix density ranging from 1.5 g/cc to 1.7 g/cc.
- High density solids with density range from 1.5 to 2.0 g/cc.
- Vegetation or simulated vegetation standards are prepared in customer supplied counting containers with an approximate density of 0.6 g/cc.
- Simulated gas standards are prepared in customer supplied gas counting containers. These low-density (0.02 g/cc) standards have the same gamma-ray attenuation characteristics as actual gas standards and greatly extend the energy range and useful life of the calibration standard.
- Point sources are mounted in various geometries, again to your specifications.



### SPECTRUM OF ANALYTICS' MIXED GAMMA STANDARD

**ENERGY**, keV



### Efficiency Curve for Mixed Gamma Standard

### **Other Mixtures**

Analytics' Mixed Gamma Standard utilizes the basic eight radionuclides listed as Option 1 in the Mixed Gamma-Ray Standards Table. The approximate gamma-ray emission rate for a 3 microCi (111 kBq) source is given as an example. Option 2 adds <sup>241</sup>Am to the mixture to extend the energy range down to 59.5 keV. Option 3 adds <sup>85</sup>Sr to give a gamma-ray emission at 514 keV, which is useful in some applications. Option 4 adds both <sup>241</sup>Am and <sup>85</sup>Sr. To further extend the low-energy range to 46.5 keV, <sup>210</sup>Pb can be added to the mixture. In order to measure coincidence-summing effects <sup>65</sup>Zn (1115 keV) and <sup>54</sup>Mn (835 keV) can be added. Option 5 replaces the <sup>203</sup>Hg in the mixture with <sup>51</sup>Cr, and adds <sup>85</sup>Sr. Option 6, True Coincidence Correction (TCC) mixture, is used with special software to correct for coincidence summing effects. Custom mixtures for other applications such as Nal(TI) spectrometry can also be prepared. See tables listed for all options.



For additional information consult our technical representatives.

# **Gamma-Ray Standards**

### **Mixed Gamma-Ray Standards Table**

Option 1 Basic Eight Radionuclide Mixture						
Radio-Nuclide	Energy (keV)	Half-Life	Approx Emission Rate*			
<sup>109</sup> Cd	88	462.6 d	2900			
57Co	122	271.79 d	1900			
139Ce	166	137.6 d	2400			
<sup>203</sup> Hg	279	46.61 d	4500			
<sup>113</sup> Sn	392	115.1 d	3300			
137Cs	662	30.07 y	2200			
88Y	898	106.6 d	8000			
60Co	1173	5.271 y	3800			
60Co	1332	5.271 y	3800			
88Y	1836	106.6 d	8400			

Option 2 Basic Eight Radionuclide Mixture Plus						
Radio-Nuclide	Energy (keV)	Half-Life	Approx Emission Rate*			
<sup>241</sup> Am	59.5 keV	432 y	2200			

Option 3 Basic Eight Radion	uclide Mixture Plus		
Radio-Nuclide	Energy (keV)	Half-Life	Approx Emission Rate*
85Sr	514 keV	64.84 d	3900

Option 4 Basic Eight Radioni	uclide Mixture Plus		
Radio-Nuclide	Energy (keV)	Half-Life	Approx Emission Rate*
<sup>241</sup> Am	59.5 keV	432 y	2200
85Sr	514 keV	64.84 d	3900

\* Approximate gamma-ray emission rate (gps) from a 3 microCi (111 kBq) standard. Individual emission rates may vary from batch to batch.

### Mixed Gamma-Ray Standards Table (cont.)

on Rate*

Option 6 True Coincidence Correction Mixture (TCC)							
Radio-Nuclide	Energy (keV)	Half-Life	Approx Emission Rate*				
<sup>241</sup> Am	59.5	432 y	2300				
<sup>109</sup> Cd	88	462.6 d	2100				
57C0	122	271.79 d	1300				
139Ce	166	137.6 d	1600				
<sup>203</sup> Hg	279	46.61 d	3900				
<sup>113</sup> Sn	392	115.1 d	2100				
85Sr	514	64.84 d	4400				
134Cs	604.7	754.2 d	7000				
137(s	662	30.07 y	1500				
134Cs	795.9	754.2 d	6100				
<sup>54</sup> Mn	834.9	312.1 d	4000				
88Y	898	106.6 d	7000				
<sup>65</sup> Zn	1115.6	244.3 d	5400				
88Y	1836	106.6 d	7400				

\* Approximate gamma-ray emission rate (gps) from a 3 microCi (111 kBq) standard. Individual emission rates may vary from batch to batch.

# Single-Radionuclide Standards



Calibrations utilizing Analytics' standards have demonstrated traceability to NIST. Analytics participation in the NIST/ Nuclear Energy Institute (NIST/NEI) Measurements Assurance Program for the Nuclear Power Industry satisfies the requirements of the United States' Nuclear Regulatory Commission's Regulatory Guide 4.15, Revision 1, 1979 and ANSI N42.22-1995 American National Standard – Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.

Analytics can prepare customgeometry single-radionuclide standards utilizing a wide variety of radionuclides. Contact us with your specifications of radionuclide, activity and geometry. All custom-made, calibration standards must pass Analytics' documented qualitycontrol requirements.

### Matrices

Over the past twenty-five years Analytics has prepared custom-made standards in hundreds of different geometries utilizing many different matrices.

- Water-equivalent solid standards are prepared in hundreds of different geometries. These standards are individually traceable and much safer to handle in the counting room than liquid standards. There is no possibility of leakage, spillage or plate-out of the radioactive material. Matrix density is 1.15 g/cc.
- Air Filter standards are uniformly deposited to your specifications and sealed in customer supplied counting configurations.
- Charcoal and silver zeolite cartridge standards are prepared in your cartridges loaded to your specifications.
- Soil or sand standards are prepared in customer supplied counting containers. Matrix density range from 1.5 g/cc to 1.7 g/cc.
- High density solids with density range from 1.5 to 2.0 g/cc.
- Vegetation or simulated vegetation standards are prepared in customer supplied counting containers with an approximate density of 0.6 g/cc.
- Simulated gas standards are prepared in customer supplied gas counting containers. These low-density (0.02 g/cc) standards have the same gamma-ray attenuation characteristics as actual gas standards and greatly extend the energy range and useful life of the calibration standard.
- Point sources are mounted in various geometries, again to your specifications.

If you do not find your specific geometry give us a call. Let us put our experience in preparing custom standards to work for you.

Each standard is prepared gravimetrically with a calibrated balance. After preparation, each standard is counted with a calibrated detector system.

# **Gas Standards**



### **Simulated-Gas Standards**

Analytics' custom-made, simulated-gas standards provide calibration for gamma-ray spectrometers over a wide energy range. The standards are prepared using Analytics' mixed gamma-ray standard mixtures deposited on a low-density polystyrene matrix in your actual counting containers. The matrix has a density of 0.015 to 0.020 g/cc. These standards require no attenuation corrections over the energy range 59.5 to 1836 keV. The simulated-gas standards have several advantages over gas standards. The simulated standards provide a wider energy range, have longer useful life, require no transfers and are leak proof.

All custom-made, simulated-gas standards are prepared gravimetrically from NIST traceable solutions and are thoroughly QC tested against actual gas standards in the same geometry.

### **Unpressurized Gas Standards**

Analytics supplies unpressurized transferable gas standards allowing customers to perform calibrations on virtually any counting container using an actual gas. These standards are supplied in a 33-mL glass sphere with two stopcocks and a septum port for transfer. A transfer kit, including a calibrated gas syringe and instructions, can be purchased to perform multiple accurate transfers and calibrations from the standard.

Radionuclides available as unpressurized gas standards are <sup>133</sup>Xe, <sup>127</sup>Xe, <sup>85</sup>Kr, and a mixed standard including all three radionuclides. The mixed standard provides the widest energy range calibration practical with real radioactive gasses. The mixed gas standard has gamma-ray emissions at 81, 145, 172, 202, 375, and 514 keV.

### **Pressurized Gas Standards**

Analytics supplies pressurized gas standards for the calibration of effluent monitors. These standards are prepared volumetrically from calibrated NIST traceable gas standards. These standards are pressurized with nitrogen and are available as either approximately 20 liters of gas in a 500-mL steel cylinder (lecture bottle) or as approximately 130 liters of gas in a 2.3-L steel cylinder. Regulators are available for an additional charge. Radionuclides available as pressurized gas standards are 1<sup>33</sup>Xe and <sup>85</sup>Kr.







# Liquid Standards



All liquid radionuclide standards are prepared gravimetrically from NIST traceable solutions. After preparation all standards are QC tested with our calibrated counting systems.

Analytics will provide relative expanded uncertainties (expressed in % of value) or expanded uncertainties (expressed in same units as the certified value) with a coverage factor of 2, which approximates a 95% confidence level for all standards. Uncertainties are estimated using the guidance in NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results".

### Custom

Custom liquid standards are available in a wide range of activities and volumes as single radionuclide standards, or as custom mixtures. Custom liquid standards are available in 5-, 10-, 20- or 50-mL flame-sealed glass vials.

Liquid standards are also available in larger volume flame-sealed reagent bottles of 100-, 250-, 500- and 1000-mL volumes. The storage bottles have a ground glass cap to prevent evaporation and to reseal the standard for storage between calibrations.

### Stock

Certain longer-lived liquid radionuclide standards are available from stock providing rapid delivery. Stock liquids are available in 5-mL flame-sealed glass vials at activities specified in the Radioactive Liquid Standards—Stock table on page 18.

### **Low-Level Tracers**

Low-level radioactive tracer solutions are available in flame-sealed reagent bottles with a ground glass cap to minimize evaporative losses. These samples are particularly useful for radiochemical measurements, which require a spike for yield determinations. These solutions may also be used as control samples for various analytes.



# Liquid Standards

### **Radioactive Liquid Standards—Custom**

Radio- nuclide	Chemical Form, Carrier	Volume, ml	Activity, kBq	Activity, microCi	Relative Expanded Uncertainty (k=2)%*
241Am	Am (III) in 1M HCI, Carrier Free	5 - 50	1.85 to 740	0.05 to 20	2.0
243Am	Am (III) in 1M HCI, Carrier Free	Call for availability			
133Ba	Ва (II) in 0.1М HCl, 30 µg/g Ва	5 - 50	3.7 to 1850	0.1 to 50	1.7
207Bj	Bi(III) in 1M HCl, 30 µg/g Bi	5 - 50	1.85 to 3.7	0.05 to 0.1	2.0
<sup>14</sup> C	Labeled glucose (50 µg/g) + formaldehyde (1 µg/g) in water	5 - 50	1.85 to 370	0.05 to 10	3.5
14C	Na <sub>2</sub> CO <sub>3</sub> in 0.001M NaOH, 30 µg/g	5 - 50	1.85 to 370	0.05 to 10	3.5
45Ca	Ca(II) in 0.1М HCl, 30 µg/g Ca	5 - 50	3.7 to 3700	0.1 to 100	2.5
109Cd	Cd (II) in 0.1M HCl, 30 µg/g Cd	5 - 50	37 to 3700	1 to 100	3.5
139Ce	Ce(III) in 0.1M HCl, 30 µg/g Ce	5 - 50	3.7 to 1850	0.1 to 50	2.0
141Ce	Ce(III) in 0.1M HCI, 30 µg/g Ce	5 - 50	3.7 to 1850	0.1 to 50	2.5
36C	CI (-I) in 0.0005M NaOH, 30 µg/g CI	5 - 50	1.85 to 37	0.05 to 1	1.7
244Cm	Cm (III) in 1M HCI, Carrier free	5 - 50	1.85 to 3.7	0.05 to 0.1	2.0
57Co	Co(II) in 0.1M HCl, 30 µg/g Co	5 - 50	3.7 to 3700	0.1 to 100	1.7
58Co	Со(II) in 0.1М HCI, 30 µg/g Со	Call for availability			
60C0	Co(II) in 0.1М HCl, 30 µg/g Co	5 - 50	3.7 to 3700	0.1 to 100	1.2
51Cr	Cr(III) in 0.1M HCl, 30 μg/g Cr	5 - 50	37 to 7400	1 to 200	1.7
134Cs	Cs(I) in 0.1M HCl, 30 µg/g Cs	5 - 50	3.7 to 3700	0.1 to 100	1.7
137Cs	Cs(I) in 0.1M HCl, 30 µg/g Cs	5 - 50	3.7 to 3700	0.1 to 100	1.7
152Eu	Eu(III) in 0.1M HCl, 30 µg/g Eu	5 - 50	3.7 to 1850	0.1 to 50	1.7
Fe-55	Fe(III) in 0.1M HCl, 30 µg/g Fe	5 - 50	3.7 to 3700	0.1 to 100	4.5
<sup>59</sup> Fe	Fe(III) in 0.1M HCl, 30 µg/g Fe	5 - 50	3.7 to 3700	0.1 to 100	1.7
148Gd	Gd(III) in 1M HCI, Carrier free	Call for availability			
3Н	Tritiated water	5 - 50	3.7 to 3700	0.1 to 100	3.0
<sup>203</sup> Hg	Hg (II) in 0.1M HCl, 30 µg/g Hg	5 - 50	3.7 to 185	0.1 to 5	1.7
125	l(-I) in 0.01M NaOH + 0.006M Na <sub>2</sub> SO <sub>3</sub> , 30 μg/g l	5 - 50	3.7 to 3700	0.1 to 100	3.5
129	l(-I) in 0.01M NaOH + 0.006M Na <sub>2</sub> SO <sub>3</sub> , 30 μg/g I	5 - 50	1.85 to 1850	0.05 to 0.1	3.0
131]	I(-I) in 0.01M NaOH + 0.006M Na <sub>2</sub> SO <sub>3</sub> , 30 µg/g I	5 - 50	3.7 to 3700	0.1 to 100	1.7
<sup>54</sup> Mn	Mn(II) in 0.1M HCl, 30 μg/g Mn	5 - 50	3.7 to 1850	0.1 to 50	1.7
Mixed Gamma	Cd (II) –109, Co (II) –57, Ce (III) –139 Hg (II) –203, Sn (IV) –113, Cs (I) –137, Y(III) –88 and Co (II) –60 in 4M HCl, 30 µg/g carrier for each nuclide	5 - 50	3.7 to 740	0.1 to 20	3.3
22Na	Na(I) in 0.1M HCl 30 µg/g Na	5 - 50	3.7 to 1850	0.1 to 50	2.0

Radio- nuclide	Chemical Form, Carrier	Volume, ml	Activity, kBq	Activity, microCi	Relative Expanded Uncertainty (k=2)%*
59Ni	Ni (II) in 0.1M HCl, 30 µg/g Ni	5 - 50	1.85 to 3.7	0.05 to 0.1	4.5
63Ni	Ni (II) in 0.1M HCl, 10 µg/g Ni	5 - 50	1.85 to 37	0.05 to 1	3.0
237Np	Np (V) in 2M HCl, Carrier free	Call for availability			
32P	H <sub>3</sub> PO₄ in 0.01M HCl, 30 µg/g P	5 - 50	18.5 to 29600	0.5 to 800	1.7
210Pb	Pb (II) in 1M HNO <sub>3</sub> , Carrier free	5 - 50	3.7 to 37	0.1 to 1	3.3
147Pm	Pm(III) in 0.1M HCl, 30 μg/g Eu	5 - 50	3.7 to 185	0.1 to 5	1.7
209Po	Po(IV) in 2M HCI, Carrier free	Call for availability			
236Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	Call for availability			
238Pu	Pu (VI) in 3M HNO <sub>3</sub> , Carrier free	5 - 50	3.7 to 37	0.1 to 1	2.0
239Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	5 - 50	0.37 to 37	0.01 to 1	2.0
241PU	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	Call for availability			
226Ra	Ra(II) in 0.1M HCI, 50 µg/g Ba	5 - 50	3.7 to 370	0.1 to 10	5.0
228Ra	Ra(II) in 0.1M HCl, 50 μg/g Ba	5 - 50	1.85 to 185	0.05 to 5	4.0
106Ru	Ru(III) in 0.1M HCl, 50 µg/g Ru	Call for availability			
355	$Na_2SO_4$ in water, 30 µg/g S	5 - 50	3.7 to 3700	0.1 to 100	1.7
125Sb	Sb(III) in 6M HCl, 30 µg/g Sb	5 - 50	3.7 to 1850	0.1 to 50	3.4
113Sn	Sn(IV) in 4M HCl, 30 µg/g Sn	5 - 50	3.7 to 1850	0.1 to 50	1.7
855r	Sr(II) in 0.1M HCl, 30 μg/g Sr	5 - 50	3.7 to 1850	0.1 to 50	1.7
89Sr	Sr(II) in 0.1M HCl, 30 μg/g Sr	5 - 50	3.7 to 1850	0.1 to 50	1.7
905r	Sr(II) in 0.1M HCl, 30 µg/g Sr	5 - 50	1.85 to 1850	0.05 to 50	1.7
99Tc	Tc(VII) in 0.001M KOH, Carrier free	5 - 50	3.7 to 1850	0.1 to 50	2.5
228Th	Th(IV) in 0.5M HNO <sub>3</sub> , Carrier free	5 - 50	3.7 to 37	0.1 to 1	3.5
229Th	Th (IV) in 0.5M HNO <sub>3</sub> , Carrier free	Call for availability			
230Th	Th(IV) in 0.5M HNO <sub>3</sub> , Carrier Free	5 - 50	0.37 to 37	0.01 to 1	2.0
Th-Natural	Th(IV) in 0.5M HNO3 ( $^{228}\mathrm{Th}$ in equilibrium with $^{232}\mathrm{Th}$ )	Call for availability			
204T	TI(I) in 0.1M HCI, 30 μg/g TI	5 - 50	3.7 to 185	0.1 to 5	1.7
232U	U(VI) in 1M HNO <sub>3</sub> , Carrier free	5 - 50	3.7	30.1	5.0
233U	U(VI) in 1M HNO <sub>3</sub> , Carrier free	5 - 50	0.37 to 18.5	0.01 to 0.5	2.0
U-Natural	U(VI) in 1M HNO <sub>3</sub> (includes $^{234}U + ^{235}U + ^{238}U$ )	5 - 50	0.37 to 3.7	0.01 to 0.1	3.3
88Y	Y(III) in 0.1M HCl, 30 µg/g Y	5 - 50	3.7 to 370	0.1 to 10	1.2
65Zn	Zn (II) in 0.1M HCl, 30 µg/g Zn	5 - 50	3.7 to 1850	0.1 to 50	1.7

### Radioactive Liquid Standards—Custom (cont.)

\*Nominal values and may differ based on specific calibrations.

# Liquid Standards

### **Radioactive Liquid Standards—Stock**

Radio- nuclide	Chemical Form, Carrier	Volume, ml	Activity, kBa	Activity, microCi	Relative Expanded Uncertainty (k=2)%*
<sup>241</sup> Am	Am (III) in 1M HCI, Carrier Free	5	18.5 and 37	0.5 and 1	2.0
14C	Labeled glucose (50 $\mu$ g/g) + formaldehyde (1 $\mu$ g/g) in water	5	37	1	3.5
14C	Na <sub>2</sub> CO <sub>3</sub> in 0.001M NaOH, 30 µg/g	5	37	1	3.5
36(]	Cl (-1) in 0.0005M NaOH, 30 µg/g Cl	5	37	1	1.7
60C0	Co(II) in 0.1M HCl, 30 μg/g Co	5	37 and 185	1 and 5	1.2
137Cs	Cs(I) in 0.1M HCl, 30 µg/g Cs	5	37 and 185	1 and 5	1.7
152Eu	Eu(III) in 0.1М HCl, 30 µg/g Eu	5	37 and 185	1 and 5	1.7
55Fe	Fe(III) in 0.1M HCl, 30 µg/g Fe	5	37	1	4.5
3H	Tritiated water	5	37 and 185	1 and 5	3.0
129]	I (-I) in 0.01M NaOH + 0.006M Na <sub>2</sub> SO <sub>3</sub> , 30 µg/g I	5	3.7	0.1	3.0
Mixed Gamma plus addition of <sup>241</sup> Am	Cd (II) -109, Co (II) -57, Ce (III) -139, Hg (II) -203, Sn (IV) -113, Cs (I) -137, Y (III) -88 and Co (II) -60 in 4M HCl, 30 µg/g carrier for each nuclide; Am-241 carrier free	5	185	5	3.3
59Ni	Ni (II) in 0.1M HCl, 30 µg/g Ni	5	3.7	0.1	4.5
236Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	5	0.37 and 0.925	0.01 and 0.025	2.0
239Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	5	37	1	2.0
226Ra	Ra(II) in 0.1M HCl, 50 μg/g Ba	5	3.7, 18.5, 37	0.1, 0.5, 1	5.0
228Ra	Ra(II) in 0.1M HCl, 50 µg/g Ba	5	3.7 and 18.5	0.1 and 0.5	4.0
90Sr	Sr(II) in 0.1M HCl, 30 μg/g Sr	5	3.7 and 37	0.1 and 1	1.7
99Tc	Tc(VII) in 0.001M KOH, Carrier free	5	3.7 and 37	0.1 and 1	2.5
229Th	Th(IV) in 0.5M HNO <sub>3</sub> , Carrier free	5	0.37	0.01	3.5
230Th	Th (IV) in 0.5M HNO <sub>3</sub> , Carrier Free	5	3.7 and 18.5	0.1 and 0.5	2.0
232U	U(VI) in 1M HNO <sub>3</sub> , Carrier free	5	3.7	0.1	5.0
233U	U(VI) in 1M HNO <sub>3</sub> , Carrier free	5	3.7 and 18.5	0.1 and 0.5	2.0
U-Natural	U(VI) in 1M HNO <sub>3</sub> (includes $^{234}U + ^{235}U + ^{238}U$ )	5	1.85	0.05	3.3

Radio- nuclide	Chemical Form, Carrier	Volume, ml	Activity, Bq/mL	Activity, pCi/mL	Relative Expanded Uncertainty (k=2)%*
243Am	Am (III) in 1M HCI, Carrier Free	100 - 1000	0.1 to 1	2.7 to 27	4.0
236Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	2.0
238Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	2.0
239Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	2.0
242Pu	Pu(VI) in 3M HNO <sub>3</sub> , Carrier free	100 -1000	0.01 to 0.1	0.27 to 2.7	2.0
226Ra	Ra(II) in 0.1M HCl, 50 µg/g Ba	100 - 1000	0.1 to 1	2.7 to 27	5.0
<sup>228</sup> Ra	Ra (II) in 0.1M HCl, 50 µg/g Ba	100 - 1000	0.1 to 1	2.7 to 27	4.0
90Sr	Sr(II) in 0.1M HCl, 30 μg/g Sr	100 - 1000	0.1 to 1	2.7 to 27	1.7
99Tc	Tc(VII) in 0.001M KOH, Carrier free	100 - 1000	0.1 to 1	2.7 to 27	2.5
229Th	Th(IV) in 0.5M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	3.5
230Th	Th(IV) in 0.5M HNO <sub>3</sub> , Carrier Free	100 - 1000	0.1 to 1	2.7 to 27	2.0
Th-Natural	Th (IV) in 0.5M HNO $_3$ ( $^{228}$ Th in equilibrium with $^{232}$ Th)	100 - 1000	0.1 to 1	2.7 to 27	5.0
232U	In 1M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	5.0
233U	In 1M HNO <sub>3</sub> , Carrier free	100 - 1000	0.1 to 1	2.7 to 27	2.0
U-Natural	In 1M HNO <sub>3</sub> (Consist of <sup>234</sup> U + <sup>235</sup> U + <sup>238</sup> U)	100 - 1000	0.1 to 1	2.7 to 27	3.3

### Radioactive Liquid Standards—Low-Level Tracers

# **Health Physics Standards**



Analytics provides custom-made calibration standards for alpha-/betaparticle measurements using proportional counters, GM counters and scintillation counters as well as standards for gamma/x-ray measurements using scintillation detectors and solid-state detectors. Analytics' standards provide the most accurate calibrations for wipe test determinations, airborne particulate and gaseous measurements, wide-area contamination measurements, internal dosimetry (whole-body counting), waste-drum measurements, decontamination/decommissioning and environmental measurements.

All custom-made alpha, beta or gamma-ray calibration standards must pass Analytics' documented quality-control testing:

Analytics' standards have demonstrated traceability to NIST. Analytics participation in the NIST/ Nuclear Energy Institute (NIST/NEI) Measurements Assurance Program for the Nuclear Power Industry satisfies the requirements of the United States' Nuclear Regulatory Commission's Regulatory Guide 4.15, Revision 1, 1979, and ANSI N42.22-1995 American National Standard – Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.

Each standard is prepared gravimetrically with a calibrated balance. After preparation, each standard is counted with a calibrated counting system.

The counting efficiency is compared to the counting efficiency of at least one independent standard and agreement must be within Analytics' stated uncertainty. For quality-control testing of custom-geometry standards, Analytics maintains a current database including efficiencies from thousands of alpha, beta and gamma-ray standards.



# **Health Physics Standards**

### **Airborne Particulate and Wipe-Test Determinations**

Analytics supplies custom-geometry filter-paper standards that provide accurate calibrations for air particulate and contamination (wipe test) measurements. Analytics' custom-made alpha and beta filter-paper standards are Mylar™ covered and calibrated in total activity contained in the standard. As shown in the published study (Reference 1), Mylar™ covered activity calibrated standards are vastly superior to electrodeposited, emission-rate calibrated standards for alpha/beta air filter and wipe-test determinations. Measurements performed using instruments calibrated with emission-rate sources or electrodeposited standards may under report the activity by as much as 100% for alpha emitters, 40% for low-energy beta emitters, and 25% for high-energy beta emitters. The Mylar™ covering gives realistic attenuation characteristics and the custom mounting using the customer's filter and planchet gives realistic backscattering characteristics. The Mylar™ covering can be 0.5, 0.85 or 1.7 mg/cm<sup>2</sup> depending on the application. Other coverings are available upon request.

Analytics' filter standards are prepared gravimetrically from calibrated solutions. A wide variety of alpha, beta or gamma-ray emitting radionuclides can be used. The preparation is performed using a computer- controlled applicator that applies a large number of microliter-sized drops in the specified active area on a Mylar<sup>™</sup> covering for alpha/beta counting or on a more rugged polyester tape for gamma-ray counting. The advantages of this preparation technique are discussed in Reference 2. After the drops are evaporated the Mylar<sup>™</sup>/tape covering is fixed to the customer specified filter substrate with the activity between the covering and the filter. The covering and filter composite is then mounted in the customers' planchet or specified backing for counting. The calibration of the standard comes from the gravimetric preparation and is given in total activity contained in the standard. After preparation the standard is QC tested as described at the beginning of this section.

Analytics' filter standards can be prepared with a wide variety of active areas to accurately reproduce the actual counting geometry: circular, semi-circular, a quarter circle to simulate a folded filter, square, rectangular and many others. For special applications the activity can be made to vary across the active area.

#### References

1 McFarland, R.C., "Comparison of Alpha and Beta Calibration Standards for Air-filter and Wipe-Test Analyses: Does Your Analysis Seriously Under-Report the Activity?" Radioact. Radiochem., 9(3), 8, (1998).

2 McFarland, R.C., "Geometric Considerations in the Calibration of Germanium Detectors for Filter-Paper Counting." Radioact Radiochem., 2(1), 4, (1991).



### **Planchets (Simulated Evaporated Liquid)**

Planchet standards simulating an evaporated liquid are prepared for use in gross alpha and gross beta determinations. As with the filter standards, the standard is prepared gravimetrically on Mylar<sup>™</sup> using the computer controlled applicator. The Mylar<sup>™</sup> is mounted directly in the customer's planchet without a filter or backing. The backscatter and attenuation characteristics simulate an evaporated liquid in a planchet with a solid residue of approximately 0.5 or 0.85 mg/cm<sup>2</sup>.

### **Airborne Radio-Iodine Determinations**

Analytics supplies mixed and single radionuclide gamma-ray standards for airborne radio-iodine determinations. The calibrated radionuclide solution is gravimetrically dispensed and evaporated on activated charcoal or silver zeolite then is sealed in the customer's canister or cartridge. The activity can be deposited on the first 3 to 5 mm of the charcoal or zeolite material to simulate the distribution found in actual samples (faceloaded) or homogenously loaded throughout the cartridge to calibrate for "flip" counting applications. A thorough discussion of the measurement of airborne radio-iodine can be found in D.M. Montgomery's paper, "Calibrating Germanium Detectors for Assaying Radio-iodine in Charcoal Cartridges", Radioact. Radiochem, 1(2),4, (1990).

Charcoal or silver zeolite canister or cartridge standards can be prepared using Analytics' mixed gamma-ray standard or using single radionuclides such as <sup>125</sup>l or <sup>131</sup>l. In applications where gamma-ray coincidence summing is not a problem <sup>133</sup>Ba can be used. For more information on coincidence summing see "The Counting Room: Special Edition" referenced previously.





# **Health Physics Standards**

### **Surface-Contamination Monitors**

Standards for alpha, beta and gamma-ray surface contamination monitors can be supplied in many different sizes. Alpha and beta standards are Mylar<sup>™</sup> covered. As discussed in the section on air particulate and wipe test standards these Mylar<sup>™</sup>-covered activity calibrated standards are vastly superior to emission-rate electrodeposited standards for contamination determinations. The Mylar<sup>™</sup> covering can be 0.5, 0.85 or 1.7 mg/cm<sup>2</sup> depending on the application. Gamma-ray contamination monitor standards are contained in a more durable plastic covering.

Analytics' surface contamination standards are prepared gravimetrically from calibrated solutions. A wide variety of alpha, beta or gamma-ray emitting radionuclides can be used. The preparation is performed using a computer-controlled applicator that applies a large number of microliter sized drops in the specified active area as described previously. Geometries prepared include the standard square  $10 \times 10$  cm,  $10 \times 15$  cm, and up to  $1 \times 1$  m standards. Other configurations are available. As with all of Analytics' standards, after preparation each standard is QC tested on a calibrated detector and the efficiency data must agree with at least one independent standard in the same geometry. Analytics maintains extensive files on previously prepared contamination monitor standards for QC comparisons.


#### Internal Dosimetry (Whole Body Counting)

Analytics prepares whole body counting standards for a wide variety of systems and phantoms including the Fastscan<sup>™</sup>, BOMAB<sup>™</sup>, Humanoid and several types of bottle phantom systems. Standards are supplied as water-equivalent solid standards or in liquid form for transfer to various types of phantoms. The water-equivalent solid standards are prepared directly in some of the compartmentalized phantoms or in bottles to be placed in cavities in other phantoms or as sets of small cylinders to be placed in a phantom. If your dosimetry program is required to measure the contamination in wild animals found around your facility, Analytics has prepared large volume standards to simulate deer or smaller animals. A wide variety of radionuclides and mixtures of radionuclides can be used. Contact us with your requirements.



#### Large-Volume Gamma-Ray Standards for Waste Assay and Effluent Monitoring

Analytics has prepared a wide variety of large-volume, solid gammaray standards in drums, and in the large-volume counting chambers of effluent monitors. These solid standards provide safe long-lived standards for calibration and routine detector QC monitoring. Solid standards can be prepared in various matrices: water-equivalent solid or sand depending on the desired attenuation characteristics. These standards are prepared gravimetrically from calibrated solutions. Due to the large volume, low activity and unusual shape of these standards, QC testing is performed by taking a sample of the filling material and counting in a calibrated geometry. Many different radionuclides can be used. Contact us with your requirements.

### **Electrodeposited Standards**



Analytics supplies custom geometry electrodeposited standards for alpha spectrometry. The standards can be prepared on 19.2 mm, 24.1 mm or 47.1 mm stainless steel disks with various active areas. The following mixtures of radionuclides are available:

- Natural Uranium, <sup>239</sup>Pu and <sup>241</sup>Am
- 230Th, 239Pu and 244Cm
- 230Th, 239Pu, 244Cm and 241Am
- Mixed Alpha "Stock" disk—U-Natural, <sup>239</sup>Pu and <sup>241</sup>Am 24.1 mm diameter x 0.6 mm thick stainless steel disk, 24.1 mm diameter active area, 1.7 Bq (100 dpm) per isotope (available to ship in 7 work days).

Single radionuclide standards can be prepared using any of the radionuclides in the mixtures as well as <sup>238</sup>Pu, and depleted or enriched uranium. All standards are calibrated in total alpha emission rate measured by gas-flow or scintillation counting. In addition, mixed standards are certified for individual radionuclides using alpha spectrometry.

<sup>99</sup>Tc calibrated for only beta emission rate is available, and can be prepared on 24.1 mm or 47.1 mm stainless steel disks with various active areas.



# **Liquid Scintillation Counting Standards**



## Inter-Laboratory Cross-Check Programs



#### Quenched

Custom quench standard sets (typically 5-10 vials) for liquid scintillation counting can be prepared using the customer's LS counting fluid (cocktail). Standards are prepared gravimetrically and flame sealed in glass LS vials. Radionuclides available include, but are not limited to the following:

3H		63Ni
14C		99Tc
36C		89Sr
55Fe		90Sr

After preparation, the quenched sets are counted on one of Analytics' calibrated liquid scintillation counting systems. Contact us with your specific requirements. Customers can supply their specific type of liquid scintillation vials.

#### Unquenched

A set contains <sup>3</sup>H, <sup>14</sup>C, and a background sample. Activities are 5 kBq (300,000 dpm) for <sup>3</sup>H and 2.16 kBq (130,000 dpm) for <sup>14</sup>C.

#### Alpha/Beta

A set contains <sup>241</sup>Am, <sup>36</sup>Cl and a background sample. Typical activities are 1.6 kBq (100,000 dpm) for each isotope. Other radionuclides and activities are available upon request.



The verification of analytical performance through a blind cross-check program is an integral part of an effective quality-assurance program; and is recommended by the United States Nuclear Regulatory Commission, the Institute of Nuclear Power Operations and ANSI N42.23 -1996 American National Standard Measurement and Associated Instrument Quality Assurance for Radioassay Laboratories.

Two distinct inter-laboratory cross-check programs are offered by Analytics. The Inter-Laboratory Cross-Check Program for nuclear power plant laboratories provides blind samples that simulate routine effluent samples. The Inter-Laboratory Cross-Check Program for environmental measurements laboratories provides blind samples at environmental levels in water, milk, soil, simulated vegetation, air filters and charcoal cartridges. Each program provides quarterly, blind samples at concentrations that permit an evaluation of your analytical accuracy. The concentration of radionuclides covers a range that allows for reasonable counting statistics.

#### Advantages

- Samples can be used for the training and testing of personnel and procedures.
- Interferences and activity levels can be varied to better test procedures and equipment.
- Analytics' samples are carefully prepared from calibrated standards and shipped in stable forms, therefore the samples' activities are more accurately known.
- Traceability is maintained through Analytics' participation in measurement assurance programs with NIST/NEI.

Training, procedure testing and measurements assurance are all areas that benefit from Analytics' Inter-Laboratory Cross-Check Programs.

#### Applications

- Performance and technique evaluation
- Technician qualification
- Internal quality-control samples
- Accuracy and precision evaluation
- Evaluating sample-preparation procedures
- Testing radiochemical procedures
- Exploring new laboratory techniques
- Qualifying computer software



### **Inter-Laboratory Cross-Check Programs**

#### **Nuclear Power Plant Laboratories**

In 1982, Analytics developed a comprehensive, inter-laboratory cross-check program for radiochemistry analysis. The Inter-Laboratory Cross-Check Program for nuclear power plant laboratories is a quarterly program designed specifically for the nuclear power industry and commercial laboratories performing effluent and 10 CFR Part 61 analyses. This program provides blind samples whose composition and activity levels simulate plant effluent and health physics samples. The table listed below summarizes sample matrices and radionuclide combinations routinely available on a quarterly basis. Analytics can adjust sample types and activity levels to meet your particular needs. Typical radioactive and stable interfering species are present in each sample.

Sample	Form	Activity*	Activity*
55Fe	20-mL Liquid	5E-3 microCi/g	111 Bq/g
Gross Alpha	20-mL Liquid	1E-4 microCi/g	148 Bq/g
Gross Beta	20-mL Liquid	5E-3 microCi/g	111 Bq/g
Gamma Isotopic	20-mL Liquid	1E-1 microCi/g	3.7 kBq/g
<sup>89</sup> Sr / <sup>90</sup> Sr (89) (90)	20-mL Liquid 20-mL Liquid	5E-2 microCi/g 5E-3 microCi/g	1.85 kBq/g 111 Bq/g
Tritium	20-mL Liquid	5E-3 microCi/g	111 Bq/g
Gamma Isotopic	Solid	5E-1 microCi	18.5 kBq
Gross Alpha Planchet	Solid	5E-3 microCi	111 Bq
Gross Beta Planchet	Solid	5E-3 microCi	111 Bq
1311 on Charcoal	Solid	1.0 microCi	37 kBq
Whole Body Unknowns	Solid, 5+1 LSV or Fastscan™ LSV	4.5 microCi	166.5 kBq
<sup>85</sup> Kr <sup>133</sup> Xe	Gas Ampoule	10 microCi 5 microCi	370 kBq 185 kBq
85Kr 133Xe	33-mL Gas-Sphere	80 microCi 10 microCi	2960 kBq 370 kBa

\*Values are less than or equal to activity stated.

Special mixture for part 61 including transuranics, 129I and others upon request.

The gamma isotopic sample is a variable mixture of fission and activation products commonly found in nuclear power plants. These cross-check samples are available in air filter, liquid or water-equivalent solid forms in your specific geometry. Whole body unknowns price includes 5 quart bottles and 1 liquid scintillation vial or a Fastscan<sup>™</sup> in liquid scintillation vial, containers supplied by Analytics. The <sup>133</sup>Xe / <sup>85</sup>Kr gas sample is available in a sealed gas-counting vial or a transferable glass sphere. A transfer kit is available for an additional charge. There is a minimum of four samples per shipment. An additional fee will apply for less than 4 items per shipment.

#### **Reporting Procedures**

Sample price includes comparison report with one result per sample. Comparison reports for multiple results (eg. detectors, shelves, etc.) are available at an additional cost. You will receive a report using the NRC Confirmatory Measurements criteria and format for comparing analytical measurements within 15 work days from our receipt of your results. If a disagreement can not be resolved by reanalysis of the data, we will ship follow-up samples at your request at standard published rates, subject to availability. Analytics compiles periodic summaries of data from all participants for comparison. These summaries do not provide individual results in order to maintain confidentiality.

#### **Environmental Measurements Laboratories**

This inter-laboratory cross-check program provides blind samples at environmental levels on a quarterly basis at concentrations that permit an evaluation of your analytical accuracy. The table below summarizes sample matrices and radionuclide combinations routinely available on a quarterly basis. Gamma-ray emitters include mixed-activation products with half-lives greater than seven days. Activity listed is per radionuclide. Contact Analytics for information on special orders and custom configurations.



Sample	Analysis	Radionuclides	Sample Size	Activity	Activity
Vegetation (simulated)	Gamma-ray emitters	Minimum of six	1.0 L(~550 g)	0.05-0.5 pCi/g	1.85 — 18.5 mBq/g
Water	Alpha/Beta	241Am, 137Cs	1.0 L	10-300 pCi/L	370 — 1.11 E4 mBq/L
Water	Tritium	ЗН	0.5 L	2000-15000 pCi/L	7.4 E4 — 5.55E5 mBq/L
Water	Gamma-ray emitters*	Minimum of six	1.0 L	50-300 pCi/L	1850 — 1.11 E4 mBq/L
Water	Transuranics	241Am, 238Pu, 239Pu, 237Np, 244Cm	1.0 L	1-10 pCi/L	37 – 370 mBq/L
Water	Natural radioactivity	238U, 234U, 232Th, 226Ra, 228Ra	1.0 L	25-100 pCi/L	925 – 3700 mBq/L
Water	Beta emitters	89Sr, 90Sr, 99Tc	1.0 L	10-100 pCi/L	370 – 3700 mBq/L
Soil	Gamma-ray emitters	Minimum of six	500 cc (750 g)	0.05-0.5 pCi/g	1.85 — 18.5 mBq/g
Soil	Transuranics	<sup>238</sup> Pu, <sup>239</sup> Pu, <sup>237</sup> Np, <sup>244</sup> Cm	3 x 50 g	1-10 pCi/g	37 — 370 mBq/g
Soil	Natural radioactivity	238U, 234U, 232Th, 226Ra, 228Ra	3 x 50 g	0.1-1.0 pCi/g	3.7 — 37 mBq/g
Soil	Beta emitters	89Sr, 90Sr, 99Tc	3 x 50 g	1-10 pCi/g	37 — 370 mBq/g
Milk	Gamma-ray emitters*	Minimum of six	1.0 L	50-300 pCi/L	1850 — 1.11 E4 mBq/L
Milk	Radiochemical	905r, 1311	1.0 L	10-100 pCi/L	370 – 3700 mBq/L
Milk	Beta emitters	89Sr, 90Sr	1.0 L	10-100 pCi/L	370 - 3700 mBq/L
Air Filter	Alpha/Beta	241Am, 137Cs	1 filter	10-250 pCi	370 – 9250 mBq
Air Filter	Gamma-ray emitters	Minimum of six	1 filter	50-200 pCi	1850 — 7.4 E3 mBq
Air Filter	Transuranics	238Pu, 239Pu, 237Np, 244Cm	1 filter	1-10 pCi	37 — 370 mBq
Air Filter	Natural radioactivity	238U, 234U, 232Th, 226Ra, 228Ra	1 filter	1-100 pCi	37 — 3700 mBq
Air Filter	Beta emitters	89Sr, 90Sr, 99Tc	1 filter	10-100 pCi	370 — 3700 mBq
Charcoal cartridge	Gamma-ray emitters	131	1 cartridge	10-100 pCi	370 — 3700 mBg

\*Includes 131 l between 10-100 pCi/L (370 – 3700 mBq/L) mBq=millibecquerel

There is a minimum of four samples per shipment. An additional fee will apply for less than 4 items per shipment.

#### **Reporting Procedures**

Sample price includes comparison report with one result per sample. Comparison reports for multiple results (eg. detectors, shelves, etc.) are available at an additional cost. You will receive a report within 15 work days from our receipt of your results. The known values along with client values are tabulated with the ratios of the known to reported values. Since data quality objectives vary among laboratories, no pass/fail criteria are used.

### **General Information**

#### Contact

Eckert & Ziegler Analytics 1380 Seaboard Industrial Blvd. Atlanta, GA 30318 USA Phone: (404) 352-8677 Fax: (404) 352-2837 Email: analytics@ezag.com Web: www.ezag.com

Mail payments to: 24937 Avenue Tibbets Valencia, CA 91355

Invoice Questions: (661) 309-1010

#### **Licensing Requirements**

It is company policy to require written verification of the customer's materials license for all items. No orders will be processed without a copy of the customer's license on file at Analytics, or a signed document on company letterhead stating that the customer's license authorizes possession of the desired items in the form and quantity described on the purchase order. Compliance with applicable local, state and federal regulations concerning procurement and possession of radioactive materials is the responsibility of the customer.

#### Analytics Mixed Gamma Standards

Basic 8 isotope mixture is available continuously throughout the year. It is prepared four times a year: January, April, July and October.

#### Analytics Inter-Laboratory Cross-Check Programs

Nuclear Power Plant Laboratories: Radiochemical cross-check samples ship in February, May, August, and November. Documentation and containers in duplicate (if needed) are required by the first of the month prior to shipping.

Environmental Measurements Laboratories: Environmental cross-check samples ship in March, June, September and December. Documentation and containers in duplicate (if needed) are required by the first of the month prior to shipping.

#### Availability

Analytics manufactures custom made calibration standards with minimal stock items. Normal shipping is four to six weeks after receipt of purchase order and customer supplied containers (in duplicate) if needed. Please contact customer service for more information to meet your requirements. Liquid standards are available three weeks after receipt of order. And all stocks are available seven workdays after receipt of order.

International customers must provide a purchase order, End Use Statement, license and containers (in duplicate if needed). International orders are charged a handling fee per shipment.

#### **Certificates of Calibration**

Each standard is shipped with a Certificate of Calibration stating traceability to NIST. Certificates of Calibration are not provided for crosscheck samples or check sources.

#### **Returns Policy**

Due to the nature of our products, all sales are final and no items can be returned for credit unless the customer has demonstrated that the product does not meet specifications. Such a claim must be made within 30 days of receipt of order and the source returned to Analytics, within 60 days after receipt of the shipment.

NOTE: Before any return is made, Analytics MUST be notified so that a return authorization number can be assigned and proper shipping arrangements can be made. Shipments returned without a proper authorization number may be refused upon delivery.

Full credit will be given for sources that are found not to meet specifications as long as the source is returned to Analytics within the 60 day period mentioned above. Analytics will pay the return freight for the source, and the freight on the replacement.

Sources reported and returned after the 60 day period will not be given credit, nor will Analytics pay for the return freight.

In the event that the sources are being returned from an overseas location, the shipment must be sent with DDP (Delivery Duty Paid) terms so that the customer is billed for all fees.

### **Terms and Conditions**

1. DEFINITIONS. A. The word "goods" as used herein means products offered or acknowledged in this catalog, ordered by Buyer and furnished by Seller. B. The word "services" means testing and other services offered or acknowledged in this catalog, ordered by Buyer and furnished by Seller. B. The word "services" means testing and other services offered or acknowledged in this catalog, ordered by Buyer and furnished by Seller. B. The word "services" means testing and other services offered or acknowledged in this catalog, ordered by Buyer and provided by Seller.

2. GENERAL. The terms and conditions set forth herein shall exclusively govern the sale of goods by Seller to Buyer and the furnishing of services by Seller to Buyer. Acceptance of this offer or of the goods or services furnished under quotations or acknowledgements is expressly limited to the terms and conditions contained herein. Any terms and conditions stated by Buyer in any purchase order or other document accepting or ordering such goods or services containing statements, clauses, terms or conditions modifying, adding to, repugnant to, or inconsistent with the terms and conditions of Seller herein contained, may only be deemed accepted by Seller if so stated in writing by a duly authorized signatory of Seller. Buyer further expressly agrees that such terms accepted by Seller are accepted only upon the condition and with the express understanding that, notwithstanding any statements, clauses, terms or conditions of Super, the liabilities of Seller shall be determined solely by the terms and conditions stated herein. Acceptance by Buyer of any goods offered for sale or services performed by Seller is expressly limited to the terms and conditions contained herein, and acceptance of said terms shall be deemed to be acceptance of the Buyer's performance inconsistent with any term or condition nervin shall constitute a waiver as to said term or condition only.

3. PRICES. All prices quoted are in U.S. dollars, F.O.B. Atlanta, Georgia. Quoted prices do not include charges for shipping, handling, insurance and hazardous materials documentation. State, use, consumption, compensating and excise taxes and retailers occupations taxes payable or collectable by Seller in connection with its sales shall be in addition to invoice prices and are not listed on the invoice unless specifically noted. Buyer will reimburse Seller for same at the time of payment of the invoice, whether or not such taxes are separately stated on the invoice. If Buyer claims exemption from any of these taxes, Buyer shall promptly furnish satisfactory proof of such exemption and shall indemnify Seller for any loss or damage, including attorneys' fees, Seller may incur in the event any taxing authority finds that Seller should have collected tax.

4. DELIVERY. All delivery dates are estimated as accurately as possible; however, Seller shall not be liable for any loss, damage or delay caused or occasioned by acts of God, fire, strikes, insurrection, riot, accident, embargo, delay of carrier, act of civil or military authority, failure of a supplier to make timely delivery, the requirements of any statute, order or directive of any governmental authority, or, without limiting the generality of the foregoing, by any other cause which is unavoidable or beyond Seller's reasonable control. If delays from any such cause occur, the delivery time is correspondingly extended.

5. TITLE AND RISK OF LOSS. Title to and risk of loss of goods shall pass to the Buyer upon delivery to carrier even if transportation costs are prepaid by the Seller.

6. PAYMENT TERMS. Payment shall be due 30 days from date of invoice. If Buyer requests Seller to hold goods for delivery later than scheduled, the invoice shall bear the scheduled delivery date and payment shall be due 30 days from the scheduled delivery date. Buyer bears all risk of loss or damage while such goods are in Seller's possession and shall pay all reasonable charges for goods held for more than two months and shall reimburse Seller for all use or personal property taxes levied on held goods at any time while in Seller's possession. Seller shall have the right to modify, change or withdraw credit at any time and without notice. If in Seller's judgment the financial responsibility of Buyer becomes impaired or unsatisfactory or if Buyer defaults under any contract with Seller. Seller may demand and Buyer shall give advance cash payment or satisfactory security and Seller may withhold shipments until such payment or security is received. Buyer expressly waives any right of set-off and shall make no deductions from payments due hereunder or for any damages of any type claimed by Buyer against Seller.

7. LIMITED WARRANTY. ANALYTICS warrants that at the time of shipment the products sold by it are free from defects in material and workmanship and conform to specifications, which accompany the product. ANALYTICS makes no other warranty, expressed or implied, with respect to the products, including any warranty of merchantability or fitness for any particular purpose. Complaints of breach of warranty on radioactive products must be received in writing by ANALYTICS within two half-lives of the radioactive material or 30 days, whichever first occurs. The maximum liability for any breach of warranty shall be replacement of the product or refund of the invoice price of the product. ANALYTICS shall in no case be liable for special, incidental or consequential damages of any kind.

8. LIMITATION OF LIABILITY AND INDEMNIFICATION. SELLER ASSUMES NO LIABILITY FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND. Buyer by acceptance of the goods or services assumes all liability for, and shall indemnify and hold Seller harmless against, the consequence of use or misuse by Buyer, its employees or others. Further, Buyer agrees to defend any and all suits, claims and demands brought against Seller and agrees to and will indemnify Seller and save it harmless from and against any and all suits, claims and demands whatsoever for injuries to or death of any person, or damage to or loss of property alleged out of, in connection with or to be incidental to Seller's furnishing of goods or services contemplated herein, whether or not such injury, death, loss or damage shall be caused or contributed to by the joint or concurring negligence of Seller. Buyer further agrees to and will pay, liquidate, discharge and satisfy any and all judgements, awards or expenses which may be rendered against or incurred by Seller on account of injuries to or death of any person or loss or damage to any property whatsoever, caused by, arising out of, in connection with or incidental to Seller's furnishing of the goods or services contemplated herein, including but not limited to all costs of suit, attorneys' fees and expenses in connection therewith, whether or not such judgement, award or expense is rendered against or incurred by Seller, in whole or in part, because of the joint or concurring negligence of the Seller's furnishing of the goods or services contemplated herein shall give rise to a conclusive presense which may be rendered against or incurred by Feller's into the joint or concurring negligence of the Seller's furnishing of the goods or services contemplated herein, including but not limited to all costs of suit, attorneys' fees and expenses in connection therewith, whether or not such judgement, award or expense is rendered against or incurred by Seller or in part, because of the joint or concurring

9. CHANGES AND GOODS MADE TO BUYER'S SPECIFICATIONS. Seller reserves the right where possible to make any change in material or in its design which is an improvement but bears no obligation to do so. If goods are made to specifications of Buyer, it is upon the express condition that Buyer shall assume all responsibility and shall indemnify and hold the Seller harmless if the goods infringe or contribute to the infringement of, or are alleged to infringe or contribute to the infringement, copyright or trademark where such infringement arose out of the designs, drawings or specifications supplied by Buyer alone or in combination with elements supplied by Seller.

10. SELLER INSPECTION AND TESTING. The goods are inspected and, where practicable, submitted to Seller's standard tests at Seller's plant before delivery. Buyer agrees to pay Seller reasonable additional charges for any additional tests which Buyer requires Seller to perform.

11. BUYER INSPECTION AND ACCEPTANCE. Within 30 days after tender of delivery to or receipt by Buyer of any shipment, Buyer shall inform Seller in writing if the goods are found defective or short in any respect. Failure to so inform Seller or any use by Buyer of the goods shall constitute conclusive evidence that Seller satisfactorily performed and Buyer waives any right to reject such goods thereafter.

12. COMPLIANCE WITH LAWS. Buyer agrees that in the performance hereof it will comply with all applicable laws, statutes, rules, regulations or orders of the National government or political subdivision thereof and same shall be deemed incorporated by reference herein. A. In the United States: Federal and State regulations require a copy of a Buyer's NRC license, Agreement State License, or Licensing State License together with all amendments, to be on file with Seller before any shipment of radioactive materials can be made. Buyer and Seller each warrant that it is an equal opportunity employer and that if this order is placed as a contract or subcontract under United States Government prime contract, those clauses required by federal law to be included are herein incorporated by reference. B. In Canada: A copy of the Buyer's AECB license, together with all amendments must be on file with Seller prior to any shipment of radioactive materials.

13. LIMITATION PERIOD. Causes of action for breach of contract relative to any order for goods or services shall not be asserted after one year from the date that said cause of action occurs, provided that this limitation shall not apply to actions by Seller to recover purchase price of the goods.

14. CANCELLATION. The contract arising out of Buyer's order cannot be canceled, transferred to others, or changed after receipt by Seller, except as may mutually be agreed in writing between the parties.

15. APPLICABLE LAW. Seller reserves any and all rights and remedies provided by law. The contract arising out of Buyer's order shall be interpreted and construed in accordance with the laws of the State of California.

16. WAIVERS. No waiver by Seller of any breach of any provision hereof shall constitute a waiver of any other breach of such provision. Seller's failure to object to provisions contained in any communications from Buyer shall not be deemed an acceptance of such provisions or as a waiver of the provisions hereof.

17. NO OTHER REPRESENTATIONS. There are no understandings, agreements, representations or warranties, either written or oral, relative to the goods or services that are not fully expressed in this document. No statement, recommendation or assistance made or offered through its representatives or by any sales literature in connection with the use of any goods, shall be or constitute a waiver by Seller or any of the provisions hereof. The provisions of this document supersede and cancel any previous understanding or agreement between the parties with respect to the subject matter hereof and this document expresses the final and complete understanding of the parties.

18. ARBITRATION. All disputes arising out of this contract shall be determined by binding arbitration in accordance with the rules of the American Arbitration. In such arbitration, the prevailing party shall be awarded attorneys' fees and costs (including costs of experts) and the provisions of California Code of Civil Procedure Section 1283.05 shall apply.

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