

ML:IB:WOM

4F6P
SEALED SOURCE FILES

Minnesota Mining and
Manufacturing Company
2501 Hudson Road
St. Paul 19, Minnesota

Attention: Mr. Robert J. Kunz

Gentlemen:

Reference is made to your letters of November 15, 1963,
March 3, 1964, and March 13, 1964, concerning your
Model 4F6P strip source and your Model 6C6A medical
applicator.

The information referenced above has been evaluated,
and we find the equipment acceptable for licensing
purposes.

Very truly yours,

William O. Miller
Isotopes Branch
Division of Materials
Licensing

bcc: Sealed Source Files

9805290067 960126
PDR RC * PDR
SSD

ML:IB

WOMiller/mog

9805290067 4/ 164

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-²⁷⁶~~106~~-S

DATE:

PAGE 1 OF 7

SEALED SOURCE TYPE: Strip Source

MODEL: 4F6P

MANUFACTURER/DISTRIBUTOR:

3M Health Physics Services
3M Center, Building 224-2E-06
St. Paul, MN 55144-1000

ISOTOPE:

Cesium-137

MAXIMUM ACTIVITY:

10.00 curies (370.0 GBq)

LEAK TEST FREQUENCY: 6 Months

PRINCIPAL USE: (D) Gamma Gauge

CUSTOM SOURCE: _____ YES _____ X _____ NO

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

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SEALED SOURCE TYPE: Strip Source

DESCRIPTION:

The 4F6P source is a doubly-encapsulated strip source. Cesium-137 (Cs-137) is absorbed into small ceramic particles. The isotope is then permanently fixed to the particles using a heat treatment to create 3M Brand Radiating Microspheres. The microspheres are loaded into a 0.125 in. (0.318 cm) outer diameter, 0.0697 in. (0.1770 cm) average inner diameter type 410 stainless steel inner tube. After the microspheres are loaded, a nominally 0.0695 in. (0.1765 cm) diameter, 0.250 in. (0.635 cm) long inner plug made from type 304 stainless steel is inserted into each end and silver brazed in place, sealing the microspheres inside.

Spacer rings made from type 304 stainless steel are placed around the inner tube and silver brazed in place about 1.000 in. (2.540 cm) apart. The spacer rings are 0.050 in. (0.127 cm) thick, with a 0.435 in. (1.105 cm) outer diameter and a 0.130 in. (0.330 cm) diameter hole in their middle to accommodate the inner tube. One end of the inner tube is inserted into an end plug made from type 304 stainless steel. The end plug is 0.750 in. (1.905 cm) long with three 0.250 in. (0.635 cm) long sections. Beginning from one end, the first section is 0.500 in. (1.270 cm) in diameter, the middle section is 0.438 in. (1.113 cm) in diameter, and the final section decreases from a diameter of 0.438 in. (1.113 cm) at a 5° angle over its length to a diameter of 0.394 in. (1.001 cm). The inner tube fits into a 0.135 in. (0.343 cm) diameter hole bored a depth of 0.300 in. (0.762 cm) into the end plug's narrow end. That hole has an 82° countersink to 0.250 in. (0.635 cm) diameter. The brazing material is placed in this area when the tube is silver brazed into the end plug. The wide end of the end plug has a 0.250 in. (0.635 cm) diameter hole bored to a depth of 0.250 in. (0.635 cm).

A 0.500 in. (1.270 cm) outer diameter, 0.444 in. (1.128 cm) inner diameter type 304 stainless steel outer tube is placed over the spacer rings and pushed over the middle and narrow sections of the end plug. A second end plug is inserted into the open end of the outer tube so it fits over the inner tube and is TIG welded in place. The overall length of the Model 4F6P source varies

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

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SEALED SOURCE TYPE: Strip Source

DESCRIPTION: (Continued)

from 2.500 in. (6.350 cm) to 73.50 in. (1.870 m). The total length is always 1.500 in. (3.810 cm) longer than the active length.

DIAGRAM:

See Attachment 1

LABELING:

The following is engraved on the side of the outer capsule:

3M Company
Model 4F6P-XXXX
XXX mc Cs-137

Sources are labeled with serial number, as well as designation of isotope, active length, and number of millicuries.

CONDITIONS OF NORMAL USE:

The 4F6P was specifically designed to be compatible with gauging devices manufactured by Ohmart Corporation.

PROTOTYPE TESTING:

A prototype of the Model 4F6P source was tested according to the specifications of ANSI N542-1977 and achieved a classification of 77C53346.

In addition, prototypes were subjected to the following destructive tests prior to their original approval:

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

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SEALED SOURCE TYPE: Strip Source

PROTOTYPE TESTING: (Continued)

1. Heat to 1,832 °F (1,000 °C) for 30 minutes
2. Quench from 1,832 °F (1,000°C) to the temperature of cold water at 68 °F (20°C)
3. Impact of 2 lb-ft, 20 times on each of two points 180° apart, 3 in. (7.6 cm) from the end of the source
4. Source bent approximately 30° at 2 points

After each test the sources were smear tested and leak tested. All wipe tests were negative (less than 1×10^{-4} μCi (3.700 Bq) of removable radioactivity) and all leak tests were negative (no leakage detected).

EXTERNAL RADIATION LEVELS:

External radiation dose rates were calculated for a 10.00 Ci (370.0 GBq) Cs-137 source. The dose rates are based on an NIST traceable standard and are as follows:

<u>Distance</u> (from surface)		<u>Maximum Radiation Level</u>	
(cm)	(in.)	(R/hr)	(Sv/hr)
5	1.97	1320	13.2
30	11.81	36.6	0.37
100	39.37	3.3	0.033

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

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SEALED SOURCE TYPE: Strip Source

QUALITY ASSURANCE AND CONTROL:

The following quality control procedures were followed during production of this source:

1. The inner tube was wipe tested after the first inner plug was welded.
2. The inner tube was wipe tested after both inner plugs were welded.
3. The entire source was wipe tested prior to welding the second outer plug. If the source failed the wipe test, the source was cleaned and retested until a negative wipe test was obtained.
4. The completed source was wipe tested upon completion of fabrication, after a 7-day storage period, and during packaging for shipment.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- This source may be used only by persons specifically licensed by the NRC or an Agreement State.
- Handling, storage, use, transfer, and disposal: to be determined by the licensing authority.
- This source shall not be subjected to environmental or other conditions of use which exceed ANSI Classification 77C53346. (ANSI N542-1977)
- This source shall be leak tested at intervals not to exceed 6 months using techniques capable of detecting 0.005 microcurie (185.0 Bq) of removable contamination.
- This registration sheet and the information contained within the references shall not be changed without the written consent of the NRC.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

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SEALED SOURCE TYPE: Strip Source

SAFETY ANALYSIS SUMMARY:

The Model 4F6P sealed source is not a current product manufactured or distributed by 3M Health Physics Services. However, 3M Health Physics Services will continue to receive Model 4F6P sources for disposal.

Based on our review of the Model 4F6P sealed source, and the information and test data cited below, we continue to conclude that the Model 4F6P sealed source is acceptable for specific licensing purposes.

Furthermore, we continue to conclude that the Model 4F6P source would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

REFERENCES:

The following supporting documents for the Model 4F6P sealed source are hereby incorporated by reference and are made a part of this registry document:

- 3M Health Physics Services' letters dated August 6, 1991, April 11, 1984, January 6, 1965, and March 18, 1964, with enclosures thereto
- ANSI Tests - Reclassification Radioactive Sources, Static Control Systems/3M - Test Report dated August 31, 1982.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

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SEALED SOURCE TYPE: Strip Source

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: _____

Reviewer: _____
Thomas W. Rich

Date: _____

Concurrence: _____
Steven L. Baggett

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

ATTACHMENT 1

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

PAGE 1 OF 6

SEALED SOURCE TYPE: Strip Source

MODEL: 4F6P

Note: This source is the same as the 4F3C, except that the
4F3C is Co-60.

MANUFACTURER/DISTRIBUTOR:

3M Health Physics Services
3M Center, Building 224-2E-06
St. Paul, MN 55144-1000

ISOTOPE:

Cesium-137

MAXIMUM ACTIVITY:

10 curies (370 GBq)

LEAK TEST FREQUENCY: 6 Months

PRINCIPAL USE: (D) Gamma Gauge

CUSTOM SOURCE: _____ YES _____ X _____ NO

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

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SEALED SOURCE TYPE: Strip Source

DESCRIPTION:

Larger than the outer dia.

The 4F6P source is a doubly-encapsulated strip source. Cesium-137 (Cs-137) is absorbed into small ceramic particles. The isotope is then permanently fixed to the particles using a heat treatment to create 3M Brand Radiating Microspheres. The microspheres are loaded into a 0.125 in. (0.318 cm) outer diameter, 0.690 in. (1.753 cm) inner diameter type 410 stainless steel inner tube. After the microspheres are loaded, a 0.070 in. (0.178 cm) diameter, 0.250 in. (0.635 cm) long inner plug made from type 304 stainless steel is inserted into each end and silver brazed in place, sealing the microspheres inside.

nominal dimensions.

where did this # come from, dis # 12-1921-3538-7 indicates 0.0695-0.0697" old drawing indicates 0.069 ± 0.070"

Spacer rings made from type 304 stainless steel are placed around the inner tube and silver brazed in place about 1 in. (2.54 cm) apart. The spacer rings are 0.050 in. (0.127 cm) thick, with a 0.435 in. (1.105 cm) outer diameter and a 0.130 in. (0.330 cm) diameter hole in their middle to accommodate the inner tube. One end of the inner tube is inserted into an end plug made from type 304 stainless steel. The end plug is 0.750 in. (1.905 cm) long with three 0.250 in. (0.635 cm) long sections. Beginning from one end, the first section is 0.500 in. (1.270 cm) in diameter, the middle section is 0.438 in. (1.113 cm) in diameter, and the final section decreases from a diameter of 0.438 in. (1.113 cm) at a 5° angle over its length to a diameter of 0.394 in. (1.001 cm). The inner tube fits into a 0.135 in. (0.343 cm) diameter hole bored a depth of 0.300 in. (0.762 cm) into the end plug's narrow end. That hole has an 82° countersink to 0.250 in. (0.635 cm) diameter. The brazing material is placed in this area when the tube is silver brazed into the end plug. The wide end of the end plug has a 0.250 in. (0.635 cm) diameter hole bored to a depth of 0.250 in. (0.635 cm).

A 0.500 in. (1.270 cm) outer diameter, 0.444 in. (1.128 cm) inner diameter type 304 stainless steel outer tube is placed over the spacer rings and pushed over the middle and narrow sections of the end plug. A second end plug is inserted into the open end of the outer tube so it fits over the inner tube and is TIG welded in place. The overall length of the Model 4F6P source varies

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SEALED SOURCE TYPE: Strip Source

DESCRIPTION: (Continued)

from 2.500 in. (6.35 cm) to 73.500 in. (1.870 m). The active length is always 1.500 in. (3.810 cm) longer than the active length.

DIAGRAM:

See Attachment 1.

LABELING:

The following is engraved on the side of the outer capsule:

3M Company
Model 4F6P-XXXX
XXX mc Cs-137

Sources are labeled with serial number, isotope, active length, and number of millicuries.

CONDITIONS OF NORMAL USE:

The 4F6P was specifically designed to be compatible with gauging devices manufactured by the Ohmart Corporation.

PROTOTYPE TESTING:

A prototype of the Model 4F6P source was tested according to the specifications of ANSI N542-1977 and achieved a classification of 77C53346.

4/30/82 [signature]

In addition, older version was tested to ... (Appendix B of 3/16/64 H.)

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SEALED SOURCE TYPE: Strip Source

EXTERNAL RADIATION LEVELS:

External radiation dose rates were calculated for a 10.0 Ci (370 GBq) Cs-137 source. The dose rates are based on an NIST traceable standard and are as follows:

<u>Distance</u> (from surface)		<u>Maximum Radiation Level</u>	
(cm)	(in)	(R/hr)	(Sv/hr)
5	1.97	1320	13.2
30	11.81	36.6	0.37
100	39.37	3.3	0.033

QUALITY ASSURANCE AND CONTROL:

The following quality control procedures were followed during production of this source:

1. The inner tube was wipe tested after the first inner plug was welded.
2. The inner tube was wipe tested after both inner plugs were welded.
3. The entire source was wipe tested prior to welding the second outer plug. If the source failed the wipe test, the source was cleaned and retested until a negative wipe test was obtained.
4. The completed source was wipe tested upon completion of fabrication, after a 7-day storage period, and during packaging for shipment.

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SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

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SEALED SOURCE TYPE: Strip Source

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- This source has been distributed only to persons specifically licensed by the NRC or an Agreement State.
- Handling, storage, use, transfer, and disposal: to be determined by the licensing authority.
- This source shall not be subjected to environmental or other conditions of use which exceed ANSI Classification 77C53346. (ANSI N542-1977)
- This source shall be leak tested at intervals not to exceed 6 months using techniques capable of detecting 0.005 microcurie (185 Bq) of removable contamination.
- This registration sheet and the information contained within the references shall not be changed without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and test data contained in the references cited below, we continue to conclude that the Model 4F6P sealed source was acceptable for specific licensing purposes.

Furthermore, we continue to conclude that the Model 4F6P source would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

As of the effective date of this document, the Model 4F6P sealed source is not a current product manufactured or distributed by 3M Health Physics Services. However, 3M Health Physics Services will continue to receive 4F6P sources for disposal.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

PAGE 6 OF 6

SEALED SOURCE TYPE: Strip Source

REFERENCES:

The following supporting documents for the Model 4F6P sealed source are hereby incorporated by reference and are made a part of this registry document:

- 3M Health Physics Services' letters dated August 6, 1991, April 11, 1984, February 10, 1965, January 6, 1965, and March 18, 1964, with enclosures thereto

I don't think this is a 3M letter.

Test report dated August 31, 1982

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: _____

Reviewer: _____
Thomas W. Rich

Date: _____

Concurrence: _____
Steven L. Baggett

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR-460-S-106-S

DATE:

ATTACHMENT 1

NR4605106S

4FGP

SSDs: 7/11/84, 4/29/64

Correct:

4/11/84 LTR: 3M → SLB: chng max activity from 20 Ci to 10 Ci **

8/31/82 ANSI testing

2/10/65 LTR: 3M → AEC: modified plug as $L_{\text{rem}} = 1'' + L_{\text{act}}$, not $1.5'' + L_{\text{active}}$.
(plug sticks further into capsule)

1/6/65 LTR: 3M to AEC: dngs. enclosed: A-1921-127, -243

3/18/64 LTR: 3M → AEC: pls. req. 4FGP.

³⁷Cs strip source, for Ohmart. 1" $L_{\text{active}} < 72''$
 $L_{\text{rem}} = L_{\text{active}} + 1.5''$ * 20 Ci max **

Labeling: engraved on outer housing

Appendix A: QA/QC info.

Appendix B: PT info.

3 M Comp and
Model 4FGP - 3/1/84
xxx inc CS-137

Dwg's.

A	12-1921-3556-9	1/9/82	"Inner Tube 4FGP"
B	12-1921-3538-7	1/11/82	"Inner Tube Plug 4FGP"
A	12-1921-0853-3	1/9/82	"Spacer Ring 4FGP"
A	12-1921-0852-5	1/9/82	"End Plug 4FGP"
B	12-1921-3558-5	1/9/82	"Assembly Inner Tube 4FGP"
A	12-1921-3557-7	1/9/82	"Outer Tube 4FGP"
B	12-1921-3559-3	1/9/82	"Assembly Outer Tube 4FGP"
B	12-1921-0855-8	1/9/82	"Assembly Strip Source 4FGP"
A	1921-127	3/17/64	"OHMART Strip Source Double Encapsulation"
A	1921-127	1/24/64	"Strip Source Double Encapsulation"
A	1921-243	1/18/64	"End Plug."

3M Health Physics Services

3M Center Bldg. 224-2E-06
St. Paul, MN 55144-1000
612/736 0498

Rec'd
8/7/91
3M

August 6, 1991

U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Attn: Mr. Steven L. Baggett
Nuclear Material Safety and Safeguards
Medical and Commercial Use Safety Branch
Mail Stop 6H3

Subject: Inactive Source Registrations

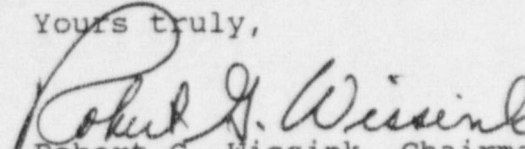
Gentlemen:

In accordance with a July 25, 1991 telephone conversation between Mr. Melvin R. Peters, 3M, and Mr. John W. Lubinski, NRC, enclosed is a listing of registered 3M sources which should be terminated. The manufacturing of these sources either has been, or will have been, permanently discontinued by September 30, 1991.

It is our understanding that upon termination:

1. The registrations will become part of NRC's inactive file, but present users of the sources may continue to use them.
2. 3M can accept the sources for disposal and leak testing, but cannot refurbish or repair them.
3. 3M, on a best effort basis, will provide the NRC with a listing of the total number of sources sold and the date of the last sale.
4. The annual maintenance fee for the registrations will be waived.

Yours truly,


Robert G. Wissink, Chairman
Isotope Committee

Enclosure: 3M Inactive Source List (July 27, 1991)

7608270101 310 5-11/32-

INVOICE #	LICENSE #	SOURCE MODEL #
AMO 6645 91	S12 1129	THORIUM
AMO 6541 91	22 00057 34G	703
AMO 6628 91	NR 045CS 101 S	4F6Y
AMO 6629 91	NR 0459S 102 S	3F1G
AMO 6551 91	NR 0460S 101 U	4F6D
AMO 6552 91	NR 0460S 102 S	4F6H
AMO 6553 91	NR 0460S 103 U	4F6G
AMO 6554 91	NR 0460S 105 U	6B6F
AMO 6555 91	NR 0460S 106 U	4F6P
AMO 6556 91	NR 0460S 107 S	1C2A, 1C2B
AMO 6557 91	NR 0460S 108 U	4F3B
AMO 6558 91	NR 0460S 109 U	4F3C
AMO 6543 91	NR 0460D 110 U	3M1C
AMO 6544 91	NR 0460D 111 U	3M1B
AMO 6559 91	NR 0460S 112 U	3E4G
AMO 6560 91	NR 0460S 113 U	4D3A
AMO 6561 91	NR 0460S 114 U	4D3B
AMO 6562 91	NR 0460S 115 U	4D6D
AMO 6563 91	NR 0460S 116 U	4D6F
AMO 6564 91	NR 0460S 117 U	5F1D
AMO 6565 91	NR 0460S 118 U	5F1E
AMO 6566 91	NR 0460S 119 U	5F1F
AMO 6567 91	NR 0460S 120 U	5F1G
AMO 6568 91	NR 0460S 121 U	3L2B
AMO 6569 91	NR 0460S 122 U	3L2A
AMO 6545 91	NR 0460D 123 U	3M1F
AMO 6570 91	NR 0460S 124 U	3L2C
AMO 6571 91	NR 0460S 125 U	1E2J
AMO 6572 91	NR 0460S 126 U	3F1G
AMO 6573 91	NR 0460S 127 U	4F1E
AMO 6574 91	NR 0460S 128 U	5F1H
AMO 6575 91	NR 0460S 129 U	3E4O
AMO 6576 91	NR 0460S 130 U	5F1N
AMO 6577 91	NR 0460S 131 U	5F1N (MODIFIED)
AMO 6578 91	NR 0460S 132 U	7B8L
AMO 6579 91	NR 0460S 133 U	6H6A
AMO 6580 91	NR 0460S 134 U	6H6B
AMO 6581 91	NR 0460S 135 U	4D6M
AMO 6582 91	NR 0460S 136 U	3L2E
AMO 6583 91	NR 0460S 137 S	6500 & 6520 (FORMERLY 6D6C)
AMO 6584 91	NR 0460S 138 U	3L2D
AMO 6585 91	NR 0460S 139 U	3Q1D
AMO 6586 91	NR 0460S 140 U	2E4L, 3E4S
AMO 6587 91	NR 0460S 141 U	3F1R
AMO 6546 91	NR 0460D 142 G	902, 902F, 903
AMO 6588 91	NR 0460S 143 S	4P6E
AMO 6589 91	NR 0460S 144 S	4P6M
AMO 6547 91	NR 0460D 145 U	3M1L
AMO 6590 91	NR 0460S 146 U	3G9A
AMO 6592 91	NR 0460S 147 U	3B4G
AMO 6591 91	NR 0460S 147 S	3B4G
AMO 6593 91	NR 0460S 148 U	4F3F
AMO 6594 91	NR 0460S 149 U	4F3G

07/29/91

MINNESOTA MINING & MFG (TO INACTIVE STATUS)

PAGE 2

INVOICE #	LICENSE #	SOURCE MODEL #
AMO 6595 91	NR 0460S 151 S	6530, 6540 (FORMERLY 6B6G) ✓
AMO 6548 91	NR 0460D 152 U	6H6D ✓
AMO 6596 91	NR 0460S 153 S	ALBUMIN MICROSPHERES (HUMAN) TC-99M <i>available 12/7</i>
AMO 6549 91	NR 0460D 154 U	6H6E SOURCE APPLICATOR, 8C9T SAFE ✓
AMO 6597 91	NR 0460S 155 S	4D6L ✓
AMO 6598 91	NR 0460S 156 S	4D6P ✓
AMO 6599 91	NR 0460S 158 U	3F1I, 3F1J, 3F1L ✓
AMO 6600 91	NR 0460S 159 U	3F1V ✓
AMO 6601 91	NR 0460S 160 U	4P6T ✓ <i>NR 4603 8736</i>
AMO 6602 91	NR 0460S 161 U	4F3D ✓
AMO 6603 91	NR 0460S 162 U	4F3H ✓
AMO 6604 91	NR 0460S 163 S	4F6S ✓
AMO 6605 91	NR 0460S 164 S	3E40 ✓
AMO 6606 91	NR 0460S 165 S	6701 ✓
AMO 6550 91	NR 0460D 168 G	702, 703, 704 <i>D</i>
AMO 6609 91	NR 0460S 169 S <i>sm</i>	6510, 6550, 6570 (FORMERLY 6B6G) ✓
AMO 6610 91	NR 0460S 170 S	4P6V ✓
AMO 6611 91	NR 0460S 171 S	4F6ST ✓