



International Isotopes Inc.

August 24, 2012

John P. Jankovich, Ph.D.
U.S. NRC
FSME/DMSSA/LISD/LB
11545 Rockville Pike
MS TWFN 8E24
Rockville, MD 20852

Subject: Request to Amend NR-1235-S-102-S.

Dear Dr. Jankovich,

International Isotopes Inc. requests to amend Registry of Sealed Sources and Devices Safety Evaluation of Sealed Source number NR-1235-S-102-S to include new models; BM06V-5 series, BM06V-10 series and BM06V-20 series. The Models BM06V-5, 10 and 20 represent 5 cc, 10 cc and 20 cc serum vials and are intended to be utilized with pressurized ion chamber dose calibrators. Maximum and nominal activities and available radionuclides are the same as the Models BM06S and BM06E series source geometries currently registered in NR-1235-S-102-S.

A total of 6 prototype sources containing Ge-68 were successfully tested in accordance to ANSI/HPS N43.6-2007, Sealed Radioactive Sources – Classification, to achieve a classification of C22312. Suggested revisions to NR-1235-S-102-S and documentation of test results supporting the requested revisions are enclosed with this letter

Should you have any questions, please contact me by phone at (208) 524-5300 or by email at jjmiller@intisoid.com.

Sincerely,

John J. Miller, CHP
Radiation Safety Officer

JJM-2012-25

Enclosures as Stated

The following revisions, noted in **Bold**, to NR-1235-S-102-S are requested:

Page 1, Revise the Model Section to include new Model designators

MODEL:

BM06E Series
 BM06S Series
BM06V5 Series
BM06V10 Series
BM06V20 Series

Pages 2 - 3, Revise the Description Section as follows:

DESCRIPTION:

The Model BM06 Series sealed sources are intended for use as reference standards to check the response of dose calibrators used to measure research, diagnostic, and therapeutic radiopharmaceuticals. The BM06 Series offers these reference standards in ~~two~~ **five** differing geometries. The first of these is the 30 ml vial geometry referred to as the BM06E. The second geometry is the 5 cc syringe geometry referred to as the BM06S. **Geometries 3, 4 and 5 simulate 5 cc, 10 cc and 20 cc serum vials and are referred to as the BM06V5, BM06V10 and BM06V20 respectively. Both the BM06E and BM06S Series** All of these source geometries consist of a radioisotope in a chloride or nitrate complex uniformly dispersed in high impact epoxy casting resin (Emerson & Cuming Stycast 1264 or equivalent) color coded to visually differentiate the radioisotopes, which is then cured in either a 30 ml dose calibrator vial (**BM06E**), ~~or~~ a facsimile of a 5 cc syringe (**BM06S**), **or in 5 cc, 10 cc or 20 cc serum vials (BM06V5, BM06V10, BM06V20 respectively).**

The BM06E epoxy containing the dispersed radioactivity is sandwiched between two layers of epoxy which does not contain radioactive material. A rubber septum or equivalent material is chemically welded into the neck of the vial and a color coded (to visually differentiate the radioisotopes) screw top cap is chemically welded onto the vial so that disassembly without destruction of the vial is not possible.

The **BM06S** syringe geometry consists of a body and cap manufactured with a translucent **or color coded** acrylic. The body is filled with a layer of epoxy containing dispersed radioactivity which is sealed beneath a layer of epoxy containing no radioactive material. A screw type acrylic cap, color coded to match the epoxy matrix is chemically welded into the body of the syringe so that disassembly without destruction of the syringe is not possible.

The BM06V geometries consists of break-resistant plastic, type PETG (glycol-modified polyethylene terephthalate) with a 20 mm septum cap and aluminum crimp seal. The body is filled with a layer of epoxy containing dispersed radioactivity which is sealed beneath a layer of epoxy containing no radioactive material. The septum cap is set in place and then crimped onto the vial with an aluminum crimp top. The non-radioactive epoxy layer provides a barrier to the radioactive epoxy matrix should the end user remove the crimp top and septum. Access to the radioactive epoxy matrix is not possible without destruction of the vial.

Each source is supplied to the customer in a shielded storage pig.

The BM06 Series ~~consists of twelve~~ can be provided in **thirty models configurations** encompassing ~~two~~ **five** geometries and six isotopes. ~~The BM06E is approximately 1.25 inches in diameter and 3.5 inches in height. The BM06S is approximately 0.625 inches in diameter and 2.94 inches in height.~~ The following table delineates the isotope **and geometry** differences between the **BM06 Models of the BM06E and BM06S Series:**

Model Number	Isotope	Geometry
BM06E-33	Barium-133	30 ml vial
BM06E-37	Cesium-137	30 ml vial
BM06E-60	Cobalt-60	30 ml vial
BM06E-22	Sodium-22	30 ml vial
BM06E-57	Cobalt-57	30 ml vial
BM06E-68	Germanium-68	30 ml vial
BM06S-33	Barium-133	5 cc syringe
BM06S-37	Cesium-137	5 cc syringe
BM06S-60	Cobalt-60	5 cc syringe
BM06S-22	Sodium-22	5 cc syringe
BM06S-57	Cobalt-57	5 cc syringe
BM06S-68	Germanium-68	5 cc syringe
BM06V5-33	Barium-133	5 cc serum vial
BM06V5-37	Cesium-137	5 cc serum vial
BM06V5-60	Cobalt-60	5 cc serum vial
BM06V5-22	Sodium-22	5 cc serum vial
BM06V5-57	Cobalt-57	5 cc serum vial
BM06V5-68	Germanium-68	5 cc serum vial
BM06V10-33	Barium-133	10 cc serum vial
BM06V10-37	Cesium-137	10 cc serum vial
BM06V10-60	Cobalt-60	10 cc serum vial
BM06V10-22	Sodium-22	10 cc serum vial
BM06V10-57	Cobalt-57	10 cc serum vial
BM06V10-68	Germanium-68	10 cc serum vial
BM06V20-33	Barium-133	20 cc serum vial
BM06V20-37	Cesium-137	20 cc serum vial
BM06V20-60	Cobalt-60	20 cc serum vial
BM06V20-22	Sodium-22	20 cc serum vial
BM06V20-57	Cobalt-57	20 cc serum vial
BM06V20-68	Germanium-68	20 cc serum vial

Source dimensions are provided in Attachments 2, 3 and 4.

Page 3, Revise the Diagram Section to reference a 4th attachment.

DIAGRAM:

See Attachments 1 through 3 4.

Page 4, Revise the Prototype Testing Section to include a new paragraph:

PROTOTYPE TESTING:

A prototype vial and syringe source, containing Co-57, designated as Models BM06E-57 and BM06S-57, were constructed and tested in accordance with ANSI N43.6-1997 and achieved a sealed source classification of ANSI 97C22312. Only a prototype BM06E-57 and BM06S-57 were tested because the maximum activity of this model was significantly higher than the other models and a failure of the source that would release radioactive material would be more readily detected. There is no difference in the construction materials or assembly methods for the different models in the BM06E Series and no difference in the construction materials or assembly methods for the different models in the BM06S Series.

A total of six Model BM06V series prototype sources were tested, two for each of the geometries, containing Ge-68 at activity levels ranging from 55.4 uCi to 220 uCi. The manufacturing method for the BM06V series serum source geometries is similar to the BM06E and BM06S series. All of the prototype sources were made from the same batch of epoxy mixed with Ge-68. The range of activity corresponds with the active volume area of the source geometries. Each prototype source was uniquely identified as indicated in the table below:

Prototype	Activity⁽¹⁾
BM06V5-1	55.4 uCi
BM06V5-2	57.7 uCi
BM06V10-1	109.7 uCi
BM06V10-2	110.4 uCi
BM06V20-1	220.0 uCi
BM06V20-2	220.0 uCi
⁽¹⁾ Reference date of 04/16/2012 12:25	

The level of activity of the prototype sources was considered sufficient to readily identify leakage through dry wipe testing and was low enough to minimize personnel exposure during the tests.

Slight deformation of serum vial body as a result of the high temperature test did not result in a breach of source or leakage of radioactive material from the source. All of the prototype sources were successfully tested in accordance with ANSI N43.6-2007 and achieved a sealed source classification of ANSI 07C22312.

Page 5, Revise the External Radiation Levels Section as follows:

EXTERNAL RADIATION LEVELS:

Maximum radiation levels for these sources are as follows:

Model	Contact Dose	Dose at 5 cm	Dose at 30 cm	Dose at 100 cm
BM06E-33	39	10	1.4	0.1
BM06E-37	45	12	1.6	0.1
BM06E-60	160	30	1.0	0.2
BM06E-22	470	78	6.0	0.6
BM06E-57	293	68	5.9	1.2
BM06E-68	526	89	7.2	1.0
BM06S-33	456	49	1.7	0.2
BM06S-37	558	60	2.1	0.2
BM06S-60	352	38	1.4	0.1
BM06S-22	891	95	3.4	0.3
BM06S-57	1382	158	12	2.4
BM06S-68	905	96	3.4	0.2
BM06V5-33	432	19	0.8	0.1
BM06V5-37	375	16	0.7	0.1
BM06V5-60	370	16	0.7	0.1
BM06V5-22	1362	59	2.4	0.2
BM06V5-57	5580	240	9.8	0.9
BM06V5-68	1578	68	2.8	0.3
BM06V10-33	348	18	0.8	0.1
BM06V10-37	301	16	0.7	0.1
BM06V10-60	297	16	0.7	0.1
BM06V10-22	1095	57	2.4	0.2
BM06V10-57	4562	234	9.8	1.0
BM06V10-68	1269	66	2.8	0.3
BM06V20-33	253	16	0.7	0.1
BM06V20-37	222	14	0.6	0.1
BM06V20-60	218	14	0.6	0.1
BM06V20-22	806	52	2.3	0.2
BM06V20-57	3445	221	9.9	0.1
BM06V20-68	936	61	2.7	0.3

External radiation levels in mrem/hr

Note: Dose rates for Models BM06E-57, BM06E-68 and BM06S-57 were measured on prototype sources manufactured by International Isotopes Idaho, Inc., and corrected to the maximum activities for these sources. Dose rates for Models BM06E-33, 37, 22 and 60 measured on NIST traceable sources of similar construction and geometry and corrected to

the maximum activities for these sources. Dose rates for Models BM06S-33, 37, 60, 22 and 68 were calculated using MicroShield.

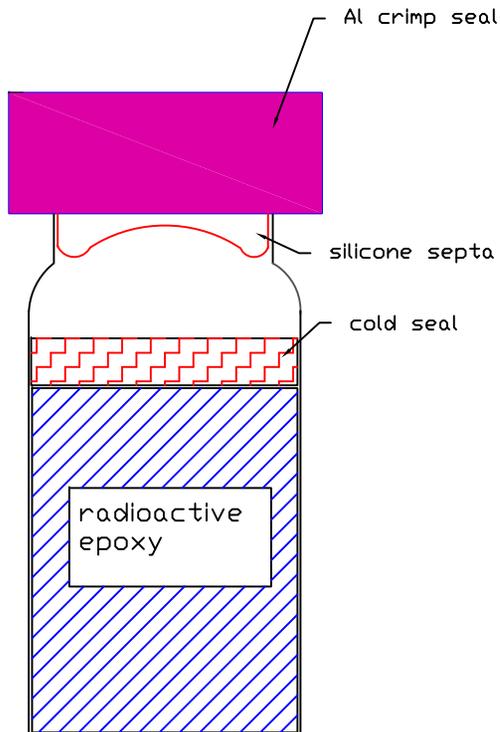
Dose rates for Models BM06V5, BM06V10 and BM06V20 were calculated using MicroShield. Radiation measurements were obtained on the prototype sources, corrected to the maximum activity levels and found to be within $\pm 15\%$ of the modeled results at the 30 cm and 100 cm distances. Modeled results are significantly higher than measured results at the contact and 5 cm distances, this is due, in part, to MicroShield overestimation of exposure rate at very close distances to the radiation source and that the actual radiation detector is located approximately 0.25 inches inside of the body of the instrument.

Page 8, Revise the Safety Analysis Summary to include the reference to the BM06V series source in the first and third paragraphs.

Revise attachments to include Model BM06V 5 cc, 10 cc, 20 cc Vials as Attachment 4

The following additional items are enclosed to support this request:

- Drawing of the Model BM06V 5 cc, 10 cc, 20 cc Vials
- F-204 Rev B SSD Testing and Documentation_BM06v5-1
- F-204 Rev B SSD Testing and Documentation_BM06v5-2
- F-204 Rev B SSD Testing and Documentation_BM06v10-1
- F-204 Rev B SSD Testing and Documentation_BM06v10-2
- F-204 Rev B SSD Testing and Documentation_BM06v20-1
- F-204 Rev B SSD Testing and Documentation_BM06v20-2
- MicroShield Output BM06V5-22
- MicroShield Output BM06V5-33
- MicroShield Output BM06V5-37
- MicroShield Output BM06V5-57
- MicroShield Output BM06V5-60
- MicroShield Output BM06V5-68
- MicroShield Output BM06V10-22
- MicroShield Output BM06V10-33
- MicroShield Output BM06V10-37
- MicroShield Output BM06V10-57
- MicroShield Output BM06V10-60
- MicroShield Output BM06V10-68
- MicroShield Output BM06V20-22
- MicroShield Output BM06V20-33
- MicroShield Output BM06V20-37
- MicroShield Output BM06V20-57
- MicroShield Output BM06V20-60
- MicroShield Output BM06V20-68



STANDARD MODEL TABLE				
MODEL NO.	NUCLIDE	MAXIMUM ACTIVITY	COLOR CODE	GOMETRY
BM06V5-22	Na-22	0.50 MCI	YELLOW	5CC VIAL
BM06V10-22	Na-22	0.50 MCI	YELLOW	10CC VIAL
BM06V20-22	Na-22	0.50 MCI	YELLOW	20CC VIAL
BM06V5-60	Co-60	0.10 MCI	BLUE	5CC VIAL
BM06V10-60	Co-60	0.10 MCI	BLUE	10CC VIAL
BM06V20-60	Co-60	0.10 MCI	BLUE	20CC VIAL
BM06V5-57	Co-57	15.0 MCI	RED	5CC VIAL
BM06V10-57	Co-57	15.0 MCI	RED	10CC VIAL
BM06V20-57	Co-57	15.0 MCI	RED	20CC VIAL
BM06V5-37	Cs-137	0.50 MCI	GREEN	5CC VIAL
BM06V10-37	Cs-137	0.50 MCI	GREEN	10CC VIAL
BM06V20-37	Cs-137	0.50 MCI	GREEN	20CC VIAL
BM06V5-33	Ba-133	0.50 MCI	BLK/GRY	5CC VIAL
BM06V10-33	Ba-133	0.50 MCI	BLK/GRY	10CC VIAL
BM06V20-33	Ba-133	0.50 MCI	BLK/GRY	20CC VIAL
BM06V5-68	Ge-68	1.20 MCI	PURPLE	5CC VIAL
BM06V10-68	Ge-68	1.20 MCI	PURPLE	10CC VIAL
BM06V20-68	Ge-68	1.20 MCI	PURPLE	20CC VIAL

MODEL DIMENSIONAL TABLE			
MODEL	VOLUME	NOMINAL HEIGHT ⁽¹⁾	NOMINAL DIAMETER
BM06V5-	5 cc	39.5mm	22.3mm
BM06V10-	10 cc	50.0mm	23.6mm
BM06V20-	20 cc	58.1mm	29.6mm

NOTE 1: HEIGHT DIMENSION IS VIAL ONLY AND DOES NOT INCLUDE SEPTA OR CRIMP SEAL

Model BM06V 5cc, 10cc, 20cc Vials



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V5-	Test Source ID:	#1
General Description:	5 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	55.4 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Slight bulging of plastic neck, no cracks or breaks	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No change in visual appearance	RJ
Impact:	13:58/08.16.2012	13:58/08.16.2012	Small impression in plastic but no breaks	RJ
Vibration:	No test			
Puncture:	14:24/08.16.2012	14:24/08.16.2012	Small impression in tape of label but no breaks	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V5-	Test Source ID: #1
General Description: 5 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 55.4 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/13:59	38	-10.1	<MDA	Rick Jensen
High Temp:	08.14/15:15	52	11.8	<MDA	Rick Jensen
External Pressure:	08.16/09:22	53	10.6	<MDA	Rick Jensen
Impact:	08.16/14:53	57	14.6	<MDA	Rick Jensen
Puncture:	08.16/15:02	46	3.6	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 Day	08.23/09:55	40	-3.2	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b)))^{1/2}]\} / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicon MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not measured	20.91	30 cm	Not measured	0.26
5 cm	Not measured	3.81	100 cm	Not measured	0.02

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V5-	Test Source ID:	#1
General Description:	5 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	55.4 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

The model BM06V5 has been successfully tested and achieved a classification of: 07C22312

The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V5-	Test Source ID:	#2
General Description:	5 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	57.7 uCi	Reference Date:	04/16/2012 12:25
		Isotope:	Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Slight bulging of plastic neck, more bulged on side closest to heat element. No breaks	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No change in visual appearance	RJ
Impact:	14:10/08.16.2012	14:10/08.16.2012	Small scratch in plastic but no break	RJ
Vibration:	No test			
Puncture:	14:26/08.16.2012	14:26/08.16.2012	No visible damage	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V5-	Test Source ID: #2
General Description: 5 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 57.7 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/14:03	40	-8.1	<MDA	Rick Jensen
High Temp:	08.14/15:16	39	-1.2	<MDA	Rick Jensen
External Pressure:	08.16/09:25	49	6.6	<MDA	Rick Jensen
Impact:	08.16/14:54	49	6.6	<MDA	Rick Jensen
Puncture:	08.16/15:03	31	-11.4	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 Day	08.23/09:56	40	-3.2	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b)))^{1/2}]\} / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicon MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not Measured	20.91	30 cm	Not Measured	0.26
5 cm	Not Measured	3.91	100 cm	Not Measured	0.02

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V5-	Test Source ID:	#2
General Description:	5 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	57.7 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

- The model BM06V5 has been successfully tested and achieved a classification of: 07C22312
- The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V10-	Test Source ID:	#1
General Description:	10 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	109.7 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Slight bulging of plastic vial neck. No breaks	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No visible damage	RJ
Impact:	14:12/08.16.2012	14:12/08.16.2012	No visible damage	RJ
Vibration:	No test			
Puncture:	14:28/08.16.2012	14:28/08.16.2012	No visible damage	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V10-	Test Source ID: #1
General Description: 10 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 109.7 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/14:05	58	9.9	<MDA	Rick Jensen
High Temp:	08.14/15:18	33	-7.2	<MDA	Rick Jensen
External Pressure:	08.16/09:26	29	-13.4	<MDA	Rick Jensen
Impact:	08.16/14:55	40	-2.4	<MDA	Rick Jensen
Puncture:	08.16/15:04	48	5.6	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 Day	08.23/09:57	44	0.8	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b)))^{1/2}]\} / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicron MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not Measured	49.91	30 cm	Not Measured	0.46
5 cm	Not Measured	6.16	100 cm	Not Measured	0.04

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V10-	Test Source ID: #1
General Description: 10 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 109.7 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

- The model BM06V10 has been successfully tested and achieved a classification of: 07C22312
- The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V10-	Test Source ID:	#2
General Description:	10 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	110.4 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Very slight bulging of plastic neck. No breaks	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No change in visual appearance	RJ
Impact:	14:10/08.16.2012	14:10/08.16.2012	No visible damage	RJ
Vibration:	No test			
Puncture:	14:26/08.16.2012	14:26/08.16.2012	No visible damage	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V10-	Test Source ID: #2
General Description: 10 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 110.4 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/14:13	54	5.9	<MDA	Rick Jensen
High Temp:	08.14/15:19	46	5.8	<MDA	Rick Jensen
External Pressure:	08.16/09:28	44	1.6	<MDA	Rick Jensen
Impact:	08.16/14:57	35	-7.4	<MDA	Rick Jensen
Puncture:	08.16/15:06	41	-1.4	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 day	08.23/09:59	46	2.8	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b))^{1/2})]\} / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicron MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not Measured	49.91	30 cm	Not Measured	0.46
5 cm	Not Measured	6.16	100 cm	Not Measured	0.05

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V10-	Test Source ID: #2
General Description: 10 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 110.4 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

- The model BM06V10 has been successfully tested and achieved a classification of: 07C22312
- The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V20-	Test Source ID: #1
General Description: 20 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 220 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Inward pinch of metal lid on side of lid, no bulging. No breaks	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No change in visual appearance	RJ
Impact:	14:16/08.16.2012	14:16/08.16.2012	No visible damage	RJ
Vibration:	No test			
Puncture:	14:32/08.16.2012	14:32/08.16.2012	Small impression on plastic but no break	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V20-	Test Source ID: #1
General Description: 20 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 220 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/14:17	46	-2.1	<MDA	Rick Jensen
High Temp:	08.14/15:21	62	21.8	<MDA	Rick Jensen
External Pressure:	08.16/09:29	45	2.6	<MDA	Rick Jensen
Impact:	08.16/14:58	43	0.6	<MDA	Rick Jensen
Puncture:	08.16/15:07	42	-0.4	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 Day	08.23/10:00	58	14.8	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b)))^{1/2}]\} / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicron MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not Measured	79.91	30 cm	Not Measured	0.91
5 cm	Not Measured	12.91	100 cm	Not Measured	0.1

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V20-	Test Source ID:	#1
General Description:	20 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	220 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

- The model BM06V20 has been successfully tested and achieved a classification of: 07C22312
- The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V20-	Test Source ID:	#2
General Description:	20 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	220 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

ANSI/HPS N43.6-2007 Classification

	Temp.	Pressure	Impact	Vibration	Puncture	Bending
Minimum Classification:	2	2	2	1	2	N/A
Tested Classification:	2	2	3	1	3	N/A

Designation: **07C22312** (consistent with BM06E and BM06S)

ANSI/HPS N43.6-2007 Classification Performance Test Procedure

Low Temperature: -40°C (-40°F) for 20 minutes (dry ice used)

High Temperature: +80°C (+176°F) for 1hr then cool slowly to ambient temperature

External Pressure: 25 kPa absolute (3.6 psi) for 5 minutes then to atmospheric (repeat 1 time)

Impact: 200 g (7 oz) from 1 m (3.28 ft)

Vibration: No Test

Puncture: 1 g (15.4 gr) from 1 m (3.28 feet)

Bend: Not Applicable

Evaluation: Following each test, the test source shall be visually inspected for damage and wipe tested immediately after each test and then 7 days following the completion of the last test. Prototype sources that do not contain radioactive material will be subjected to the appropriate non-radioactive test method per ISO 9978 Radiation protection – Sealed radioactive sources - Leakage test methods.

	Time/Date Start	Time/Date Stop	Visual Inspection	Recorded By
Low Temperature:	12:31/08.10.2012	13:47/08.10.2012	No loss of integrity	RJ
High Temperature:	13:49/08.14.2012	14:47/08.14.2012	Moderate sized outward bulge of plastic neck on side closest to heating element.	RJ
External Pressure:	08:52/08.16.2012	09:04/08.16.2012	No change in visual appearance	RJ
Impact:	14:18/08.16.2012	14:18/08.16.2012	Small scratch on plastic but no break	RJ
Vibration:	No test			
Puncture:	14:34/08.16.2012	14:34/08.16.2012	Small impression on plastic but no break	RJ
Bend:	Not Applicable			



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator: BM06V20-	Test Source ID: #2
General Description: 20 cc dose calibrator vial source.	
Source Model Isotope(s): Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68	
Principal Use: Medical Reference Source	Code: X
Prototype Source Activity: 220 uCi	Reference Date: 04/16/2012 12:25 Isotope: Ge-68

Post ANSI Test Wipe Analysis Results

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200 (8/10)	195229	072013	20%	48.1	1	10	6.06E-5
2200 (8/14)	195229	072013	20%	40.2	1	10	5.60E-5
2200 (8/16)	195229	072013	20%	42.4	1	10	5.73E-5

Test	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Low Temp:	08.10/14:20	51	2.9	<MDA	Rick Jensen
High Temp:	08.14/15:23	42	1.8	<MDA	Rick Jensen
External Pressure:	08.16/09:30	58	15.6	<MDA	Rick Jensen
Impact:	08.16/15:00	31	-11.4	<MDA	Rick Jensen
Puncture:	08.16/15:08	48	5.6	<MDA	Rick Jensen

ISO 9978:1992(E) Post 7 Day Wipe Analysis Result

Instrument	Serial No.	Cal. Due	% Eff.	Background Count Rate R _b (cpm)	Sample Count Time t _s (min)	Background Count Time t _b (min)	MDA ⁽¹⁾ (uCi)
2200	195229	072013	20%	43.2	1	10	5.78E-5

	Date/Time of Survey	Gross Count Rate (cpm)	Net Count Rate (cpm)	Activity (uCi)	Recorded By
Post 7 Day	08.23/10:01	49	5.8	<MDA	Rick Jensen

$$^{(1)}\text{MDA} = 4.5\text{E-}7 \times \{3 + 3.29[(R_b t_s (1 + (t_s/t_b))^{1/2})] / \{\text{Efficiency} \times t_s\}$$

Radiation Profile Record

Survey Instrument: Bicron MicroRem Serial No.: B346V Calibration Due: 12/8/2012

Record dose rate in mr/hr

Location	⊥ to the YZ Plane	⊥ to the XZ Plane	Location	⊥ to the YZ Plane	⊥ to the XZ Plane
On-Contact	Not Measured	79.91	30 cm	Not Measured	0.91
5 cm	Not Measured	12.91	100 cm	Not Measured	0.09

Radiation Survey Performed by: John Miller Date: 8/22/2012



International Isotopes Inc.

Sealed Source Testing, Evaluation, and Documentation Form

Source Model Designator:	BM06V20-	Test Source ID:	#2
General Description:	20 cc dose calibrator vial source.		
Source Model Isotope(s):	Na-22, Co-60, Cs-137, Ba-133, Co-57, and Ge-68		
Principal Use:	Medical Reference Source	Code:	X
Prototype Source Activity:	220 uCi	Reference Date:	04/16/2012 12:25 Isotope: Ge-68

Non-Radioactive Leak Test Method

ISO 9928 Test Method: Not Applicable

Date of Test	Results (SAT/UNSAT)	Performed By (Print/Sign)

Prototype Testing Notes

Dry ice used for low temperature test, low temperature recorded at -55.8°F
Highest temperature recorded during high temperature test 198°F
Impact hammer weight = 201.3 grams.
Puncture hammer weight = 13.1 grams

Performance Testing Conclusion (Check Appropriate Box)

The model BM06V20 has been successfully tested and achieved a classification of: 07C22312

The model _____ was unsuccessfully tested against the _____ performance criteria

Engineer: /s/Rick Jensen 8/23/2012
Signature Date

Radiation Safety Officer : /s/John Miller 8/23/2012
Signature Date

Quality Assurance : /s/Audrey Nelson 8/24/2012
Signature Date

Case Title: BM06V5-22
Description: 0.2 mCi Na-22
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Na-22	2.0000e-004	7.4000e+006	1.9137e+001	7.0806e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.511	1.331e+07	2.787e+05	3.124e+05
1.2745	7.396e+06	4.030e+05	4.270e+05	7.068e+02	7.489e+02
TOTALS:	2.070e+07	6.817e+05	7.395e+05	1.254e+03	1.362e+03

Results - Dose Point # 2 - (6.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.511	1.331e+07	1.218e+04	1.355e+04
1.2745	7.396e+06	1.756e+04	1.854e+04	3.079e+01	3.251e+01
TOTALS:	2.070e+07	2.973e+04	3.209e+04	5.469e+01	5.912e+01

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.901e+02	5.484e+02	9.620e-01	1.076e+00
1.2745	7.396e+06	7.082e+02	7.497e+02	1.242e+00	1.315e+00
TOTALS:	2.070e+07	1.198e+03	1.298e+03	2.204e+00	2.391e+00

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.640e+01	5.231e+01	9.108e-02	1.027e-01
1.2745	7.396e+06	6.723e+01	7.144e+01	1.179e-01	1.253e-01
TOTALS:	2.070e+07	1.136e+02	1.238e+02	2.090e-01	2.280e-01

Case Title: BM06V5-33
Description: 0.25 mCi Ba-133
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm³</u>	<u>Bq/cm³</u>
Ba-133	2.5000e-004	9.2500e+006	2.3921e+001	8.8508e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	2.520e+03	4.266e+03	2.349e+01	3.976e+01
0.031	5.866e+06	4.772e+03	8.113e+03	4.302e+01	7.314e+01
0.035	2.105e+06	2.138e+03	3.784e+03	1.354e+01	2.397e+01
0.0532	1.981e+05	3.632e+02	6.363e+02	8.651e-01	1.516e+00
0.0796	2.356e+05	6.868e+02	1.073e+03	1.089e+00	1.701e+00
0.081	3.050e+06	9.060e+03	1.408e+04	1.427e+01	2.219e+01
0.1606	5.540e+04	3.422e+02	4.507e+02	5.734e-01	7.551e-01
0.2231	4.085e+04	3.573e+02	4.371e+02	6.453e-01	7.895e-01
0.2764	6.385e+05	7.002e+03	8.350e+03	1.313e+01	1.566e+01
0.3028	1.645e+06	1.987e+04	2.347e+04	3.773e+01	4.458e+01
0.356	5.596e+06	8.014e+04	9.305e+04	1.548e+02	1.798e+02
0.3838	8.019e+05	1.243e+04	1.432e+04	2.416e+01	2.783e+01

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	2.340e+07	1.397e+05	1.720e+05	3.273e+02	4.316e+02

Results - Dose Point # 2 - (6.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.0306	3.168e+06	1.116e+02	1.853e+02	1.040e+00	1.727e+00
0.031	5.866e+06	2.113e+02	3.522e+02	1.905e+00	3.175e+00
0.035	2.105e+06	9.446e+01	1.637e+02	5.984e-01	1.037e+00
0.0532	1.981e+05	1.599e+01	2.728e+01	3.809e-02	6.497e-02
0.0796	2.356e+05	3.019e+01	4.599e+01	4.787e-02	7.291e-02
0.081	3.050e+06	3.983e+02	6.038e+02	6.274e-01	9.512e-01
0.1606	5.540e+04	1.501e+01	1.944e+01	2.515e-02	3.257e-02
0.2231	4.085e+04	1.565e+01	1.891e+01	2.827e-02	3.416e-02
0.2764	6.385e+05	3.065e+02	3.616e+02	5.748e-01	6.781e-01
0.3028	1.645e+06	8.694e+02	1.017e+03	1.651e+00	1.931e+00
0.356	5.596e+06	3.505e+03	4.033e+03	6.772e+00	7.790e+00
0.3838	8.019e+05	5.436e+02	6.207e+02	1.056e+00	1.206e+00
TOTALS:	2.340e+07	6.117e+03	7.448e+03	1.436e+01	1.870e+01

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.0306	3.168e+06	4.399e+00	7.459e+00	4.100e-02	6.953e-02
0.031	5.866e+06	8.332e+00	1.419e+01	7.511e-02	1.279e-01
0.035	2.105e+06	3.743e+00	6.633e+00	2.371e-02	4.202e-02
0.0532	1.981e+05	6.388e-01	1.116e+00	1.521e-03	2.659e-03
0.0796	2.356e+05	1.209e+00	1.879e+00	1.917e-03	2.978e-03
0.081	3.050e+06	1.595e+01	2.466e+01	2.513e-02	3.885e-02
0.1606	5.540e+04	6.025e-01	7.900e-01	1.009e-03	1.324e-03
0.2231	4.085e+04	6.288e-01	7.668e-01	1.136e-03	1.385e-03
0.2764	6.385e+05	1.232e+01	1.465e+01	2.310e-02	2.747e-02
0.3028	1.645e+06	3.495e+01	4.118e+01	6.639e-02	7.821e-02
0.356	5.596e+06	1.410e+02	1.633e+02	2.724e-01	3.154e-01
0.3838	8.019e+05	2.187e+01	2.513e+01	4.250e-02	4.883e-02
TOTALS:	2.340e+07	2.456e+02	3.017e+02	5.749e-01	7.566e-01

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.0306	3.168e+06	4.072e-01	7.064e-01	3.796e-03	6.585e-03
0.031	5.866e+06	7.717e-01	1.345e+00	6.957e-03	1.212e-02
0.035	2.105e+06	3.483e-01	6.332e-01	2.206e-03	4.011e-03
0.0532	1.981e+05	5.988e-02	1.080e-01	1.426e-04	2.572e-04
0.0796	2.356e+05	1.137e-01	1.816e-01	1.802e-04	2.879e-04
0.081	3.050e+06	1.500e+00	2.384e+00	2.363e-03	3.755e-03
0.1606	5.540e+04	5.680e-02	7.583e-02	9.516e-05	1.270e-04
0.2231	4.085e+04	5.936e-02	7.334e-02	1.072e-04	1.325e-04
0.2764	6.385e+05	1.164e+00	1.400e+00	2.183e-03	2.626e-03
0.3028	1.645e+06	3.303e+00	3.934e+00	6.274e-03	7.472e-03
0.356	5.596e+06	1.333e+01	1.559e+01	2.575e-02	3.012e-02
0.3838	8.019e+05	2.068e+00	2.399e+00	4.019e-03	4.661e-03

Page : 3
DOS File : BM06V5-33.ms6
Run Date: August 1, 2012
Run Time: 10:05:48 AM
Duration : 00:00:00

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	2.340e+07	2.318e+01	2.883e+01	5.408e-02	7.216e-02

Case Title: BM06V5-37
Description: 0.2 mCi Cs-137
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions		
Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points				
	<u>X</u>	<u>Y</u>	<u>Z</u>	
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in	
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in	
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in	
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in	



Shields			
<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input				
Grouping Method : Actual Photon Energies				
<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ba-137m	1.8920e-004	7.0004e+006	1.8103e+001	6.6983e+005
Cs-137	2.0000e-004	7.4000e+006	1.9137e+001	7.0806e+005

Buildup
 The material reference is : Source

Integration Parameters	
Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm						
<u>Energy</u>	<u>Activity</u>	<u>Fluence Rate</u>	<u>Fluence Rate</u>	<u>Exposure Rate</u>	<u>Exposure Rate</u>	
<u>MeV</u>	<u>photons/sec</u>	<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>	
0.0318	1.449e+05	1.241e+02	2.132e+02	1.034e+00	1.776e+00	
0.0322	2.674e+05	2.341e+02	4.039e+02	1.884e+00	3.251e+00	
0.0364	9.731e+04	1.055e+02	1.881e+02	5.991e-01	1.069e+00	
0.6616	6.299e+06	1.731e+05	1.901e+05	3.355e+02	3.685e+02	
TOTALS:	6.809e+06	1.735e+05	1.909e+05	3.390e+02	3.746e+02	

Results - Dose Point # 2 - (6.29,1.4,0) cm						
<u>Energy</u>	<u>Activity</u>	<u>Fluence Rate</u>	<u>Fluence Rate</u>	<u>Exposure Rate</u>	<u>Exposure Rate</u>	
<u>MeV</u>	<u>photons/sec</u>	<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>	
0.0318	1.449e+05	5.494e+00	9.249e+00	4.576e-02	7.704e-02	

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0322	2.674e+05	1.036e+01	1.751e+01	8.337e-02	1.410e-01
0.0364	9.731e+04	4.657e+00	8.138e+00	2.646e-02	4.624e-02
0.6616	6.299e+06	7.554e+03	8.250e+03	1.464e+01	1.599e+01
TOTALS:	6.809e+06	7.574e+03	8.284e+03	1.480e+01	1.626e+01

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	2.169e-01	3.733e-01	1.807e-03	3.110e-03
0.0322	2.674e+05	4.092e-01	7.074e-01	3.293e-03	5.693e-03
0.0364	9.731e+04	1.848e-01	3.301e-01	1.050e-03	1.875e-03
0.6616	6.299e+06	3.043e+02	3.337e+02	5.898e-01	6.469e-01
TOTALS:	6.809e+06	3.051e+02	3.351e+02	5.960e-01	6.576e-01

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	2.011e-02	3.543e-02	1.675e-04	2.951e-04
0.0322	2.674e+05	3.797e-02	6.718e-02	3.056e-04	5.407e-04
0.0364	9.731e+04	1.721e-02	3.157e-02	9.778e-05	1.794e-04
0.6616	6.299e+06	2.883e+01	3.181e+01	5.589e-02	6.167e-02
TOTALS:	6.809e+06	2.890e+01	3.195e+01	5.646e-02	6.269e-02

Case Title: BM06V5-57
Description: 15.0 mCi Co-57
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm³</u>	<u>Bq/cm³</u>
Co-57	1.5000e-002	5.5500e+008	1.4353e+003	5.3105e+007

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>		<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	2.191e+06	3.088e+06	3.436e+03	4.842e+03
0.1365	5.885e+07	3.059e+05	4.202e+05	4.919e+02	6.756e+02
0.536	1.591e+05	3.504e+03	3.913e+03	6.872e+00	7.674e+00
0.692	8.874e+05	2.555e+04	2.797e+04	4.935e+01	5.402e+01
TOTALS:	5.345e+08	2.526e+06	3.540e+06	3.984e+03	5.579e+03

Results - Dose Point # 2 - (6.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>		<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	9.619e+04	1.328e+05	1.508e+02	2.083e+02
0.1365	5.885e+07	1.342e+04	1.809e+04	2.159e+01	2.909e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.536	1.591e+05	1.531e+02	1.698e+02	3.001e-01	3.329e-01
0.692	8.874e+05	1.115e+03	1.214e+03	2.154e+00	2.345e+00
TOTALS:	5.345e+08	1.109e+05	1.523e+05	1.749e+02	2.400e+02

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.858e+03	5.410e+03	6.049e+00	8.482e+00
0.1365	5.885e+07	5.386e+02	7.362e+02	8.660e-01	1.184e+00
0.536	1.591e+05	6.162e+00	6.868e+00	1.208e-02	1.347e-02
0.692	8.874e+05	4.493e+01	4.910e+01	8.676e-02	9.483e-02
TOTALS:	5.345e+08	4.448e+03	6.202e+03	7.014e+00	9.774e+00

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.633e+02	5.209e+02	5.697e-01	8.167e-01
0.1365	5.885e+07	5.075e+01	7.080e+01	8.160e-02	1.138e-01
0.536	1.591e+05	5.835e-01	6.551e-01	1.144e-03	1.285e-03
0.692	8.874e+05	4.258e+00	4.681e+00	8.222e-03	9.040e-03
TOTALS:	5.345e+08	4.189e+02	5.970e+02	6.607e-01	9.408e-01

Case Title: BM06V5-60
Description: 0.05 mCi Co-60
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm³</u>	<u>Bq/cm³</u>
Co-60	5.0000e-005	1.8500e+006	4.7842e+000	1.7702e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.6938	3.018e+02	8.714e+00	9.536e+00	1.682e-02	1.841e-02
1.1732	1.850e+06	9.248e+04	9.839e+04	1.653e+02	1.758e+02
1.3325	1.850e+06	1.056e+05	1.116e+05	1.832e+02	1.937e+02
TOTALS:	3.700e+06	1.981e+05	2.100e+05	3.485e+02	3.695e+02

Results - Dose Point # 2 - (6.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.6938	3.018e+02	3.803e-01	4.139e-01	7.342e-04	7.991e-04
1.1732	1.850e+06	4.030e+03	4.271e+03	7.202e+00	7.633e+00
1.3325	1.850e+06	4.600e+03	4.847e+03	7.981e+00	8.410e+00

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	3.700e+06	8.631e+03	9.119e+03	1.518e+01	1.604e+01

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.532e-02	1.674e-02	2.958e-05	3.232e-05
1.1732	1.850e+06	1.625e+02	1.727e+02	2.904e-01	3.087e-01
1.3325	1.850e+06	1.855e+02	1.960e+02	3.219e-01	3.401e-01
TOTALS:	3.700e+06	3.481e+02	3.688e+02	6.124e-01	6.488e-01

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.452e-03	1.596e-03	2.803e-06	3.081e-06
1.1732	1.850e+06	1.543e+01	1.646e+01	2.757e-02	2.942e-02
1.3325	1.850e+06	1.762e+01	1.868e+01	3.056e-02	3.241e-02
TOTALS:	3.700e+06	3.304e+01	3.514e+01	5.813e-02	6.183e-02

Case Title: BM06V5-68
Description: 0.5 mCi Ge-68/Ga-68
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	2.8 cm	1.1 in
Radius	1.09 cm	0.4 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.29 cm 0.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 2	6.29 cm 2.5 in	1.4 cm 0.6 in	0 cm 0.0 in
# 3	31.29 cm 1 ft 0.3 in	1.4 cm 0.6 in	0 cm 0.0 in
# 4	101.29 cm 3 ft 3.9 in	1.4 cm 0.6 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	10.451 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ga-68	5.0000e-004	1.8500e+007	4.7842e+001	1.7702e+006
Ge-68	5.0000e-004	1.8500e+007	4.7842e+001	1.7702e+006

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	6.892e+05	7.726e+05	1.353e+03	1.516e+03
1.0145	4.452e+04	1.913e+03	2.049e+03	3.517e+00	3.768e+00
1.0774	6.086e+05	2.784e+04	2.974e+04	5.063e+01	5.409e+01
1.8831	2.636e+04	2.153e+03	2.247e+03	3.392e+00	3.540e+00
TOTALS:	3.358e+07	7.211e+05	8.066e+05	1.410e+03	1.578e+03

Results - Dose Point # 2 - (6.29,1.4,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	3.011e+04	3.352e+04	5.909e+01	6.578e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
1.0145	4.452e+04	8.339e+01	8.897e+01	1.533e-01	1.636e-01
1.0774	6.086e+05	1.214e+03	1.291e+03	2.207e+00	2.348e+00
1.8831	2.636e+04	9.373e+01	9.757e+01	1.477e-01	1.537e-01
TOTALS:	3.358e+07	3.150e+04	3.499e+04	6.160e+01	6.845e+01

Results - Dose Point # 3 - (31.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.212e+03	1.356e+03	2.379e+00	2.662e+00
1.0145	4.452e+04	3.362e+00	3.598e+00	6.181e-03	6.615e-03
1.0774	6.086e+05	4.893e+01	5.222e+01	8.898e-02	9.496e-02
1.8831	2.636e+04	3.783e+00	3.945e+00	5.960e-03	6.216e-03
TOTALS:	3.358e+07	1.268e+03	1.416e+03	2.480e+00	2.769e+00

Results - Dose Point # 4 - (101.29,1.4,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.147e+02	1.294e+02	2.252e-01	2.539e-01
1.0145	4.452e+04	3.189e-01	3.429e-01	5.865e-04	6.305e-04
1.0774	6.086e+05	4.643e+00	4.977e+00	8.444e-03	9.050e-03
1.8831	2.636e+04	3.595e-01	3.760e-01	5.664e-04	5.923e-04
TOTALS:	3.358e+07	1.201e+02	1.350e+02	2.348e-01	2.642e-01

Case Title: BM06V10-22
Description: 0.2 mCi Na-22
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Na-22	2.0000e-004	7.4000e+006	1.3052e+001	4.8292e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	1.331e+07	2.216e+05	2.514e+05	4.348e+02	4.934e+02
1.2745	7.396e+06	3.218e+05	3.431e+05	5.643e+02	6.016e+02
TOTALS:	2.070e+07	5.433e+05	5.945e+05	9.991e+02	1.095e+03

Results - Dose Point # 2 - (6.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	1.331e+07	1.172e+04	1.312e+04	2.301e+01	2.576e+01
1.2745	7.396e+06	1.694e+04	1.794e+04	2.971e+01	3.146e+01
TOTALS:	2.070e+07	2.866e+04	3.106e+04	5.271e+01	5.722e+01

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.847e+02	5.454e+02	9.514e-01	1.071e+00
1.2745	7.396e+06	7.018e+02	7.451e+02	1.231e+00	1.307e+00
TOTALS:	2.070e+07	1.187e+03	1.290e+03	2.182e+00	2.377e+00

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.605e+01	5.221e+01	9.039e-02	1.025e-01
1.2745	7.396e+06	6.686e+01	7.126e+01	1.173e-01	1.250e-01
TOTALS:	2.070e+07	1.129e+02	1.235e+02	2.077e-01	2.274e-01

Case Title: BM06V10-33
Description: 0.25 mCi Ba-133
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ba-133	2.5000e-004	9.2500e+006	1.6315e+001	6.0365e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.0306	3.168e+06	1.909e+03	3.339e+03
0.031	5.866e+06	3.618e+03	6.361e+03	3.262e+01	5.735e+01
0.035	2.105e+06	1.637e+03	3.021e+03	1.037e+01	1.914e+01
0.0532	1.981e+05	2.834e+02	5.253e+02	6.750e-01	1.251e+00
0.0796	2.356e+05	5.395e+02	8.843e+02	8.553e-01	1.402e+00
0.081	3.050e+06	7.118e+03	1.161e+04	1.121e+01	1.828e+01
0.1606	5.540e+04	2.703e+02	3.666e+02	4.528e-01	6.141e-01
0.2231	4.085e+04	2.827e+02	3.534e+02	5.106e-01	6.382e-01
0.2764	6.385e+05	5.547e+03	6.740e+03	1.040e+01	1.264e+01
0.3028	1.645e+06	1.575e+04	1.894e+04	2.991e+01	3.596e+01
0.356	5.596e+06	6.358e+04	7.500e+04	1.228e+02	1.449e+02
0.3838	8.019e+05	9.868e+03	1.154e+04	1.917e+01	2.242e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
TOTALS:	2.340e+07	1.104e+05	1.387e+05	2.568e+02	3.457e+02

Results - Dose Point # 2 - (6.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	1.049e+02	1.770e+02	9.780e-01	1.650e+00
0.031	5.866e+06	1.987e+02	3.367e+02	1.791e+00	3.036e+00
0.035	2.105e+06	8.928e+01	1.578e+02	5.656e-01	9.994e-01
0.0532	1.981e+05	1.526e+01	2.673e+01	3.634e-02	6.367e-02
0.0796	2.356e+05	2.890e+01	4.507e+01	4.582e-02	7.146e-02
0.081	3.050e+06	3.813e+02	5.917e+02	6.006e-01	9.321e-01
0.1606	5.540e+04	1.440e+01	1.892e+01	2.413e-02	3.170e-02
0.2231	4.085e+04	1.504e+01	1.836e+01	2.716e-02	3.315e-02
0.2764	6.385e+05	2.946e+02	3.507e+02	5.525e-01	6.577e-01
0.3028	1.645e+06	8.359e+02	9.857e+02	1.587e+00	1.872e+00
0.356	5.596e+06	3.371e+03	3.908e+03	6.513e+00	7.550e+00
0.3838	8.019e+05	5.230e+02	6.014e+02	1.016e+00	1.169e+00
TOTALS:	2.340e+07	5.873e+03	7.218e+03	1.374e+01	1.807e+01

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	4.249e+00	7.316e+00	3.961e-02	6.820e-02
0.031	5.866e+06	8.053e+00	1.393e+01	7.260e-02	1.256e-01
0.035	2.105e+06	3.635e+00	6.569e+00	2.303e-02	4.162e-02
0.0532	1.981e+05	6.262e-01	1.123e+00	1.491e-03	2.674e-03
0.0796	2.356e+05	1.189e+00	1.890e+00	1.885e-03	2.997e-03
0.081	3.050e+06	1.569e+01	2.481e+01	2.472e-02	3.909e-02
0.1606	5.540e+04	5.940e-01	7.897e-01	9.952e-04	1.323e-03
0.2231	4.085e+04	6.206e-01	7.643e-01	1.121e-03	1.380e-03
0.2764	6.385e+05	1.217e+01	1.459e+01	2.281e-02	2.737e-02
0.3028	1.645e+06	3.452e+01	4.101e+01	6.557e-02	7.788e-02
0.356	5.596e+06	1.393e+02	1.625e+02	2.691e-01	3.140e-01
0.3838	8.019e+05	2.161e+01	2.501e+01	4.200e-02	4.859e-02
TOTALS:	2.340e+07	2.423e+02	3.003e+02	5.649e-01	7.507e-01

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	3.947e-01	6.947e-01	3.679e-03	6.476e-03
0.031	5.866e+06	7.483e-01	1.324e+00	6.746e-03	1.194e-02
0.035	2.105e+06	3.394e-01	6.289e-01	2.150e-03	3.984e-03
0.0532	1.981e+05	5.890e-02	1.089e-01	1.403e-04	2.594e-04
0.0796	2.356e+05	1.122e-01	1.834e-01	1.779e-04	2.908e-04
0.081	3.050e+06	1.480e+00	2.407e+00	2.332e-03	3.792e-03
0.1606	5.540e+04	5.620e-02	7.607e-02	9.415e-05	1.274e-04
0.2231	4.085e+04	5.878e-02	7.337e-02	1.062e-04	1.325e-04
0.2764	6.385e+05	1.153e+00	1.400e+00	2.163e-03	2.625e-03
0.3028	1.645e+06	3.274e+00	3.932e+00	6.218e-03	7.468e-03
0.356	5.596e+06	1.322e+01	1.557e+01	2.554e-02	3.009e-02
0.3838	8.019e+05	2.051e+00	2.396e+00	3.986e-03	4.656e-03

Page : 3
DOS File : BM06V10-33.ms6
Run Date: August 1, 2012
Run Time: 10:22:01 AM
Duration : 00:00:00

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
TOTALS:	2.340e+07	2.295e+01	2.880e+01	5.333e-02	7.184e-02

Case Title: BM06V10-37
Description: 0.2 mCi Cs-137
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions		
Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points			
	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields			
<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input				
Grouping Method : Actual Photon Energies				
<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ba-137m	1.8920e-004	7.0004e+006	1.2347e+001	4.5684e+005
Cs-137	2.0000e-004	7.4000e+006	1.3052e+001	4.8292e+005

Buildup
 The material reference is : Source

Integration Parameters	
Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm						
<u>Energy</u>	<u>Activity</u>	<u>Fluence Rate</u>	<u>Fluence Rate</u>	<u>Exposure Rate</u>	<u>Exposure Rate</u>	
<u>MeV</u>	<u>photons/sec</u>	<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>	
0.0318	1.449e+05	9.436e+01	1.679e+02	7.860e-01	1.398e+00	
0.0322	2.674e+05	1.782e+02	3.185e+02	1.434e+00	2.564e+00	
0.0364	9.731e+04	8.099e+01	1.511e+02	4.601e-01	8.583e-01	
0.6616	6.299e+06	1.377e+05	1.528e+05	2.670e+02	2.963e+02	
TOTALS:	6.809e+06	1.381e+05	1.535e+05	2.697e+02	3.011e+02	

Results - Dose Point # 2 - (6.364,1.8,0) cm						
<u>Energy</u>	<u>Activity</u>	<u>Fluence Rate</u>	<u>Fluence Rate</u>	<u>Exposure Rate</u>	<u>Exposure Rate</u>	
<u>MeV</u>	<u>photons/sec</u>	<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>	
0.0318	1.449e+05	5.173e+00	8.856e+00	4.309e-02	7.377e-02	

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0322	2.674e+05	9.760e+00	1.678e+01	7.855e-02	1.351e-01
0.0364	9.731e+04	4.408e+00	7.865e+00	2.504e-02	4.469e-02
0.6616	6.299e+06	7.277e+03	7.985e+03	1.411e+01	1.548e+01
TOTALS:	6.809e+06	7.296e+03	8.019e+03	1.425e+01	1.573e+01

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	2.099e-01	3.671e-01	1.748e-03	3.058e-03
0.0322	2.674e+05	3.962e-01	6.962e-01	3.189e-03	5.603e-03
0.0364	9.731e+04	1.797e-01	3.278e-01	1.021e-03	1.862e-03
0.6616	6.299e+06	3.011e+02	3.317e+02	5.837e-01	6.431e-01
TOTALS:	6.809e+06	3.019e+02	3.331e+02	5.896e-01	6.536e-01

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	1.953e-02	3.495e-02	1.627e-04	2.911e-04
0.0322	2.674e+05	3.688e-02	6.633e-02	2.968e-04	5.338e-04
0.0364	9.731e+04	1.679e-02	3.145e-02	9.542e-05	1.787e-04
0.6616	6.299e+06	2.863e+01	3.174e+01	5.550e-02	6.153e-02
TOTALS:	6.809e+06	2.870e+01	3.187e+01	5.606e-02	6.254e-02

Case Title: BM06V10-57
Description: 15.0 mCi Co-57
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm³</u>	<u>Bq/cm³</u>
Co-57	1.5000e-002	5.5500e+008	9.7889e+002	3.6219e+007

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	1.727e+06	2.526e+06	2.708e+03	3.961e+03
0.1365	5.885e+07	2.413e+05	3.430e+05	3.880e+02	5.515e+02
0.536	1.591e+05	2.786e+03	3.148e+03	5.464e+00	6.174e+00
0.692	8.874e+05	2.034e+04	2.249e+04	3.929e+01	4.342e+01
TOTALS:	5.345e+08	1.992e+06	2.895e+06	3.141e+03	4.562e+03

Results - Dose Point # 2 - (6.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	9.223e+04	1.297e+05	1.446e+02	2.033e+02
0.1365	5.885e+07	1.288e+04	1.764e+04	2.071e+01	2.836e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.536	1.591e+05	1.474e+02	1.644e+02	2.890e-01	3.224e-01
0.692	8.874e+05	1.074e+03	1.175e+03	2.075e+00	2.269e+00
TOTALS:	5.345e+08	1.063e+05	1.486e+05	1.677e+02	2.342e+02

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.801e+03	5.422e+03	5.959e+00	8.501e+00
0.1365	5.885e+07	5.308e+02	7.371e+02	8.535e-01	1.185e+00
0.536	1.591e+05	6.094e+00	6.831e+00	1.195e-02	1.340e-02
0.692	8.874e+05	4.446e+01	4.882e+01	8.586e-02	9.427e-02
TOTALS:	5.345e+08	4.382e+03	6.215e+03	6.910e+00	9.794e+00

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.592e+02	5.240e+02	5.632e-01	8.215e-01
0.1365	5.885e+07	5.018e+01	7.115e+01	8.069e-02	1.144e-01
0.536	1.591e+05	5.791e-01	6.538e-01	1.136e-03	1.282e-03
0.692	8.874e+05	4.229e+00	4.670e+00	8.166e-03	9.019e-03
TOTALS:	5.345e+08	4.142e+02	6.004e+02	6.532e-01	9.462e-01

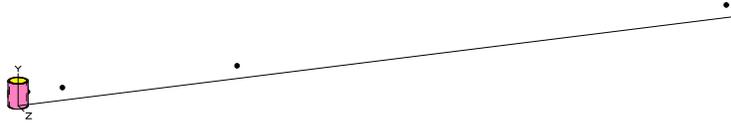
Case Title: BM06V10-60
Description: 0.05 mCi Co-60
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm³</u>	<u>Bq/cm³</u>
Co-60	5.0000e-005	1.8500e+006	3.2630e+000	1.2073e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.6938	3.018e+02	6.937e+00	7.666e+00	1.339e-02	1.480e-02
1.1732	1.850e+06	7.381e+04	7.905e+04	1.319e+02	1.413e+02
1.3325	1.850e+06	8.432e+04	8.969e+04	1.463e+02	1.556e+02
TOTALS:	3.700e+06	1.581e+05	1.687e+05	2.782e+02	2.969e+02

Results - Dose Point # 2 - (6.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.6938	3.018e+02	3.664e-01	4.006e-01	7.074e-04	7.734e-04
1.1732	1.850e+06	3.888e+03	4.133e+03	6.947e+00	7.386e+00
1.3325	1.850e+06	4.438e+03	4.690e+03	7.700e+00	8.137e+00

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	3.700e+06	8.326e+03	8.824e+03	1.465e+01	1.552e+01

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.516e-02	1.664e-02	2.927e-05	3.213e-05
1.1732	1.850e+06	1.610e+02	1.717e+02	2.878e-01	3.068e-01
1.3325	1.850e+06	1.839e+02	1.948e+02	3.190e-01	3.380e-01
TOTALS:	3.700e+06	3.449e+02	3.665e+02	6.068e-01	6.448e-01

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.442e-03	1.592e-03	2.784e-06	3.074e-06
1.1732	1.850e+06	1.534e+01	1.642e+01	2.741e-02	2.934e-02
1.3325	1.850e+06	1.752e+01	1.863e+01	3.040e-02	3.232e-02
TOTALS:	3.700e+06	3.286e+01	3.505e+01	5.781e-02	6.167e-02

Case Title: BM06V10-68
Description: 0.5 mCi Ge-68/Ga-68
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.6 cm	1.4 in
Radius	1.164 cm	0.5 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.364 cm 0.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 2	6.364 cm 2.5 in	1.8 cm 0.7 in	0 cm 0.0 in
# 3	31.364 cm 1 ft 0.3 in	1.8 cm 0.7 in	0 cm 0.0 in
# 4	101.364 cm 3 ft 3.9 in	1.8 cm 0.7 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	15.324 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ga-68	5.0000e-004	1.8500e+007	3.2630e+001	1.2073e+006
Ge-68	5.0000e-004	1.8500e+007	3.2630e+001	1.2073e+006

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	5.478e+05	6.217e+05	1.075e+03	1.220e+03
1.0145	4.452e+04	1.526e+03	1.647e+03	2.805e+00	3.028e+00
1.0774	6.086e+05	2.221e+04	2.390e+04	4.039e+01	4.346e+01
1.8831	2.636e+04	1.722e+03	1.805e+03	2.713e+00	2.844e+00
TOTALS:	3.358e+07	5.733e+05	6.490e+05	1.121e+03	1.269e+03

Results - Dose Point # 2 - (6.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	2.898e+04	3.245e+04	5.689e+01	6.370e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
1.0145	4.452e+04	8.041e+01	8.609e+01	1.478e-01	1.583e-01
1.0774	6.086e+05	1.170e+03	1.250e+03	2.128e+00	2.272e+00
1.8831	2.636e+04	9.050e+01	9.441e+01	1.426e-01	1.487e-01
TOTALS:	3.358e+07	3.033e+04	3.388e+04	5.931e+01	6.628e+01

Results - Dose Point # 3 - (31.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.199e+03	1.349e+03	2.352e+00	2.647e+00
1.0145	4.452e+04	3.330e+00	3.576e+00	6.123e-03	6.575e-03
1.0774	6.086e+05	4.847e+01	5.190e+01	8.815e-02	9.438e-02
1.8831	2.636e+04	3.752e+00	3.921e+00	5.910e-03	6.177e-03
TOTALS:	3.358e+07	1.254e+03	1.408e+03	2.453e+00	2.754e+00

Results - Dose Point # 4 - (101.364,1.8,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.139e+02	1.291e+02	2.235e-01	2.534e-01
1.0145	4.452e+04	3.170e-01	3.420e-01	5.830e-04	6.289e-04
1.0774	6.086e+05	4.616e+00	4.964e+00	8.394e-03	9.027e-03
1.8831	2.636e+04	3.578e-01	3.750e-01	5.637e-04	5.908e-04
TOTALS:	3.358e+07	1.192e+02	1.348e+02	2.330e-01	2.636e-01

Case Title: BM06V20-22
Description: 0.2 mCi Na-22
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Na-22	2.0000e-004	7.4000e+006	7.6474e+000	2.8295e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	1.331e+07	1.603e+05	1.853e+05	3.147e+02	3.637e+02
1.2745	7.396e+06	2.344e+05	2.523e+05	4.111e+02	4.424e+02
TOTALS:	2.070e+07	3.947e+05	4.375e+05	7.258e+02	8.061e+02

Results - Dose Point # 2 - (6.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	1.331e+07	1.052e+04	1.202e+04	2.065e+01	2.360e+01
1.2745	7.396e+06	1.532e+04	1.639e+04	2.686e+01	2.875e+01
TOTALS:	2.070e+07	2.583e+04	2.842e+04	4.751e+01	5.235e+01

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.646e+02	5.345e+02	9.118e-01	1.049e+00
1.2745	7.396e+06	6.781e+02	7.281e+02	1.189e+00	1.277e+00
TOTALS:	2.070e+07	1.143e+03	1.263e+03	2.101e+00	2.326e+00

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec <u>No Buildup</u>	<u>Fluence Rate</u> MeV/cm ² /sec <u>With Buildup</u>	<u>Exposure Rate</u> mR/hr <u>No Buildup</u>	<u>Exposure Rate</u> mR/hr <u>With Buildup</u>
0.511	1.331e+07	4.469e+01	5.183e+01	8.772e-02	1.017e-01
1.2745	7.396e+06	6.542e+01	7.053e+01	1.147e-01	1.237e-01
TOTALS:	2.070e+07	1.101e+02	1.224e+02	2.024e-01	2.254e-01

Case Title: BM06V20-33
Description: 0.25 mCi Ba-133
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ba-133	2.5000e-004	9.2500e+006	9.5593e+000	3.5369e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>		<u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	1.286e+03	2.347e+03	1.199e+01	2.187e+01
0.031	5.866e+06	2.441e+03	4.482e+03	2.200e+01	4.040e+01
0.035	2.105e+06	1.121e+03	2.181e+03	7.099e+00	1.382e+01
0.0532	1.981e+05	1.995e+02	3.994e+02	4.751e-01	9.513e-01
0.0796	2.356e+05	3.836e+02	6.746e+02	6.081e-01	1.070e+00
0.081	3.050e+06	5.062e+03	8.851e+03	7.975e+00	1.394e+01
0.1606	5.540e+04	1.937e+02	2.746e+02	3.245e-01	4.601e-01
0.2231	4.085e+04	2.032e+02	2.623e+02	3.670e-01	4.737e-01
0.2764	6.385e+05	3.994e+03	4.992e+03	7.490e+00	9.362e+00
0.3028	1.645e+06	1.135e+04	1.401e+04	2.155e+01	2.662e+01
0.356	5.596e+06	4.588e+04	5.543e+04	8.863e+01	1.071e+02
0.3838	8.019e+05	7.125e+03	8.520e+03	1.384e+01	1.656e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
TOTALS:	2.340e+07	7.923e+04	1.024e+05	1.824e+02	2.526e+02

Results - Dose Point # 2 - (6.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	8.680e+01	1.538e+02	8.091e-01	1.433e+00
0.031	5.866e+06	1.647e+02	2.934e+02	1.485e+00	2.645e+00
0.035	2.105e+06	7.520e+01	1.415e+02	4.764e-01	8.961e-01
0.0532	1.981e+05	1.327e+01	2.546e+01	3.160e-02	6.065e-02
0.0796	2.356e+05	2.542e+01	4.300e+01	4.030e-02	6.816e-02
0.081	3.050e+06	3.355e+02	5.642e+02	5.285e-01	8.889e-01
0.1606	5.540e+04	1.278e+01	1.766e+01	2.142e-02	2.959e-02
0.2231	4.085e+04	1.339e+01	1.695e+01	2.418e-02	3.062e-02
0.2764	6.385e+05	2.629e+02	3.231e+02	4.930e-01	6.058e-01
0.3028	1.645e+06	7.465e+02	9.073e+02	1.418e+00	1.723e+00
0.356	5.596e+06	3.015e+03	3.591e+03	5.825e+00	6.938e+00
0.3838	8.019e+05	4.681e+02	5.523e+02	9.096e-01	1.073e+00
TOTALS:	2.340e+07	5.220e+03	6.630e+03	1.206e+01	1.639e+01

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	3.726e+00	6.756e+00	3.473e-02	6.298e-02
0.031	5.866e+06	7.074e+00	1.290e+01	6.377e-02	1.163e-01
0.035	2.105e+06	3.252e+00	6.288e+00	2.060e-02	3.983e-02
0.0532	1.981e+05	5.799e-01	1.144e+00	1.381e-03	2.724e-03
0.0796	2.356e+05	1.115e+00	1.934e+00	1.768e-03	3.067e-03
0.081	3.050e+06	1.472e+01	2.538e+01	2.319e-02	3.998e-02
0.1606	5.540e+04	5.626e-01	7.895e-01	9.425e-04	1.323e-03
0.2231	4.085e+04	5.898e-01	7.555e-01	1.065e-03	1.364e-03
0.2764	6.385e+05	1.159e+01	1.438e+01	2.173e-02	2.698e-02
0.3028	1.645e+06	3.292e+01	4.039e+01	6.252e-02	7.671e-02
0.356	5.596e+06	1.330e+02	1.598e+02	2.570e-01	3.087e-01
0.3838	8.019e+05	2.066e+01	2.457e+01	4.014e-02	4.774e-02
TOTALS:	2.340e+07	2.298e+02	2.951e+02	5.289e-01	7.277e-01

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0306	3.168e+06	3.498e-01	6.487e-01	3.261e-03	6.047e-03
0.031	5.866e+06	6.645e-01	1.240e+00	5.991e-03	1.118e-02
0.035	2.105e+06	3.070e-01	6.087e-01	1.945e-03	3.856e-03
0.0532	1.981e+05	5.521e-02	1.123e-01	1.315e-04	2.675e-04
0.0796	2.356e+05	1.065e-01	1.900e-01	1.688e-04	3.012e-04
0.081	3.050e+06	1.406e+00	2.492e+00	2.214e-03	3.927e-03
0.1606	5.540e+04	5.388e-02	7.706e-02	9.027e-05	1.291e-04
0.2231	4.085e+04	5.656e-02	7.347e-02	1.022e-04	1.327e-04
0.2764	6.385e+05	1.112e+00	1.398e+00	2.086e-03	2.621e-03
0.3028	1.645e+06	3.160e+00	3.923e+00	6.002e-03	7.450e-03
0.356	5.596e+06	1.278e+01	1.551e+01	2.469e-02	2.997e-02
0.3838	8.019e+05	1.985e+00	2.384e+00	3.857e-03	4.633e-03

Page : 3
DOS File : BM06V20-33.ms6
Run Date: August 1, 2012
Run Time: 10:35:26 AM
Duration : 00:00:00

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	2.340e+07	2.204e+01	2.866e+01	5.054e-02	7.051e-02

Case Title: BM06V20-37
Description: 0.2 mCi Cs-137
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions		
Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points			
	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields			
<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input				
Grouping Method : Actual Photon Energies				
<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Ba-137m	1.8920e-004	7.0004e+006	7.2345e+000	2.6768e+005
Cs-137	2.0000e-004	7.4000e+006	7.6474e+000	2.8295e+005

Buildup
 The material reference is : Source

Integration Parameters	
Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.0318	1.449e+05	6.388e+01	1.189e+02
0.0322	2.674e+05	1.208e+02	2.263e+02	9.720e-01	1.821e+00
0.0364	9.731e+04	5.564e+01	1.099e+02	3.161e-01	6.244e-01
0.6616	6.299e+06	9.988e+04	1.125e+05	1.936e+02	2.181e+02
TOTALS:	6.809e+06	1.001e+05	1.129e+05	1.955e+02	2.215e+02

Results - Dose Point # 2 - (6.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.0318	1.449e+05	4.304e+00	7.766e+00

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0322	2.674e+05	8.134e+00	1.476e+01	6.546e-02	1.188e-01
0.0364	9.731e+04	3.729e+00	7.109e+00	2.119e-02	4.039e-02
0.6616	6.299e+06	6.545e+03	7.305e+03	1.269e+01	1.416e+01
TOTALS:	6.809e+06	6.561e+03	7.335e+03	1.281e+01	1.439e+01

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	1.852e-01	3.425e-01	1.542e-03	2.853e-03
0.0322	2.674e+05	3.502e-01	6.517e-01	2.818e-03	5.245e-03
0.0364	9.731e+04	1.615e-01	3.169e-01	9.177e-04	1.801e-03
0.6616	6.299e+06	2.893e+02	3.246e+02	5.608e-01	6.293e-01
TOTALS:	6.809e+06	2.900e+02	3.259e+02	5.661e-01	6.392e-01

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.0318	1.449e+05	1.742e-02	3.296e-02	1.451e-04	2.746e-04
0.0322	2.674e+05	3.295e-02	6.276e-02	2.652e-04	5.051e-04
0.0364	9.731e+04	1.527e-02	3.073e-02	8.674e-05	1.746e-04
0.6616	6.299e+06	2.785e+01	3.146e+01	5.400e-02	6.099e-02
TOTALS:	6.809e+06	2.792e+01	3.159e+01	5.449e-02	6.194e-02

Case Title: BM06V20-57
Description: 15.0 mCi Co-57
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Co-57	1.5000e-002	5.5500e+008	5.7356e+002	2.1222e+007

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	1.235e+06	1.909e+06	1.936e+03	2.993e+03
0.1365	5.885e+07	1.727e+05	2.584e+05	2.777e+02	4.155e+02
0.536	1.591e+05	2.017e+03	2.320e+03	3.956e+00	4.549e+00
0.692	8.874e+05	1.476e+04	1.655e+04	2.850e+01	3.196e+01
TOTALS:	5.345e+08	1.424e+06	2.186e+06	2.246e+03	3.445e+03

Results - Dose Point # 2 - (6.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u>		<u>Exposure Rate</u>	
		<u>MeV/cm²/sec</u>	<u>MeV/cm²/sec</u>	<u>mR/hr</u>	<u>mR/hr</u>
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	8.162e+04	1.223e+05	1.280e+02	1.917e+02
0.1365	5.885e+07	1.141e+04	1.657e+04	1.834e+01	2.665e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.536	1.591e+05	1.323e+02	1.506e+02	2.594e-01	2.952e-01
0.692	8.874e+05	9.668e+02	1.075e+03	1.867e+00	2.076e+00
TOTALS:	5.345e+08	9.413e+04	1.401e+05	1.484e+02	2.207e+02

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.588e+03	5.481e+03	5.626e+00	8.594e+00
0.1365	5.885e+07	5.018e+02	7.421e+02	8.068e-01	1.193e+00
0.536	1.591e+05	5.844e+00	6.692e+00	1.146e-02	1.312e-02
0.692	8.874e+05	4.274e+01	4.776e+01	8.253e-02	9.222e-02
TOTALS:	5.345e+08	4.138e+03	6.277e+03	6.527e+00	9.892e+00

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.1221	4.746e+08	3.433e+02	5.367e+02	5.382e-01	8.415e-01
0.1365	5.885e+07	4.802e+01	7.258e+01	7.722e-02	1.167e-01
0.536	1.591e+05	5.623e-01	6.488e-01	1.103e-03	1.272e-03
0.692	8.874e+05	4.115e+00	4.628e+00	7.948e-03	8.937e-03
TOTALS:	5.345e+08	3.960e+02	6.146e+02	6.245e-01	9.685e-01

Case Title: BM06V20-60
Description: 0.05 mCi Co-60
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions

Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>µCi/cm³</u>	<u>Bq/cm³</u>
Co-60	5.0000e-005	1.8500e+006	1.9119e+000	7.0739e+004

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u>		<u>Exposure Rate</u> <u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.6938	3.018e+02	5.032e+00	5.642e+00
1.1732	1.850e+06	5.374e+04	5.813e+04	9.604e+01	1.039e+02
1.3325	1.850e+06	6.144e+04	6.595e+04	1.066e+02	1.144e+02
TOTALS:	3.700e+06	1.152e+05	1.241e+05	2.026e+02	2.183e+02

Results - Dose Point # 2 - (6.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u>		<u>Exposure Rate</u> <u>mR/hr</u>	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
		0.6938	3.018e+02	3.297e-01	3.664e-01
1.1732	1.850e+06	3.513e+03	3.777e+03	6.277e+00	6.750e+00
1.3325	1.850e+06	4.014e+03	4.285e+03	6.964e+00	7.435e+00

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
TOTALS:	3.700e+06	7.527e+03	8.063e+03	1.324e+01	1.419e+01

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.457e-02	1.628e-02	2.814e-05	3.143e-05
1.1732	1.850e+06	1.555e+02	1.678e+02	2.779e-01	2.998e-01
1.3325	1.850e+06	1.777e+02	1.904e+02	3.084e-01	3.302e-01
TOTALS:	3.700e+06	3.332e+02	3.581e+02	5.862e-01	6.301e-01

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm²/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	3.018e+02	1.403e-03	1.578e-03	2.709e-06	3.046e-06
1.1732	1.850e+06	1.500e+01	1.625e+01	2.680e-02	2.904e-02
1.3325	1.850e+06	1.715e+01	1.844e+01	2.975e-02	3.199e-02
TOTALS:	3.700e+06	3.215e+01	3.469e+01	5.656e-02	6.104e-02

Case Title: BM06V20-68
Description: 0.5 mCi Ge-68/Ga-68
Geometry: 7 - Cylinder Volume - Side Shields

Source Dimensions		
Height	3.9 cm	1.5 in
Radius	1.461 cm	0.6 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	1.661 cm 0.7 in	1.95 cm 0.8 in	0 cm 0.0 in
# 2	6.661 cm 2.6 in	1.95 cm 0.8 in	0 cm 0.0 in
# 3	31.661 cm 1 ft 0.5 in	1.95 cm 0.8 in	0 cm 0.0 in
# 4	101.661 cm 3 ft 4.0 in	1.95 cm 0.8 in	0 cm 0.0 in



Shields

Shield Name	Dimension	Material	Density
Source	26.153 cm ³	Stycast 1264 A/B	1.1
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.2 cm	PETG	1.27

Source Input

Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm ³	Bq/cm ³
Ga-68	5.0000e-004	1.8500e+007	1.9119e+001	7.0739e+005
Ge-68	5.0000e-004	1.8500e+007	1.9119e+001	7.0739e+005

Buildup

The material reference is : Source

Integration Parameters

Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (1.661,1.95,0) cm

Energy MeV	Activity photons/sec	Fluence Rate		Exposure Rate	
		MeV/cm ² /sec	MeV/cm ² /sec	mR/hr	mR/hr
		No Buildup	With Buildup	No Buildup	With Buildup
0.511	3.290e+07	3.965e+05	4.582e+05	7.781e+02	8.993e+02
1.0145	4.452e+04	1.110e+03	1.211e+03	2.040e+00	2.227e+00
1.0774	6.086e+05	1.616e+04	1.758e+04	2.939e+01	3.196e+01
1.8831	2.636e+04	1.257e+03	1.327e+03	1.981e+00	2.091e+00
TOTALS:	3.358e+07	4.150e+05	4.783e+05	8.116e+02	9.355e+02

Results - Dose Point # 2 - (6.661,1.95,0) cm

Energy MeV	Activity photons/sec	Fluence Rate		Exposure Rate	
		MeV/cm ² /sec	MeV/cm ² /sec	mR/hr	mR/hr
		No Buildup	With Buildup	No Buildup	With Buildup
0.511	3.290e+07	2.601e+04	2.973e+04	5.105e+01	5.836e+01

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
1.0145	4.452e+04	7.257e+01	7.869e+01	1.334e-01	1.447e-01
1.0774	6.086e+05	1.057e+03	1.142e+03	1.922e+00	2.077e+00
1.8831	2.636e+04	8.204e+01	8.626e+01	1.292e-01	1.359e-01
TOTALS:	3.358e+07	2.722e+04	3.104e+04	5.324e+01	6.071e+01

Results - Dose Point # 3 - (31.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.149e+03	1.322e+03	2.255e+00	2.594e+00
1.0145	4.452e+04	3.211e+00	3.495e+00	5.905e-03	6.427e-03
1.0774	6.086e+05	4.677e+01	5.073e+01	8.505e-02	9.225e-02
1.8831	2.636e+04	3.635e+00	3.831e+00	5.727e-03	6.036e-03
TOTALS:	3.358e+07	1.202e+03	1.380e+03	2.351e+00	2.699e+00

Results - Dose Point # 4 - (101.661,1.95,0) cm

<u>Energy</u> MeV	<u>Activity</u> photons/sec	<u>Fluence Rate</u> MeV/cm ² /sec		<u>Exposure Rate</u> mR/hr	
		<u>No Buildup</u>	<u>With Buildup</u>	<u>No Buildup</u>	<u>With Buildup</u>
0.511	3.290e+07	1.105e+02	1.282e+02	2.169e-01	2.515e-01
1.0145	4.452e+04	3.096e-01	3.386e-01	5.693e-04	6.226e-04
1.0774	6.086e+05	4.510e+00	4.914e+00	8.202e-03	8.937e-03
1.8831	2.636e+04	3.511e-01	3.711e-01	5.531e-04	5.847e-04
TOTALS:	3.358e+07	1.157e+02	1.338e+02	2.262e-01	2.617e-01