

Manufactured for:



**Radiation
Therapy
Resources, Inc.**

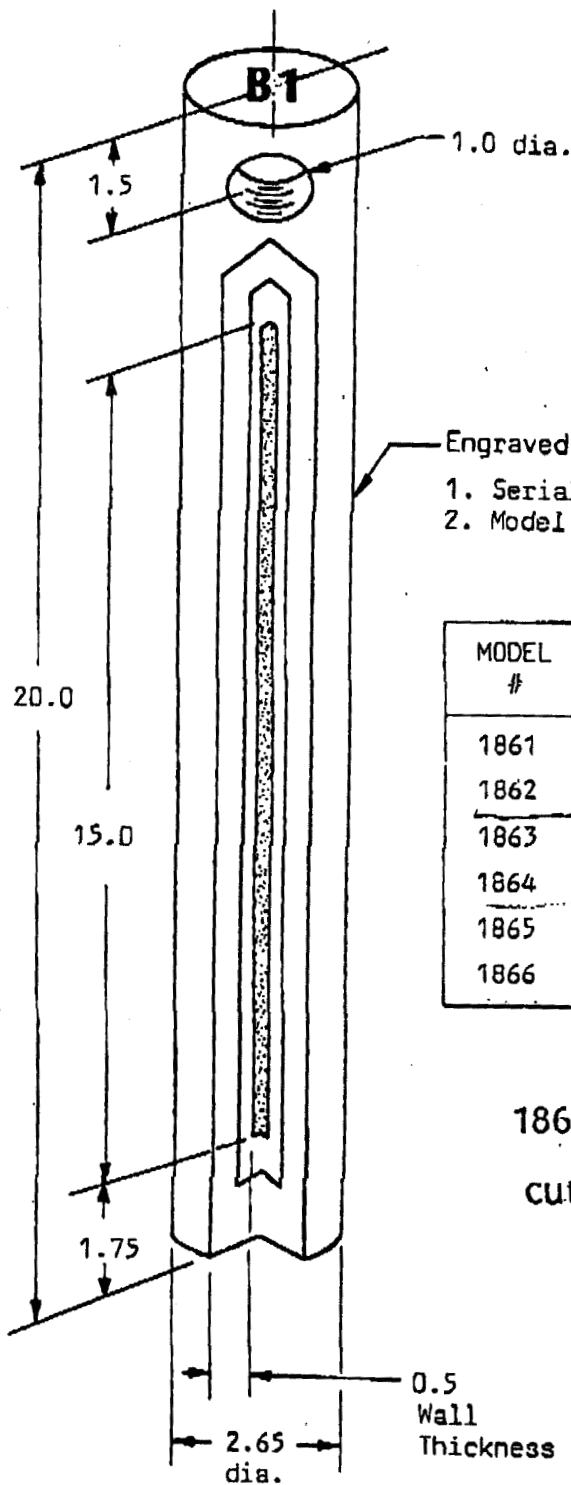
25213 Avenue Stanford, Valencia, CA 91355
☐ (800) 255-2580 ☐ (805) 257-0267

¹³⁷Cs 1860 SERIES TUBE SOURCES

**Important instructions for the safe handling
& use of radioactive sources**

Instruction Manual #142

1860-1185:.1



Standard Tube Source
Low density matrix
Double encapsulated
Color Coded

Engraved with:

1. Serial #
2. Model #

MODEL #	CONTENT		I.D. COLOR
	mgRaeq	mCi ¹³⁷ Cs	
1861	5	12.8	Purple
1862	10	25.6	Red ✓
1863	15	38.4	Black
1864	20	51.2	White ✓
1865	25	64.0	Blue
1866	30	76.8	Orange ✓

1860-series
 cut-away

NOTES:

1. All dimensions in mm
2. Inner & outer capsules & plugs are 316L stainless steel
3. Sealed by fusion welding
4. Colors are epoxy enamel
5. Dimensional tolerance ±0.05
6. Matrix density is approx. 3 gm/cc

Radiation Therapy Resources, Inc.
 25213 Ave. Stanford, Valencia, CA 91355 USA 805/257-0261 800/255-2580

2006

30.32 (G)

32.74

Inv. 200684-2



Therapy Resources, Inc.

25213 Avenue Stanford, Valencia, CA 91355
 ☐ (800) 255-2580 ☐ (805) 257-0267

LEAK TEST and CERTIFICATE OF CALIBRATION

Brachytherapy Tube Source

Model Number: 1862

Source Number: _____*

Mean Activity: 29.4 mCi ¹³⁷Cs, equivalent to 11.5 mg radium on September 14, 1986

The ¹³⁷Cs contains less than 1% ¹³⁴Cs and has a half-life of 30.0 years.
 Conversion performed by a Γ factor ratio of 2.557 (¹³⁷Cs RHM = 0.3226,
 radium RHM = 0.825 with 0.5 mm platinum filtration). Ref. National Council
 on Radiation Protection and Measurements (NCRP) No. 41, Pg. 8, Appendix A.

METHOD OF CALIBRATION

Calibrated by the measurement of the electrical current produced in a well-type
 4 π gamma ionization chamber. The response of the chamber to gamma radiation
 had been previously calibrated with standards traceable to the National Bureau of
 Standards. The accuracy of determination is $\pm 2\%$ and the precision of deter-
 mination is $\pm 1\%$. All determinations are at the 95% confidence level.

SEALED SOURCE TEST

Prototype sources have been successfully tested to (1) American National Standards
 Institute (ANSI) N44.1 - 1973; (2) U.S. Atomic Energy Commission 10 CFR Part 71
 "Special Form"; (3) U.S. Department of Transportation 49 CFR Parts 100-199,
 46 CFR, Part 146 and 14 CFR Part 103 "Special Form"; and (4) International
 Atomic Energy Agency (IAEA) Safety Series No. 6 "Special Form".

RADIOACTIVITY LEAKAGE/CONTAMINATION TEST

The source was tested for surface contamination and radioactive leakage
 immediately after manufacture and just prior to shipment, pursuant to
 ANSI N44.2 - 1973, Procedure A1. 3, Immersion Test.

IMMERSION TEST

At time of shipment no source exceeds 222 DPM.
 All determinations are at the 95% confidence level.

The source was determined to be free of leakage or contamination as specified
 by applicable regulations and specifications.

Radiation Therapy Resources, Inc. certifies that this sealed source has been
 manufactured in conformance with approved specifications and has been tested
 as described herein.

*See other side if certificate is for more than one source.

ISSUED TO:

ST. ANTHONY'S MEDICAL CTR.
 CROWN POINT, INDIANA

Active Length: 1.5 cm.Color Code: RED



Therapy
Resources, Inc.

25213 Avenue Stanford, Valencia, CA 91355
☐ (800) 255-2580 ☐ (805) 257-0261

LEAK TEST and
CERTIFICATE OF CALIBRATION

Brachytherapy Tube Source

Model Number: 1864

Source Number: _____ *

Mean Activity: 58.0 mCi ¹³⁷Cs, equivalent to 22.7 mg radium on September 14, 1986

The ¹³⁷Cs contains less than 1% ¹³⁴Cs and has a half-life of 30.0 years.
Conversion performed by a Γ factor ratio of 2.557 (¹³⁷Cs RHM = 0.3226,
radium RHM = 0.825 with 0.5 mm platinum filtration). Ref. National Council
on Radiation Protection and Measurements (NCRP) No. 41, Pg. 8, Appendix A.

ISSUED TO:

ST. ANTHONY'S MEDICAL CTR.
CROWN POINT, IN

Active Length: 1.5 cm.

Color Code: WHITE

METHOD OF CALIBRATION

Calibrated by the measurement of the electrical current produced in a well-type
4 π gamma ionization chamber. The response of the chamber to gamma radiation
had been previously calibrated with standards traceable to the National Bureau of
Standards. The accuracy of determination is \pm 2% and the precision of deter-
mination is \pm 1%. All determinations are at the 95% confidence level.

SEALED SOURCE TEST

Prototype sources have been successfully tested to (1) American National Standards
Institute (ANSI) N44.1 - 1973; (2) U.S. Atomic Energy Commission 10 CFR Part 71
"Special Form"; (3) U.S. Department of Transportation 49 CFR Parts 100-199,
46 CFR, Part 146 and 14 CFR Part 103 "Special Form"; and (4) International
Atomic Energy Agency (IAEA) Safety Series No. 6 "Special Form".

RADIOACTIVITY LEAKAGE/CONTAMINATION TEST

The source was tested for surface contamination and radioactive leakage
immediately after manufacture and just prior to shipment, pursuant to
ANSI N44.2 - 1973, Procedure A1. 3, Immersion Test.

IMMERSION TEST

At time of shipment no source exceeds 222 DPM.
All determinations are at the 95% confidence level.

The source was determined to be free of leakage or contamination as specified
by applicable regulations and specifications.

Radiation Therapy Resources, Inc. certifies that this sealed source has been
manufactured in conformance with approved specifications and has been tested
as described herein.

*See other side if certificate is for more than one source.



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LEAK TEST and
CERTIFICATE OF CALIBRATION

Brachytherapy Tube Source

Model Number: 1866

Source Number: _____*

Mean Activity: 86.3 mCi ¹³⁷Cs, equivalent to 33.7 mg radium on September 14, 1986

The ¹³⁷Cs contains less than 1% ¹³⁴Cs and has a half-life of 30.0 years.
 Conversion performed by a Γ factor ratio of 2.557 (¹³⁷Cs RHM = 0.3226,
 radium RHM = 0.825 with 0.5 mm platinum filtration). Ref. National Council
 on Radiation Protection and Measurements (NCRP) No. 41, Pg. 8, Appendix A.

METHOD OF CALIBRATION

Calibrated by the measurement of the electrical current produced in a well-type
 4 π gamma ionization chamber. The response of the chamber to gamma radiation
 had been previously calibrated with standards traceable to the National Bureau of
 Standards. The accuracy of determination is $\pm 2\%$ and the precision of deter-
 mination is $\pm 1\%$. All determinations are at the 95% confidence level.

SEALED SOURCE TEST

Prototype sources have been successfully tested to (1) American National Standards
 Institute (ANSI) N44.1 - 1973; (2) U.S. Atomic Energy Commission 10 CFR Part 71
 "Special Form"; (3) U.S. Department of Transportation 49 CFR Parts 100-199,
 46 CFR, Part 146 and 14 CFR Part 103 "Special Form"; and (4) International
 Atomic Energy Agency (IAEA) Safety Series No. 6 "Special Form".

RADIOACTIVITY LEAKAGE/CONTAMINATION TEST

The source was tested for surface contamination and radioactive leakage
 immediately after manufacture and just prior to shipment, pursuant to
 ANSI N44.2 - 1973, Procedure A1. 3, Immersion Test.

IMMERSION TEST

At time of shipment no source exceeds 222 DPM.
 All determinations are at the 95% confidence level.

The source was determined to be free of leakage or contamination as specified
 by applicable regulations and specifications.

Radiation Therapy Resources, Inc. certifies that this sealed source has been
 manufactured in conformance with approved specifications and has been tested
 as described herein.

*See other side if certificate is for more than one source.

ISSUED TO:

ST. ANTHONY'S MEDICAL CTR.
 CROWN POINT, IN

Active Length: 1.5 cm.

Color Code: ORANGE

Technical note: Monte Carlo derivation of TG-43 dosimetric parameters for radiation therapy resources and 3M Cs-137 sources

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(Received 3 March 2005; revised 13 May 2005; accepted for publication 17 May 2005; published 13 July 2005)

In clinical brachytherapy dosimetry, a detailed dose rate distribution of the radioactive source in water is needed in order to plan for quality treatment. Two Cs-137 sources are considered in this study; the Radiation Therapy Resources 67-800 source (Radiation Therapy Resources Inc., Valencia, CA) and the 3M model 6500/6D6C source. A complete dosimetric dataset for both sources has been obtained by means of the Monte Carlo GEANT4 code. Dose rate distributions are presented in two different ways; following the TG43 formalism and in a 2D rectangular dose rate table. This 2D dose rate table is helpful for the TPS quality control and is fully consistent with the TG43 dose calculation formalism. In this work, several improvements to the previously published data for these sources have been included: the source asymmetries were taken explicitly into account in the MC calculations, TG43 data were derived directly from MC calculations, the data radial range was increased, the angular grid in the anisotropy function was increased, and TG43 data is now consistent with the along and away dose rate table as recommended by the TG43 update. © 2005 American Association of Physicists in Medicine. [DOI: 10.1118/1.1949748]

I. INTRODUCTION

In clinical brachytherapy dosimetry, a detailed dose rate distribution of the radioactive source in water is needed. This dose rate distribution is used as input data for the treatment planning system (TPS). The dose rate distribution is usually given in the form of an along and away table (a 2D Cartesian look up table) and in the form given by the TG43 formalism.^{1,2} The dose rate distributions calculated with the TG43 formalism should be within a $\pm 2\%$ agreement with the along and away 2D table.²

In this study, two ¹³⁷Cs sources are considered: Radiation Therapy Resources 67-800 source³ (Radiation Therapy Resources Inc., Valencia, CA) and the 3M model 6500/6D6C source.⁴

The Radiation Therapy Resources (RTR) source was first studied by Williamson,³ by means of Monte Carlo (MC), giving a 2D along and away dose rate distribution of the source in an unbounded liquid water phantom, but making the approximation that the source is symmetrical with respect to its transversal axis. Liu *et al.*⁵ have recently carried out a study directed at obtaining the TG43 parameters for this source using the Sievert summation method with the parameters calculated by Williamson in his study.³ Nevertheless, the 2D along and away dose rate table calculated using the TG43 parameters obtained by Liu *et al.*⁵ does not reproduce the corresponding table calculated by Williamson³

within the required precision stated by the TG43 update² ($\pm 2\%$ agreement). Differences of up to 6% exist between the two calculations.

The 3M source was also studied first by Williamson,⁴ obtaining a detailed 2D dose rate distribution calculated with MC taking into account the asymmetry of the source and

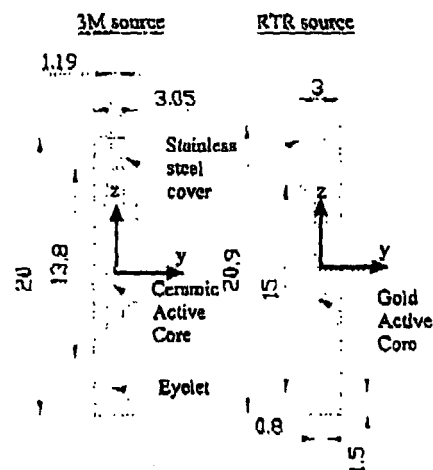


FIG. 1. Schematic view of the RTR and 3M ¹³⁷Cs. Data have been obtained from the studies of Williamson (Refs. 3 and 4). All dimensions are in mm. The coordinate axes are shown and their centers are located at the geometrical center of each source.

TABLE I. Atomic composition (by weight) and mass density of the source components.

Component	Material	Atomic composition (%)	Density (g/cm ³)
RTR active core	Gold	Au(100%)	19.3
RTR stainless steel cover	Stainless steel	C(0.026%), Mn(1.4%), Si(0.42%), P(0.019%), S(0.003%), Cr(16.8%), Mo(2.11%), Ni(11.01%), Fe(68.21%)	7.8
3M active core	Zirconium phosphate glass	O(70%), P(20%), Zr(10%)	2.22
3M stainless steel cover	AISI 316 stainless steel	Si(2%), Cr(20%), Mn(2%), Fe(67%), Ni(9%)	8.02

assuming a water phantom of 15 cm in radius. Liu et al. have also studied this source, but supposing the source to be symmetrical. The calculation of the 2D dose rate distribution using the TG43 parameters given by Liu et al. again presents discrepancies, of up to 7%, with respect to the data given by Williamson for this source.

The purpose of the present study is to use the MC GEANT4 code⁶ to obtain a complete and coherent set of the dosimetric parameters for these ¹³⁷Cs sources improving the previously published data. In order to achieve this, the source asymmetries were explicitly considered in the MC calculations, TG43 data were derived directly from MC calculations.

TABLE II. Dose rate (cGy h⁻¹ U⁻¹) in water per unit air-kenna strength around the RTR source Z axis in the along source longitudinal axis with its center located at the geometrical center of the source.

Distance along z (cm)	Distance away y (cm)															
	0	0.25	0.5	0.75	1	1.5	2	2.5	3	4	5	6	7	8	10	14
14	0.00284	0.00288	0.00294	0.00298	0.00304	0.00312	0.00320	0.00329	0.00333	0.00338	0.00331	0.00320	0.00305	0.00287	0.00249	0.00176
10	0.00564	0.00582	0.00599	0.00618	0.00635	0.00671	0.00698	0.00713	0.00719	0.00704	0.00668	0.00621	0.00568	0.00514	0.00413	0.00258
8	0.00861	0.00908	0.00949	0.00986	0.01026	0.01102	0.01145	0.01158	0.01151	0.01090	0.00998	0.00893	0.00789	0.00692	0.00527	0.00307
7	0.01107	0.01182	0.01242	0.01307	0.01373	0.01480	0.01526	0.01529	0.01499	0.01384	0.01234	0.01079	0.00933	0.00801	0.00593	0.00331
6	0.01488	0.01598	0.01706	0.01809	0.01919	0.0207	0.0211	0.0208	0.0200	0.01782	0.01537	0.01303	0.01099	0.00925	0.00662	0.00355
5	0.0208	0.0230	0.0249	0.0269	0.0287	0.0304	0.0304	0.0292	0.0274	0.0232	0.01920	0.01573	0.01288	0.01059	0.00732	0.00378
4	0.0318	0.0361	0.0400	0.0440	0.0467	0.0481	0.0460	0.0426	0.0385	0.0305	0.0239	0.01880	0.01490	0.01198	0.00800	0.00399
3	0.0557	0.0660	0.0759	0.0834	0.0862	0.0827	0.0741	0.0643	0.0551	0.0400	0.0294	0.0221	0.01696	0.01330	0.00861	0.00417
2.5	0.0793	0.0982	0.1151	0.1243	0.1246	0.1126	0.0957	0.0796	0.0657	0.0454	0.0323	0.0237	0.01794	0.01391	0.00888	0.00424
2	0.1270	0.1632	0.1933	0.1991	0.1896	0.1571	0.1246	0.0982	0.0779	0.0509	0.0350	0.0252	0.01881	0.01445	0.00911	0.00430
1.5	0.253	0.333	0.374	0.348	0.305	0.222	0.1612	0.1195	0.0908	0.0563	0.0376	0.0265	0.01955	0.01490	0.00930	0.00435
1	...	1.044	0.871	0.661	0.503	0.308	0.202	0.1413	0.1031	0.0609	0.0397	0.0276	0.0201	0.01525	0.00944	0.00440
0.75	...	2.39	1.393	0.905	0.633	0.354	0.223	0.1510	0.1084	0.0628	0.0405	0.0280	0.0204	0.01538	0.00951	0.00441
0.5	...	5.08	2.06	1.172	0.764	0.397	0.240	0.1591	0.1127	0.0643	0.0411	0.0283	0.0205	0.01548	0.00955	0.00442
0.25	...	6.63	2.57	1.391	0.871	0.430	0.253	0.1651	0.1157	0.0653	0.0416	0.0285	0.0207	0.01555	0.00957	0.00442
0	...	7.10	2.82	1.512	0.932	0.449	0.260	0.1683	0.1174	0.0659	0.0418	0.0286	0.0207	0.01559	0.00958	0.00443
-0.25	...	7.13	2.84	1.521	0.937	0.450	0.260	0.1686	0.1175	0.0659	0.0418	0.0286	0.0207	0.01560	0.00959	0.00443
-0.5	...	6.75	2.63	1.418	0.884	0.434	0.254	0.1659	0.1161	0.0654	0.0416	0.0285	0.0207	0.01556	0.00956	0.00442
-0.75	...	5.46	2.16	1.212	0.783	0.403	0.242	0.1603	0.1133	0.0645	0.0412	0.0284	0.0206	0.01549	0.00955	0.00442
-1	...	2.76	1.496	0.947	0.654	0.361	0.225	0.1524	0.1091	0.0630	0.0406	0.0280	0.0204	0.01540	0.00951	0.00441
-1.5	0.524	0.622	0.593	0.501	0.408	0.270	0.1849	0.1322	0.0981	0.0591	0.0388	0.0272	0.01992	0.01511	0.00939	0.00437
-2	0.211	0.261	0.281	0.272	0.248	0.1918	0.1448	0.1102	0.0854	0.0540	0.0365	0.0260	0.01926	0.01473	0.00922	0.00433
-2.5	0.1174	0.1438	0.1585	0.1629	0.1581	0.1360	0.1114	0.0899	0.0726	0.0486	0.0339	0.0246	0.01846	0.01423	0.00902	0.00428
-3	0.0758	0.0911	0.1008	0.1063	0.1068	0.0985	0.0857	0.0727	0.0610	0.0430	0.0310	0.0230	0.01754	0.01366	0.00877	0.00421
-4	0.0403	0.0463	0.0508	0.0541	0.0562	0.0560	0.0526	0.0478	0.0426	0.0331	0.0255	0.01976	0.01552	0.01236	0.00818	0.00405
-5	0.0254	0.0281	0.0306	0.0324	0.0338	0.0349	0.0342	0.0325	0.0302	0.0251	0.0205	0.01658	0.01347	0.01098	0.00750	0.00385
-6	0.01750	0.01895	0.0204	0.0215	0.0224	0.0234	0.0235	0.0230	0.0219	0.01921	0.01639	0.01379	0.01151	0.00963	0.00681	0.00362
-7	0.01283	0.01371	0.01459	0.01525	0.01582	0.01665	0.01692	0.01678	0.01634	0.01489	0.01313	0.01138	0.00979	0.00836	0.00612	0.00338
-8	0.00986	0.01040	0.01095	0.01139	0.01175	0.01233	0.01264	0.01266	0.01248	0.01168	0.01060	0.00943	0.00828	0.00723	0.00545	0.00314
-10	0.00628	0.00651	0.00678	0.00697	0.00714	0.00746	0.00766	0.00775	0.00775	0.00752	0.00708	0.00655	0.00595	0.00537	0.00428	0.00265
-14	0.00311	0.00315	0.00322	0.00330	0.00334	0.00341	0.00350	0.00355	0.00358	0.00358	0.00349	0.00337	0.00319	0.00300	0.00259	0.00181



Sisters of St. Francis Health Services
SAINT ANTHONY

1201 South Main Street • Crown Point, IN 46307-8483
 219.738.2100 • 219.663.8120
 www.stanthonymedicalcenter.com

March 11, 2011

James Mullauer
 NRC

We currently have 14 CS137 sources.

Manufacturer: Radiation Therapy Resources, Inc.

3m
 Round

Model Number of Sources.	Activity as of Sept 16, 1986	Current Activity March 1, 2011
1862 6	29.4 mCi/ea	16.6 mCi/ea
1864 6	58.0 mCi/ea	32.8 mCi/ea
1866 2	86.3 mCi/ea	48.9 mCi/ea
Total 14	Total Activity =	394.2 mCi

Gd 153 source (for storage only, but not in use) has activity of 1 Ci on Dec 6, 1986 and current activity is 8.6×10^{-6} Ci or 0.0000086 microcurie.

Rod Source

Thank you

Ram Basavatia
 Ram Basavatia



St. Anthony Medical Center, Inc.

SEMI-ANNUAL SEALED SOURCES WIPE TESTS

Wipes Taken On 2-18-2011Wipes Counted On 2-18-2011

By _____

By Ram Basavath

Serial No.	Rad. Therapy Sources, Inc. Model No.	Assayed mCi-Cs 137 As of 9/16/86	Assayed mgRa-Equiv As of 9/16/86	Count Time	CPM	Contamination
G1 (1477 MC) I2 (1495 MC) E2 (1460 MC) E7 (1465 MC) 12 (1461 MC) 12 (1486 MC)	RED 1862 Nominal 10 mg	29.4 30.0 27.8 29.2 29.5 29.5 Avg. 29.4	11.5 11.7 11.3 11.4 11.5 11.5 Avg. 11.5	1 min	12	<.005 µCi
Q3 (1568 MC) R1 (1575 MC) T1 (1584 MC) 12 (1581 MC) 12 (1576 MC) T6 (1589 MC)	WHITE 1864	57.0 57.2 57.2 57.0 59.7 59.8 Avg. 58.0	22.2 22.4 22.4 22.2 23.3 23.4 Avg. 22.7	1 min 1 min	16	<.005 µCi
V6 (2554 NS) W3 (2560 NS)	ORANGE 1866	86.5 86.0 Avg. 86.3	33.8 33.6 Avg. 33.7	1 min	16	<.005 µCi
L BLOCK				1 min	19	<.005 µCi
SAFE				1 min	17	<.005 µCi
BACKGROUND				1 min	12	—
CONTROL	CS137	S/N 4206-156 See NRS Certificate		1 min	193.7 x 10 ²	
NOTE:		Activity on 1/28/05 is 0.56 µCi				

The wipes were assayed using Wipe Test Counter Victoreen Model 05-578

Checked By: Ram