THE MEDICAL CENTER OF DELAWARE

ADDRESS REPLY TO:

DEPARTMENT OF RADIATION THERAPY

CARLO A. CUCCIA, M.D., F.A.C.R.
EKKEHARD S. SCHUBERT, M.D.
DONALD C. TILTON, D.O.
VIROON DONAVANIK, M.D.

DIPLOMATES
AMERICAN BOARD OF RADIOLOGY

EDWARD TORVIK, Sc.D.
JOSEPH A. ROSE, B.S.E.E.

July 3, 1985

John D. Kinneman, Chief
Nuclear Materials Safety Section A
U.S. Nuclear Regulatory Commission
Region I
630 Park Avenue
King of Prussia, PA 19406

License Nos. 07-12153-02
07-12153-03
Docket Nos. 030-01303
030-17578

Dear Mr. Kinneman:

Enclosed you will find our response to the violations cited in your letter dated June 13, 1985.

Our discussions with Mrs. Taylor and the comments contained in your letter and the citations have motivated us to re-evaluate some of our management control procedures in the Department of Radiation Therapy. We intend to periodically re-evaluate these management control procedures to insure that we are in compliance with NRC regulations and conditions attached to our license.

Yours truly,

Edward Torvik

Edward Torvik, Sc.D., Physicist

ET/el

CHRISTIANA HOSPITAL
4755 OGLETOWN-STANTON ROAD
P.O. BOX 6001
NEWARK, DELAWARE 19718

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

RECEIVED
VICE PRES MED AFFAIRS
JUN 19 1985

JUN 13 1985

WILMINGTON MEDICAL CENTER

Docket Nos. 030-01303
030-17578

License Nos. 07-12153-02
07-12153-03

Wilmington Medical Center
ATTN: Allston J. Morris, M.D.
Vice President for Medical Affairs
P. O. Box 1668
Wilmington, Delaware 19899

PLEASE NOTE NEW NAME OF MEDICAL CENTER

THE MEDICAL CENTER OF DELAWARE
501 WEST 14TH STREET
P.O. BOX 1668
WILMINGTON, DELAWARE 19899

Gentlemen:

Subject: Inspection Report No. 85-01

This refers to the routine safety inspection conducted by Mrs. Marlene J. Taylor of this office on January 18, 1985, and March 28, 1985, and special closeout inspection on February 22, 1985, of activities authorized by NRC License Nos. 07-12153-02 and 07-12153-03 and to the discussions of our findings held by Mrs. Taylor with yourself and Mr. J. Solge and Dr. E. Torvik of your staff at the conclusion of the inspection.

The inspection was an examination of activities conducted under your license as they relate to radiation safety and to compliance with the Commission's rules and regulations and the conditions of your licenses. The closeout inspection is described in the attached inspection report. The inspection consisted of selective examinations of procedures and representative records, interviews with personnel, measurements made by the inspector, and observations by the inspector.

Our inspector also verified the steps you have taken to correct the violation brought to your attention in the enclosure to our letter dated January 6, 1982. We have no further questions regarding your action at this time.

As described in the enclosed Inspection Report, our inspector also reviewed the results of your closeout survey of the General Division. We are concerned that this survey failed to identify significant quantities of radioactive material which had been left in the Radium Room at that location. In your reply to this letter, please discuss this matter and describe what actions you plan to take to ensure the adequacy of future radiation and contamination surveys. Please also describe your actions to assure that all statements submitted in support of requests for licensing actions are accurate. You received approval to release this facility for unrestricted use in separate correspondence.

Based on the results of this inspection, it appears that certain of your activities were not conducted in full compliance with NRC requirements, as set forth in the Notice of Violation, enclosed herewith as Appendix A. These vio-

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APPENDIX A

NOTICE OF VIOLATION

Wilmington Medical Center
Wilmington, Delaware 19899

Docket Nos. 030-01303
030-17578
License Nos. 07-12153-02
07-12153-03

As a result of the inspection conducted on January 18, 1985, and February 22, 1985, and in accordance with the NRC Enforcement Policy (10 CFR 2, Appendix C), the following violations were identified:

A. 10 CFR 20.201(b) requires that each licensee make such surveys as may be necessary to comply with all sections of Part 20. As defined in 10 CFR 20.201(a), "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions.

1. Contrary to the above, as of February 22, 1985, adequate surveys (evaluations) were not performed to assure compliance with 10 CFR 20.101, a regulation that limits the exposure to the extremities of individuals. Specifically, the dose to the extremities of an employee who prepared and administered radiopharmaceutical doses was not adequately evaluated. While the individual wore an extremity dosimeter, it was not worn on the hand which was used to handle the radioactive material and therefore, did not constitute an adequate evaluation of the individual's extremity dose.

2. Contrary to the above, surveys were not made to assure compliance with 10 CFR 20.301, which describes authorized means of disposing of licensed material contained in waste. Specifically, on February 2, 1985, a survey was not performed to identify contamination on a vial containing measurable amounts of contamination prior to disposing of the vial in the normal trash.

3. Contrary to the above, as of February 22, 1985, surveys were not made to assure compliance with 10 CFR 20.105, which specifies the limits for radiation levels in unrestricted areas. Specifically, the surveys in the Radium Room in the General Division were inadequate in that they failed to identify radiation levels of approximately 10mR/hr resulting from iridium-192 seeds which had been inadvertently left there. seeds

These are a Severity Level IV violations. (Supplement IV)

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B. 10 CFR 20.105(b) requires that radiation levels in unrestricted areas be limited so that an individual who was continuously present in the area could not receive a dose in excess of 2 millirems in any hour or 100 millirems in any seven consecutive days.

Contrary to the above, on March 12, 1985, March 15, 1985, March 19, 1985, and March 20, 1985, radiation levels of three to five milliroentgen per hour existed in the patient rooms (unrestricted areas) adjacent to rooms used for brachytherapy patients treated with cesium-137.

This is a Severity Level IV violation. (Supplement IV)

C. Condition 20 of License No. 07-12153-02 requires that licensed material be possessed and used in accordance with statements, representations and procedures contained in an application dated July 27, 1982, and letters dated October 18, 1982, March 18, 1983, April 27, 1983, May 12, 1983, April 26, 1984, June 26, 1984, and ALARA Program received November 5, 1980.

1. Item 15, Paragraph No. 4 of the application dated July 27, 1982, requires that syringe shields always be used for routine preparation of patient doses and administration to patients.

   Contrary to the above, on February 22, 1985, personnel failed to use syringe shields in the preparation of patient doses.

2. Block 14 of application dated July 27, 1982, requires that radioactive material be used in accordance with Appendix F of Regulatory Guide 10.8.

   Item 2.C and D of Appendix F requires that surveys be performed to determine the exposure rates on the surface and at three feet from each incoming package of radioactive materials.

   Contrary to the above, on February 5, 1985 and February 19, 1985, no exposure rates were determined for incoming technetium-99m generators. In addition, on February 11, 1985, no exposure rates were determined for a package containing millicurie amounts of xenon-133.

These are Severity Level IV violations. (Supplement VI)

D. Condition 15 of License No. 07-12153-02 requires that sealed sources containing licensed material be tested for leakage at intervals not to exceed six months.

Contrary to the above, your cesium-137, cobalt-60, and barium-133 sealed sources in Nuclear Medicine were not tested for leakage from January 25, 1982, to January 23, 1984, an interval of more than six months.

This is a Severity Level IV violation. (Supplement VI)

E. 10 CFR 35.14(b)(5)(v) requires that sealed sources possessed and used pursuant to Group VI of Schedule A of 10 CFR 35.100 be physically inventoried quarterly to account for all the sources received and possessed.

Contrary to the above, as of February 22, 1985, iridium-192 sealed sources were not physically inventoried to account for all the sources received and possessed. Count Ir

This is a Severity Level IV violation. (Supplement VI)

F. 10 CFR 35.22(b)(2) requires that the monthly spot-check measurements on teletherapy units required by §35.22(a) include a determination of the accuracy of all distance measuring devices used for treating humans and a determination of the congruence between the radiation field and the field indicated by the light beam localizing device. Dist In Rad Field Light Field

Contrary to the above, as of February 22, 1985, monthly spot-check measurements performed on the teletherapy units did not include either of these determinations on many occasions in 1983 and 1984.

This is a Severity Level IV violation. (Supplement VI)

G. 10 CFR 35.22(a) requires that spot check measurements be performed on each teletherapy unit at intervals not exceeding one month.

Contrary to the above, no spot check measurements were performed on the Eldorado 78 teletherapy unit in January 1985, and no checks were performed on the Theratron 80 unit in May 1984 and July 1983. Spot Check: Eldo Jan 85 Thr- May 84 July 83

This is a Severity Level IV violation (Supplement VI)

Pursuant to the provisions of 10 CFR 2.201, Wilmington Medical Center is hereby required to submit to this office within thirty days of the date of the letter which transmitted this Notice, a written statement or explanation in reply, including: (1) the corrective steps which have been taken and the results achieved; (2) corrective steps which will be taken to avoid further violations; and (3) the date when full compliance will be achieved. Where good cause is shown, consideration will be given to extending this response time.

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 30-1303/85-01

Docket No. 030-01303

License No. 07-12153-02 Priority 3 Category G

Licensee: Wilmington Medical Center
P. O. Box 1668
Wilmington, Delaware

Facility Name: Wilmington Medical Center

Inspection At: General Division, 201 South Broom Street, Wilmington, Delaware

Inspection Conducted: February 22, 1985

Inspector: Marlene J. Taylor 6/4/85
Marlene J. Taylor date
Radiation Specialist

Approved by: John D. Kinneman 6/4/85
John D. Kinneman, Chief date
Nuclear Materials Section A

Inspection Summary: Inspection on February 19, 1985 (Report 30-01303/85-01)

Areas Inspected: Special, announced closeout inspection including review of areas covered in licensee's survey report, interview of licensee personnel and independent measurements at the licensee's facility at the General Division, Wilmington, Delaware, for removable contamination.

Results: One violation was identified: Inadequate survey to assure compliance with 10 CFR 20.105 (paragraph 3). The licensee's report accurately reflected the condition of areas surveyed at the General Division, except for one area. This radioactive material was removed from this area during the inspection.

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HSPP

DETAILS

1. Persons Contacted

*Dr. E. Torvik, Radiation Safety Officer
*Mr. J. Solge, Radiation Safety Technician

*Present at exit interview

2. Decontamination and Survey Plans

The inspector reviewed the decontamination report. This report indicated no measurable radioactive contamination remained at the General Division.

3. Observation and Measurements

The inspector took 30 wipes in the Nuclear Medicine Department, 10 wipes in the Radium Room and 2 wipes in the Teletherapy Treatment Rooms. These wipes were assayed for beta contamination using a Tennelec Model LB 5100 gas flow proportional counter in the Region I Laboratory in King of Prussia, Pennsylvania. The results of these wipes (Attachment 1) were within the NRC guidelines for releasing a facility for unrestricted use. Surveys were conducted of the Nuclear Medicine Department, Radium Room, and Teletherapy Treatment Rooms using a Ludlum 3 Geiger Counter with a thin end window probe. The results of these surveys indicate no radiation levels in excess of normal background in the Nuclear Medicine and Teletherapy Treatment Rooms. However, in the Radium Room an area where radiation levels of 20 millirem per hour were found. Close examination of this area revealed 20 iridium-192 seeds on the floor. Once the seeds were secured in a lead pig by the RSO, the radiation levels in the area were at background levels. The results of the radiation surveys after the seeds were removed are given in Attachment 2.

The finding of the iridium-192 seeds in the Radium Room indicate that a proper survey had not been preformed to assure that radiation levels in an unrestricted area were not exceeding regulatory limits. This is an apparent violation of 10 CFR 20.105.

4. Exit Interview

The inspector summarized the scope and results of the inspection with the individuals identified in Section 1.

THE MEDICAL CENTER OF DELAWARE, INC.

Docket Nos. 030-01303
030-17578

License Nos. 07-12153-02
07-12153-03

ITEM A

1. The chief nuclear medicine technologist will inspect all technologists at the start of each working day and after lunch to verify that finger ring dosimeters are being worn on the appropriate hand. Also the radiation safety technologist will periodically inspect the technologists to insure that all technologists are wearing finger ring dosimeters on the appropriate hand.

2. Our procedures prohibit the disposal of vials, alcohol wipes, etc., in the non-radioactive trash containers. Personnel performing end of day close out surveys are required to monitor all non-radioactive trash containers to insure that contaminated material has not inadvertently been discarded. The chief nuclear medicine technologist has conducted a review session on procedures that must be performed in order to bring us into compliance with our license and the requirements of 10CFR20.

3. Survey of Radium Room at the General Division:

   The Iridium-192 seeds that were left behind in the radium room was due to complacency on the part of the medical physicist performing this survey. Surveys of this type that will be made in the future will consist of two parts:

   1. Survey by Radiation Safety Technologist, and

   2. A follow-up survey by the medical physicist

   Another procedure that has been put into place is that a physical inventory is being made every month by the medical physicist and a written report as to the current status of all sealed sources is being submitted to the Radiation Safety Officer.

ITEM B

The statements contained in Item B are not true. These exposure rates of 3 to 5 mR per hour were measured at the surface of walls adjacent to brachytherapy patient's room. These two adjacent rooms are left vacant when middle room is occupied by brachytherapy patient. Extrapolation of these exposure rates to occupied patient rooms would reduce exposure rates to less than 2 mR per hour and to less than 100 mR in any seven (7) consecutive days. A Cesium-137 mobile lead barrier reduced entrance door exposure rates below these limits.

These two vacant adjacent rooms were classified as controlled areas with access controlled by nursing personnel.

We intend to continue this practice until shielded brachytherapy rooms have been constructed which will then permit these adjacent rooms to be occupied by other types of patients.

ITEM C

1. Syringe shields:

   All technologists are required to use syringe shield when administering radioactive material to patients. The chief technologist and the radiation safety technologist will increase their surveillance of personnel working with patients to insure that they are complying with license requirements and requirements of 10CFR20. Consistent violation of NRC regulations and conditions attached to license will lead to termination of employment at this institution.

2. Radiation Survey of Packages containing Radioactive Material

   All nuclear medicine technologists have attended a review session with respect to these violations. Consistent, non-performance of required surveys, of conditions attached to license, and NRC regulations will lead to termination of employment with this institution.

ITEM D

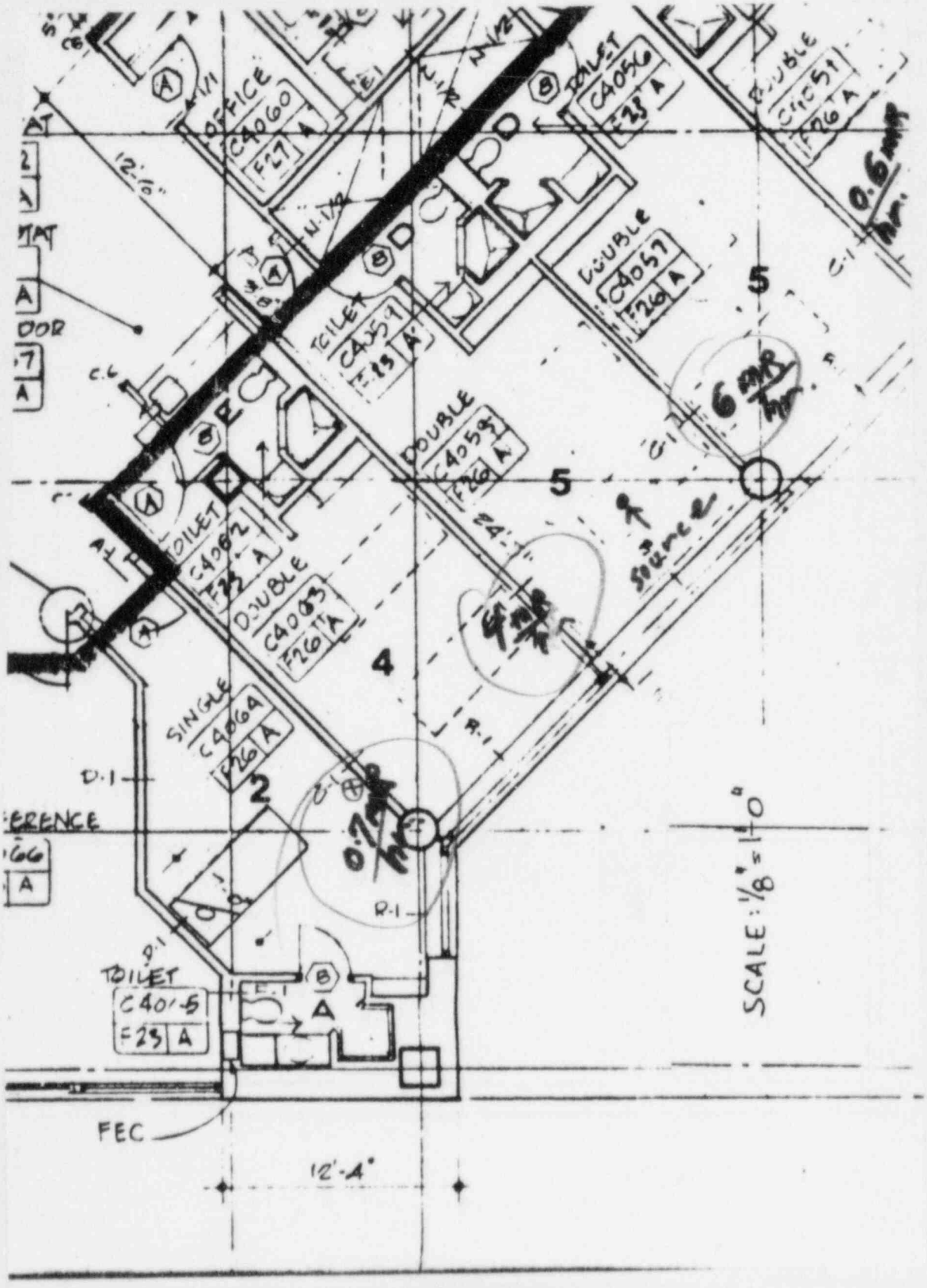
The statement in Item D, Failure to Test sealed Radioactive Sources for leakage is incorrect. Documentation of these test results are currently on file at the radiation safety technologist office (Wilmington Hospital) and copies of these reports are on file at the radiation safety office (Christiana). Enclosed you will find copies of cited missing leak test reports.

ITEMS E,F,G

Monthly Spot Checks, and Sealed Sources Inventory:

Procedures put into effect since inspection by the NRC require that the medical physicist submit to the Chief of the Medical Physics Section a written report on all items required in 10CFR35 for monthly spot checks, and a report on the results of physical inventory on all sealed sources under the control of the Department of Radiation Therapy. This report is reviewed by the Chief of the Medical Physics Section, and initialed, then forwarded to the Director of the Department of Radiation Therapy. The Director of the Department of Radiation Therapy spot checks items included in this report, and if accepted, returns report for filing with required NRC documents.

THE MEDICAL CENTER OF DELAWARE INC.
CHRISTIANA HOSPITAL



12/78

Delaware Division Nuclear Medicine
WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{57}Co
Mfg. Model No.:	NES-206
Serial No:	2060280A-15
Listed Activity:	4.6 mCi
Date Activity Calibrated for:	2/22/80
Location:	Prog Lab
Instrument Used to Count Wipes:	Mark-Counter well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	8696
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2747
Total Sample Counting Time	10 min
Sample Counting Rate	275 cpm
Net Sample Counting Rate	-15.
Conversion Factor (C F)	6.0×10^{-7} uCi/cpm
Wipe Activity	$< 6.0 \times 10^{-7}$ mCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{137}Cs
Mfg. Model No.:	NES-356
Serial No:	208-163-23
Listed Activity:	217 uCi
Date Activity Calibrated for:	8/11/75
Location:	Prog lab
Instrument Used to Count Wipes:	Mech-tronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	8696
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2713
Total Sample Counting Time	10 min
Sample Counting Rate	271 cpm
Net Sample Counting Rate	-19.
Conversion Factor (C F)	2.4×10^{-6} uCi/cpm
Wipe Activity	$< 2.4 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine
WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{60}Co
Mfg. Model No.:	NES-354
Serial No:	208-163-25
Listed Activity:	51.04 C
Date Activity Calibrated for:	7/15/75
Location:	Prog Lab
Instrument Used to Count Wipes:	Mediatronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	8696
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2755
Total Sample Counting Time	10 min.
Sample Counting Rate	276 cpm
Net Sample Counting Rate	-14.
Conversion Factor (C F)	8.0×10^{-7} uCi/cpm
Wipe Activity	$< 5.0 \times 10^{-7}$ uC. ($< 5.0 \times 10^{-3}$ uC.)

12178

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{57}Co
Mfg. Model No.:	NES-352
Serial No:	3520779A-30
Listed Activity:	1.09 mCi
Date Activity Calibrated for:	7/12/79
Location:	Hot lab
Instrument Used to Count Wipes:	Mech-tronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	9690
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2774
Total Sample Counting Time	10 min
Sample Counting Rate	277 cpm
Net Sample Counting Rate	-12
Conversion Factor (C F)	~~6.0x10-7~~ uCi / cpm
Wipe Activity	$<6.0\times10^{-7}$ uCi ($<5.0\times10^{-3}$ uCi)

12/78

General Division Nuclear Medicine
WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{137}Cs
Mfg. Model No.:	NES-356
Serial No:	3560979A-09
Listed Activity:	202 μCi
Date Activity Calibrated for:	9/19/79
Location:	Hot lab
Instrument Used to Count Wipes:	Mechtronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	8696
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	3351
Total Sample Counting Time	10
Sample Counting Rate	335 cpm
Net Sample Counting Rate	45
Conversion Factor (C F)	2.4×10^{-6} uCi/cpm
Wipe Activity	1.1×10^{-4} μCi ($< 5.0 \times 10^{-3}$ μCi)

12/78

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

1/25/82

Sealed Source Wipe Test Report

All sealed adioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCurie, source must be removed from use and either repaired or disposed of.

Radionuclide:	^{60}Co
Mfg. Model No.:	NES-354
Serial No:	3540879A-13
Listed Activity:	52.0 uCi
Date Activity Calibrated for:	8/28/79
Location:	Hot Lab
Instrument Used to Count Wipes:	Mech-tronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	869
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2815
Total Sample Counting Time	10 min.
Sample Counting Rate	282 cpm
Net Sample Counting Rate	-8.
Conversion Factor (C F)	8.0×10^{-7} uCi/cpm
Wipe Activity	$< 8.0 \times 10^{-7}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

Sealed Source Wipe Test Report

1/25/82

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{133}Ba
Mfg. Model No.:	NES-358
Serial No:	208-163-24
Listed Activity:	257 uCi
Date Activity Calibrated for:	7/1/75
Location:	Hot Lab
Instrument Used to Count Wipes:	Mechtronics well counter
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL 100
b. Counting window	Integral
Background Counts:	869
Background Counting Time:	30 min.
Background Counting Rate	290 cpm
Total Sample Counts	2755
Total Sample Counting Time	10 min
Sample Counting Rate	276 cpm
Net Sample Counting Rate	-16.
Conversion Factor (C F)	1.3×10^{-6} uCi/cpm
Wipe Activity	$< 1.3 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	~~Co~~ ^{57}Co
Mfg. Model No.:	NES-352
Serial No:	3520891A-14
Listed Activity:	990 uCi
Date Activity Calibrated for:	8/10/81
Location:	Prog Dept
Instrument Used to Count Wipes:	Multi-tronics 1100
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL 100
b. Counting window	~~Integral~~
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	476.9 cpm
Total Sample Counts	144685
Total Sample Counting Time	10 min
Sample Counting Rate	446.9 cpm
Net Sample Counting Rate	-30.0
Conversion Factor (C F)	5.4×10^{-6} uCi/cpm
Wipe Activity	$< 5.4 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/87

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{137}Cs
Mfg. Model No.:	NES-356
Serial No:	208-163-23
Listed Activity:	217 uC
Date Activity Calibrated for:	8/11/75
Location:	Prep Lab
Instrument Used to Count Wipes:	Mark-Tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL160
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	41273
Total Sample Counting Time	10 min
Sample Counting Rate	4127 cpm
Net Sample Counting Rate	-642
Conversion Factor (C F)	2.3×10^{-6} uCi/cpm
Wipe Activity	$< 2.3 \times 10^{-6}$ uC (<5.0 x 10^{-3} dpm)

12/78

Delaware Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{60}Co
Mfg. Model No.:	NES-354
Serial No:	208-163-25
Listed Activity:	51.0 uCi
Date Activity Calibrated for:	7/15/75
Location:	Prog Van
Instrument Used to Count Wipes:	Nuclear-Chicago well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	44177
Total Sample Counting Time	10 min.
Sample Counting Rate	4418 cpm
Net Sample Counting Rate	-301
Conversion Factor (C F)	2.0×10^{-7} uCi/cpm
Wipe Activity	$< 2.0 \times 10^{-7}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

2178

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	57Co
Mfg. Model No.:	NES-352
Serial No:	3520779A-30
Listed Activity:	1.09 mCi
Date Activity Calibrated for:	7/12/79
Location:	Hot lab
Instrument Used to Count Wipes:	Mach-Tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	28569
Total Sample Counting Time	10 min.
Sample Counting Rate	3857 cpm
Net Sample Counting Rate	-912
Conversion Factor (C F)	5.4×10^{-6} uCi/cpm
Wipe Activity	$< 5.4 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Dental Division Nuclear Med.

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{137}Cs
Mfg. Model No.:	NES-356
Serial No:	3560979A-09
Listed Activity:	202 uCi
Date Activity Calibrated for:	9/19/77
Location:	Hot lab
Instrument Used to Count Wipes:	Well-type well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	45575
Total Sample Counting Time	10 min
Sample Counting Rate	4558 cpm
Net Sample Counting Rate	-211
Conversion Factor (C F)	2.3×10^{-6} uCi/cpm
Wipe Activity	$< 2.3 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{60}Co
Mfg. Model No.:	NES-354
Serial No:	3540979A-13
Listed Activity:	52.0 μCi
Date Activity Calibrated for:	8/28/79
Location:	Hot Lab
Instrument Used to Count Wipes:	Mech-tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	49613
Total Sample Counting Time	10 min.
Sample Counting Rate	4961 cpm
Net Sample Counting Rate	192
Conversion Factor (C F)	7.0×10^{-7} uCi/cpm
Wipe Activity	1.3×10^{-4} μCi ($< 5.0 \times 10^{-3}$ μCi)

12/78

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{133}Ba
Mfg. Model No.:	NES-358
Serial No:	208-163-24
Listed Activity:	257 uCi
Date Activity Calibrated for:	7/1/75
Location:	Hot lab
Instrument Used to Count Wipes:	Mech-tronics 1100
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	45102
Total Sample Counting Time	10 min
Sample Counting Rate	4510 cpm
Net Sample Counting Rate	-259.
Conversion Factor (C F)	1.2×10^{-6} uCi/cpm
Wipe Activity	$< 1.2 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

7/20/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{195}Au
Mfg. Model No.:	NES-387
Serial No:	387041280-05
Listed Activity:	1.0 mCi
Date Activity Calibrated for:	4/82
Location:	Hot lab
Instrument Used to Count Wipes:	Mach-tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	143064
Background Counting Time:	30 min.
Background Counting Rate	4769 cpm
Total Sample Counts	46015
Total Sample Counting Time	10 min
Sample Counting Rate	4602 cpm
Net Sample Counting Rate	-167
Conversion Factor (C F)	5.4×10^{-6} uCi/cpm
Wipe Activity	$< 5.4 \times 10^{-6}$ uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

Delaware Division Nuclear Medicine NEW SOURCE

WILMINGTON MEDICAL CENTER

10/2/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{57}Co
Mfg. Model No.:	NES-206
Serial No:	206/0822-34
Listed Activity:	5.1 mCi
Date Activity Calibrated for:	10/20/82
Location:	Hot lab
Instrument Used to Count Wipes:	Mach-Tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	3519
Background Counting Time:	30 min.
Background Counting Rate	117 cpm
Total Sample Counts	2181
Total Sample Counting Time	10 min
Sample Counting Rate	218 cpm
Net Sample Counting Rate	101 cpm
Conversion Factor (C F)	1.0×10^{-7} uCi/cpm
Wipe Activity	1.01×10^{-5} uCi ($< 5.0 \times 10^{-3}$ uCi)

12/78

New Source

General Division Nuclear Medicine

WILMINGTON MEDICAL CENTER

11/2/82

Sealed Source Wipe Test Report

All sealed radioactive sources must be wiped tested for removable activity at intervals not to exceed 6 months. The removable activity SHALL NOT exceed 0.005 microCuries. If test results yield results greater than 0.005 microCuries source must be removed from use and either repaired or disposed of.

Radionuclide:	^{57}Co
Mfg. Model No.:	NES-206
Serial No:	2061082B-35
Listed Activity:	5.1 mCi
Date Activity Calibrated for:	10/20/82
Location:	Hot Lab
Instrument Used to Count Wipes:	Mach-Tronics well
Detector Voltage:	1200
Instrument Settings:	
a. Discriminator	LL100
b. Counting window	Integral
Background Counts:	3519
Background Counting Time:	30 min.
Background Counting Rate	117 cpm
Total Sample Counts	1696
Total Sample Counting Time	10 min.
Sample Counting Rate	170 cpm
Net Sample Counting Rate	53 cpm
Conversion Factor (C F)	1.0×10^{-7} uCi/cpm
Wipe Activity	5.3×10^{-6} uCi ($< 5.0 \times 10^{-3}$ uCi)

Nuclear Radiation Development
2937 Alt Blvd. North · Grand Island, New York 14072
Telex: 91-578 Telephone: 716-773-7634

NRD

SOLD TO
WILMINGTON MEDICAL CENTER
Delaware Division Box 1668
Wilmington, DE 19899

SHIP TO

ATTN: Linda Schmidt
Immunopathology Lab

2066

9/15/82

CUSTOMER P.O.	NRD S.O.	DATE OF ANALYSIS
	09434	9/15/82

3	Wipe Test Results	$25.00	3	0	$25.00

PAID IN FULL BY CHECK #00-306609

LEAK TEST CERTIFICATE

NUMBER OF SAMPLES ANALYZED (3)
LEAK TEST METHOD Wipes
RADIOACTIVE MATERIAL Ni-63
PERSON PERFORMING TEST _____ / ANALYSIS L. Murphy
SAMPLE ANALYZED IN A (X) WINDOWLESS GAS FLOW PROPORTIONAL COUNTER
( ) ALPHA SCINTILLATION COUNTER
( ) LIQUID SCINTILLATION COUNTER
( ) OTHER _____

TESTS ARE WITHIN PRESCRIBED LIMITS (X)
GREATER THAN PRESCRIBED LIMITS ( )

TEST RESULTS

WIPE NUMBER	MODEL NUMBER — SERIAL NUMBER	MICROCURIES / SAMPLES
Entrance	H2189	Less than .0001
Housing	H2189	Less than .0001
Exit	H2189	Less than .0001

Rec'd & reviewed 9/22/82

SIGNED Nancy P Goetsch
TITLE Nancy P. Goetsch, Health Physics
DATE 9/15/82

ORIGINAL CERTIFICATE

Nuclear Radiation Development
2937 Alt Blvd. North - Grand Island, New York 14072
Telex: 91-578 Telephone: 716-773-7634

NRD

SOLD TO
WILMINGTON MEDICAL CENTER
Delaware Division
Wilmington, DE 19899
Attn: Accounts Payable

1715

SHIP TO
Dr. L. Schmidt
Dept. of Immunopathology

CUSTOMER P.O.	NRD S.O.	DATE OF ANALYSIS
	03619	/ /

3	Wipe Test Results	$40.00	3	0	040.00
	H2189				

PAID IN FULL BY CHECK #203552

LEAK TEST CERTIFICATE

NUMBER OF SAMPLES ANALYZED (3)
LEAK TEST METHOD Wipes
RADIOACTIVE MATERIAL N163
PERSON PERFORMING TEST _____ / ANALYSIS L. Murphy
SAMPLE ANALYZED IN A (X) WINDOWLESS GAS FLOW PROPORTIONAL COUNTER
( ) ALPHA SCINTILLATION COUNTER
( ) LIQUID SCINTILLATION COUNTER
( ) OTHER _____

TESTS ARE WITHIN PRESCRIBED LIMITS (X)
GREATER THAN PRESCRIBED LIMITS ( )

TEST RESULTS

WIPE NUMBER	MODEL NUMBER — SERIAL NUMBER	MICROCURIES / SAMPLES
Entrance	H 2189	Less than .0001
Housing	H 2189	Less than .0001
Exit	H 2189	Less than .0001

Receipt requested
3/3/82

SIGNED Nancy P Goetsch
TITLE Nancy P. Goetsch-Health Physics
DATE ~~2/26/82~~

ORIGINAL CERTIFICATE

NUCLEAR REGULATORY COMMISSION INSPECTION

Inspection Date: February 22, 1985

NRC Inspector: Marlene J. Taylor

Time Interval: 9:00 A.M. to 6:30 P.M.

Areas Inspected:

A. Christiana Hospital

1. Nuclear Medicine Section

2. Radiation Therapy

B. Wilmington General Hospital

1. Nuclear Medicine Section

2. Radiation Therapy

a. Theratron-80 Room

b. Eldorado-78 Room

c. Radium Storage Room

Reported Non-Compliance Items:

A. Christiana Hospital

1. Nuclear Medicine Section

a. Radioactive material disposed in non-radioactive trash container.

b. Technologist withdrawing radioactive material using unshielded syringe.

c. Technologist wearing finger ring dosimeter on left hand but using right hand to make injection.

d. Using unapproved oatmeal-Tc-99_m test.

A. Christiana Hospital (cont'd)

2. Radiation Therapy

a. Following records were incomplete:

1. Monthly required performance check for all teletherapy units.

2. Monthly inventory of radioactive sources.

3. Leak test reports for all sealed sources was incomplete.

4. Listing of all survey meters, where located, when calibrated.

5. Previous ion chamber dosimeter system calibration records could not be found.

B. Wilmington General Hospital

1. Nuclear Medicine Section

a. Leaving lead shielded containers behind at the Wilmington General without destroying I.D. labels.

2. Radiation Therapy

a. Incomplete survey of the Radium Storage Room. NRC Inspector found 20 Iridium-192 seeds in right hand rear corner of the Radium Storage Room.

The following items were not in compliance with 10CFR35 or with conditions attached to our license:

Section 21 requires that a full calibration will be performed for all teletherapy at:

1. At source replacement,

2. When teletherapy unit is relocated,

3. At intervals not to exceed one (1) year,

4. Following any repair of the unit that includes removal of the source or major repair of components associated with the source exposure assembly

5. Whenever monthly spot-check measurements indicate that output values differ by more than 5 percent from the value obtained at last full calibration, corrected for physical decay.

Full calibration measurements shall include determination of:

1. The exposure rate or dose rate to an accuracy within +/- 3 percent for the range of field sizes and for the range of distances used in radiation therapy.

2. The congruence between the radiation field and the field indicated by the light beam localizing device.

3. The uniformity of the radiation field and its dependence upon the orientation of the useful beam.

4. Timer accuracy.

5. The accuracy of all distance measuring devices used for treating patients.

6. The exposure rate or dose rate values shall be mathematically corrected for physical decay for intervals not to exceed one month.

7. Full calibration measurements and physical decay corrections shall be performed by an expert qualified by training and experience.

Section 24 defines a qualified expert as one who:

1. Is certified by the American Board of Radiology in Therapeutic Radiological Physics, or

2. Has the following minimum training and experience,

   a. A Master's or Doctor's degree in Physics, Biophysics, Radiological Physics or Health Physics.

   b. One year of full time training in Therapeutic Radiological Physics, and

   c. One year of full time experience in a Radiotherapy Facility including personal calibration and spot check of at least one teletherapy unit.

Condition 18, Teletherapy License:

Prior to initiation of a treatment program, and subsequent to each installation of a teletherapy source, radiation surveys and tests shall be performed in accordance with the following:

A. A radiation survey shall be made of:

   1. The teletherapy source housing, with the teletherapy source in the "OFF" position. The maximum and average radiation levels at one meter from the teletherapy source in the "OFF" position shall not exceed 10 milliroentgens per hour and 2 milliroentgens per hour, respectively.

   2. All areas adjacent to the treatment room with the teletherapy source in the "ON" position. The survey, except Item (c) shall be performed with a phantom in the primary beam of radiation and shall clearly establish:

      (a) That radiation levels in restricted areas are not likely to cause personnel exposure in excess of the limits specified in Section 20.101, Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation".

      (b) That quantities of radiation in unrestricted areas do not exceed the limits specified in Section 20.105(b), 10CFR20.

      (c) The intensity of the primary beam of radiation at a specified distance from the teletherapy source.

B. Tests shall be made to determine proper operation of:

1. Electrical interlocks on entrance doors to the teletherapy treatment room.

2. The teletherapy source "ON-OFF" indicators, both at the source housing and on the teletherapy machine control panel.

3. Electrical or mechanical stops installed for the purpose of limiting use of the primary beam of radiation (restriction of source housing angulation or elevation, carriage or stand travel and operation of the beam "ON-OFF" mechanism).

4. The teletherapy treatment timing device.

C. A report in duplicate of the results of the above surveys and tests shall be sent to the U.S. Nuclear Regulatory Commission, Region I, Nuclear Materials Section, 631 Park Avenue, King of Prussia, Pennsylvania 19406, not later than thirty (30) days following each installation of a teletherapy source.

Section 22, Requirement to perform periodic Spot-check measurements of Teletherapy Units.

I. When Required:

Spot check measurements are to be performed on each teletherapy unit at intervals not to exceed one month.

II. Spot Check Requirements:

1. Timer accuracy.

2. The congruence between the field indicated by the light beam localizing device and radiation field indicator.

3. The accuracy of all distance measuring devices.

4. The exposure rate, dose rate or a quantity related in a known manner to these rates for one typical set of operating conditions.

5. The percent difference between the measured exposure rate determined in item number 4) and decay correct value that was obtained at last full calibration.

Section 25 requires that each radiation monitor located in the teletherapy room must be tested for proper operation each day before treating patients. No records to support that this is being done.

Section 27 requires that the following records must be preserved for five (5) years after completion of the full calibration or after inspection and servicing.

1. Full calibration measurement reports made under 35.21.

2. Records of calibration of the instruments used to make these measurements under 35.23.

3. Records of inspection and servicing of the teletherapy unit under 35.26.

Section 27 requires that the following records must be preserved for two (2) years.

1. Records of spot-check measurements and corrective actions under 35.22 and

2. Calibration of instruments used to make spot-check measurements under 35.23.

THE MEDICAL CENTER OF DELAWARE, INC.

Department of Radiation Therapy

Monthly Quality Assurance for: 6/85

Machine Calibration (Output, % Diff. in Output, O.D.I. Accuracy and Radiation Field-Light Field Coincidence)

THERATRON Et.

THERATRON A Et

ELDORADO Et.

Survey of Isotope Storage Area Et

Inventory of Radioactive Sources Et.h

Interlocks, Warning Lights, Wall Monitors Et.

+

Wipe Test Results for Cs^{137}, Sr^{90}, Co^{60}

Performed by: JH

Reviewed by : Et.

THE MEDICAL CENTER OF DELAWARE, INC.

Department of Radiation Therapy

Date 8/3/11

Theratron and Theratron A

Emergency Switches	Ther.	Ther. A
Lt Couch	✓	✓
Rt Couch	✓	✓
Console	✓	✓
On-Off Lights		
Console	✓	✓
Machine	✓	✓
Door	✓	✓
Door Interlock	✓	✓
Collision Device	✓	✓
Wall Monitor	✓	✓
Timer (2 min.)	✓	✓
Laser Accuracy	not installed	N/A

Eldorado

Emergency Switches	
Stand Lt	✓
Stand Rt	✓
Console	✓
On-Off Lights	
Console	✓
Machine	✓
Door	✓
Door Interlock	✓
Wall Monitor	✓
Timer (2 min.)	✓

THE MEDICAL CENTER OF DELAWARE, INC.

CHRISTIANA HOSPITAL

Department of Radiation Therapy

Date: 6/6/[illegible]

INVENTORY CONTROL FORM

Interstitial Radium Needles

No. of Units	Drawer Location	Radium (Equiv.)	Total Length	
30	A	1.0	44	✓
34	B	2.0	44	✓
20	C	1.5	60	✓
20	D	3.0	60	✓
20	E	1.15	42	✓
15	F	1.33	32	
20	G	1.75	58	✓
15	H	0.66	32	
	Total	276 mgm		

Intracavitary Cesium Sources

11	NP	5.6	19.1	✓
18	NP	10.9	19.1	✓
6	P	15.9	19.1	✓

Heyman Cesium Sources

30	---	9.3	---	✓

Cesium Calibration Source ✓

Strontium Eye Applicator ✓

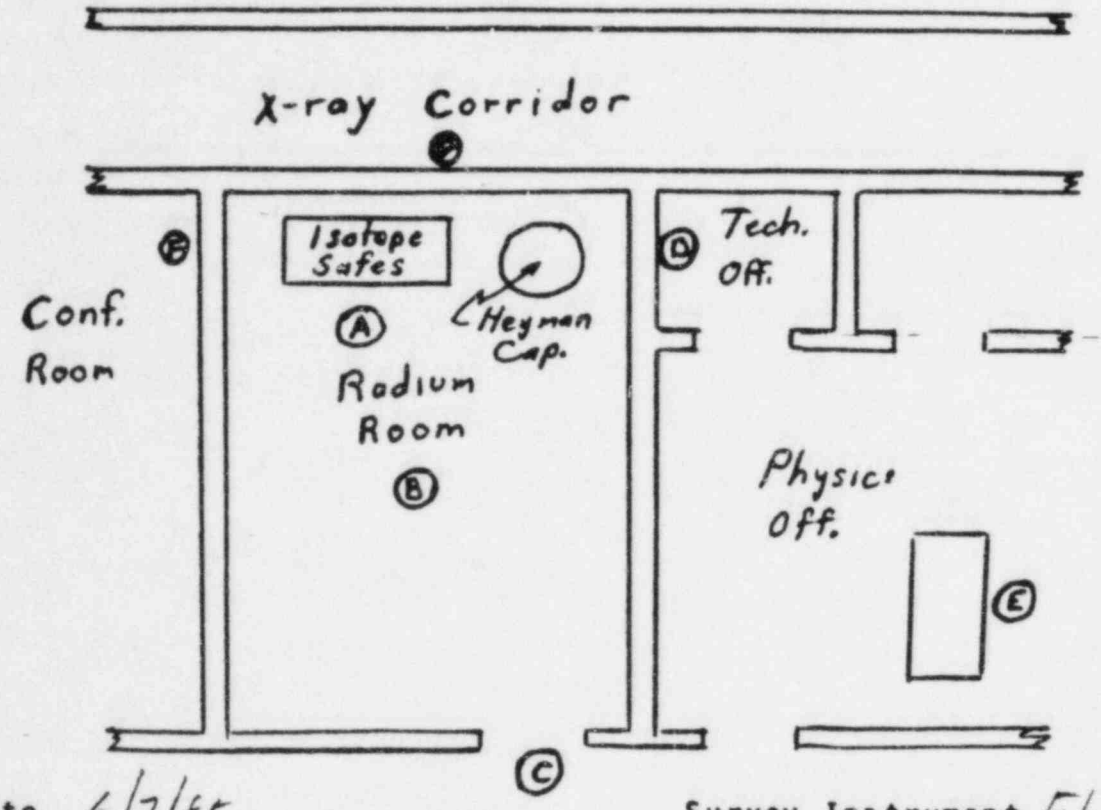
Other

It [illegible] (Schwarz 72-6) 13.5 mCi Sealed and stored in trash

P[illegible] applicator[illegible] } Temp stored in High Energy [illegible]

ISOTOPE STORAGE AREA

SURVEY FORM



Date 6/7/65

Survey Instrument Eberline E-120

Survey Inst. Calc. Date 6/65

Consistency Reading of Survey Instrument 40

Is Cons. Read. within ± 20% (Yes) No

Location	Reading (MR/hr)
A - Working Area	2.0
B - Center of Ra. Rm	0.35 (C: In corridor 5 ft.)
C - Door of Ra. Rm	0.05
D - Technicians Office	0.2
E - Secretary's Chair	BKG
F - Conference Room	0.2
G - X-ray Corridor	0.2
Floor above	0.1
Floor below	0.2

High Energy Rm < 2 mr/hr outside Control Area

MONTHLY QUALITY CONTROL REPORT

TREATMENT MACHINE : THERATRON

DATE : 6/ 3/85

CALIBRATION INSTRUMENT - KEITHLY 602 ELECTROMETER

SSD - 80.0 CM

FIELD SIZE - 10X10 CM

——— INPUT PARAMETERS ———

AVERAGE ELECTROMETER READING (1 MIN) - 3.915 X10-8 VOLTS

AVERAGE ELECTROMETER READING (2 MIN) - 3.886 X10-8 VOLTS

TEMPERATURE - 22.0 DEGREES C

BAROMETRIC PRESSURE - 760.1 MM HG

TPCF = (760/PRESS)(273+TEMP)/295 = 1.000

——— OUTPUT MEASUREMENT ———

OUTPUT = (READ2-READ1)/(2.0-1.0) X CCF X TPCF

% DIFF = (MEAS-LISTED)/(LISTED) X 100%

LISTED OUTPUT AT DMAX - 129.11 RAD/MIN

MEASURED OUTPUT AT DMAX - 130.95 RAD/MIN

PER CENT DIFFERENCE IN OUTPUT - 1.42%

——— TIMER ERROR ———

T.E. = (READ2 X 1.0)-(READ1 X 2.0)/(READ1-READ2)

LISTED TIMER ERROR - 0.028 MIN

MEASURED TIMER ERROR - -0.0280 MIN (OK!)

——— O.D.I. ACCURACY ———

DISTANCE INDICATED BY MEASURING STICK - 80.0 CM

O.D.I. AGREES WITHIN 2 MM

——LIGHT FIELD AND RADIATION FIELD ALIGNMENT——

AGREEMENT WITHIN 3 MM ? - YES - DENSITOMETER SCAN ACCOMPANIES REPORT

MONTHLY QUALITY CONTROL REPORT

TREATMENT MACHINE : THERATRON A

DATE : 6/ 3/85

CALIBRATION INSTRUMENT - KEITHLY 602 ELECTROMETER

SSD - 80.0 CM

FIELD SIZE - 10X10 CM

——— INPUT PARAMETERS ———

AVERAGE ELECTROMETER READING (1 MIN) - 1.918 X10-8 VOLTS

AVERAGE ELECTROMETER READING (2 MIN) - 4.026 X10-8 VOLTS

TEMPERATURE - 22.0 DEGREES C

BAROMETRIC PRESSURE - 761.0 MM HG

TPCF = (760/PRESS)(273+TEMP)/295 = 0.999

——— OUTPUT MEASUREMENT ———

OUTPUT = (READ2-READ1)/(2.0-1.0) X CCF X TPCF

% DIFF = (MEAS-LISTED)/(LISTED) X 100%

LISTED OUTPUT AT DMAX - 139.04 RAD/MIN

MEASURED OUTPUT AT DMAX - 137.68 RAD/MIN

PER CENT DIFFERENCE IN OUTPUT - -0.98%

——— TIMER ERROR ———

T.E. = (READ2 X 1.0)-(READ1 X 2.0)/(READ1-READ2)

LISTED TIMER ERROR - 0.008 MIN

MEASURED TIMER ERROR - -0.0900 MIN (OK!)

——— O.D.I. ACCURACY ———

DISTANCE INDICATED BY MEASURING STICK - 80.0 CM

O.D.I. AGREES WITHIN 2 MM

——LIGHT FIELD AND RADIATION FIELD ALIGNMENT——

AGREEMENT WITHIN 3 MM ? - YES - DENSITOMETER SCAN ACCOMPANIES REPORT

MONTHLY QUALITY CONTROL REPORT

TREATMENT MACHINE : ELDORADO

DATE : 6/ 3/85

IBRATION INSTRUMENT - KEITHLY 602 ELECTROMETER

- 70.0 CM

LD SIZE - 10X10 CM

——— INPUT PARAMETERS ———

RAGE ELECTROMETER READING (1 MIN) - 1.271 X10-8 VOLTS

RAGE ELECTROMETER READING (2 MIN) - 2.559 X10-8 VOLTS

PERATURE - 22.0 DEGREES C

AMETRIC PRESSURE - 761.0 MM HG

F = (760/PRESS)(273+TEMP)/295 = 0.999

——— OUTPUT MEASUREMENT ———

PUT = (READ2-READ1)/(2.0-1.0) X CCF X TPCF

IFF = (MEAS-LISTED)/(LISTED) X 100%

TED OUTPUT AT DMAX - 87.74 RAD/MIN

SURED OUTPUT AT DMAX - 88.20 RAD/MIN

CENT DIFFERENCE IN OUTPUT - 0.53%

——— TIMER ERROR ———

. = (READ2 X 1.0)-(READ1 X 2.0)/(READ1-READ2)

TED TIMER ERROR - 0.012 MIN

SURED TIMER ERROR - -0.0135 MIN (OK!)

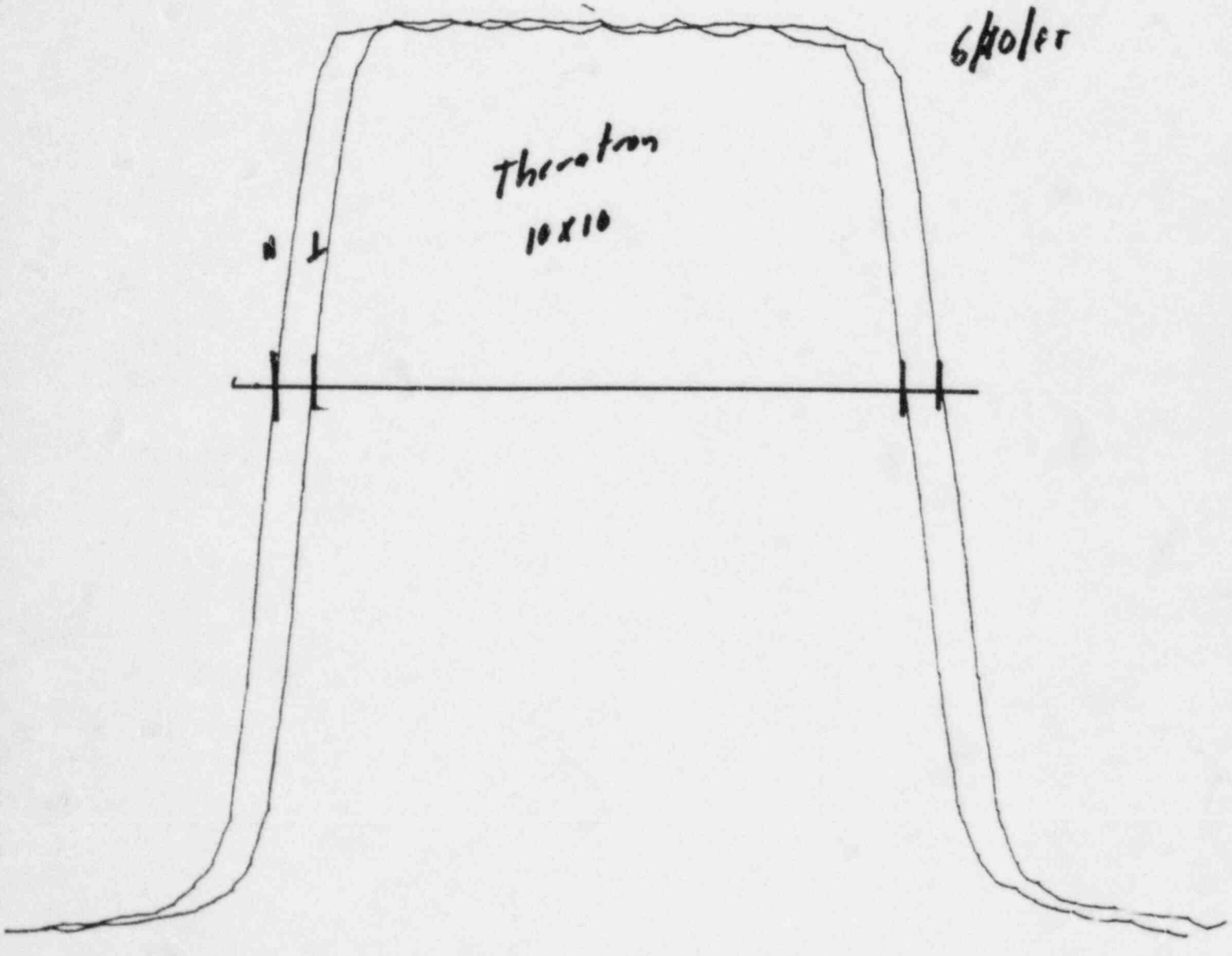
——— O.D.I. ACCURACY ———

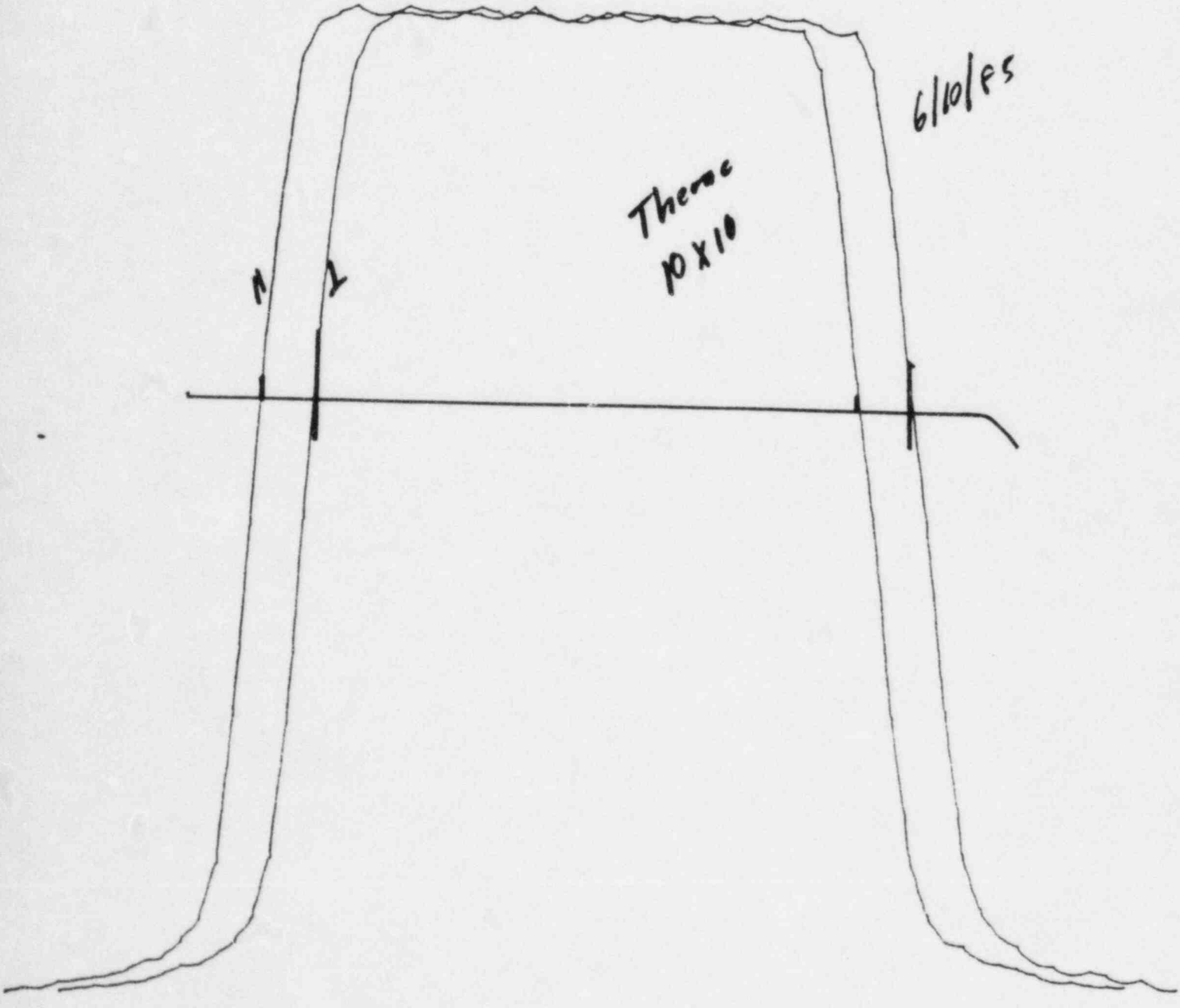
TANCE INDICATED BY MEASURING STICK - 70.0 CM

.I. AGREES WITHIN 2 MM

—LIGHT FIELD AND RADIATION FIELD ALIGNMENT—

EMENT WITHIN 3 MM ? - YES - DENSITOMETER SCAN ACCOMPANIES REPORT


6 Holes
Thruston
10 x 10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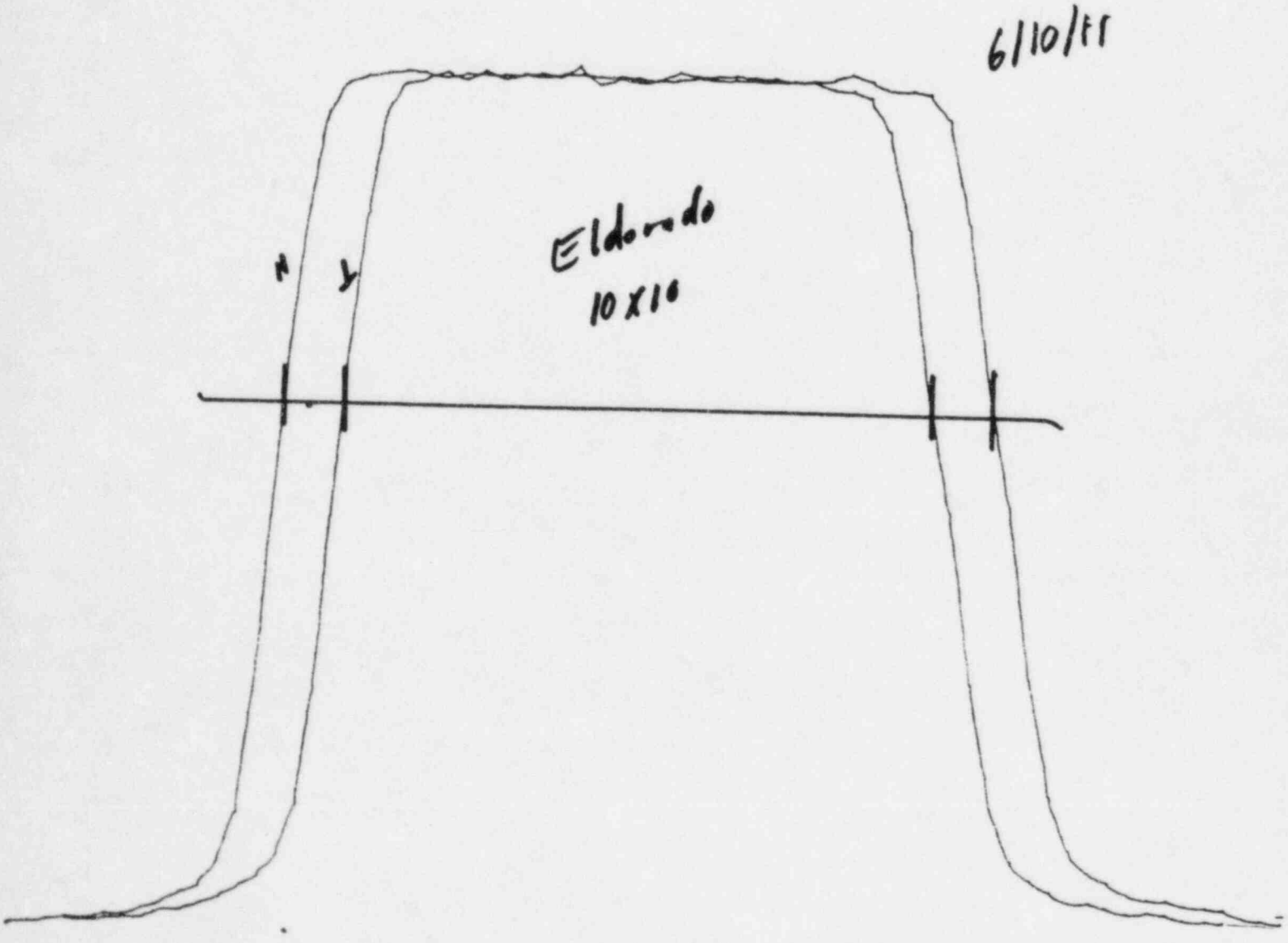
6/10/11
Eldorado
10 x 10

Department of Radiation Therapy

WIPE TEST RESULTS Date 6/9/85

Mechtronics Scintillation Detector Isotope Tested Sr^{90} (Eye Applicator)

KV - 1.2 kV ΔE 1V@10

Gain - 512 E - 2.6 Activity of Standard 0.005 μCi

Bkg Counts (1 min)		Standard Counts (1 min)	
3	334	3	4661
	311		4516
	362		4509
Avg	336/3 = 112 cpm	Avg	4560/3 = 1520 cpm

MDA (Counts) = $3\sqrt{\frac{Bkg}{t}} = 3\sqrt{\frac{112}{3}}$ = 18 Counts/min

MDA (uCi) = $\frac{(\text{Act Standard})(\text{MDA Counts})}{(\text{Standard Counts})} = \frac{(0.005\,\mu Ci)(18\ \text{counts/min})}{(1520)}$ = 0.00006 μCi (MDA)

WIPE RESULTS (3 min / 1 min) Net Counts

Sr^{90} Eye Applicator

	319			
	368			
	228			
Avg	338/3 = 112 cpm	- Bkg 112	= 0 cpm	MDA = 18 cpm (0.00006 μCi)

OK

Avg _____ - Bkg _____ = _____

Avg _____ - Bkg _____ = _____

Avg _____ - Bkg _____ = _____

Department of Radiation Therapy

WIPE TEST RESULTS Date 6/9/88

Mechtronics Scintillation Detector Isotope Tested Co^{60} (Theratron 1 / Theratron 2 / Eldorado)

KV - 1.3 kV ΔE - 1V@10

Gain - 512, 2 E - 3.9

2/7/61 4 mos
45 mCi ε .9569 =

Activity of Standard 0.431 μCi

Bkg Counts (1 min)		Standard Counts (1 min)	
	79		329,293
	72		329,819
	87		320,477
Avg	79	Avg	329,896

MDA (Counts) = $3\sqrt{\frac{Bkg}{t}} = 3\sqrt{\frac{79\,cpm}{1\,min}}$ = 27 Counts/min

MDA (uCi) = $\frac{(Act\ Standard)(MDA\ Counts)}{(Standard\ Counts)} = \frac{(0.931\,\mu Ci)(27\ cts)}{(329,896)}$ =

0.00009 μCi (MDA)

WIPE RESULTS (1 min)

			Net Counts
Theratron ①	85		
	78		
	82		
Avg	82	- Bkg 79 =	+3 cts/min
Theratron ②	99		
	94		
	81		
Avg	88	- Bkg 79 =	+11 cts/min
Eldorado	99		
	83		
	77		
Avg	85	- Bkg 79 =	+6 cts/min
	~~X~~		
	~~X~~		
	~~X~~		
Avg		- Bkg ____ =	____

All < MDA (27 c/m = 0.00009 μCi) OK!

JAR

Department of Radiation Therapy

WIPE TEST RESULTS

Date 6/7/85

Mechtronics Scintillation Detector

Isotope Tested Cs^{137} (Heyman Cap & Calibration Source)

KV - 1.2 kV ΔE - 1V @ 10

Gain - 512 E - 2.95

Activity of Standard 8.09 μCi

Bkg Counts (~~1 min~~ 3 min)	Standard Counts (~~1 min~~ 3 min)
323	1,981,895
311	1,537,563
292	1,560,090
Avg 309/3 = 103 cpm	Avg 1,526,932/3 = 508,811 cpm

MDA (Counts) = $3\sqrt{\frac{Bkg}{t}} = 3\sqrt{\frac{103}{3}}$ = 18 Counts/min

MDA (uCi) = $\frac{(Act\ Standard)(MDA\ Counts)}{(Standard\ Counts)} = \frac{(8.09\ \mu Ci)(18\ cts/min)}{(508,811\ cts/min)}$ = 0.0003 μCi MDA

WIPE RESULTS (1 min)

		Net Counts
Heyman Set 1	269	
	299	
	289	
Avg	289/3 = 95 - Bkg 103	= -8 Cts/min
Heyman Set 2	259	
	263	
	299	
Avg	272/3 = 91 - Bkg 103	= -12 Cts/min
Heyman Set 3	287	
	289	
	286	
Avg	287/3 = 96 - Bkg 103	= -7 Cts/min
Calibration Source	318	
	319	
	~~290~~ 311	
Avg	319/3 = 105 - Bkg 103	= +2 Cts/min

all < MDA
18 cts/min
0.0003 μCi

JM

Department of Radiation Therapy

WIPE TEST RESULTS Date 6/7/88

Mechtronics Scintillation Detector Isotope Tested Cs^{137} (Gym Sources)

KV - 1.2 kV ΔE - 1V@10

Gain - 512 E - 2.95 Activity of Standard 8.09 μCi

Bkg Counts (1 min)		Standard Counts (1 min)	
	323		1,481,895
	311		1,537,363
	292		1,560,090
Avg	309/3 = 103 cpm	Avg	1526 932/3 = 508,311 cpm

MDA (Counts) = $3\sqrt{\frac{Bkg}{t}} = 3\sqrt{103/3} =$ 18 Counts/min

MDA (uCi) = $\frac{(Act\ Standard)(MDA\ Counts)}{(Standard\ Counts)} = \frac{(8.09\ \mu Ci)(18\ cts)}{(508\ 311\ cts)} =$ 0.0003 μCi MDA

WIPE RESULTS (1 min)

			Net Counts
5 mgm Ra eq	276		
	296		
	285		
Avg	276/3 = 95	- Bkg 103 =	-8 cts/min
10 mgm Ra eq	300		
	301		
	325		
Avg	309/3 = 103	- Bkg 103 =	0 cts/min
15 mgm Ra eq	311		
	317		
	314		
Avg	319/3 = 105	- Bkg 103 =	+2 cts/min
	~~X~~		
Avg		- Bkg =	

all < MDA
18 cts/min
= 0.0003 μCi