

APPLICATION FOR MATERIALS LICENSE — TELETHERAPY

INSTRUCTIONS — Complete items 1 through 22 if this is an initial application or an application for renewal of a license. Use supplemental sheets where necessary. Item 22 must be completed on all applications and signed. Retain one copy. Submit original and one copy of entire application to: Director, Office of Nuclear Materials Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Upon approval of this application, the applicant will receive a Materials License. An NRC Materials License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the License is subject to Title 10, Code of Federal Regulations, Parts 19, 20, 21, and 35 and the license fee provision of Title 10, Code of Federal Regulations, Part 170. This license fee category should be stated in Item 22 and the appropriate fee enclosed.

<p>1.a. NAME AND MAILING ADDRESS OF APPLICANT (institution, firm, clinic, physician, etc.) INCLUDE ZIP CODE</p> <p>The Medical Center of Delaware, Inc. Executive Offices Attn: Allston J. Morris, M.D. 501 W. 14th St. P.O. Box 1668 Wilmington, DE 19899</p>		<p>1.b. STREET ADDRESS(ES), ACTUAL LOCATION OF TELETHERAPY SOURCE, INCLUDING BUILDING NAME, ROOM NUMBER, ETC.</p> <p>Christiana Hospital 4755 Ogletown-Stanton Rd. P.O. Box 6001 Newark, DE 19718</p>	
<p>TELEPHONE</p>	<p>AREA CODE ( 302 )</p>	<p>NUMBER 428-2596</p>	
<p>2. PERSON TO CONTACT REGARDING THIS APPLICATION</p> <p>Edward Torvik, Physicist</p>		<p>3. THIS IS AN APPLICATION FOR: (Check appropriate item)</p> <p><input type="checkbox"/> a. NEW LICENSE</p> <p><input type="checkbox"/> b. AMENDMENT TO LICENSE NO. _____</p> <p><input checked="" type="checkbox"/> c. RENEWAL OF LICENSE NO. 07-12153-03</p>	
<p>4. INDIVIDUAL USERS (Name individuals who will use or directly supervise use of radioactive material. Complete Supplement A and B for each individual.)</p> <p>same</p>		<p>5. RADIATION SAFETY OFFICER (RSO) (Name of person designated as radiation safety officer. If other than individual user, complete resume of training and experience as in Supplement A.)</p> <p>same</p>	
<p>6. SEALED SOURCES TO BE USED IN TELETHERAPY UNITS (Attach supplemental pages if necessary)</p>			

SEE SUPPLEMENT #1

8. PERSONNEL MONITORING DEVICES		
TYPE (Check and/or complete as appropriate)	SUPPLIER (Service Company)	EXCHANGE FREQUENCY
(1) FILM BADGE — WHOLE BODY	R. S. Landauer Jr. & Co.	
(2) THERMOLUMINESCENT DOSIMETER (TLD) — WHOLE BODY		
(3) OTHER (Specify)		
<p>B604070176 B60116 REQ1 LIC30 07-12153-03 PDR</p>		<p>03807 MAY 13 1985</p>

# INFORMATION REQUIRED FOR ITEMS 10 THROUGH 21

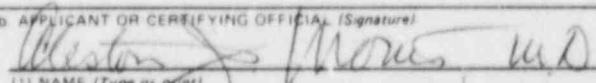
For Items 10 through 21, check the appropriate box(es) and submit a detailed description of all the requested information. Begin each item on a separate sheet. Identify the item number and the date of the application in the lower right corner of each page. If you indicate that an appendix to the teletherapy licensing guide will be followed, do not submit the pages, but specify the revision number and date of the referenced guide: Regulatory Guide 10 Rev. \_\_\_\_\_ Date: \_\_\_\_\_

10. MEDICAL ISOTOPE COMMITTEE		15. BEAM STOPS	
Names and specialties attached; and (check one)		Description of stops used to restrict beam orientation attached.	
a. Duties as in Appendix A, or		16. SHIELDING EVALUATION	
b. Equivalent duties attached.		Evaluation of proposed shielding attached.	
11. TRAINING AND EXPERIENCE		17. OPERATING AND EMERGENCY PROCEDURES	
a. Supplements A & B attached for each individual user; and		a. Description of operating procedures attached; and	
b. Supplement A attached for RSO.		b. Copy of emergency procedures attached.	
12. INSTRUMENTATION (check one)		18. INSTRUCTION OF PERSONNEL (check one)	
a. Appendix C form attached, or		a. Training program and schedule in Appendix H followed, or	
b. List manufacturer's name and model number.		b. Description of instruction program for employees attached.	
13. CALIBRATION OF INSTRUMENTS (check one)		19. LEAK TESTS OF SEALED SOURCES	
a. Appendix D, Part 2 procedures followed for instrumentation calibration, or		Description of leak test procedures attached.	
b. Description of sources, calibration frequency and equivalent procedures attached.		20. QUALIFIED EXPERT (Use only if the individual fails to meet 10 CFR 35.24 requirements.)	
14. FACILITIES AND EQUIPMENT		Statement of qualifications of the expert who will perform teletherapy calibrations attached.	
a. Description and drawing of facilities attached; and		21. ALARA PROGRAM (check one)	
b. Description of patient viewing and communicating systems attached; and		ALARA Program as in Appendix I, or	
c. Description of area safeguards attached.		Equivalent ALARA Program attached.	

## 22. CERTIFICATE

(This item must be completed by the applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 1a certifies that this application is prepared in conformity with Title 10, Code of Federal Regulations, Parts 30 and 35, and that all information contained herein, including supplements attached hereto, is true and correct to the best of our knowledge and belief.

a. LICENSE FEE REQUIRED (See section 170.31, 10 CFR 170)		b. APPLICANT OR CERTIFYING OFFICIAL (Signature) 	
(1) LICENSE FEE CATEGORY 7A		(1) NAME (Type or print) Allston J. Morris, M.D.	
(2) LICENSE FEE ENCLOSED \$ 350.00		(2) TITLE Senior Vice President for Medical Affairs	
		c. DATE May 8, 1985	

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

5/15/85

## SUPPLEMENT # 1

Christiana Hospital

6. Byproduct  
MaterialName of Source  
ManufacturerSource Model  
No.Maximum  
ActivityNumber  
of Sources

A. Cobalt-60	AECL/Neutron Products	AECL Model C-146 or C-151 or Neutron Prod. Model NPI-20-900W	9000 Curies	2
B. Cobalt-60	AECL/Neutron Products	AECL Model C-146 or C-151 or Neutron Prod. Model NPI-20-9000W	9000 Curies	2
C. Cobalt-60	AECL	C-146/C-151	9000 Curies	2

7. Teletherapy UnitsName of ManufacturerModel Number

A. AECL  
B. AECL  
C. AECL

Theratron 80  
Eldorado 78  
Theratron 80

Item #10

Medical Isotope Committee



COMMITTEE ON IONIZING RADIATION

Names and Specialties Attached:

Robert L. Meckelburg, M.D. Chairman	Nuclear Medicine
Allston J. Morris, M.D.	Admin. Representative
P. John Pegg, M.D.	Pathology
Robert Arm, D.M.D.	Dental Clinic
Carlo A. Cuccia, M.D.	Radiation Therapy
Stephen S. Grubbs, M.D.	Medical Oncology
Paul McCready, M.D.	• Radiology
Vidya Sagar, M.D.	Nuclear Medicine
Edward Torvik, Sc.D.	Radiation Safety
	Officer
Joseph Solge, R.T.	Radiation Safety
	Technologist
Ann Curtis, R.N.	Nursing
Nelia Thomas, R.T.	Nuclear Medicine

A-2. 1. THE COMMITTEE ON IONIZING RADIATION shall consist of at least five members and shall include the Directors respectively of the Departments of Radiation Therapy and Radiology, The Director of the Isotope Laboratory, the Director of the Department of Pathology or his designate, a radiation physicist, and a medical oncologist. The committee shall meet at least quarterly and keep minutes of its proceedings for submittal to staff council. In addition the committee may call for consultation from other members of the Staff as needed. The Chairman of the Committee on Cancer shall be an ex officio member of the Committee on Ionizing Radiation, and the Chairman of the Committee on Ionizing Radiation shall similarly be an ex officio member of the Committee on Cancer. The Radiation Safety Officer, if not the physicist member, shall also be a member of this committee.

The functions of this committee shall be as follows:

- (1) Inform the Credentials Committee which physicians are qualified and adequately trained in the use of radium and radioactive substances.
- (2) Make recommendations to the Staff Council concerning the use of all forms of ionizing radiation within the Medical Center, whether for diagnostic or therapeutic use. The committee shall also review and comment on training programs within the Center related to ionizing radiation.
- (3) Maintain a continuous study of safety and control of the use of radium and isotopes for diagnostic and therapeutic use within the Medical Center.
- (4) Make recommendations to the Chief Administrative Officer of the Center concerning equipment, space, facilities, and other administrative matters relating to ionizing radiation.
- (5) Monitor compliance with appropriate state and federal regulatory standards and report these matters regularly to administration and to Staff Council.
- (6) The Committee will review the Medical Center's radiation safety program annually. This will be done no later than the end of the first calendar quarter.

Item 11

TRAINING AND EXPERIENCE

See License No. 07-12153-03

Item 12  
Instrumentation

APPENDIX C  
INSTRUMENTATION

1. Survey meters

a. Manufacturer's name: Eberline  
Manufacturer's model number: E-530 G.M.  
Number of instruments available: one  
Minimum range: -0- mr/hr to 0.20 mr/hr  
Maximum range: -0- mr/hr to 200 mr/hr

4 Ranges

b. Manufacturer's name: Baird Atomic  
Manufacturer's model number: Log Survey Ion Chamber 414  
Number of instruments available: one  
Ranges: One  
Minimum range:                      mr/hr to                      mr/hr  
Maximum range: -0- mr/hr to 3000 mr/hr

2. Beam-on Monitor

Manufacturer's name: Eberline  
Manufacturer's model number: SP- I-2  
Number of instruments available: Three  
Backup Battery Power Supply: Yes x No           

3. Dosimetry System

a. Electrometer

Manufacturer's name:                                       
Manufacturer's model number:                                     

b. Probes

Manufacturer's name:                                       
Manufacturer's model number:                                       
Number of probes:                                       
Ranges:                                     

4. Other (use additional pages)

DOSIMETRY SYSTEM

1. Keithley Electrometer  
Model Number 602  
Serial Number 191720
2. Data Precision Digital Multimeter  
Model 255  
Serial Number 2607
3. PTW Chamber  
Model W 23333  
Chamber Volume: 0.6 ml.  
Chamber Material: Acrylic  
Serial Number A32T
4. Acrylic Build-up Cap  
Model 30-352

This calibration system was calibrated Aug. 22, 1984 by:

K & S Associates  
1854 Airplane Drive  
Nashville, Tennessee



CALIBRATION OF INSTRUMENTS

a. Calibration of Survey Meters

Calibration of survey meters shall be performed using the Victoreen Model 681, Small Instrument Calibrator, containing a 93.4 millicurie (9-2-77) Cesium-137 source.

1. Survey instruments will be calibrated at least annually and after servicing.
2. The calibration procedure used for any particular instrument will be the one listed by the manufacturer in their operational manual. Whenever possible, survey instruments will be calibrated at approximately one-third and two thirds of full scale reading for each scale selection.
3. Instruments will be considered in calibration as long as measured exposure rate and calculated rate differ by less than 10 percent for each point checked. Also, when higher scales are not checked or calibrated, an appropriate precautionary note will be posed on the instrument.
4. All radiation survey instruments will be calibrated in the Physics Lab of the Department of Radiation Therapy. The individual performing instrument calibration will wear a lithium fluoride ring dosimeter on his left hand and film badge dosimeter on shirt collar, left hand side. When not in use the survey instrument calibrator will be placed in the Radium Storage Room behind 5/8 inch lead shielding.

The exposure rate will be calculated using the inverse square law and the radioactive decay law.

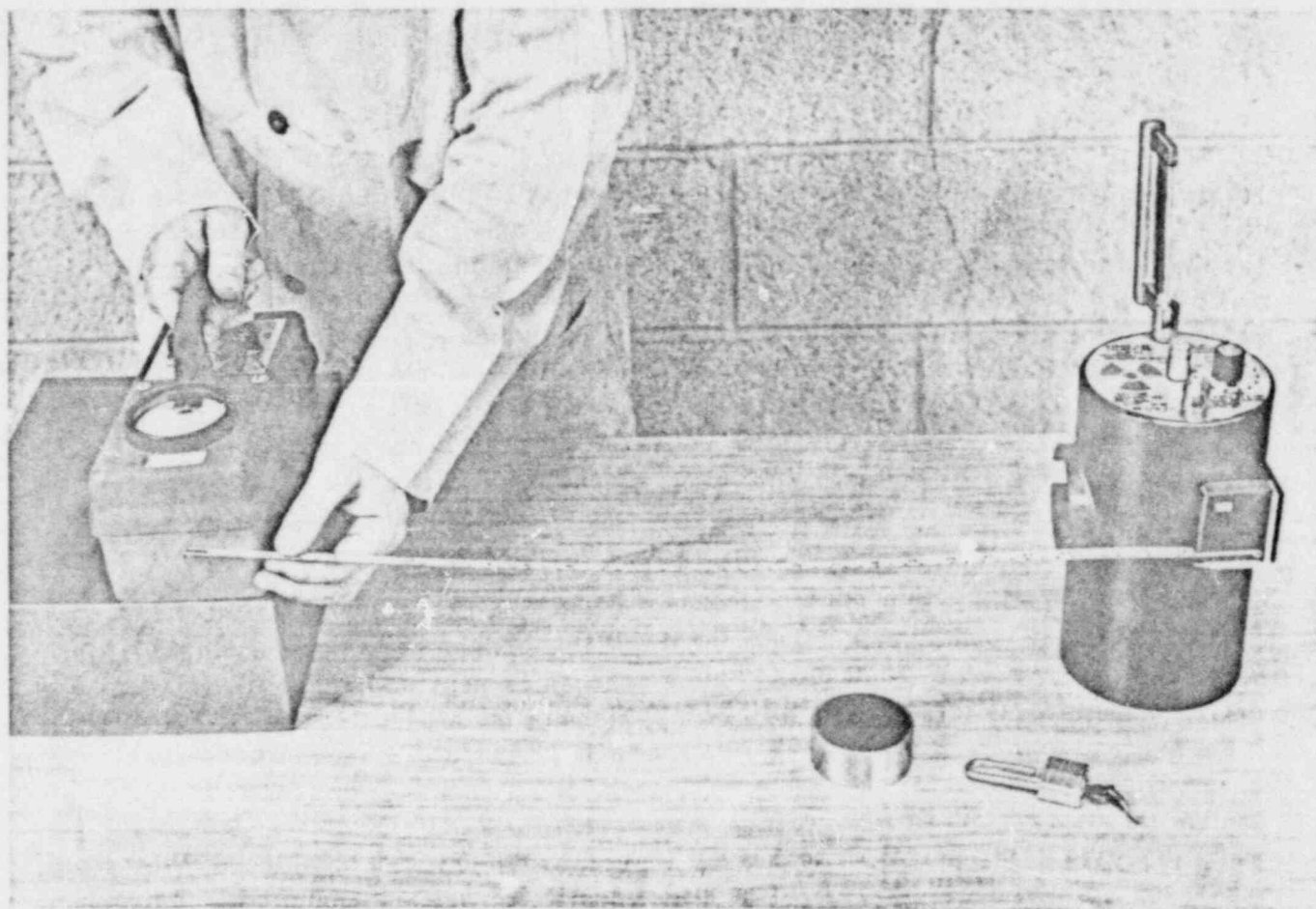
5. A record will be made for each survey meter calibrated. This will include manufacturer's name, model number, serial number, calculated vs. measured exposure rates, calibration date.

# TECHNICAL DATA

	Victoreen Instrument Division,
	10101 Woodland Avenue,
VICTOREEN	Cleveland, Ohio 44104

**SG** SELLER-GLOBE CORPORATION

## MODEL 681 . . . SMALL INSTRUMENT CALIBRATOR



### Features

- Radiation Fields For 2 mR/Hr To 1500 mR/Hr.
- Automatic Exposure Timer.
- Long Half-Life, Non-Removable  $^{137}\text{Cs}$  Source.
- Safe and Easy To Use.

The Model 681 Small Instrument Calibrator gives the user the capability of calibrating his portable survey instruments on their normally used ranges. It does away with the expense,

inconvenience and use-time lost when sending instruments to an outside calibration service. The Model 681 is safe and easy to use and can be locked to prevent unauthorized use.

## MODEL 681 . . . SMALL INSTRUMENT CALIBRATOR

### TECHNICAL INFORMATION

The Model 681 consists of a 100 mCi  $^{137}\text{Cs}$  source permanently attached to a movable rod which is installed in a lead shield casting. The assembly is enclosed in a cylindrical steel weldment which is 5 inches in diameter (12.7 cm) and 8-1/2 inches high (21.6 cm). The entire unit weighs only 31 pounds (14.1 Kg). The shipping weight is 40 pounds (18.4 Kg).

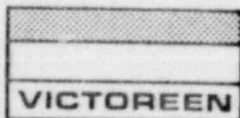
The source can be placed in two positions, either stored or exposed. In the fully shielded stored position the radiation level at the surface of the container is less than 140 mR/hr, at 6 inches away from the container it is 20 mR/hr and at 3-1/2 feet the radiation level is less than 0.5 mR/hr. In the exposed position the source is placed in front of a port which provides a 45° conical beam, horizontally oriented. The radiation level in this beam can vary from less than 2 mR/hr to over 1.5 R/hr, depending on the distance from the port. A 20:1 attenuator is provided with the Calibrator to permit low level calibrations to be made at a reasonable distance. For safety, the Calibrator includes a preset timer which limits the source's exposure

period. The timer can be set to a maximum of 15 minutes. At expiration of the preset time period the source automatically drops into the stored position.

A steel tape measure is permanently attached to the side of the Calibrator and so positioned that it can be used to measure the distance from the source to the instrument being calibrated. This data is then used to determine the actual level of radiation at the instrument.

A key lock prevents any unauthorized use of the equipment. A convenient carrying handle is provided. The overall dimensions of the Model 681 are 12-1/4 inches high (31.1 cm), 6 inches wide (15.2 cm) and 5-1/2 inches deep (14.0 cm).

Before the unit can be shipped, Victoreen must have written documentation proving the purchaser is licensed to possess 100 mCi of  $^{137}\text{Cs}$ . Victoreen will assist the purchaser in obtaining the license by providing appropriate information on the Model 681 which the purchaser can then submit with his license application.





EXTERNAL CONTAMINATION OR LEAKAGE

DATE 9-13-77 MICROCURIES 100 BY P.R.DATE 9-13-77 MICROCURIES 100 BY P.R.

Technical Operations, Incorporated

Radiation Products Division  
Burlington, Massachusetts 01803

## GAMMA RAY SOURCE CALIBRATION

Isotope

Test No.

Date Measured

Cs-13705779-2-77Source  
IdentificationRoentgens/Hr.  
at 1 Meter

Curies

S-253.02989.0434.02949 on May 2, 1975

## Source decay correction factors

Cobalt-60		Iridium-192		Cesium-137
years	mos	weeks	days	years
1.000	1.000	1.000	1.000	1.000
.877	.989	.937	.991	.977
.768	.978	.877	.981	.955
.674	.967	.821	.972	.933
.590	.957	.769	.963	.912
.518	.946	.721	.954	.892
.454	.936	.675	.945	.871
.398	.926	.632	.937	.852
.349	.916	.592		.832
.306	.905	.554		.813
.268	.895	.519		.795
.235	.886	.486		.777
.206	.877	.455		.759
5.26y		74.0d		30.2y
1.30		0.55		0.32

The gamma-ray emission of the sealed source herein described was intercompared with the radiation from a reference standard cobalt-60 source whose intensity had been established relative to a National Bureau of Standards calibrated cobalt-60 source. Comparison was made either with an uncollimated plastic-lined ionization chamber encased in a 3-mm thick aluminum container sealed against atmospheric pressure, or with an NBS-calibrated Victoreen R-meter whose readings were compensated for atmospheric pressure and temperature. All readings were corrected for air scattering and absorption. The source was measured with its axis of symmetry parallel with/perpendicular to the line joining source and detector. The reported output is believed to be accurate within  $\pm 3$  percent, the stated uncertainty of the reference NBS sources. Precision is believed to be better than  $\pm 1$  percent.

Signed

Richard R. Sandeau

Calibration performed for:

Wilmington Medical Ctr.  
Med.# 726 7/150  
Christina E. Brown  
Wilmington, Delaware

Item 13  
5/15/85

### 13 -b Calibration of Beam-On Monitor

The operational status of the beam-on monitor is determined daily, prior to initiating patient treatment. The entrance door is closed, and T.V. camera is rotated so that Beam-on monitor can be viewed on T.V. monitor. The teletherapy unit is turned to verify that monitor SOURCE ON light is lit.

### 13 -c Calibration of Dosimetry System

The total dosimetry system is sent to one of the Regional Calibration Laboratories at intervals that do not exceed two years.



Item 14  
Facilities and Equipment

## Facilities and Equipment

### a. Description and drawings of facilities:

- Figure I. Floor Plan of Radiation Therapy Dept. showing location of Eldorado 78 and Theratron 80.
- Figure II. Floor plan of the Eldorado 78 room
- Figure III. Floor plan of the Theratron 80 room
- Figure IV. Cross-section Drawing of the Eldorado 78 room
- Figure V. Cross-section Drawing of the Theratron 80 room
- Figure VI. Contour Drawing of earth shielding along outside walls
- Figure VII. Floor plan of Theratron 80 room
- Figure VIII. Cross-section drawing of the Theratron 80 room
- Figure IX. Cross-section drawing of the Theratron 80 room

All walls and ceilings irradiated by the primary beam are constructed using high density concrete (207 lbs. per cubic foot). All walls designed to provide radiation shielding against leakage and scatter will be constructed using regular concrete (147 lbs. per cubic foot).

There is no basement or communicating tunnels below the Dept. of Radiation Therapy. There are no additional structures above the Dept. of Radiation Therapy. The roof area of the Dept. of Radiation Therapy is designated as a restricted area. All work that needs to be performed on the roof must be cleared through the Radiation Safety Office. Maintenance performed by outside contractors is under the control of the Supervisor of the Maintenance Department.

Individuals will not be permitted on this roof area while radiation therapy treatment units are operating.

Radiation area signs, size 10 inches by 8 inches with letters one inch in height will be posted so that they will be clearly visible to anyone gaining access to the roof. Also a warning sign will be posted with the following message:

## Facilities and Equipment (cont'd)

PERSONNEL NOT PERMITTED  
IN THIS AREA  
WITHOUT AUTHORIZATION FROM  
THE RADIATION SAFETY OFFICE

The letters on this sign will be one inch in height.

Individuals working on the roof will not be issued individual dosimeters because all therapy units will be in OFF mode when work is being performed.

### b. Viewing and Communication Systems

All radiation therapy treatment rooms are equipped with two T.V. cameras and two T.V. monitors. All rooms are equipped with a two-way communication system so that therapy technician and patient can communicate with each other.

Patients will not be treated when:

1. Both T.V. systems are not functioning, or
2. When communicating system is not functioning.

### c. Description of Area Security Safeguard

All treatment rooms have an interlock system which prevents the unit going into "ON" mode if door is open and turns it to "OFF" mode if the door is opened when unit is in "ON" mode. Unit cannot return to "ON" mode until door is closed and system is returned to "ON" mode at the control console.

All treatment room entrance doors are equipped with locks, control console cannot be turned "ON" without control console key. All rooms have posted on the entrance door area radiation warning sign.

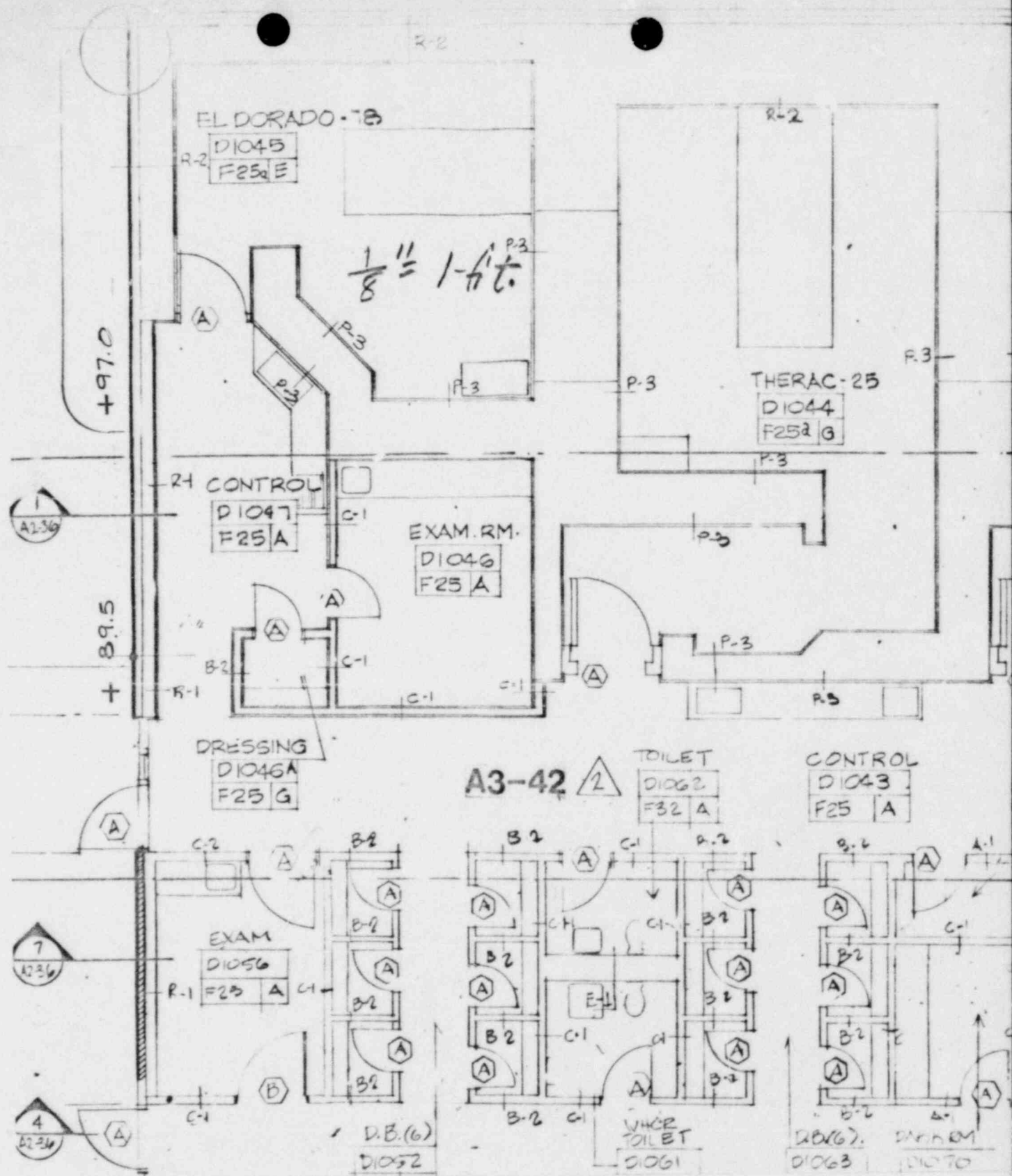
This area is classified as a controlled area and only patients and monitored personnel are to routinely be in this area.

## Facilities and Equipment (cont'd)

### d. Beam Stops

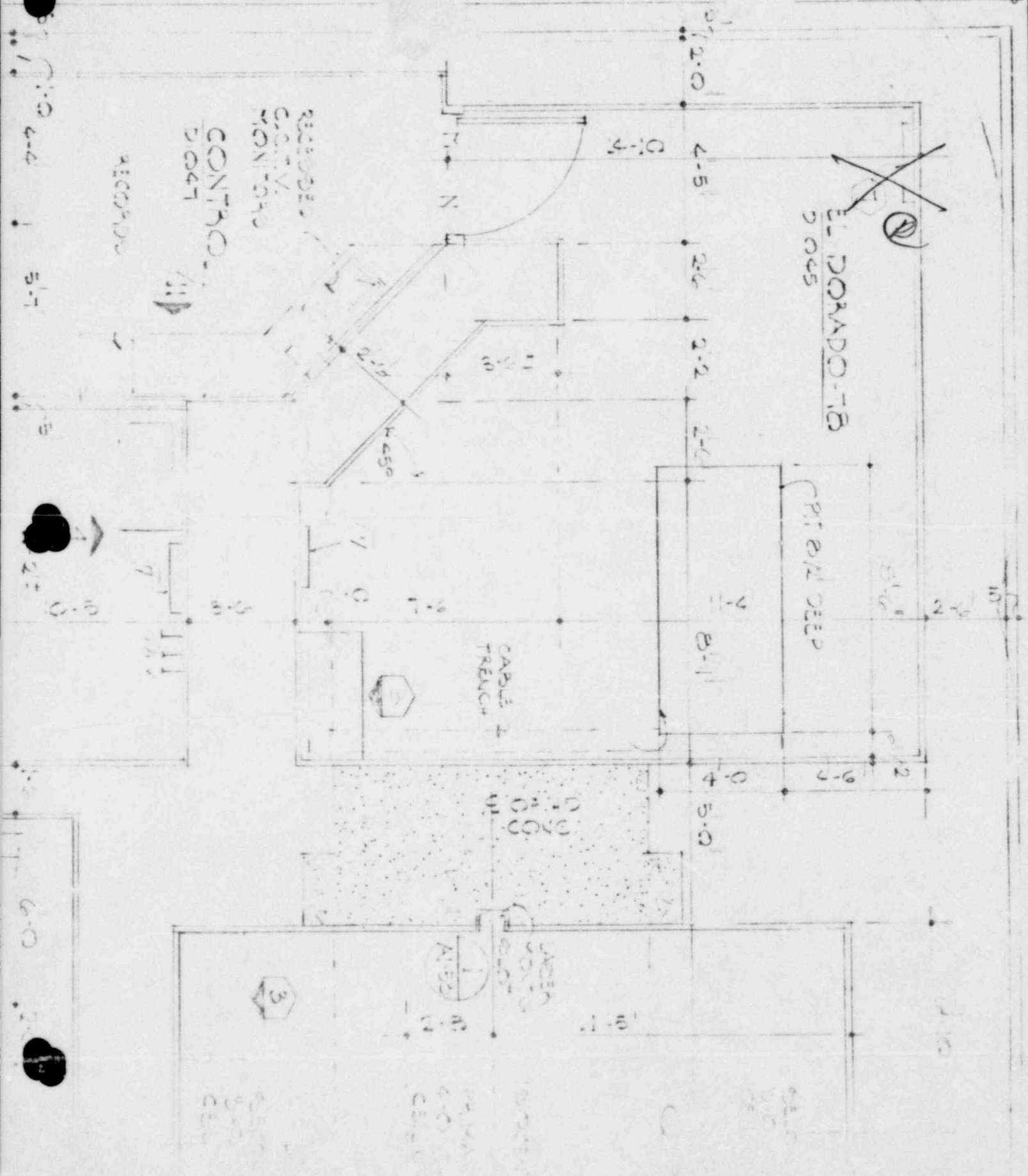
The shielding for all radiation treatment rooms has been designed for therapy equipment that does not use a Beam stopper. It was assumed that the primary beam would not be oriented toward any particular wall or ceiling more than 25 percent of total treatment time.

Figure I  
Medical Center of Delaware Inc.  
Christiana Hospital





4:6





### Figure III

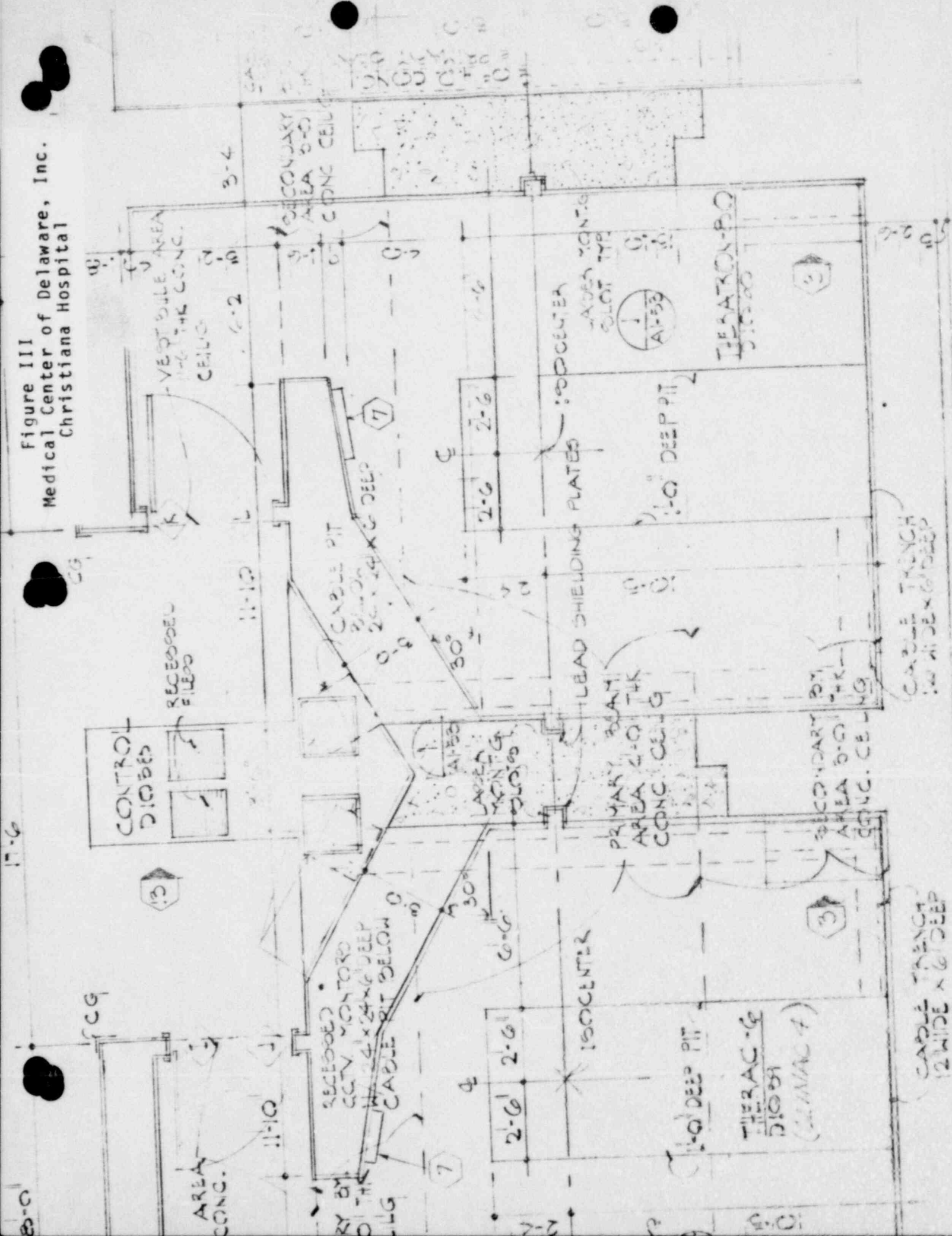
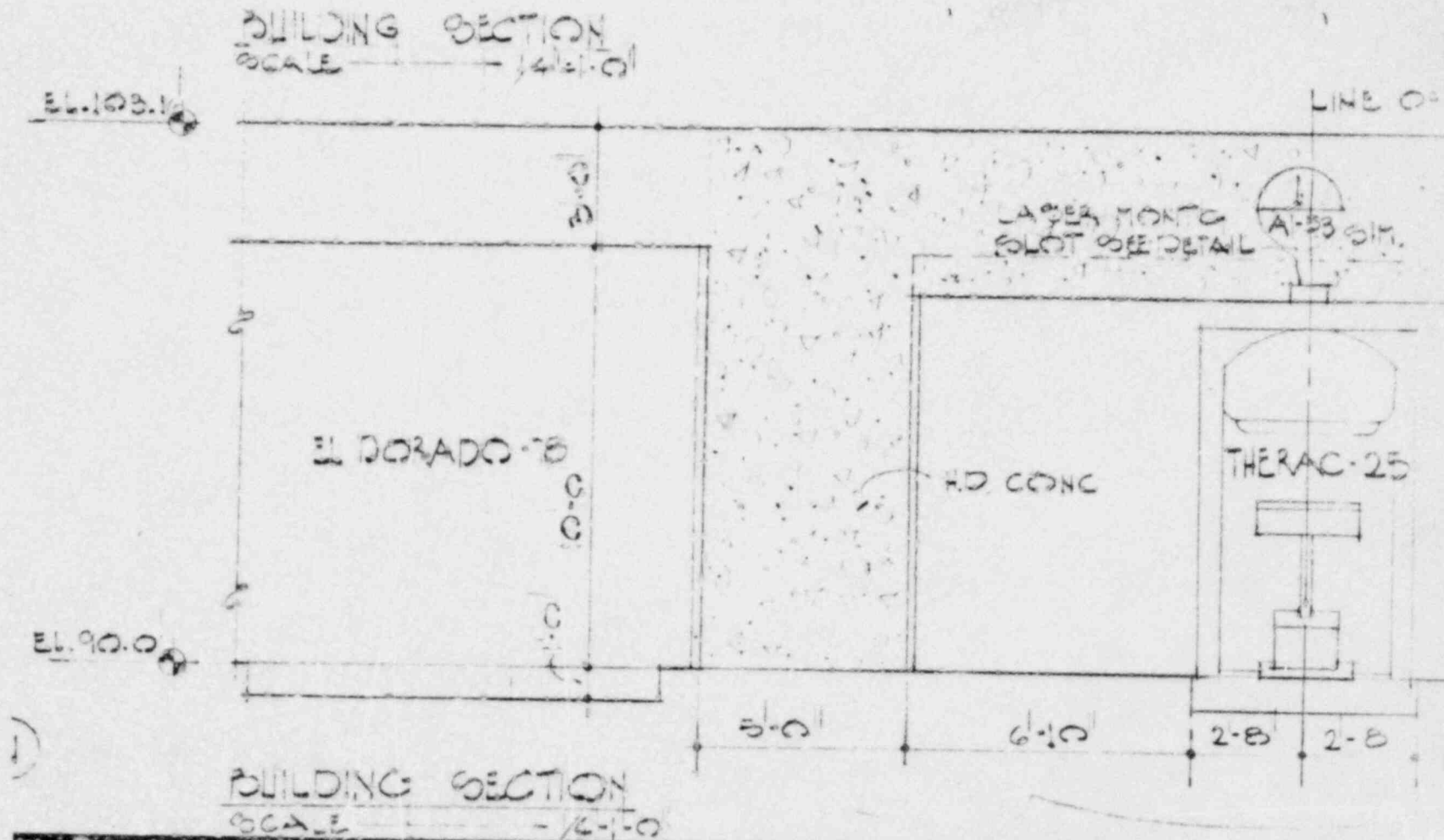


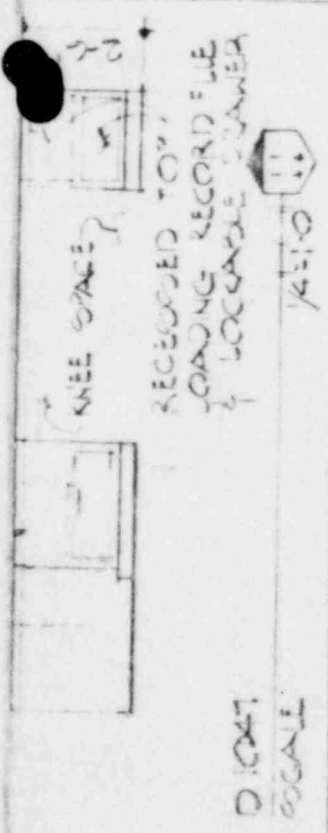
Figure IV  
Medical Center of Delaware, Inc.  
Christiana Hospital



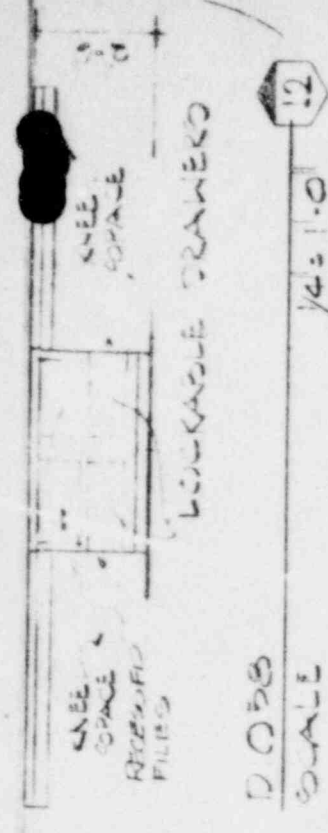
**METCALF AND ASSOCIATES**  
ARCHITECTS/ENGINEERS/PLANNERS

1054 31st STREET N.W.  
WASHINGTON, D.C. 20007

202 / 338 - 0666



DIST  
SCALE



D.O.B.  
SCALE

12

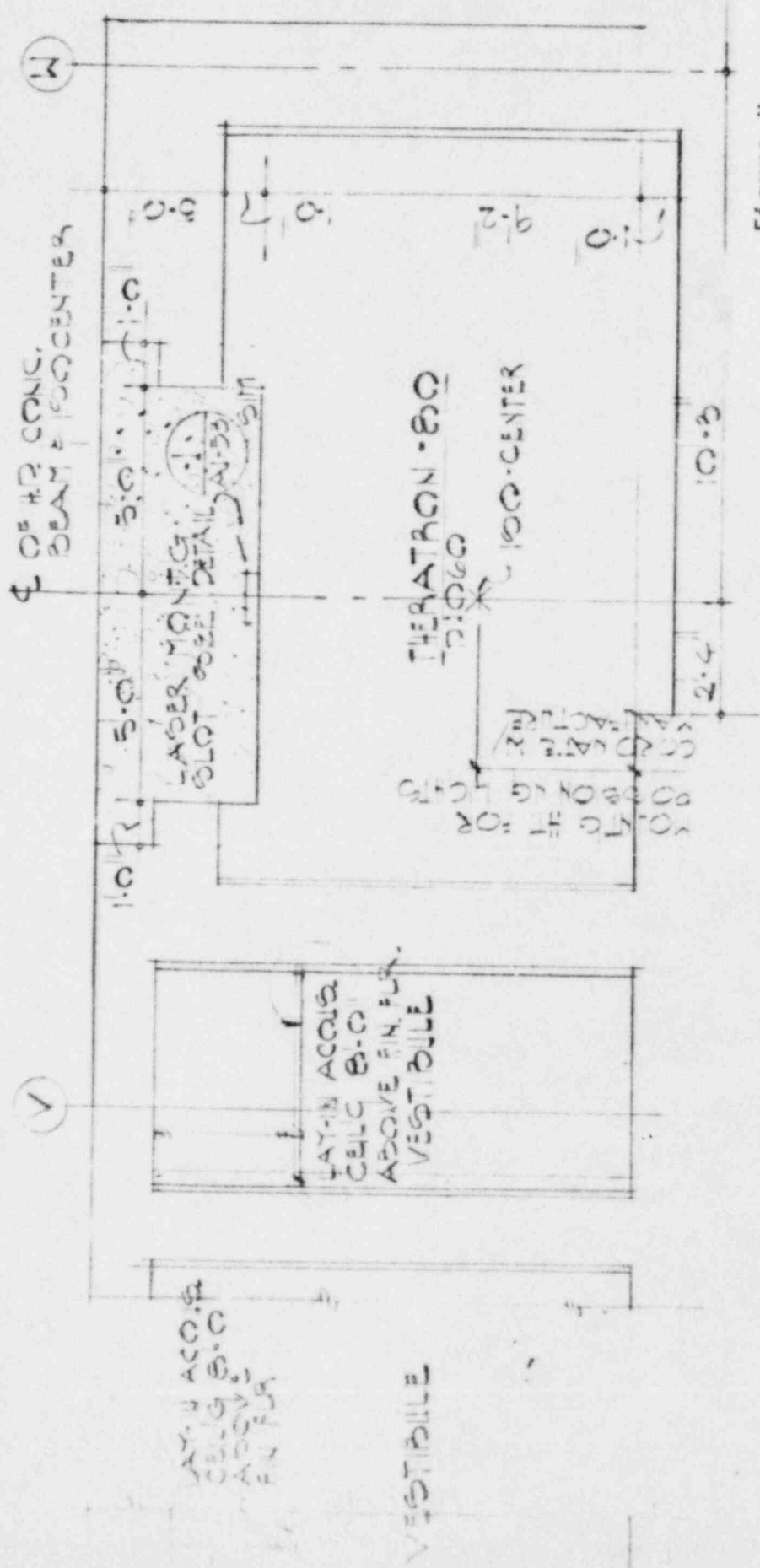
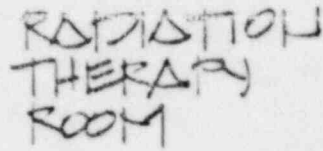


Figure V  
Medical Center of Delaware, Inc.  
Christiana Hospital

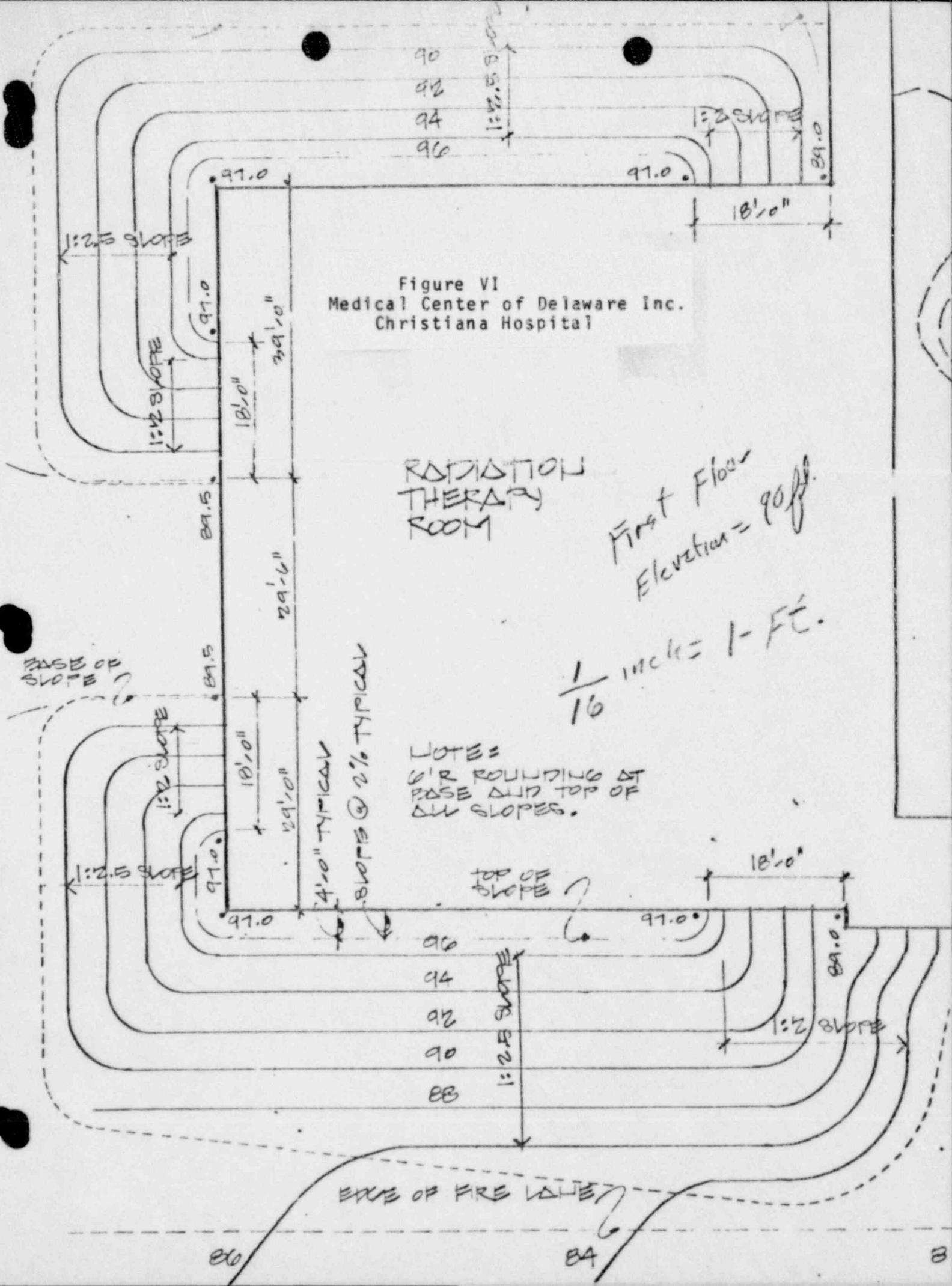
LINE OF 100-CENTER



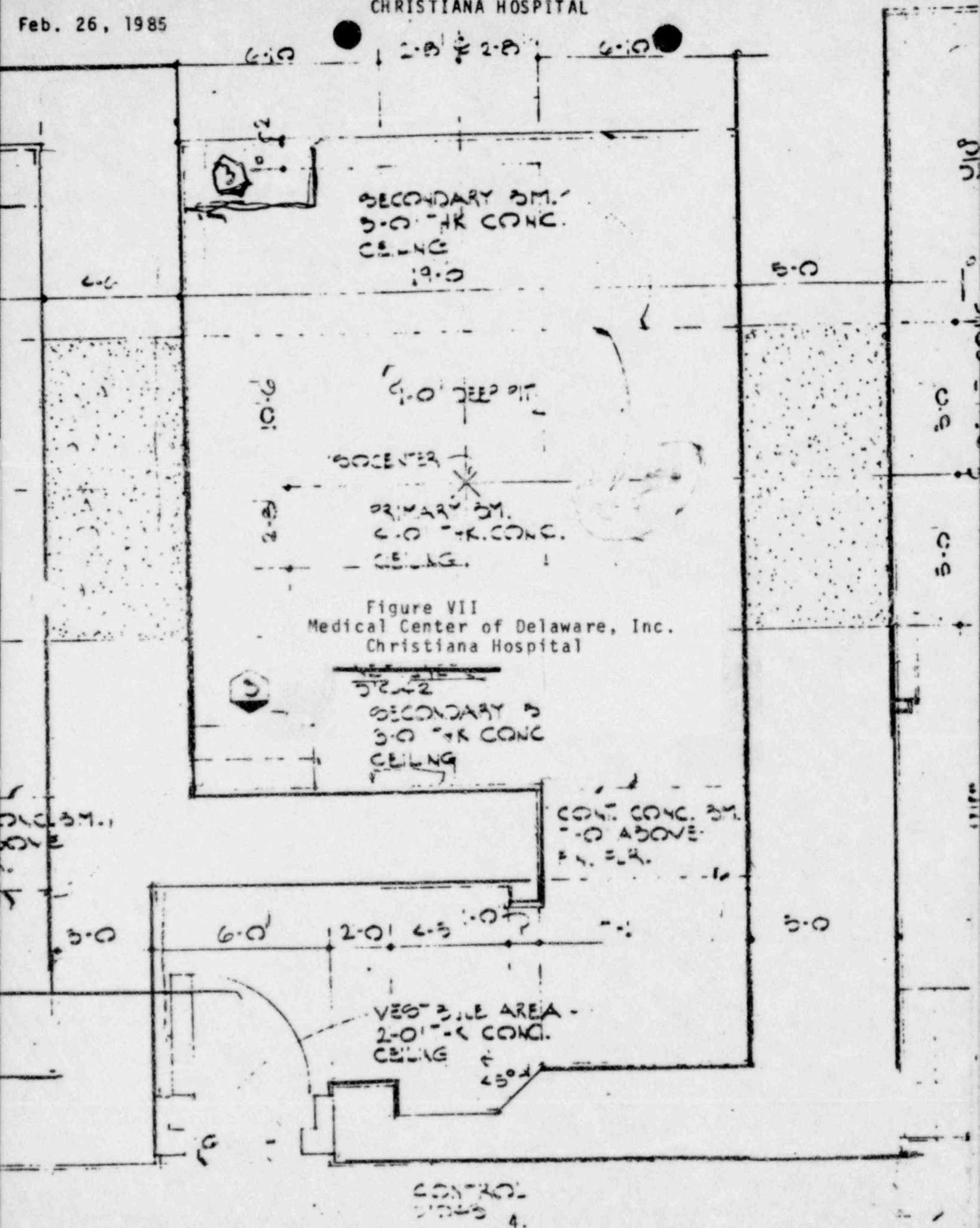
First Floor  
Elevation = 90 ft.

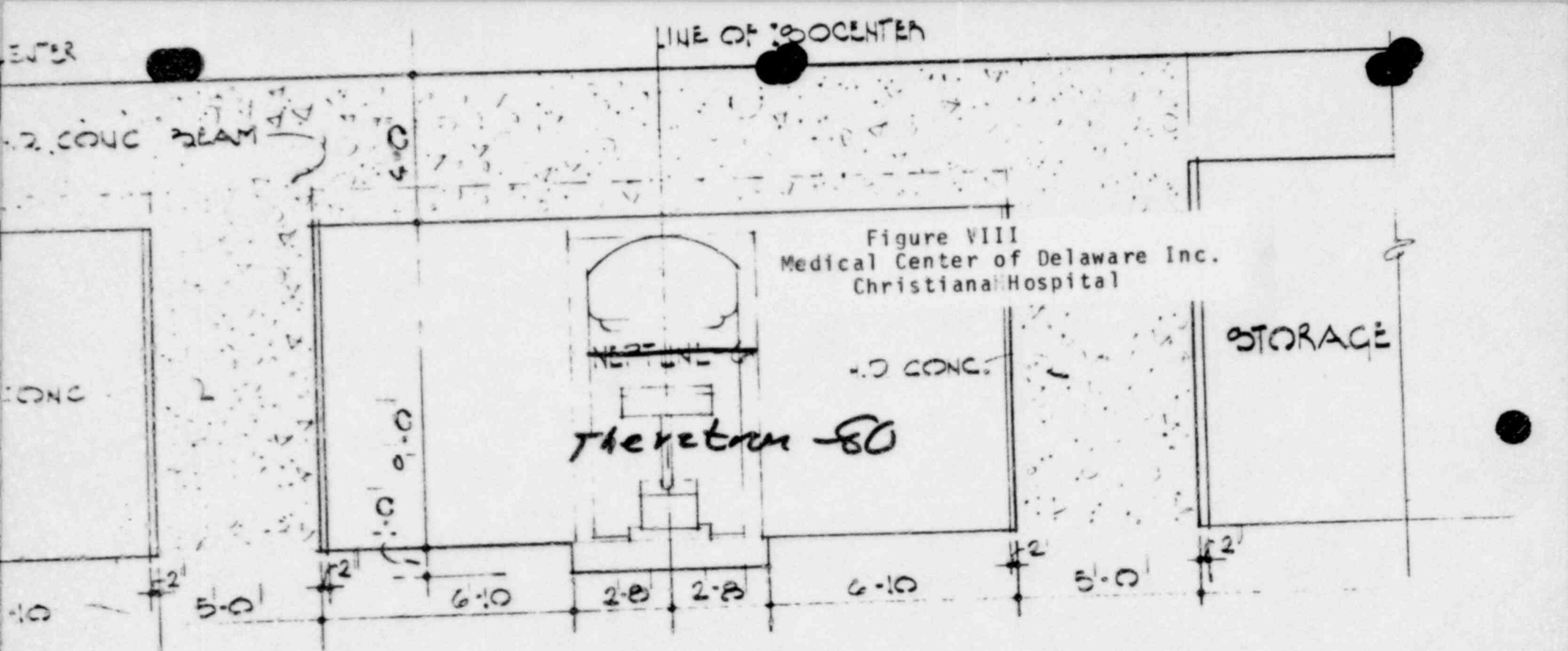
$$\frac{1}{16} \text{ inch} = 1 \text{ ft.}$$

NOTE:  
AIR ROUNDING AT  
BASE AND TOP OF  
ALL SLOPES.









COPY  
STRUCTION

TITLE:

RADIATION THERAPY

**DIVISION**

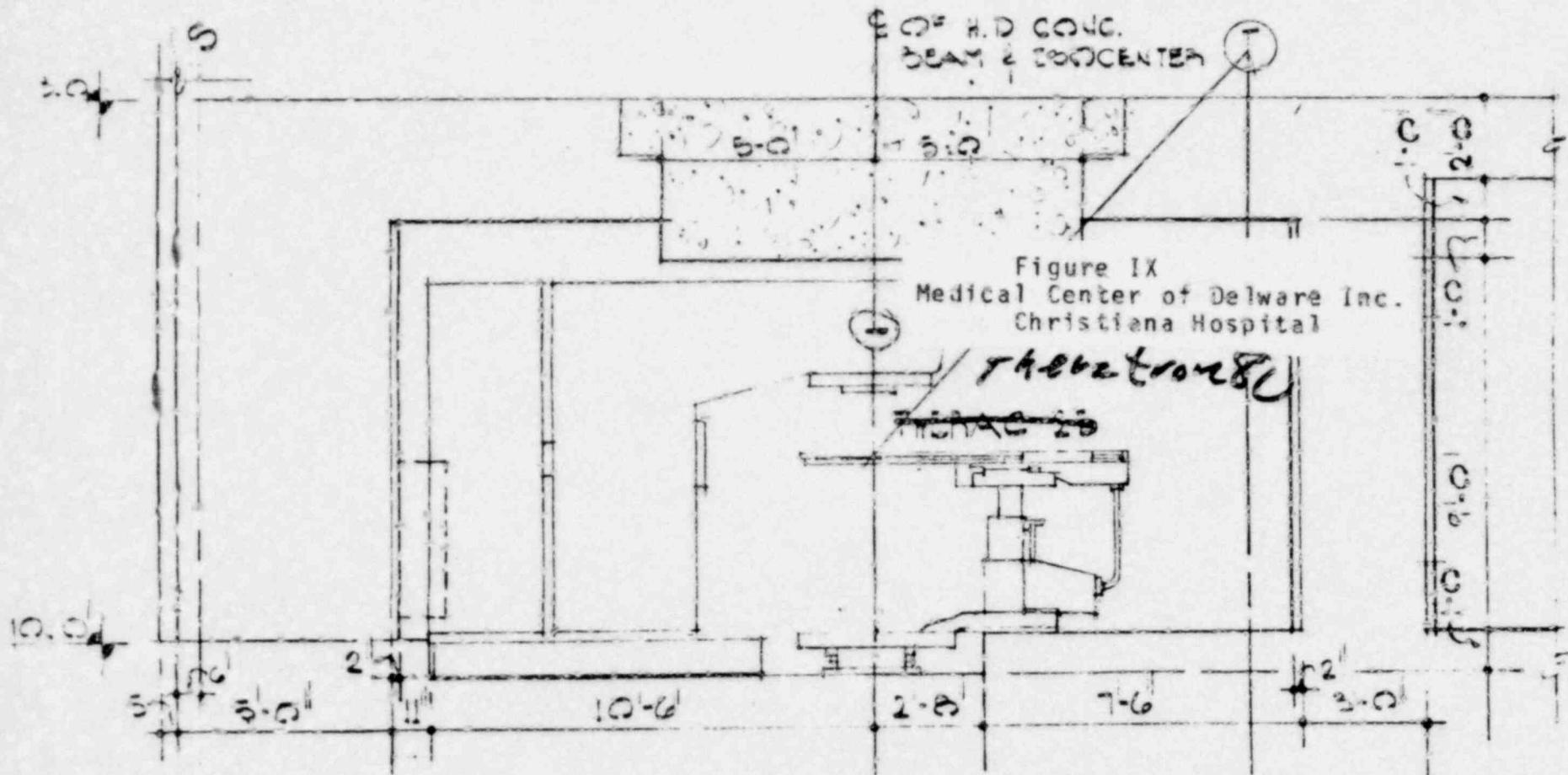
REV	DATE	SHEET NO:	
△	4/2/82	A3.4	
△		DATE:	DRAWN BY: CHK
△		9-1-80	PR. PR
△		SCALE:	NO:
△		AS NOTED	14



PLATE  
SCALE: 1/4"=1'-0"

13

SCALE: 1/4"=1'-0"



Item 15  
Beam Stops

Item 15

Beam Stops

The two AECL Theratron 80 units have a primary beam stopper. Electrical cut-out switches prevent the source from moving into "ON" mode when head is rotated so that primary beam will not be attenuated by the primary beam stopper.

The Eldorado-78 has a mercury cut-out switch which allows the primary beam to be directed no more than 37 degrees from the vertical (zero degrees) position toward the exam room wall and no more than 102 from the vertical toward the outside wall.

Item 16

Shielding Evaluation

- I. Eldorado Room
- II. Theratron 80 Room
- III. Theratron 80 Room

CALCULATED WEEKLY DOSE RATES FOR  
AREAS OUTSIDE ELDORADO ROOM

WALL LOCATION	Wall Thickness Inches	P mRads.	L mRads.	S mRads.	Total MRads	Maximum Permissible Dose Rate mR.
Rear	60" H.D.	-0-	-0-	-0-	-0-	100
Outside	30"+4 ft earth	1.78	0.01	-0-	1.79	10
Exam	42"	10.0	0.04	-0-	10.04	100
Control	30"	-0-	1.64	.01	1.65	100
Outside	24"+4 ft. earth	-0-	0.01	-0-	0.01	10
Entrance door	0.5 inch	-0-	4.4	0.2	4.60	100
Ceiling	36 inch	130.0	1.5	-0-	131.5	**

\*\*Occupancy not permitted on roof when Dept. of Radiation Therapy is treating patients.

H.D. = High Density concrete with density of 207 lbs per cubic foot

Workload =  $7.5 \times 10^{-4}$  rads per week at 1 meter from source

Scatter factor = 0.001

P = Primary

S = Scattered

Leakage factor = 0.001

L = Leakage

Shielding calculation included attenuation by 4 ft. of earth (20 inches concrete)

No occupied area above or below Eldorado Room

CALCULATED MAXIMUM HOURS DOSE RATES FOR  
AREAS OUTSIDE ELDORADO-78 ROOM

WALL LOCATION	Wall Thickness Inches	P mRads/Hr	L mRads/Hr	S mRads/Hr	Total mRads/Hr	Maximum Permissible Dose Rate mR/hr
Rear	60" H.D.	-0-	-0-	-0-	-0-	
Outside	30"+4 ft.	.07	-0-	-0-	0.07	2
Exam	42"	0.4	-0-	-0-	0.4	
Control	30"	-0-	.07	-0-	0.7	
Outside	24"+ 4 ft.	-0-	-0-	-0-	-0-	2
Entrance Door	0.5 inch	-0-	1.34	.02	1.36	
Ceiling	36"	5.20	0.60	-0-	5.8	**

\*\*Occupancy not permitted on roof when Dept. of Radiation Therapy is treating patients.

H.D. = High Density concrete with density of 207 lbs per cubic foot

Workload =  $7.5 \times 10^4$  rads per week at 1-meter from source

Scatter factor = 0.001

P = Primary

S = Scattered

Leakage factor = 0.001

L = Leakage

Shielding calculation included attenuation by 4 ft of earth (20 inches concrete)

No occupied area above or below Eldorado Room



CALCULATED WEEKLY DOSE RATES FOR  
AREAS OUTSIDE THERATRON ROOM

WALL LOCATION	Wall Thickness Inches	P mRads	L mRads	S mRads	Total mRads	T	Maximum Permissible Dose Rate mR/hr
Maxitron	40 HD	1.0	---	---	1.0	1	100
Maxitron	40	0.0	0.1	0.1	0.2	1	100
Rear	30	0.0	0.73	0.04	0.8	1	100
Therac-6	42 HD	0.6	---	---	0.6	1	100
Therac-6	42	---	0.03	0.05	0.08	1	100
Control	36	---	0.3	0.7	1.0	1	100
Entrance (Control wall)	27	---	6	0.3	6.3	1	100
Entrance (Maze wall)	20	---	17	3	20	1	100
Corridor	20	---	10	2	12	1	100
Ceiling	36 HD	3.4	0.1	---	3.5	1	100**
Ceiling	24	---	0.32	0.61	.93	1	100**

\*\*Occupancy not permitted when Therapy units are in use

Workload =  $7.5 \times 10^4$  rads per week at 1-meter from source

Leakage =  $5 \times 10^{-4}$  at 1-meter from source

90 degree scatter =  $1 \times 10^{-3}$  at one meter from scatter

USE FACTORS:

0.25 for walls and ceiling

1.00 for floor

P = Primary

L = Leakage

S = Scattered

No occupied areas above or below Theratron Room

CALCULATED MAXIMUM HO DOSE RATES FOR  
AREAS OUTSIDE THERATRON 80 ROOM

WALL LOCATION	Wall Thickness Inches	P mRads/Hr	L mRads/Hr	S mRads/Hr	Total MRads/Hr	T	Maximum Permissible Dose Rate mR/hr
Maxitron	40 HD	.030	.001	----	.031	1	
Maxitron	40	---	.002	.004	.006	1	
Rear	30	---	.029	.002	.031	1	2
Therac-6	42 HD	.023	-0-	-0-	.023	1	
Therac-6	42	---	.001	.002	.003	1	
Control	36	---	.013	.026	.039	1	
Entrance	27	---	.238	.013	.251	1	
Entrance	20	---	.675	.097	.772	1	
Corridor	20	---	.375	.054	.429	1	
Ceiling	36 HD	.135	.001	.001	.137	1	
Ceiling	24	---	.013	.032	.045	1	

Workload/hr = 3000 Rads/hr

P = Primary  
L = Leakage  
S = Scattered

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8/84

# CALCULATED WEEKLY DOSE RATES FOR AREAS OUTSIDE THERATRON ROOM

WALL LOCATION	Wall Thickness Inches	P mRads	L mRads	S mRads	Total mRads	Maximum Permissible Dose Rate mR
Exam Room	60 H.D.	1	1	1	1	100
Control	36	-0-	1	1	1	100
Entrance Door	0.5 steel 3/8 lead 4" poly	0	1	1	1	100
Therac-25	60 H.D.	1	1	1	1	100
Rear	60	-0-	1	1	1	10
Ceiling	48 H.D.	1	1	1	1	10

H.D. = High Density concrete with density of 207 lbs per cubic foot.

Workload =  $7.5 \times 10^{-4}$  rads per week at 1 meter from source

Scatter factor = 0.001

Leakage factor = 0.001

Shielding calculation included attenuation by 4 ft. of each (20 inches concrete)

P = Primary

L = Leakage

S = Scattered

The listed values should be read as less than 1 mR

8/84

# CALCULATED MONTHLY DOSE RATES FOR AREAS OUTSIDE THERATRON ROOM

WALL LOCATION	Wall Thickness Inches	P mRads	L mRads	S mRads	Total mRads	Maximum Permissible Dose Rate mR
Exam Room	60 H.D.	1	1	1	1	
Control Area	36	-0-	1	1	1	
Entrance Door	0.5 steel 3/8" lead 4" Poly	-0-	1	1	1	
Therac-25	60 H.D.	1	1	1	1	
Rear	60	0	1	1	1	2
Ceiling	48 H.D.	1	1	1	1	

H.D. = High Density concrete with density of 207 lbs per cubic foot.

Workload =  $7.5 \times 10^{-4}$  rads per week at 1 meter from source

Scatter factor = 0.001

Leakage factor = 0.001

Shielding calculation included attenuation by 4 ft. of each (20 inches concrete)

P = Primary

L = Leakage

S = Scattered

The listed values should be read as less than 1 mR

Item 17



## OPERATING AND EMERGENCY PROCEDURES

### I. Operating Procedure for Eldorado

The hospital personnel assigned to the Eldorado-78 performs the following safety checks prior to treating patients:

1. Turn on T.V. cameras, T.V. monitors, intercommunication systems.
2. Turn Eldorado-78 on.
3. Check that the GREEN "BEAM OFF" light on the control console, head, and over the door are functioning.
4. Close treatment room door. Focus T.V. camera so that wall monitor can be viewed on T.V. monitor. Turn source on and verify that wall monitor source "ON" light is lit.
5. Put Eldorado-78 in source "ON" mode; check that RED "BEAM ON" lights on the console, head, and entrance door are functioning. Return Eldorado-78 to "SOURCE OFF" mode.
6. With entrance door open, check that Eldorado-78 cannot be put into "SOURCE ON" mode.
7. Check optical distance indicator using calibration rods supplied by AECL for this unit.
8. Record date and your initials in Daily Check Log.
9. If any of the daily checks fail, notify the Chief Technologist or Physicist prior to treating patient.
10. Procedure for Securing Teletherapy Unit

At lunch time and at end of daily patient treatment the entrance door to the teletherapy unit will be locked, the control panel will be put into locked mode, and keys removed.

## II. Operating Procedure for Theratron-80

The hospital personnel assigned to the Theratron-80 perform the following safety checks prior to treating patients:

1. Turn on T.V. cameras, T.V. monitors, intercommunication systems.
2. Close treatment room door. Focus T.V. camera so that wall monitor can be viewed on T.V. monitor. Turn source on and verify that wall monitor source "ON" light is lit.
3. Turn machine on with key. Check all control console lights.
4. Turn source on, check for all "ON" lights; then turn source to "OFF" and check for all GREEN lights.
5. Check function of door interlock system by opening treatment room door and trying to turn source on.
6. Check on treatment head interlocks by swiveling head 30 degrees, both directions, and attempt to turn source on.
7. Check all controls that regulate treatment table motion. Slide tabletop in and out several times to clear tracks.
8. Check that Field light and counterbalance back indicator lights are properly aligned. Adjust if necessary.
9. If equipment cannot be properly adjusted to operate correctly, notify the Chief Technologist or the Physicist prior to treating patient.
10. Record date and your initials in Daily Check Log.
11. Notify the Chief Technologist if any of the Daily Checks result in a malfunction.
12. Procedure for Securing Teletherapy Unit

At lunch time and at end of daily patient treatment the entrance door to the teletherapy unit will be locked, the control panel will be put into locked mode, and keys removed.

17-b

Copy of Emergency Procedures for  
Theratron 80  
Eldorado-78

# IMPORTANT

AECL MODELS 76, 78, 765, 780, AND 780-CTS  
TELE THERAPY UNITS

## IF THE DRAWER FAILS TO CLOSE, PROCEED AS FOLLOWS:

1. Remove the patient from the treatment room.
  - A. If the patient is ambulatory, instruct him to get off the table and leave the room.
  - B. If the patient is not ambulatory:
    1. Enter the treatment room (avoid exposure to the useful beam)
    2. Disconnect wheel locks on treatment table, and
    3. Push treatment table from the room.
2. Close the door and secure the room against unauthorized entry.
3. Notify the following individuals:

Chief Technician: Elizabeth T. Klein

Physicians: Carlo A. Cuccia, M.D.  
Ekkehard S. Schubert, M.D.  
Donald C. Tilton, D.O.  
Viroon Donavanik, M.D.

Radiation Safety Office: 733-1453

4. All remedial action to be taken will be under the supervision of Radiation Safety Office Personnel.

APPENDIX A

# IMPORTANT

## A.E.C.L. MODELS 6, 8, 60 AND 80 TELETHERAPY UNITS

### IF THE DRAWER FAILS TO CLOSE, PROCEED AS FOLLOWS:

1. Remove the patient from the treatment room.
  - A. If the patient is ambulatory, instruct him to get off the table and leave the room.
  - B. If the patient is not ambulatory:
    1. Enter the treatment room (avoid exposure to the useful beam) and close field collimators to minimum field size.
    2. Rotate the treatment table so that patient is out of the useful treatment beam, and
    3. Transfer the patient to stretcher and remove from the room.
2. Close the door and secure the room against unauthorized entry.
3. Notify the following individuals:

Chief Technician: E. Klein

Physicians: Dr. C. Cuccia  
Dr. E. Schubert  
Dr. D. Tilton  
Dr. V. Donavanik

Radiation Safety Office: 733-1453 or 1458
4. All remedial action to be taken will be under the supervision of Radiation Safety Office Personnel.



Item 18  
INSTRUCTION OF PERSONNEL  
See Appendix H

APPENDIX H  
INSTRUCTION OF PERSONNEL

1. Content of Training Program

The training program for personnel who work with or in the vicinity of the teletherapy unit should be of sufficient scope to ensure that all personnel, including technical, clerical, housekeeping, and security personnel, receive proper instruction in the items specified in § 19.12 of 10 CFR Part 19, including:

- a. Areas where radioactive material is used;
- b. Potential hazards associated with radioactive material;
- c. Radiological safety procedures appropriate to their respective duties;
- d. Pertinent NRC regulations, including those that pertain to employee rights as specified in 10 CFR Part 19;
- e. Pertinent rules and regulations of the licensee;
- f. Pertinent conditions of the license, including specific conditions of operation and the application itself that is incorporated as part of the license;
- g. Their obligation to report unsafe conditions and the individual to whom unsafe conditions should be reported;
- h. Appropriate response to emergencies or unsafe conditions, including practice drills in the emergency procedures;
- i. Their right to be informed of their radiation exposure; and
- j. Locations where the licensee has posted or made available notices, copies of pertinent regulations, and copies of pertinent licenses and license conditions (including applications and applicable correspondence) as required by 10 CFR Part 19.

In addition, each employee will receive that portion of a facility's operating procedures that are specific for that employee's duties and responsibilities.

Item 19

Leak Tests of  
Sealed Sources

Leak Testing:

The internal surfaces of the collimator and cylinder in which the source drawer travels will be wiped at intervals not to exceed six (6) months using cotton swabs mounted on a long rod that can reach all accessible surfaces that have a high probability of being contaminated if integrity of source container has been compromised.

These wipes will be counted in a Single Channel Analyser using a Sodium Iodide radiation detector. The analyser will be energy calibrated using Cs-137 or Co-60. The relationship between counts and activity will be determined using a standardized Cobalt-60 solution with an activity that will range from 0.05 to 0.1 micro-Curie. The results obtained from counting these wipes will be recorded in the log book located at this counting instrument.

The depleted uranium trimmer bars located on the Eldorado-73 and The Theratron-80 and used as head shielding on the Clinac-4 are wipe tested at intervals not to exceed six (6) months. These wipes are counted for alpha activity by:

ICN Pharmaceuticals, Inc.  
Health Physics Services  
2727 Campus Dr., Irvine, CA 92715

LT-1 Leak Test Kit

The Leak Test Reports for the depleted uranium are on file in the Radiation Safety Office located in the Radiation Therapy Department.

The Leak Test procedures are performed by the Clinical Physicist in the Department of Radiation Therapy.

Instrument used for counting swipes:

Mfg: Mech-tronics Nuclear

Bin type unit

Model No.

251	High voltage supply
512	Amplifier with Integral-Differential Discriminator
1000	Pulse Generator
719	Counter with counting time control
X-F808	Well counter with Pre-amp.

Harshaw Chemical Co.

2" diameter x 2" thick Thallium Activated NaI crystal with std. well- coupled to a 2 inch photomultiplier tube

The minimal detectable activity is defined as:

$$M D A = 3 K \sqrt{R_{Bkg}/t}$$

M D A = minimal detectable activity

$R_B$  = Background Counting Rate

T = sample counting time

K = calibration factor in uci/counts

EXAMPLE:

High Voltage: 1300 volts

△ E ( 1-volt) set at 10

E - 3.4

Gain 512 x 2 = 1024

Cobalt-60 std: 1.042 uCi on 11-1-78

Decay corrected for 60 months: 0.536 uCi

Average Background Counting Rate: 386

M D A - 0.002 uCi

Average Counting rate from swipe: 362

Counting Rate for Co-60 Std.: 18,133 cpm

Calibration Factor:  $3 \times 10^{-5}$  uCi/count

Swipe activity does not exceed 0.002 uCi



### Radiation Safety Procedure

The electrical power to the teletherapy unit is turned off. The Clinical Physicist removes cover from the unit, swipes area travelled by source. These swipes are placed in envelopes and taken back to physics lab to be counted. The individual performing swipe wears Film Badge Dosimeter. He checks wall monitor to be sure unit is in "OFF" condition. If swipes are at the Minimal detectable activity they are discarded in non-radioactive trash container; otherwise would retain in radioactive trash container in Radium Storage Room.

The Clinical Physicist has had more than ten (10) years of experience in swiping teletherapy units for removable radio-activity.

BETWEEN: William O. Miller, Chief  
License Fee Management Branch  
Office of Administration

John E. Glenn, Chief  
Nuclear Materials Section B  
Division of Engineering and  
Technical Programs

Name change

LICENSE FEE TRANSMITTAL

A. REGION I

1. APPLICATION ATTACHED

Applicant/Licensee: The Medical Center of Delaware, Inc.

Application Dated: 5/10/85

Control No.: 03807

License No.: 07-12153-03

2. FEE ATTACHED

Amount: \$350.00

Check No.: 00038404

3. COMMENTS

Renewal

Signed Brenda Platchek

Date 5/15/85

02300

B. LICENSE FEE MANAGEMENT BRANCH

1. Fee Category and Amount: 7A \$350 6/85

2. Correct Fee Paid. Application may be processed for:

Amendment                     

Renewal                      ✓

License                     

Signed Frances Brown

Date 5/21/85

408  
5/22/85