

# FGH

Fields, Griffith, Hubbard  
and Associates, Inc.  
1141 Montleider Road  
Glendale, Illinois 60022  
312 835-4433

Certified  
Radiation  
Physicists

Western Regional Office  
2483 Whippoorwill  
Las Vegas, NE 89121  
702 731-6446

SEP 8 1981

## Exhibit 3

Theodore Fields M.S. F.A.C.R. C.H.P.  
Charles R. Griffith M.S. F.A.C.R.  
Lincoln S. Hubbard Ph.D. M.A.C.R. C.H.P.  
Michael V. Broadbent Ph.D. M.A.C.R.  
Francis E. Gannon M.S.

August 22, 1981

U.S. Nuclear Regulatory Commission  
Radioisotopes Licensing Branch  
Division of Materials and Fuel Cycle  
Facilities Licensing  
Washington, D.C. 20555

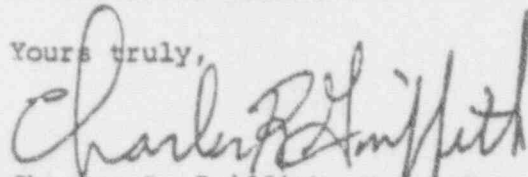
RE: License #13-02047-03

Dear Sir,

On August 14, 1981, a cobalt 60 source was installed in the  
AECL Theratron Jr. Unit at St. Margaret's Hospital, Hammond,  
Indiana.

Enclosed please find copy of the survey report. This  
material is to fulfill the requirements of condition 18  
of the above license.

Yours truly,



Charles R. Griffith, M.S., F.A.C.R.

CG/mg

cc: Regional Directory  
U.S. Nuclear Regulatory Commission  
Regional Office of Inspection  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137

## TELETHERAPY SURVEY REPORT

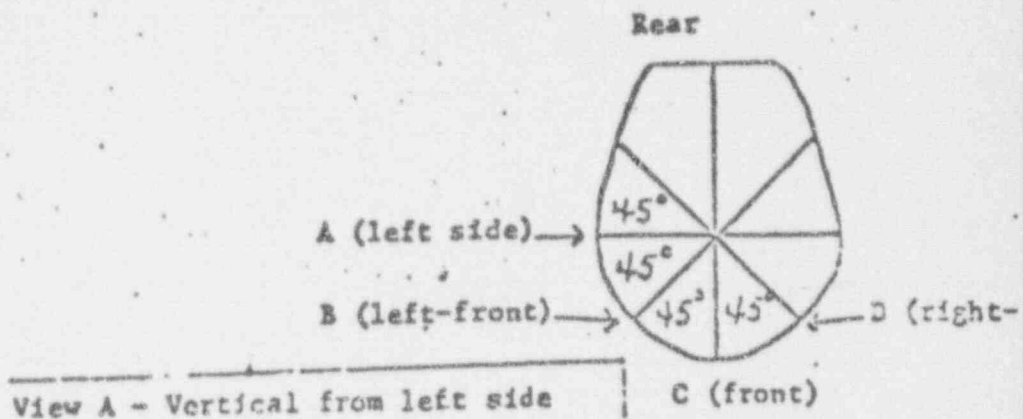
Table I

- 1 Institution: Name St. Margaret's Hospital  
 Address 25 Douglas Avenue  
 City Hammond State Indiana Zip 46320  
 N.R.C. License # 13-02047-03
- 2 Surveyor: Name Charles R. Griffith  
 Address [REDACTED]  
 City [REDACTED] State [REDACTED] Zip [REDACTED]  
 Certification Amer. Board of Radiology
- 3 Teletherapy Unit: Mfr A.E.C.L. Model Theratron Jr Serial 70  
 Teletherapy Source: Mfr Neutron Products Model NPI-20-1900W
- 4 Date of Source Installation 8-13-81
- 5 Date of Survey 8-14-81
- 6 Survey Instruments:
- | Mfr              | Model      | Cal. Date       | Cal Method                                 |
|------------------|------------|-----------------|--|
| <u>Victoreen</u> | <u>440</u> | <u>1-29-81</u>  | <u>Health Physics Int., Northbrook, IL</u> |
| <u>Victoreen</u> | <u>660</u> | <u>10-26-80</u> | <u>Victoreen, BCC, Cleveland</u>           |
- 7 Source Strength: Curies 1650 Date 6-1-81
- 8 Output: R/min 105.4 at 55 cm for 10 X 10 field on 8/14/81
- 9 Leakage Radiation: See Table II  $(105.4)(40)(.55)^2(1.05) = 2010 \text{ R/hr}$
- 10 Beam Orientation Limits & Method of Limitation  
Source head permanently fixed to beam absorber. No head angulation or tilt.
- 11 Maximum Radiation Levels, Adjacent Areas, Rotation With Beam Stop (~~See attached Survey Report~~)  
 (See attached Survey Report)
- 12 Maximum Radiation Levels, Adjacent Areas Without Beam Stop (See Table IIIB) (Not Applicable)
- 13 Check List, Mechanical Functions:  
 a) Door Interlock OK (See attached)  
 b) Source "on-off" indicators; mechanical ---, lights OK (See Attached)

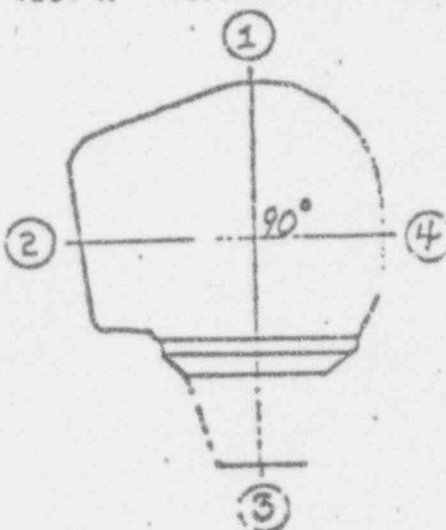
**TELETHERAPY HEAD SURVEY**  
(Source in "OFF" position.  
Measurements taken one meter  
from source)

Top View - Showing orientation  
of Views A through D

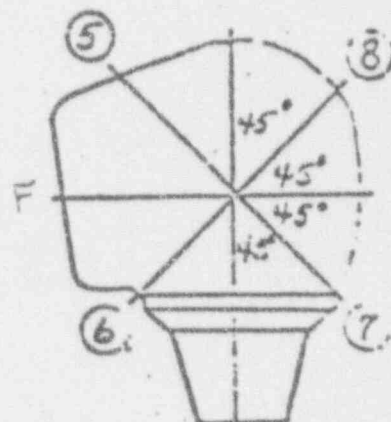
Position No.	Radiation Level (mR/hr)
View A 1	5.0
2	1.9
3	1.5
4	3.4
View B 5	2.0
6	2.0
7	2.7
8	2.2
View C 9	2.4
10	2.2
View D 11	2.4
12	2.4
13	2.0
14	1.9



View A - Vertical from left side



View B - Vertical from left-front



Average value 2.4 (See amendment 5 License 13-02047-03)

View C - Vertical from front

Maximum value 5.0

View D - Vertical from right-front

Instrument used Victoreen 440

Calibrated 1-29-81

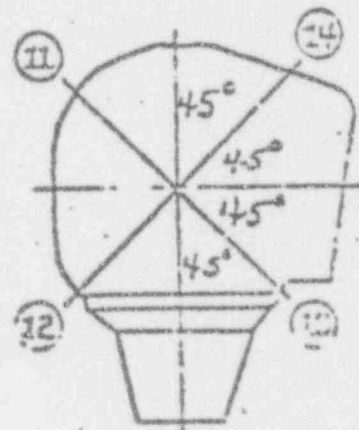
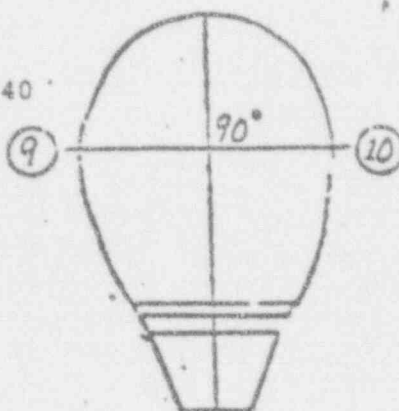
RHM 1890

Curies 1650

Date 6-1-81

Manufacturer's  
name & model #  
of teletherapy  
unit AECL

Theratron Jr.



\* allows an average of 3 mR/hr.

# Certificate of Standardization of X-Ray Machine

FOR  
ST. MARGARET'S HOSPITAL  
25 Douglas, Hammond, Indiana 46320  
BY  
THEODORE FIELDS, M.S., F.A.C.R. (Assoc.)  
CHARLES R. GRIFFITH, M.S., M.A.C.R. (Assoc.)

DIPLOMATES - AMERICAN BOARD OF RADIOLOGY, AMERICAN BOARD OF HEALTH PHYSICS, A.I.A.S.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Technique	Monitor	Peak Kilo-Volts	Primary Volt Meter With Lead	Auto Transformer 1-14-82	HVL IN MM	Milli-Amperes	Distance CM	Added Filter in MM FIELD SIZE	Roentgens Per Minute in Air				
										9-14	10-14	11-14	12-14
				112.4			50	5x5	118.8	117.5	116.2	114.9	113.7
				119.6				8x8	126.4	125.0	123.6	122.3	120.9
				120.7				10x10	227.5	126.1	124.7	123.4	122.0
				124.5				12x12	131.6	130.2	128.7	127.3	125.9
				125.0				14x14	132.1	130.6	129.2	127.8	126.4
				92.9			55	5x5	98.2	97.1	96.1	95.0	94.0
				98.9				8x8	104.5	103.4	102.2	101.1	100.0
				99.8				10x10	105.4	104.2	103.1	101.9	100.9
				103.0				12x12	108.8	107.6	106.4	105.3	104.2
				103.7				15x15	109.6	108.4	107.2	106.0	104.9
				78.1			60	5x5	82.5	81.6	80.7	79.8	78.9
				83.1				8x8	87.8	86.8	85.9	84.9	84.0
				83.9				10x10	88.6	87.6	86.6	85.7	84.8
				85.2				10x12	90.0	89.0	88.0	87.1	86.1
				86.5				12x12	91.4	90.4	89.4	88.4	87.5
				87.2				15x15	92.1	91.1	90.1	89.1	88.1

$(92.1)(60)(38) = 1990 \text{ R/M}$   
 $(109.6)(60)(35) = 1990 \text{ R/M}$

*Charles R. Griffith*

DATE 8-14-81

MACHINE  
MAKE Theratron Jr.  
TYPE AECL

CG/mg

1141 Hohlfelder Road  
Glencoe, Illinois 60022  
Phone: 835-4433 - Area Code 312

# AREA SURVEY

Field Size: 15x15 at 55cm SAD

Water phantom in beam

## Conditions:

1. Beam vertical towards floor
2. Beam 315° - 35° scatter towards east wall 6
3. Beam 270° - horizontal towards east wall 6
4. Beam 230° - 35° scatter towards ceiling
5. Beam 180° - vertical towards ceiling
6. Beam 90° - horizontal towards west wall 5
7. Beam 45° - 35° scatter towards west wall 5

Values shown are maximum for the area and the conditions indicated.

Condition		1	2	3	4	5	6	7
Area (See Drawing)								
Restricted 1 & 3	Control wall	M	M	M	M	M	M	M
Restricted 2	Room door	M	M	M	M	M	M	M
Unrestricted 4	South wall	M	M	M	M	M	M	M
Restricted 5	West wall	M	M	M	M	M	M	M
Unrestricted 6	East wall	M	1	M	M	M	M	M
Unrestricted 7 & 8	North wall	M	M	M	M	M	M	1.5
Unrestricted 9	Ceiling	M	M	M	M	M	M	M

M =  $\leq 0.25$  mR/hr

The radiation levels above meet the requirements specified in Sec. 20.101  
Title 10, Part 20, Code of Federal regulations and, Sec. 20.105(b) of 10 CFR 20.





DOOR SCHEDULE  
 SEE SHEET 10  
 5 REVISIONS / 10/10/10

⑨

NEW 4" FACING TILE WALL

CUT HOLES IN FLOOR

16" DIA. FLOOR TO UNIT

16" DIA. FLOOR TO UNIT

① ② ③

④ ⑤

1/2" UNIT TILE DOOR  
 CERAMIC TILE  
 1/2" DIA. UNIT TILE

1/2" UNIT TILE  
 CERAMIC TILE  
 1/2" DIA. UNIT TILE

SECTION A-A 1/4" = 1'-0"

SEE

APPROVED


10' SCALE  
 1" = 10'

ADDITIONS AND ALTERATIONS

ST. MARGARET HOSPITAL

25 DOUGLAS STREET, HAMMONG, INDIANA



C-7

NORTH

~~CHARGE~~ ROOM #2

250KV THERM

PA55468

三

LOCKED STORAGE AREA

ELEC. ZATTERLOCK  
ON DOOR

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21300-2000-0000

122

122



DOOR 2' x 6' 6"  
 3/4" x 1 1/2"  
 5 PLYS. 1/2" x 5/8" / PRAND

⑨

NEW 4" FACING TILE WALL

CUT HOLES IN FLOOR

2' x 5' FLOOR TO UNIT 10'

1' x 1' x 1' 1/2' UNIT 10'

① ② ③

④ ⑤

15'

1/2" UNIT TILE  
 CERAMIC TILE  
 1/2" x 5" UNIT TILE

FLOOR  
 WALL  
 CEILING

SECTION A-A 1/4" = 1'-0"

2 E.T.

APPROVED


ADDITIONS AND ALTERATIONS  
 ST. MARGARET HOSPITAL  
 25 DOUGLAS STREET, HAMMOND, INDIANA

# FIELDS, GRIFFITH & ASSOC., INC.

CERTIFIED PHYSICISTS  
AMERICAN BOARD OF HEALTH PHYSICS  
AMERICAN BOARD OF RADIOLOGY  
1141 NOHLFELDER ROAD  
GLENCOE, ILLINOIS 60022  
AREA 312 835-4433

## PROTOCOL

### TESTING OF "ON-OFF" INDICATORS OF GAMMA-BEAM TELETHERAPY UNITS

The test shall consist of the following steps:

- i) begin with the power off
- ii) turn on the power and activate unit (but not beam)
- iii) check all indicators on control, above door, on unit and monitor (if a monitor is available).
- iv) if all indicators indicate beam is "off" enter room with radiation detecting device (i.e. survey meter or chirpee). Note: the detecting device is not needed if an independent monitor is installed.
- v) determine whether the radiation levels are consistent with the beam being off.
- vi) exit room, close door
- vii) activate beam
- viii) repeat iii)
- ix) turn beam off
- x) repeat iii)

Units whose behaviour fully comply with the items below are designated "OK"

NCRP Report #33 item 4.2.1(d) 5 "There shall be on the housing and on the control panel a warning device that plainly indicates whether the beam is 'ON' or 'OFF'."

ANSI N449-1974 item 4.1.1 "Electrical and Mechanical Source Condition indicators should accurately reflect the 'on-off' condition or position of the radioactive source."

ANSI N449.1-1978 item 4.2 "Source-condition Indicator (see 4.1.1 in ANSI N449-1974 (1)). The operability of 'on' and 'off' position indicators at the control console and on the machine head and stand shall be confirmed visually. The patient viewing system (closed circuit television or mirror) should be used for treatment room source 'on' condition checks."

# FIELDS, GRIFFITH & ASSOC., INC.

CERTIFIED PHYSICISTS  
AMERICAN BOARD OF HEALTH PHYSICS  
AMERICAN BOARD OF RADIOLOGY  
1141 HOHLFELDER ROAD  
GLENCOE, ILLINOIS 60022  
AREA 312 835-4433

## PROTOCOL

### TESTING DOOR INTERLOCK OF GAMMA BEAM TELETHERAPY UNITS

The test shall consist of the following steps:

- i) turn the teletherapy unit "ON"
- ii) open the door
- iii) ascertain whether the beam is on or off
- iv) close the door
- v) without touching the control panel determine whether the beam is on or off.

Units whose behaviour fully comply with the items below are designated "OK"

NCRP Report #33, item 4.2.4(d)8: "When the door to the treatment room is opened, the beam control mechanism shall automatically and rapidly return to the OFF position where it shall remain until the door is again closed and the machine is manually reactivated from the control panel."

ANSI N449-1974 "4.1.2 Facility Door Interlock. The electrical interlock on the entrance door to the teletherapy room shall cause the radiation beam control mechanism to automatically and rapidly return to the "off" position. The machine control mechanism shall require manual reactivation from the control panel before resuming exposure."

ANSI N449.1-1978 "4.3 Door Interlock (see 4.1.2 in ANSI (1)). The test of the interlock shall be carried out by bringing the source to the "on" position, opening the door to break the interlock, and observing the sequence required to bring the source back to the "on" position. The interlock switch shall be adjusted such that any position other than the fully closed position of the door will break the circuitry and cause the source to return to the safe condition. The machine control mechanism shall require manual reactivation from the control console before resuming exposure."

NRC Teletherapy Licenses, standard clause #17B "Each entrance to the teletherapy room shall be equipped with an electrical interlock system that will turn the teletherapy machine's primary beam of radiation off immediately upon opening of any entrance door. The interlock system shall be connected in such a manner that the teletherapy machine's primary beam of radiation cannot be turned on until all treatment room entrance doors are closed and the beam "on-off" control is reset at the control panel."



# FIELDS, GRIFFITH & ASSOC., INC.

CERTIFIED PHYSICISTS  
 AMERICAN BOARD OF HEALTH PHYSICS  
 AMERICAN BOARD OF RADIOLOGY  
 1141 HOHLFELDER ROAD  
 GLENCOE, ILLINOIS 60022  
 AREA 312 835-4455

## PROTOCOL FOR CHECKING TREATMENT TIMER AND TIMER CORRECTION FACTOR

### METHOD USED



4.14.1 *Time Correction Term, Alpha ( $\alpha$ )*. The dosimeter with equilibrium cap is placed at the center of the field and the source turned "on" for a single irradiation ( $R_1$ ). The dosimeter is zeroed and left at the same location for multiple irradiations before being read out ( $R_2$ ). The total set times for single long and multiple short exposures need not be the same, but equality helps minimize errors due to instrument nonlinearity and operator error in setting times. The mathematical relationship used to calculate  $\alpha$ , the time correction term, is:

$$\frac{R_1}{t_1 + \alpha} = \frac{R_2}{t_2 + n\alpha} \quad (\text{Eq 1})$$

$$\alpha = \frac{t_1 R_2 - t_2 R_1}{n R_1 - R_2} \quad (\text{Eq 2})$$

When  $t_1 = t_2$ ,

$$\alpha = \frac{106.4 - 105.6}{2 \cdot 105.6 - 106.4} = .007 \quad \alpha = \frac{t(R_2 - R_1)}{n R_1 - R_2} \quad (\text{Eq 3})$$

where

$\alpha$  = effective time difference due to source "on-off" and timer "on-off" mechanisms

$R_1$  = average of dosimeter readings for set time  $t_1$

$R_2$  = average of dosimeter readings for set time  $t_2$  ( $n$  cumulative irradiations)

$t_1$  = time for single long irradiation

$t_2$  = time for cumulative irradiation

$n$  = number of irradiations during cumulative irradiation

The true time for the single long irradiation is  $(t_1 + \alpha)$ , where the time error may be positive or negative. If  $\alpha$  is positive, the net irradiation time is longer than the timer setting; and vice versa. The time-corrected radiation intensity would be  $R_1 / (t_1 + \alpha)$ .