

PUBLIC

030-17782

Material Licensing Branch
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir,

The following teletherapy survey report is provided in accordance with conditions 18 and 19 of NRC license No. 24-19486-01. The contents of this report follow the format given in Appendix F of the Guide for the preparation of Applications for Licenses for Medical Teletherapy Programs, FC 414-4, dated December 1985.

Sincerely yours,



Debrah Bauer R.T.T.
Chief Therapist

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PDR ADOCK 03017782 PDR
C

Pm: 8-12-96

RECEIVED

AUG 13 1996

REGION III

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Peter J. Debus, M.S., CRP (ABR)
12349 Reeds Street
Overland Park, Kansas 66209

Work: (816) 363-2158
Home: (913) 663-3598

August 6, 1996

Richard A. Morrison, M.D.
The Radiarium
17525 Medical Center Parkway
Independence, Missouri 64057

Dear Dr. Morrison:

The following teletherapy survey report is provided in accordance with conditions 18 and 19 of your NRC License No. 24-19486-01. The contents of this report follow the format given in Appendix F of the Guide for the Preparation of Applications for Licenses for Medical Teletherapy Programs, FC 414-4, dated December 1985.

Please send a copy of this report as soon as possible to:

Material Licensing Branch
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

And to:

Material Licensing Section
U.S. Nuclear Regulatory Commission
Region III
801 Warrenville Road
Lisle, Illinois 60532-4351

1. Name, address and license number of person/organization possessing the teletherapy source:

Richard A. Morrison, M.D.
Director, The Radiarium
17525 Medical Center Parkway
Independence, Missouri 64057
NRC License No. 24-19486-01

2. Person conducting the survey:

Peter J. Debus, M.S., certified in Radiological Physics (ABR), December 1978
12349 Reeds Street
Overland Park, Kansas 66209

3. Installation of the new source and 5 year inspection.
4. Source change was completed on Friday, July 12, 1996. The five year inspection was completed on Saturday, July 13, 1996.
5. The internal survey and check of interlocks were completed on July 13th. The calibration was performed on July 13th and 14th. The external survey was done on July 14th.
6. Item 10, the determination of the primary beam of radiation in roentgens per hour at a meter (RHM), was measured with a farmer-type ionization chamber and electrometer.

a. PTW Ion Chamber Model N23333 (0.6 cc), Serial No. 059 with acrylic buildup cap, connected to a Keithley Electrometer Model 602, Serial No. 61942A and a Data Precision Multimeter 248, Serial No. 15683.

b. This system was calibrated on March 29, 1996.

c. Calibration of this system was performed by:

The Accredited Dosimetry Calibration Laboratory
University of Wisconsin - Madison
1530 Medical Sciences Center
1300 University Ave.
Madison, Wisconsin 53706

The system was calibrated for Cobalt-60. Refer to ADCL Report No. ION3442 and Report No. EM2489, which are on file at the Radiarium.

Item 11, survey about the source head, and Item 15, survey in adjacent areas for rotational units, were measured with a geiger-muller tube survey meter on the 0 - 0.2 mR/hour scale and on the 0 - 2.0 mR/hour scale.

a. Ludlum Model 14C Survey Meter Serial No. 68169 with SW GM Probe Serial No. 060007.

b. Calibrated on December 21, 1995.

- c. Calibration performed by Emory Larimore, Kansas License No. 33-B429-01 (Mid-America Calibrations - Radiation Consultants of Mid-America, Inc.).

At the time of the survey, the check source reading was 2.0 mR/hour, which agrees with the recorded check source reading at the time of calibration.

7. The teletherapy unit which was surveyed is an Atomic Energy of Canada Limited (AECL) Theratron 780 Cobalt-60 Teletherapy Unit, Serial No.296.
8. The replacement teletherapy source is Neutron Products, Inc. NPI-20-6000W Cobalt-60 Source, Serial No. T-1372.
9. This source contained 5,280 curies of Cobalt-60 as of July 12, 1996.
10. With the collimator set for a 20.0 cm by 20.0 cm field size at isocenter (80.0 cm), the exposure rate was measured at a source to center of chamber distance of 100.0 cm. The measured exposure rate under the above conditions was 98.366 R/minute on July 14, 1996. This may be expressed as 5.902 RHM. The full calibration measurements, required by 10CFR Part 35, were performed during the period of July 13 - 26, 1996. A copy of this calibration report should be retained on file and not included with this survey report.
11. The attached Figure F-1, TELE[✓]THERAPY HEAD SURVEY, described the locations of the 14 points and the radiation levels measured at each of the 14 points. The maximum radiation level was 1.1 mR/hour and the average value was 0.50 mR/hour. This meets the requirements of condition 18.A(i) of your license.
12. As long as the beam is directed toward the integral beam absorber, there is no limitation on beam size or gantry rotation angle. There are mercury activated switches which limit off-beam absorber radiation to 2 - 3 degrees from vertical down toward the West wall and 60 - 61 degrees from vertical down toward the East wall. Angle orientation of the gantry is as follows: 0 degrees is vertical toward the floor; 90 degrees is horizontal toward the East wall; 180 degrees is vertical toward the ceiling; and 270 degrees is horizontal toward the West wall.
13. For measurements of radiation levels in adjacent areas, the following set-up was used:
 - a. An acrylic water tank, with outside dimensions of 40 cm length by 32 cm width was filled with water to a depth of 35 cm.
 - b. The source to phantom distance was 65 cm, except for the off-shield set-up, which was 235 cm.

- c. The field size was set at 35 cm by 35 cm, which is defined at isocenter (80.0 cm).
14. Three drawings are attached. It should be noted that the South wall of the teletherapy room is completely below ground level, and that a major portion of the East wall is also below ground level.
15. The survey results for this rotational unit are presented in a table, which is attached.
16. Not applicable to rotational unit.
17. No radiation levels exceed 2 milliroentgens per hour.
18. Test of Safety Systems:
 - a. The electrical interlock on the teletherapy treatment room door was checked in the following manner. With the door closed, and the teletherapy unit "ON", the door was opened. The unit immediately terminated the exposure. The door was then closed, but the unit did NOT come "ON", until after the MODE button on the control console had been depressed, the RESET button had been depressed, and finally the timer TR button depressed. The interruption of the exposure on opening the door was observed (verified) by the Primalert on the wall, which is visible from the open door. An attempt was made to initiate a treatment with the door open, but the control console would NOT RESET, and no exposure could be made with the door open.
 - b. The Primalert battery pack was disconnected from its power supply, and (a) above was repeated to see whether the Primalert would flash on battery power only. It was flashing, when the door was opened, but stopped after approximately two seconds, indicating that the source had returned to the "OFF" position.
 - c. The teletherapy source "ON-OFF" indicators on the head of the unit included two lights and the position of the rod which moved out of the head as the source drawer moved into the "ON" position. One of the closed circuit TV cameras was positioned so as to observe these indicators from a monitor at the control console. In addition to the normal electrical "ON-OFF" on the console and over the door, there is also a transit dosimetry system which registers on the control console. This was used as the independent radiation detection instrument. The "ON-OFF" indicators on the head, over the door, and on the control console did in fact

correspond to the actual condition of the source as determined by the transit dosimeter.

- d. With regard to the electrical and/or mechanical stops installed for the purpose of limiting use of the primary beam of radiation, the limits were described in Item 12 of this survey report. With the hand control in the treatment room, I rotated the head OFF SHIELD until the mercury limit switch activated a white light on the head. I checked the angle of the head and the projection of the light field. I would then attempt to turn the unit "ON" at the control console. However, the OFF SHIELD light would be "ON" and the RESET button would not clear, and the source would not come "ON". Various combinations of gantry angle and head angle were tried. Whenever the primary beam was "OFF SHIELD", the source could come "ON" only when the beam was directed from 2 - 3 degrees from vertical down toward the West wall through vertical down to 60 - 61 degrees from vertical down toward the East wall.
 - e. The teletherapy treatment timing device was checked with a stop watch. Its accuracy was satisfactory. The shutter error was approximately 0.01 minute, which means that a 2.00 minute setting on the timer will give 1.99 minutes of actual beam "ON" time. I was able to verify that the source returns to the "OFF" position at the end of the preset time, and that the source does not return to the "ON" position once the preset time has been reached until the timer has been zeroed and reset. The PTW chamber and Keithley dosimetry system were used for this test. The timer accuracy and shutter error were checked for a range of clinically useful times: 0.15 minute to 5.00 minutes.
19. The old teletherapy source, Neutron Products, Inc. NPI-20-6000W, Serial No. T-1111, containing 2640 curies of Cobalt-60 as of 07/01/96, was removed on July 12, 1996 and transferred to:

Neutron Products, Inc.
22301 Mt. Ephraim Road
Dickerson, Maryland 20842
License No. MD-31-025-03.

A copy of the TELETHERAPY SOURCE TRANSFER Form is enclosed.

This concludes my survey report. Thank you for the opportunity to provide this service.

Sincerely yours,

Peter J. Debus
Peter J. Debus

Enclosures

Richard A. Morrison, M.D.
Survey Report - August 6, 1996

Figure F-1
TELETHERAPY HEAD SURVEY
AECL Theratron 780, Ser. No. 296

(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 <u>0.50</u>
	2 <u>0.60</u>
	3 <u>0.75</u>
	4 <u>1.10</u>

View B	5 <u>0.35</u>
	6 <u>0.80</u>
	7 <u>0.15</u>
	8 <u>0.10</u>

View C	9 <u>0.45</u>
	10 <u>0.50</u>

View D	11 <u>0.10</u>
	12 <u>0.15</u>
	13 <u>0.75</u>
	14 <u>0.65</u>

Average value 0.50 mR/hr.

Maximum value 1.10 mR/hr.

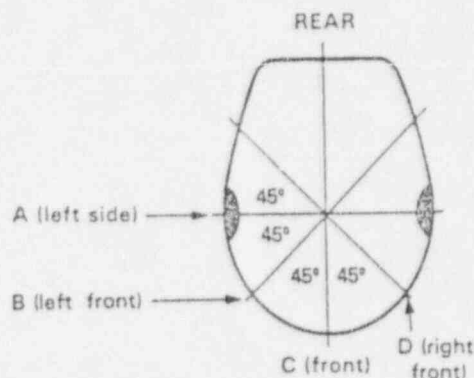
Date of survey July 13, 1996
Instrument used Ludlum Model 14C
G.M. Survey Meter #68169

Manufacturer's Neuron Products, Inc.
name & model number NPI-20-6000W
of teletherapy source Ser. No. T-1372

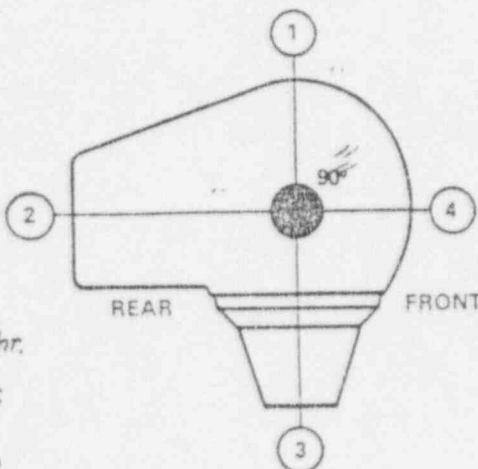
Date of installation July 12, 1996

OUTPUT 5,902 ☒ RHM
☐ RMM

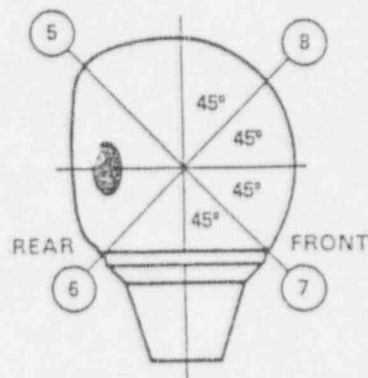
Date of output
measurement July 14, 1996



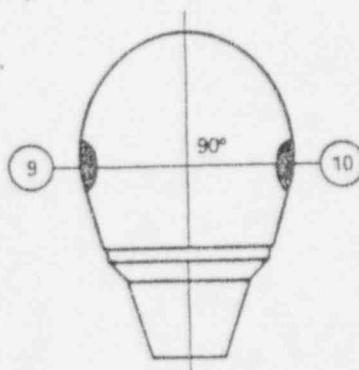
View A-Vertical
from left side



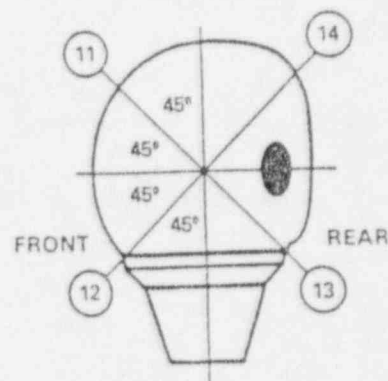
View B-Vertical
from left front



View C-Vertical
from front



View D-Vertical
from right front



Survey performed by: Peter J. Debus

The Radiarium, Independence, MO

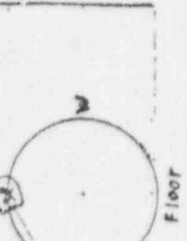
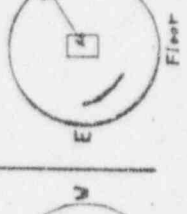
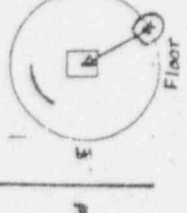
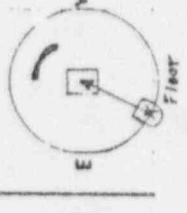
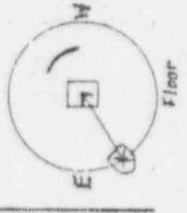
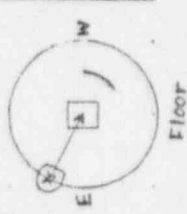
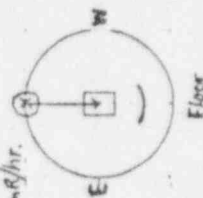
Radiation Survey Report - August 6, 1996

Performed by: Peter J. Debus on 14 July 1996

Direction of Co-60 Beam (Water Phantom in Beam)

Location of Measurement	GA = 0°	GA = 300°	GA = 240°	GA = 210°	GA = 150°	GA = 060°	GA = 0°, OFF-SHIELD Head 60° toward East Wall 235cm to Surface of Water Phantom
All measurements are in milliroentgens/hour							
E-1 (East Wall) (North Half)	0.07-0.10	0.10	0.10	0.15	0.2	0.2	0.15
E-2	0.10	0.10	0.10	0.20	1.2	1.6	0.55
S-1	0.10	0.08	0.08	0.10	0.15	0.15	0.10
W-1	0.07	0.08	0.10	0.15	0.07	0.07	0.07
W-2	0.17	1.5	0.90	0.4	0.2	0.2	0.2
W-3	0.14	0.6	0.35	0.25	0.15	0.1	0.1
W-4	0.14	0.1	0.1	0.1	0.1	0.1	0.07
N-1 (Control Console)	0.4	0.5	0.45	0.55	0.3	0.35	0.55
Door	0.2-0.75	0.2-0.5	0.2-0.6	0.2-0.45	0.25-0.7	0.35-1.2	1.0-1.8
N-2	0.07-0.5	0.07-0.3	0.07-0.3	0.07-0.35	0.8	1.1	0.7
Roof (Max. Reading)	0.10	0.10	0.10	0.45	0.4	0.15	0.15

Background: 0.02-0.04 mR/hr.



ANNEXES C+E ITEMS NOS. 8+12

EXTERIOR

THE

RADIARIUM

NORTH ↑

ON-2

EXTERIOR

CONTROL

5/8" gypsum board

W-5

Door 5mm LEAD

5/8" gypsum board

N-1

21'-5"

SUPERFICIAL X-RAY
W-4

5/8" gypsum board

9'-9"

W-3

W-2

W-1

2'-2" CONC.

1'-6"

11'-3"

1'-10" CONC.

TREATMENT ROOM

10'-0" 2'-3" CONC. ceiling

1'-8" CONC. ceiling

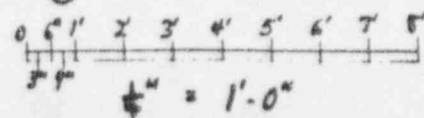
5/8" gypsum board

1'-6" CONC.

EXTERIOR

S-1

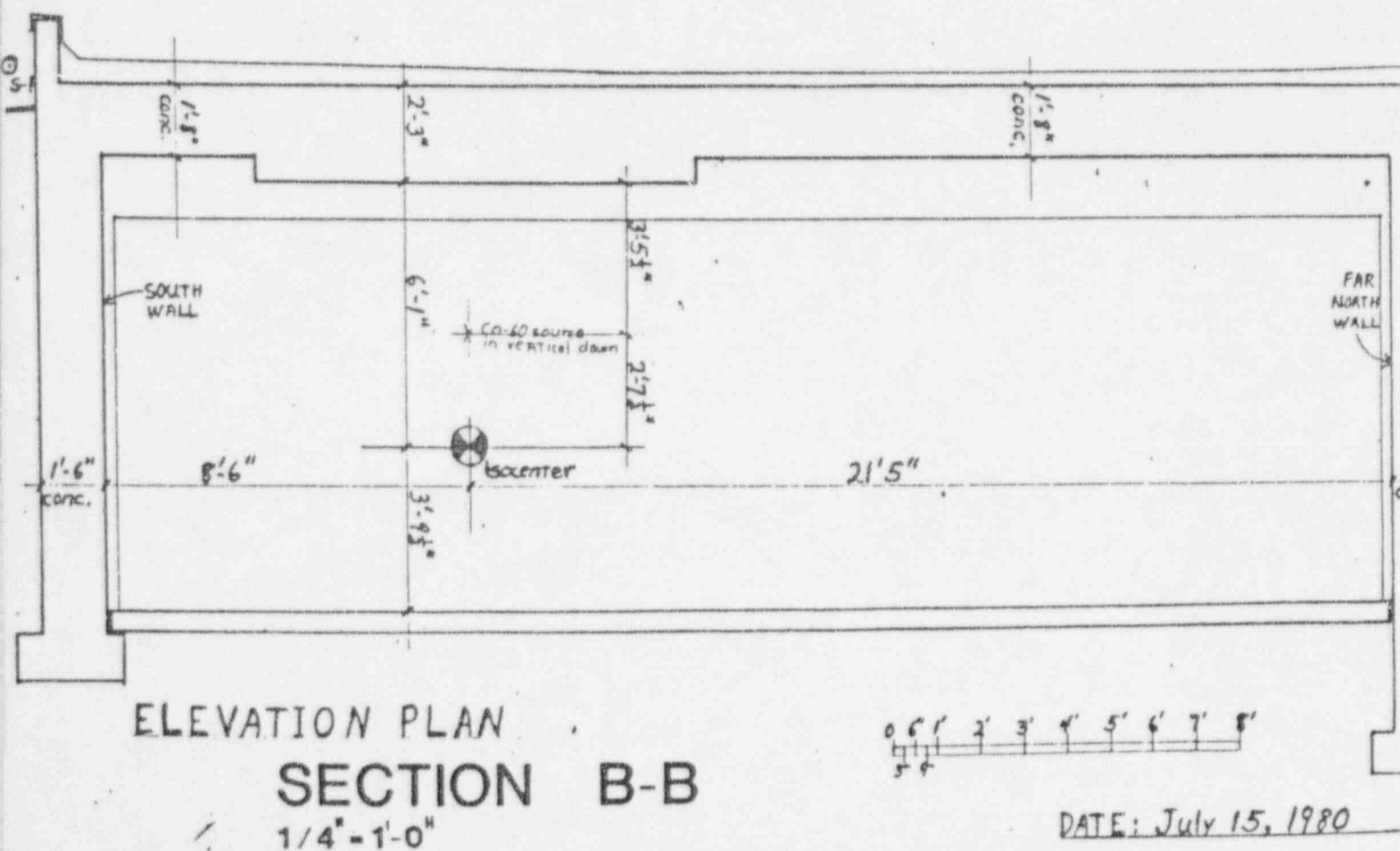
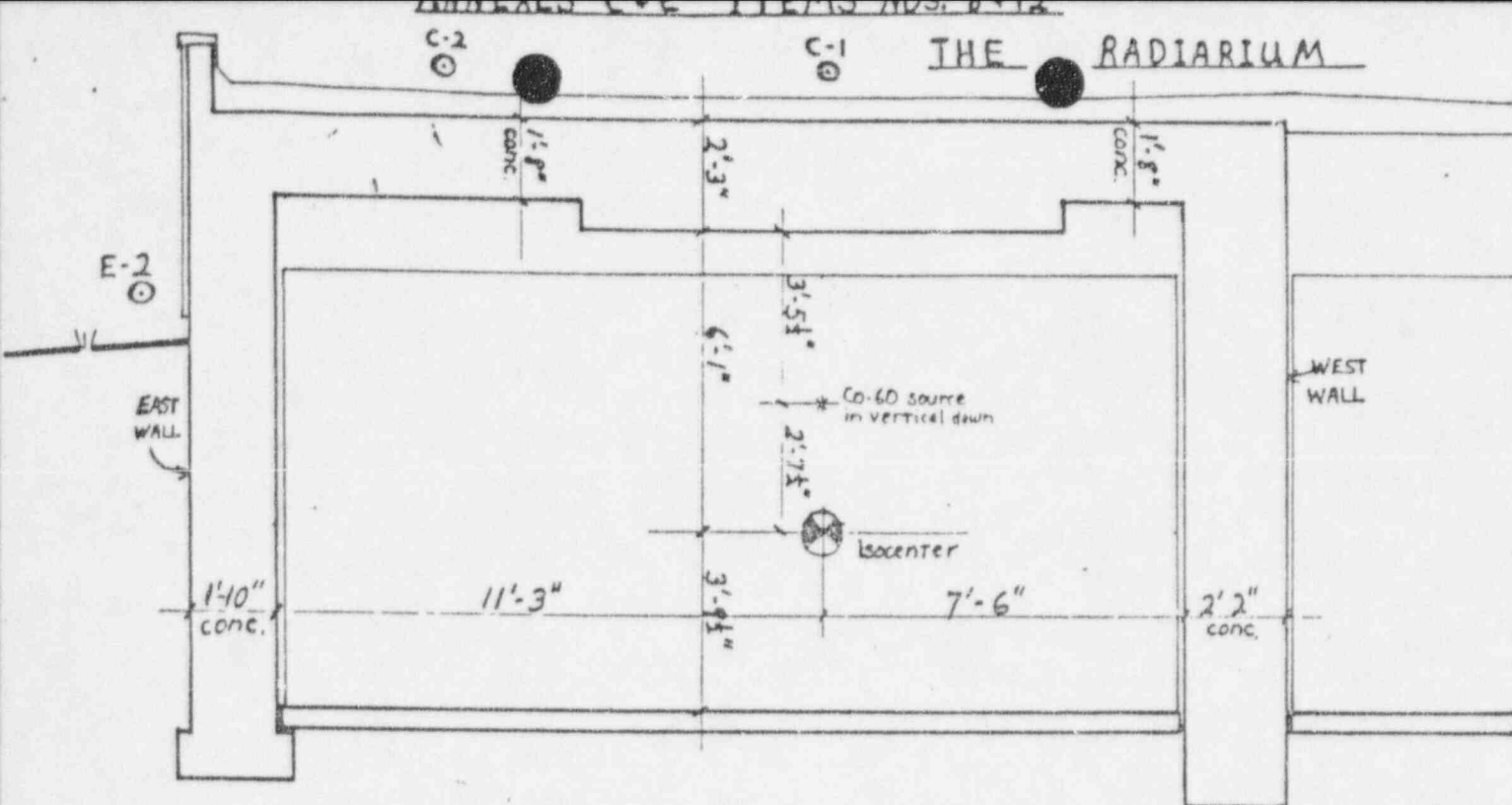
FLOOR PLAN

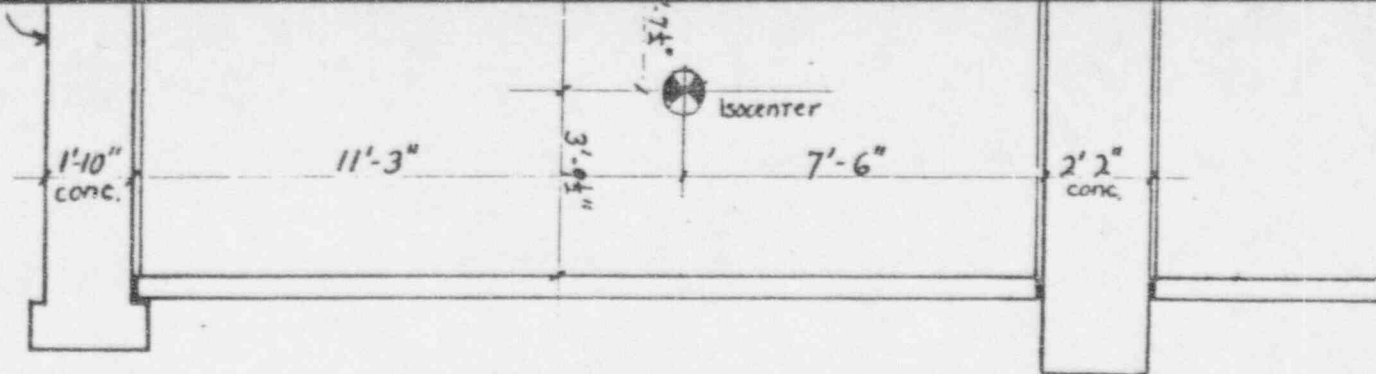


DATE: July 15, 1980

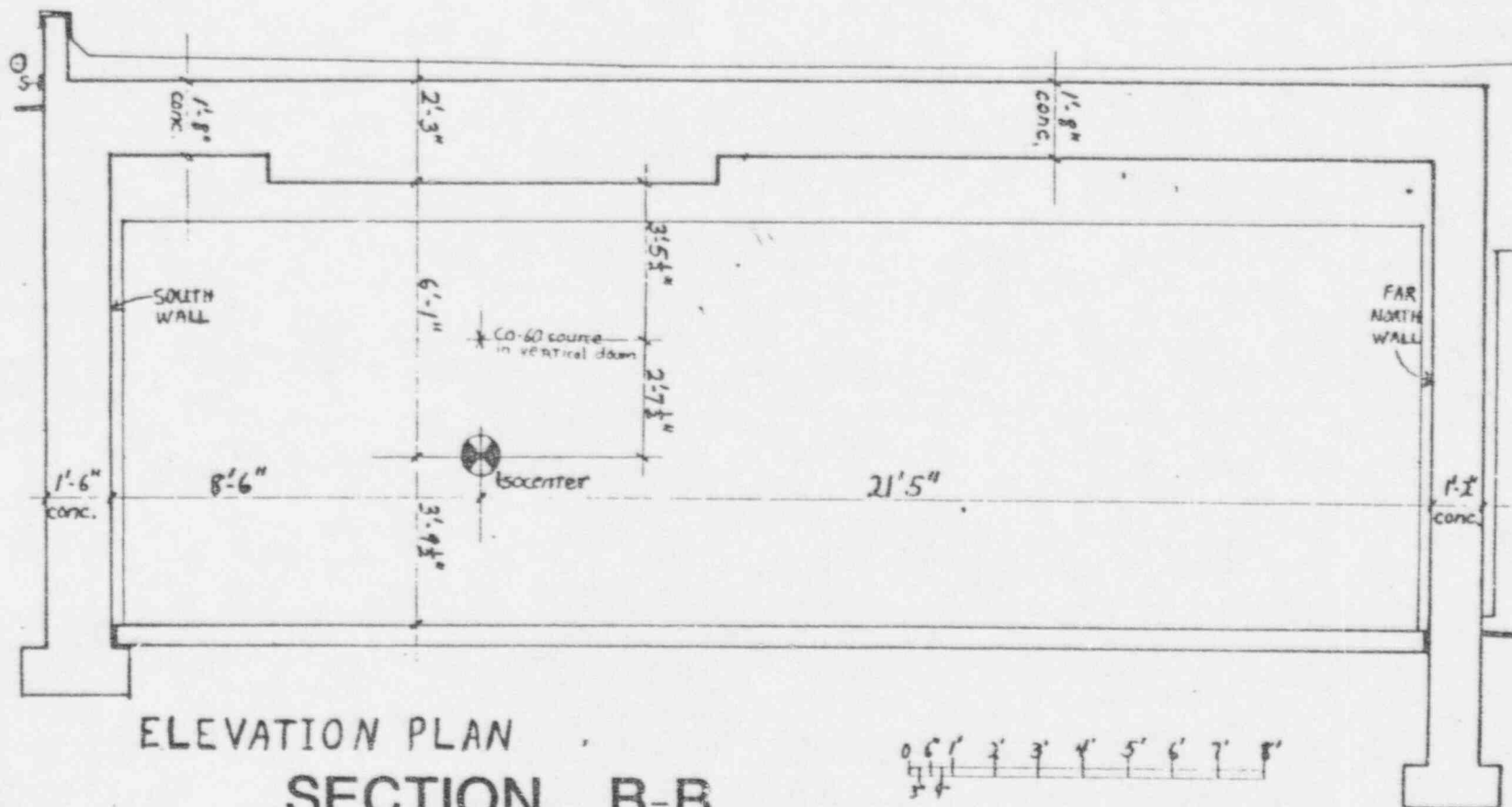
EXTERIOR

See Elev. Sx. AA





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



ELEVATION PLAN
SECTION B-B

TELETHERAPY SOURCE TRANSFER

This is to certify that a cobalt-60 source:

Model Number: NPI-20-6000W
Serial Number: T-1372
Containing 5280 curies as of July 12, 1996

and which has been determined by helium pressure test and by wipe test to be leak free, has been installed in a teletherapy unit described as follows:

Manufacturer: Atomic Energy of Canada, Ltd. (AECL)
Model Number: Theratron 780
Serial Number: 296

This source is hereby transferred from Neutron Products' Radioactive Materials License MD-31-025-03 to The Radiarium Corporation's Radioactive Materials License 24-19486-01.

This will also certify that a cobalt-60 source, described as follows:

Model Number: NPI-20-6000W
Serial Number: T-1111
Containing 2640 curies as of July 1, 1996

has been determined by a wipe test to be leak free and has been removed from the above teletherapy unit and transferred from The Radiarium Corporation's Radioactive Materials License 24-19486-01 to Neutron Products' License MD-31-025-03.

We have witnessed the inspection and operation of the above teletherapy unit after completion of the installation by Neutron Products, Inc. and have found the unit to be operating properly and safely.

Debra Bauer RHA

Date

7/12/96

Robert J. Johnson
Neutron Products, Inc.

Date

July 12, 1996

NEUTRON PRODUCTS inc