RADIATION SURVEY REPORT
BML No. 53-00458-05
Tripler Army Medical Center, Hawaii 96859

1. Administrative Data.

a. Name, address, and license number of the person or organization possessing the teletherapy unit and source:

Commander
Tripler Army Medical Center
Tripler AMC, Hawaii 96859
License No. 53-00458-05

b. Names and addresses of persons conducting survey:

(1) MAJ William A. Wright
Chief, Radiation Protection Office
Tripler AMC, Hawaii 96859

(2) SP6 Stephen W. Holmes
NCOIC, Radiation Protection Office
Tripler AMC, Hawaii 96859

(3) SP5 Stephen A. Cima
Radiation Protection Office
Tripler AMC, Hawaii 96859

c. Reason for survey. Installation of new Cobalt-60 Source on 30 November 1982.

d. Dates that survey was conducted and date of completion. Survey was conducted on 1-2 December 1982, and was completed on 29 December 1982.

e. Radiation detection instrumentation used for the survey:

(1) One each; Eberline Model RO-5B, Ionization Chamber Survey Instrument, SN333, calibrated on 27 October 1982, by Eberline Instrument Company, using a Cesium-137 Source, whose calibration is traceable to NBS.

(2) Two each; Ludlum Model 14C Geiger Meuller Survey Instruments, SN's 10054 and 22876, calibrated on 28 November 1982 and 29 September 1982, by the United States Navy Radiac Repair Facility, Pearl Harbor Naval Shipyard, Hawaii, using a Cesium-137 Source whose calibration is traceable to NBS.

2. Cobalt-60 Teletherapy Unit and Source Information.

a. Name, Model No., and Serial No. of teletherapy unit: Atomic Energy of Canada Limited (AECL), Theratron-80, Serial No. 336.

TNCL 14

b. Name, Model No., and Serial No. of teletherapy source: AECL, Type C151, Serial No. S-3416.

c. Activity of source when fabricated and when installed:

(1) Fabrication activity on 8 September 1982, 6000 Ci.

(2) Activity when installed on 30 November 1982, 5805 Ci.

d. Intensity of primary beam of radiation and timer error.

(1) Beam intensity as determined by a suitably qualified expert on 1 December 1982, 173.1 Rad/min (muscle) at 80 Cm, trimmer at 45 Cm, beam size - 10 Cm x 10 Cm, output measured in air.

(2) Timer error (on/off), -0.015 minute.

3. Teletherapy Head Survey.

A survey of the teletherapy source housing with the teletherapy source in the "off" position, showed that the maximum radiation level at one meter from the teletherapy source was 7.2 mR/hr. The average of fourteen measurements was 1.9 mR/hr. Survey results are detailed in ANNEX A.

4. Beam Orientation Interlocks.

a. Electrical stops:

(1) In the fixed mode, the "beam-on" condition can be achieved at any gantry angle so long as the beam is directed toward the beam stop.

(2) In any of the other three operational modes (rotation, arc, or skip), a "beam-on" condition can be achieved at any gantry angle so long as the beam is directed toward the beam stop.

(3) In the fixed operational mode only, the "beam-on" condition can be achieved regardless of the relationship between the head and beam stop only if the beam is directed below the horizontal.

(4) Procedure for checking electrical interlocks (1) and (2) above.

(a) The patient couch was retracted out of the beam area.

(b) The beam collimators were opened fully and the beam defining light illuminated. The gantry and head were positioned at 0^{o}. It was observed that the illuminated beam size at the beam stop was 57.2 x 58.2 Cm.

(c) The teletherapy head was rotated clockwise (CW) until the edge of the light field reached the edge of the beam absorber, with the entire field remaining on the absorber. The angular displacement of the teletherapy head was

noted to be 4°. The same procedure was used when rotating the head in a counter clockwise (CCW) direction and the angular displacement was noted to be 4° also.

(d) The unit was operated at gantry positions of 0°, 90°, 180°, and 270° and the "beam-on" condition was allowed for head rotations of 4° CW and 4° CCW.

(e) The unit was operated at gantry positions of 0°, 90°, 180°, and 270° and the "beam-on" condition was not allowed for head rotations of 5° CW or 5° CWW.

(5) Procedures for checking electrical interlock 3 above.

(a) The patient couch was retracted out of the beam area.

(b) The beam collimators were opened fully and the beam defining light was illuminated. The gantry was placed at 0° and the head rotated clockwise as shown in ANNEX B, Drawing No. 1. A "beam-on" condition was allowed until the head had rotated to 79° (11° below horizontal) at which time the "beam-on" condition was terminated.

(c) The teletherapy unit operational mode, collimator settings, beam defining light and gantry position were the same as (5b) above and as shown in ANNEX B, Drawing No. 2. The head was rotated CCW and a "beam-on" condition was allowed until the head had rotated to 77° (13° below horizontal) at which time the "beam-on" condition was terminated.

(d) The teletherapy unit operational mode, collimator settings and beam defining light were the same as (5b) above. The gantry was rotated CW to 315°. The head was rotated CCW and a "beam-on" condition was allowed until the head rotated to 79° (11° below horizontal) at which time the "beam-on" condition was terminated. The head was then rotated CW and a "beam-on" condition was allowed until the head rotated to 76° (14° below horizontal) at which time the "beam-on" condition was terminated. The unit configuration is shown in ANNEX B, Drawing No. 3.

(e) The teletherapy unit operational mode, collimator settings and beam defining light were the same as (5b) above. The gantry was rotated to 45° CCW. The head was rotated CCW and a "beam-on" condition was allowed until the head rotated to 79° (11° below horizontal) at which time the "beam-on condition was terminated. The head was then rotated CW and a "beam-on" condition was allowed until the head rotated to 80° (10° below horizontal) at which time the "beam-on" condition was terminated. The unit configuration is shown in ANNEX B, Drawing No. 4.

b. Mechanical stops.

(1) The head can be rotated to 182° CW and 167° CCW, at which point the electric drive motors disengage.

(2) Design of the unit precludes the head from angling forward or backward along the axis of rotation.

5. Tests of Safety Systems Operation.

a. Teletherapy room door electrical interlock.

(1) With power on to the console, closed the door to treatment room and manually initiated "beam-on" and "beam-off" to verify that teletherapy unit was operational.

(2) Opened the door to treatment room. Verified that the source would not move to expose position.

(3) Closed the door. Initiated "beam-on." Opened the door and verified that exposure automatically terminated.

(4) Closed the door. Verified that the source would not return to exposed position without depressing "reset" and starting the timer manually.

b. Teletherapy source "on"/"off" indicators.

(1) With power to the control console and the source in the safe position, visually verified the following:

(a) "Beam-off" is illuminated at the control console.

(b) "Shutter closed" is illuminated at the treatment room door.

(c) Green indicator light on gantry is illuminated.

(d) The beam condition indicating rod was not visible on the front of the teletherapy head.

(2) With power to the console and the source in the expose position, visually verified the following:

(a) "Beam-on" is illuminated at the control console.

(b) "Shutter open" is illuminated at the treatment room door.

(c) Red indicator light on gantry is illuminated.

(d) The beam condition indicating rod was visibly protruding from the front of the teletherapy head.

(3) During the test, visually verified that the conflicting indicators were not concurrently visible, except during the time interval of source movement while the indicators change.

6. Radiation Exposure Levels in Adjacent Areas.

a. A survey of all areas adjacent to the teletherapy exposure room was performed with the source in the "off" position. Then the adjacent areas were surveyed with the beam in the "on" position for five various beam configurations. For these measurements, an Alderson RANDO phantom was positioned in the primary beam, the beam collimators were wide open, and the trimmers were all the way up in the 45 Cm position.

b. The exposure geometry used in the "beam-on" conditions represent the most adverse clincially realizable and are shown in ANNEX C.

c. Run No. 6 is an exposure configuration which, according to records, has only been used once in the last five years of operation and is used for patients being treated for lymphoma or leukemia. It involves placing the patient in a reclining or supine position on a stretcher against the wall at floor level and then rotating the gantry and head to a position that gives maximum SSD. The collimators are opened fully and the collimator assembly rotated 90° to give a diamond beam pattern at the patient location. This exposure geometry is used to administer whole body radiation exposure to the patient.

d. Exposure measurements were taken at approximately 24 inches (60cm) from wall surfaces and 39 inches (1 meter) from the floor. The data collected is presented in ANNEX C and the therapy facility floor and roof plans and exposure measurement locations are shown in ANNEX's D and E respectively.

e. The highest exposure measurements were obtained during Run No. 6 at a position outside the east wall of the teletherapy exposure room at a distance of approximately five feet from ground level and extending approximately two feet to either side of that point. The exposure measurements were 10.5 mR/hr at a distance of two feet and 0.3 mR/hr at a distance of five meters from the wall. All other exposure rate measurements are well below the limits specified in paragraphs 20.105(b)(I) and (2) of Title 10 CFR.

f. The area immediately outside the east wall of the teletherapy exposure room is a unoccupied area and will remain so for the foreseeable future. If a beam configuration as described in paragraph 6c above is required a "Radiation Area" as described in paragraph 20.202(b2) will identified, roped off and properly posted to preclude personnel exposure during the therapy treatment.

7. The AECL Teletherapy Source (SN S-2660)was removed from the Theratron 80 teletherapy unit, reloaded into the shipping container and returned to AECL. A copy of the source disposal certificate is shown as ANNEX F.

8. The five year inspection and servicing was performed on the Theratron 80 teletherapy unit after installation of the new source and a copy of the inspection certificate is shown as ANNEX G.

William A. Wright

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MAJ, MSC
Radiation Protection Officer

ANNEX A

TELETHERAPY HEAD SURVEY

(Source in "OFF" position. Measurements taken one meter from source)

	Position No.	Radiation Level (mr/hr)
View A	1	2.0
	2	1.1
	3	3.5
	4	7.2
View B	5	1.2
	6	1.8
	7	0.7
	8	0.4
View C	9	2.0
	10	1.9
View D	11	0.4
	12	0.5
	13	2.1
	14	1.4

Average value 1.87 ≅ 1.9

Maximum value 7.2

Date of survey 1 Dec 82

Instrument used PO-2 SN 333

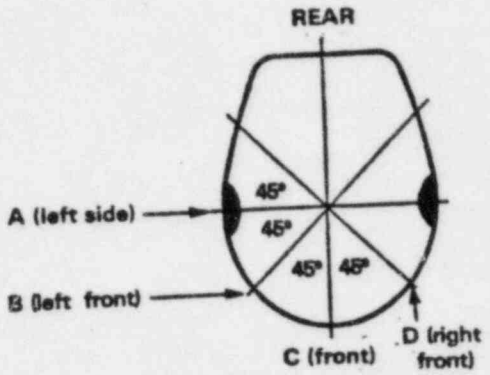
Manufacturer's name & model number of teletherapy source Model # AECL Type C151 SNS-3416

Date of installation 30 Nov 82

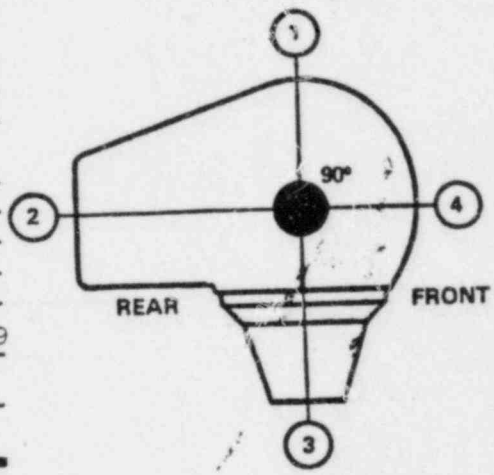
OUTPUT 173.1 R/min at 80 Cm

Date of output measurement 1 Dec 82

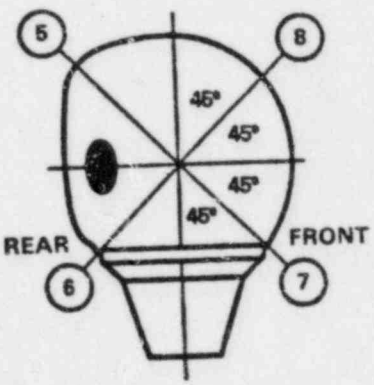
Top View-Showing orientation of Views A through D



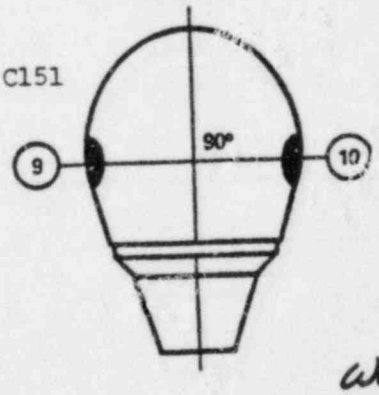
View A-Vertical from left side



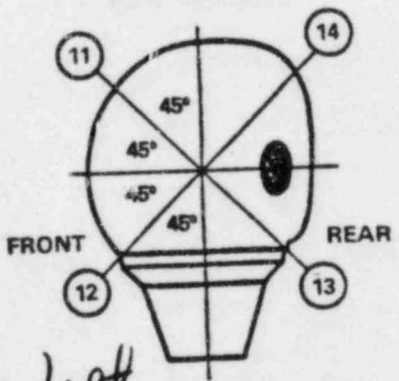
View B-Vertical from left front



View C-Vertical from front



View D-Vertical from right front



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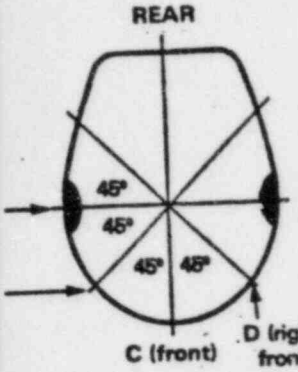
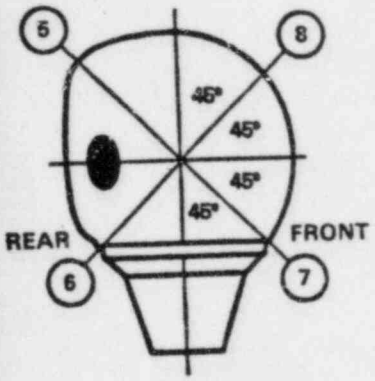
ANNEX B

	COMPUTED BY:	DATE:	FILE NO.
Therapy	CHECKED BY:	DATE:	SHEET NO.

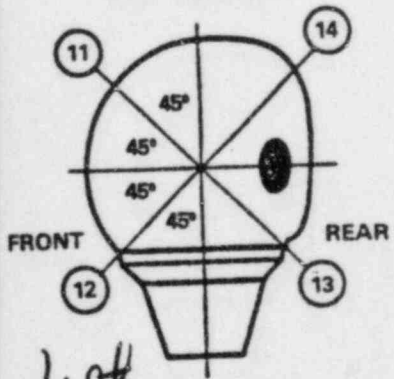
Top View-Showing orientation of Views A through D



View B-Vertical from left front



View D-Vertical from right front



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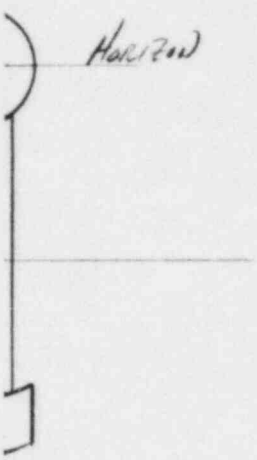

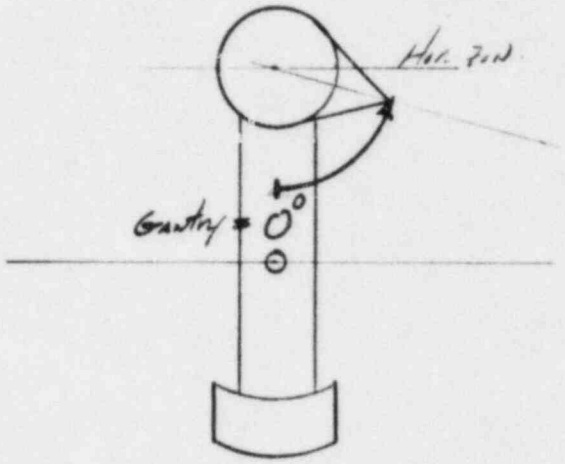

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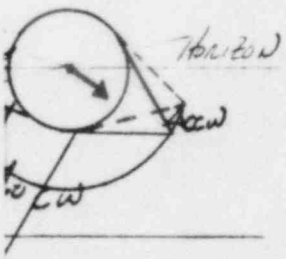

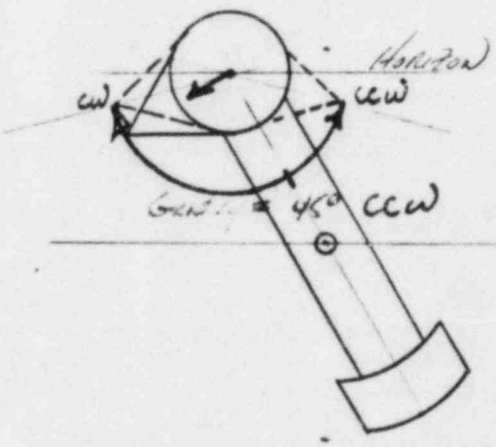

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ANNEX C

Exposure Levels in Areas Adjacent to the Teletherapy Facility

A. EXPOSURE GEOMETRY

Run #	Beam	Gantry ∠	Head Rotation	Beam Direction	Beam-Stop for Beams?	Aperture for Beams?	SSD
1	off	0°	0°	Floor	Yes	Yes	N/A
2	ON	300°CW	0°	Toward wall	Yes	Yes	80cm
3	ON	210°CW	0°	Toward Ceiling	Yes	Yes	80cm
4	ON	150°CW	0°	Toward ceiling	Yes	Yes	80CM
5	ON	60°CW	0°	Toward outside wall	Yes	Yes	80cm
6	ON	16°CCW	44.5°CW	Toward outside wall (East)	No	Yes	284.5cm

B. EXPOSURE MEASUREMENTS (mR/hr.)

Run #	Position Numbers																		
	1	2	3	4	5	6	7	8	9	10	11	(12)	(13)	(14)	(15)	(16)	(17)	(18)	*
1	0.01	0.01	0.015	0.01	0.01	0.015	0.015	0.01	0.01	0.01	0.01	0.015	0.01	0.015	0.01	0.01	0.015	0.015	N/A
2	0.10	0.04	0.20	0.025	0.040	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	N/A
3	0.02	0.02	0.15	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	N/A
4	0.02	0.02	0.13	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	N/A
5	0.02	0.02	0.12	0.02	0.02	0.02	0.03	0.05	0.02	0.02	0.02	0.015	0.016	0.01	0.01	0.02	0.01	0.015	N/A
6	0.01	0.01	0.16	0.01	0.015	0.035	0.09	0.14	0.01	0.01	0.01	0.01	0.01	0.015	0.01	0.015	0.01	0.015	10.5

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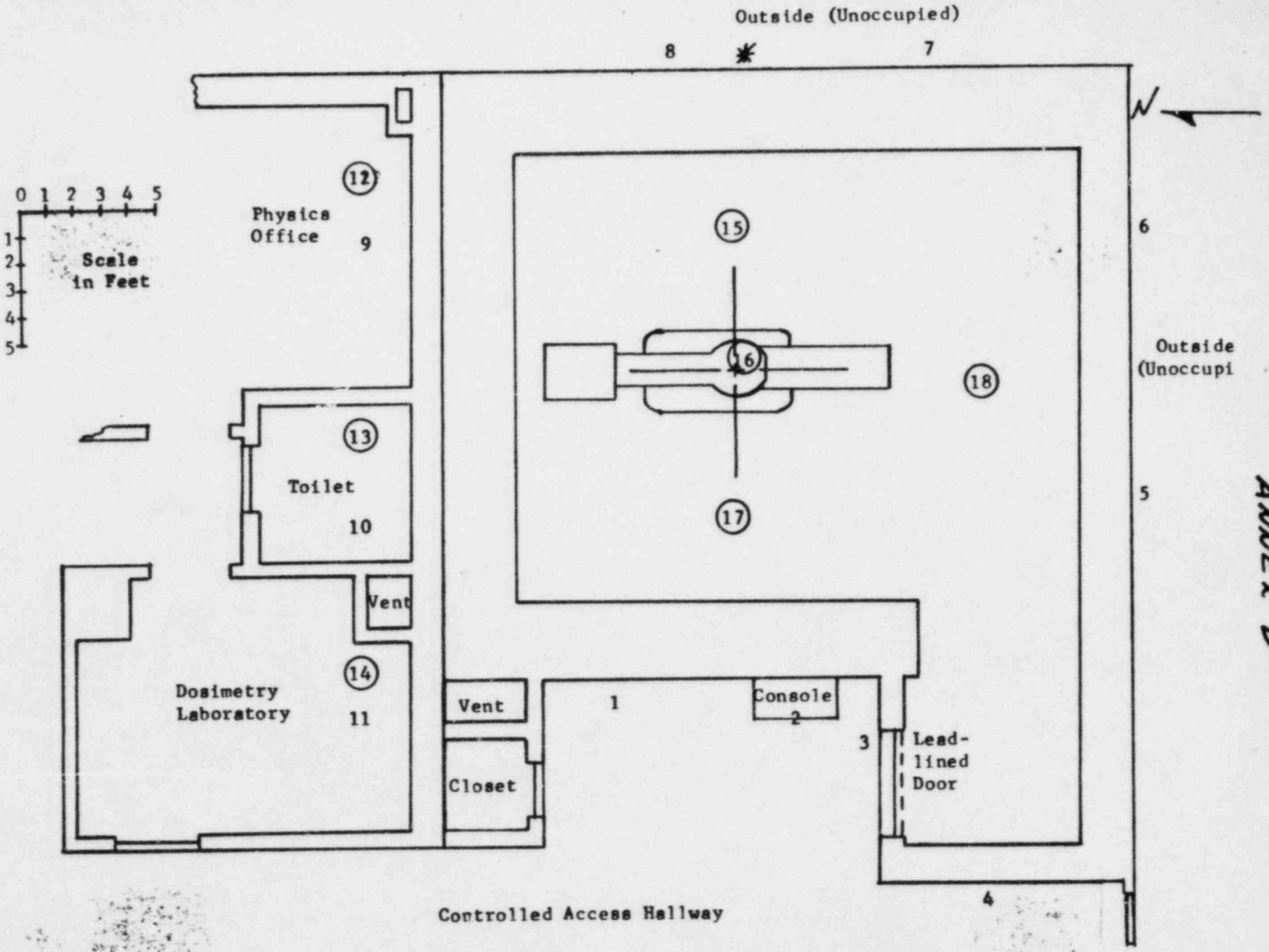

FIGURE 2. Therapy Facility Floorplan and Exposure Measurement Locations (Circled location numbers refer to locations on the second floor/roof).

* Highest exposure rate – Run #6

ANNEX D

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ANNEX E

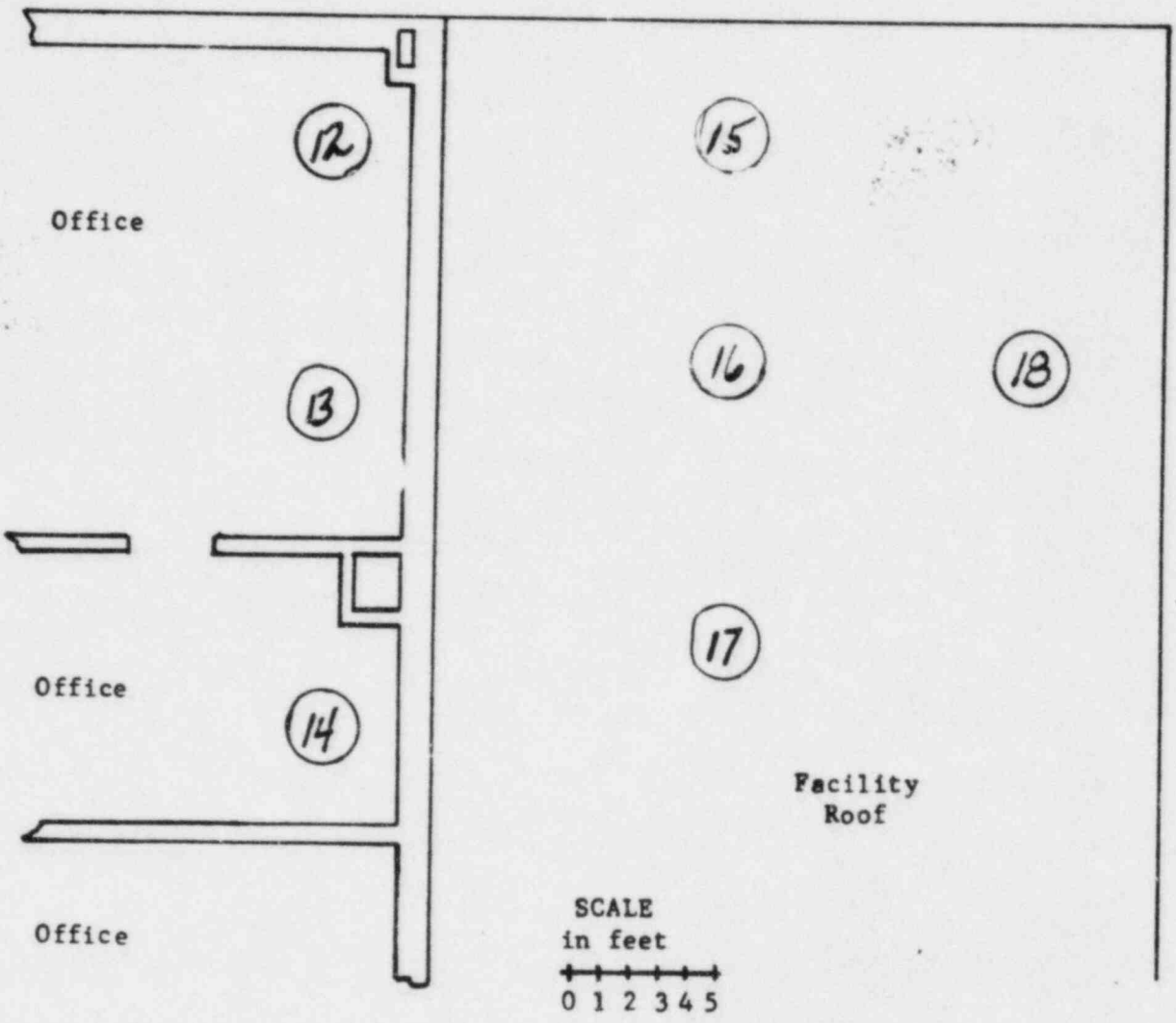

FIGURE 1. Exposure Measurements (mR/hr) at Roof /Floor Surface

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MAJ, MSC
Radiation Protection Officer

ANNEX F

Atomic Energy of Canada Limited
Commercial Products

SOURCE DISPOSAL CERTIFICATE

TO WHOM IT MAY CONCERN:

This is to certify that the following source has been removed from the unit described herein, and returned to Atomic Energy of Canada Limited, Commercial Products, Ottawa, Ontario, Canada for disposal:

COBALT 60 OR CAESIUM 137 SEALED SOURCE SERIAL NO	DEPLETED URANIUM lb	UNIT	UNIT SERIAL NO
52660		T80	336

LOCATION OF UNIT

TRIPLER ARMY MEDICAL CENTER
HAWAII 96859

Date: 11/30/82 Signed: C E Butt
A.E.C.L. Service Representative

WHITE: CUSTOMER - ON SITE
CANARY: OTTAWA - UNIT HISTORY FILE
PINK: OTTAWA - ISOTOPE LAB
BLUE: REGIONAL OFFICE

MED-021

Atomic Energy of Canada Limited
Commercial Products

INSPECTION CERTIFICATE

AUTHORIZED INSPECTION AND SERVICING OF AECL TELETHERAPY UNIT

MODEL NO. T80 SERIAL NO. 336

TELETHERAPY SOURCE SERIAL NO. 53916 CURIES 6000 DATE 9/8/87

CUSTOMER TRIPLER ARMY MEDICAL CENTER
HAWAII 96849

This teletherapy unit was inspected and serviced in accordance with Atomic Energy of Canada Limited USNRC License No. 54-00300-04.

Date of Inspection 11/30/87

This is to certify that the unit was inspected and serviced in accordance with the conditions of the License. Each teletherapy machine shall be fully inspected and serviced during source replacement or at intervals not to exceed five years.

By C E Butt 11/30/87
Authorized Source Handler (date)

MED-022

WHITE CUSTOMER - ON SITE
CANARY OTTAWA - UNIT HISTORY FILE
PINK OTTAWA E.P. UNIT HISTORY FILE
BLUE REGIONAL OFFICE

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