Harper-Grace Hospitals
Harper Hospital Division

July 21, 1980

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

Dear Sirs:

This letter is a request to amend Harper-Grace Hospitals (Harper Division) Co-60 teletherapy License No. 21-04127-06 to allow for a relocation of the unit into a new treatment facility.

When the new radiation therapy facility in the Detroit Medical Center was designed and constructed it was felt that this facility would be administered through Wayne State University's Health Care Institute. In light of this, a teletherapy licence application was submitted by Mr. Richard Cummings on February 20, 1978. License No. 21-00741-12 was issued to Wayne State University on April 4, 1978 for installation and use of an A.E.C.L. Theratron 780 with an AECL Model C-146 or C-151 Co-60 sealed source. Since that time, administrative decisions within the Detroit Medical Center have determined that the new Radiation Oncology Center would be managed by and the equipment owned by Harper Hospital. Thus, our request that License No. 21-04127-06 be amended to allow for the relocation and use of the AECL Theratron 780 teletherapy unit in the new Radiation Oncology Center (ROC).

Figure 1 shows the location of the Radiation Oncology Center within the Detroit Medical Center. The facility is connected to the Harper Division of Harper-Grace Hospitals via an underground tunnel. Figure 2 shows the layout of the ROC and the location of the Co-60 teletherapy treatment room. Attachment #1 is a report containing the estimated radiation levels that are anticipated in areas adjacent to the Co-60 teletherapy room. This report is identical to that submitted by Mr. R. Cummings and has previously been reviewed and approved by N.R.C. personnel in conjunction with W.S.U.'s license No. 21-00741-12.

The individual users for human use will be those persons currently on our license with the exception of Dr. Laurence G. Lines. We would also like to add the name of Jeannie Jones Kinzie, M.D. Dr. Kinzie is certified in Therapeutic Radiology (1972) by the American Board of Radiology. Thus, we are requesting the addition of Dr. Kinzie and the deletion of Dr. Lines. Nonhuman use for calibration, testing, and irradiation of nonhuman materials will be under the supervision of William G. Van de Riet, Ph.D. and/or Francis J. Connolly, Ph.D. as per our letter dated December 11, 1979 and all previous correspondence. Calibrations, leak testing, area surveys and related testing as required by our current license will be performed by William G. Van de Riet, Ph.D. and/or Francis J. Connolly, Ph.D.

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3990 John R., Detroit, Michigan 48201

8008050406

The only other changes that have taken or will take place since our last license renewal request dated November 16, 1978 is that we are currently using Landauer to supply our monthly personnel monitors and we will be utilizing the following radiation survey instrumentation in the new facility:

1. Victoreen Model 491 G.M. survey meter with Model 491-30 G.M. tube.

2. Victoreen Model 470 Panoramic ionization survey meter.

3. Area Monitor: Nuclear Associates "Primalert 35".

We will continue to calibrate our own survey instruments according to the procedure appearing in correspondence dated November 16, 1978 and/or the procedure outlined in an application dated February 16, 1979 for license No. 21-04127-02.

We trust this information is sufficient and would appreciate any help you can provide in processing this request in a timely fashion.

Sincerely yours,

William G. Van de Riet, Ph.D.

William G. Van de Riet, Ph.D.
Radiological Physicist

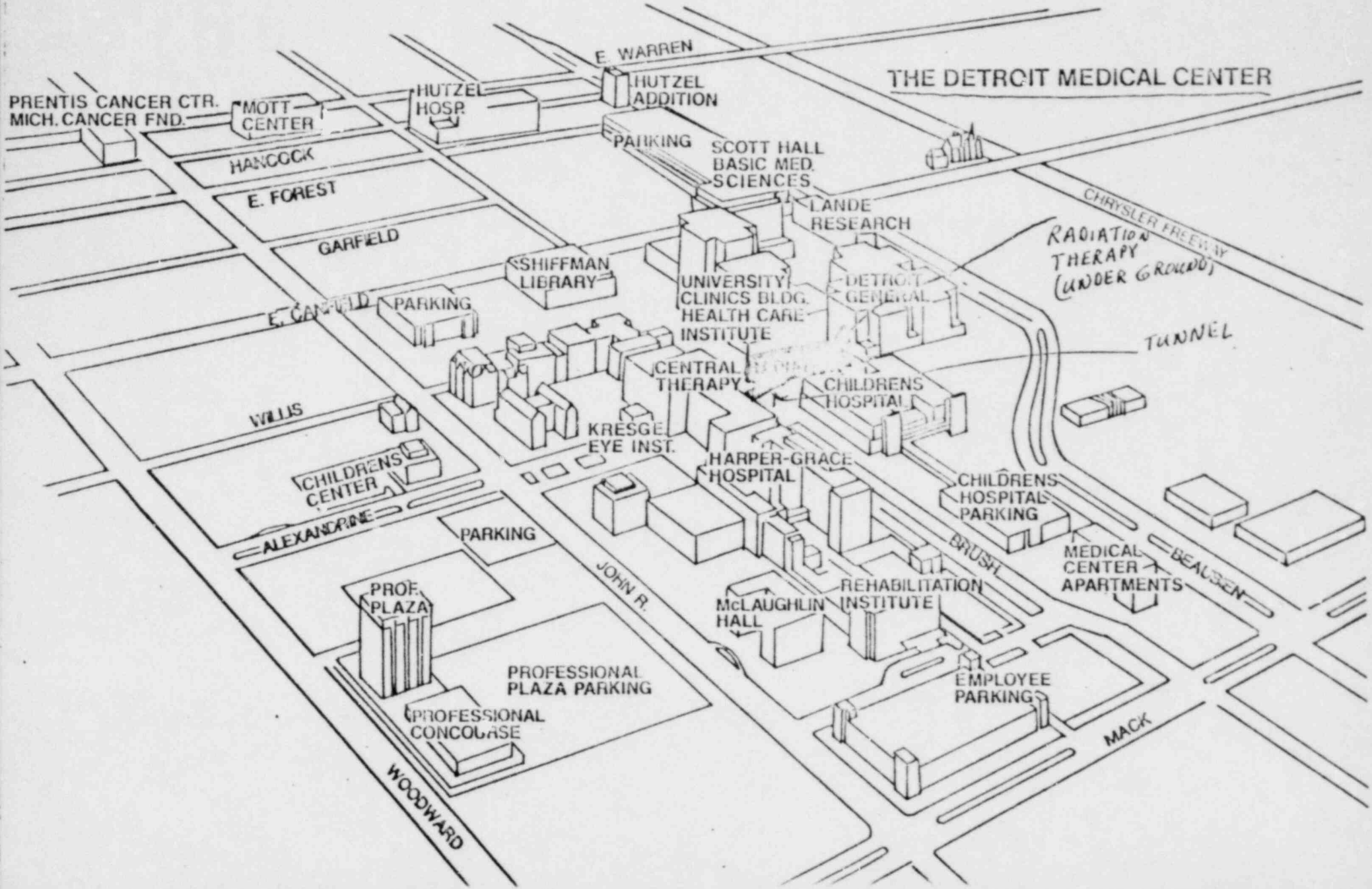
WGV/lk

cc: Thomas Feurig
Administrator

Attachments

Thomas L. Feurig
Associate Administrator

FIGURE 1


THE DETROIT MEDICAL CENTER
E. WARREN
PRENTIS CANCER CTR.
MICH. CANCER FND.
MOTT CENTER
HUTZEL HOSP.
HUTZEL ADDITION
PARKING
SCOTT HALL BASIC MED. SCIENCES
HANCOCK
E. FOREST
GARFIELD
LANDE RESEARCH
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RADIATION THERAPY (UNDER GROUND)
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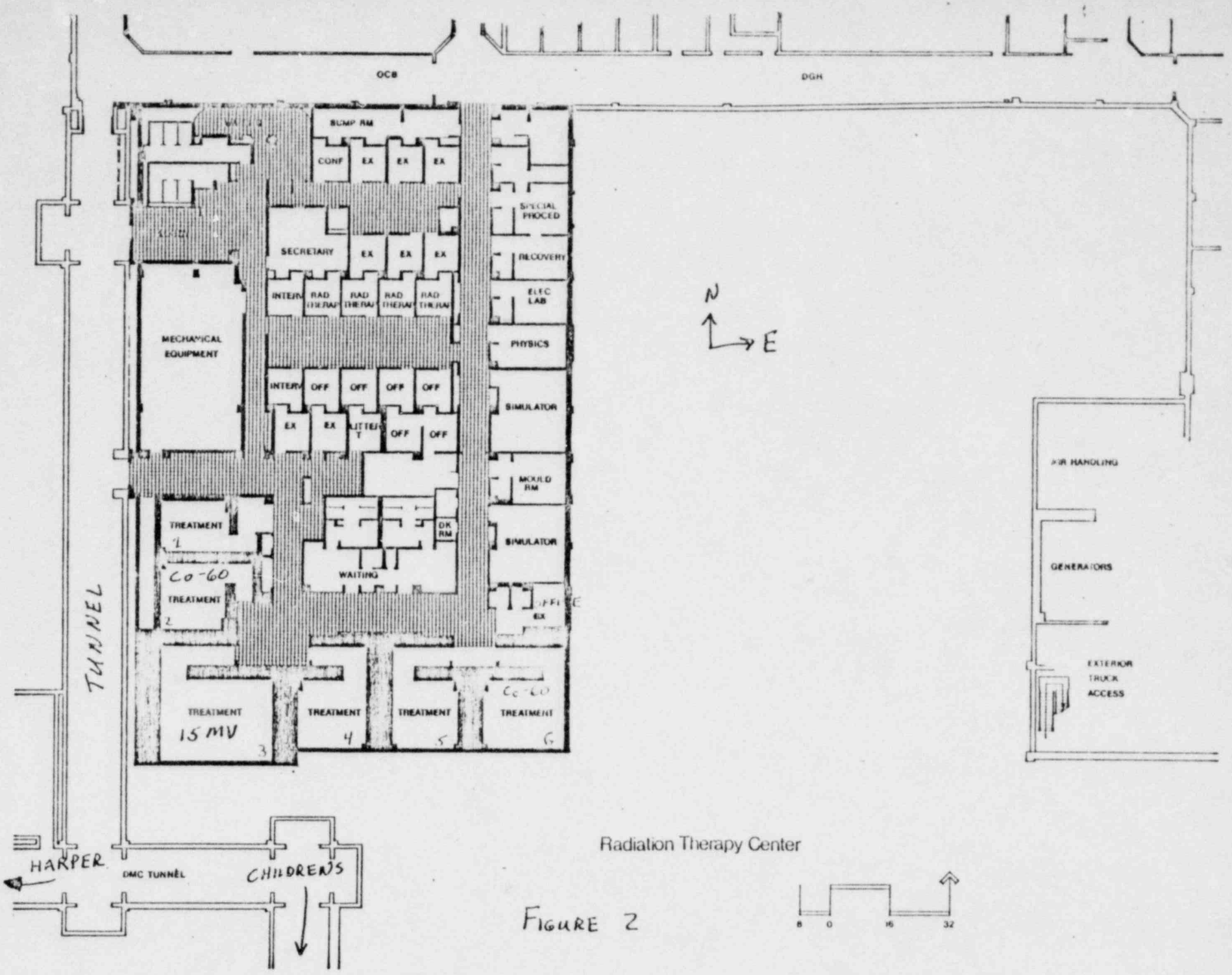
CENTRAL THERAPY
CHILDRENS HOSPITAL
WILLIS
KRESGE EYE INST.
HARPER-GRACE HOSPITAL
CHILDRENS CENTER
CHILDRENS HOSPITAL PARKING
ALEXANDRINE
PARKING
BRUSH
MEDICAL CENTER APARTMENTS
BEAUBIEN
JOHN R.
PROF. PLAZA
REHABILITATION INSTITUTE
McLAUGHLIN HALL
PROFESSIONAL PLAZA PARKING
EMPLOYEE PARKING
PROFESSIONAL CONCOURSE
MACK
WOODWARD



Radiation Therapy Center

FIGURE 2

Attachment #1

Item 13:

Facilities and Equipment

This report contains the estimated maximum radiation levels that are anticipated in areas adjacent to the Cobalt-60 teletherapy unit described in the license application. Figure 4 shows the overall layout of the Wayne State University Radiation Therapy Facility currently under construction. This facility will be completely underground with a landscaped mall above the facility. There is no occupiable space below the treatment rooms. The stairwell adjacent to the west wall represents a fire escape to ground level. The tunnel west of the fire escape connects several of the health care facilities in the Detroit Medical Center to the therapy facility and the Wayne State University Health Care Institute Clinics Building. Figures 1-3 show larger scale sections of the Cobalt-60 teletherapy treatment room and locations where anticipated radiation levels have been calculated. The walls and ceilings of the treatment rooms have been constructed with concrete having a density of 147 pounds per cubic foot. The entrance door to the teletherapy room will be provided with a 3/8 inch lead liner. Conduits and duct work for mechanical support of the room will be brought in above the entrance doors and behind the maze wall at a height of at least seven feet. Patient viewing will be by closed circuit TV monitoring. The teletherapy room will contain two cameras to provide different views and backup monitoring. In the event that both cameras fail, patient treatment will be ceased until monitoring is restored. Two-way audio communication will be provided by an intercom system.

Physical Parameters and Assumptions

The physical parameters utilized in this report are presented in Table I and were taken from NCRP Reports 34, 49, and 51. Where earth provides a portion of the shielding, tenth-value-layers (TVL) equal to twice those for concrete were utilized. NCRP Reports 34 and 49 indicate that an earth to concrete ratio of about 1.6 can be used for megavoltage radiation for dry, packed earth.

Workload: $W = 6.4 \times 10^7$ mR/week at one meter (approximately 50 patients per day at 80cm). $W = 10^8$ mR/week at isocenter (maximum head loading 7500 Ci; 7500 RHM or 125 RMM; 11,720 R per hour at isocenter).

Leakage: For barrier considerations, 0.1% leakage was assumed at one meter with the unit in the "on" position.

Beam Stopper: The counterweight of this unit is designed to absorb 99% of the primary beam and up to 35 degrees of scattered radiation from the scattering object at the center of rotation with the head locked such that the primary beam is centered on the beam stopper.

Usefactors: With the head locked such that the primary beam is centered on the beam stopper, a usefactor of one (1) has been anticipated for the primary beam directed toward the floor, usefactors of 1/4 each have been anticipated for orientation of the primary beam toward the north and south walls, and a usefactor of 1/3 has been anticipated for orientation toward the ceiling. These usefactors are meant to include both fixed beam and rotational treatment techniques. In addition, electrical interlocks will allow orientation of the primary beam away from the beam stopper when the primary beam is directed toward the floor. The anticipated usefactor for this orientation is less than 1/16.

The source in an A.E.C.L. Theratron 780 Cobalt-60 teletherapy unit is located approximately 77 inches above the floor when the unit is in the

vertical position and approximately 45.6 inches above the floor when the unit is in the horizontal position. The isocenter of this unit is 80cm from the source.

TABLE I

	Primary	30 degree	45 degree	60 degree	90 degree
Scatter Factor*		0.006	0.0036	0.0023	0.0009
TVL**	8.17	8.0	7.8	7.55	6.05

*For 400cm^2 field

**TVL's in inches of concrete (147 lbs/ft^3)

Exposure Estimates

The estimated radiation levels that are anticipated in areas around the Cobalt-60 teletherapy installation are presented in Table II. The locations considered are lettered to correspond to the lettering shown in Figures 1, 2, and 3. The type of area is marked N for non-controlled and C for controlled. The column labeled "maximum mR/hr" reflects the worst case situation and does not take into account use-factors or occupancy. The column labeled "weekly exposures full occupancy" reflects the weekly anticipated exposure utilizing the weekly workload and usefactors. The column labeled "weekly exposures" is as above, but takes into account the estimated occupancy factors shown in the table.

The weekly exposure values were calculated using the following formula:

$$\frac{mR}{week} = \sum \frac{(W) \times (Ui) \times (T) \times (Fi) \times (Si) \times (10)^{-x/TVLi} \times (.8)^2}{d^2}$$

where the sum is over orientations from 0 to 360 degrees and

W	= workload in mR per week at the isocenter (10^8 mR/week)
Ui	= usefactor for beam orientation i
T	= occupancy factor
Fi	= fractional scatter intensity for beam orientation i
Si	= beam stopper attenuation for orientation i or head leakage factor
X	= wall thickness
TVLi	= tenth-value-layer for the type of radiation under consideration
d	= distance from isocenter to the area in question
$.8^2$	= allows for inverse square since W is at isocenter

The contribution from primary, scatter, and leakage were calculated separately and summed for each orientation of the primary beam.

TABLE II - ESTIMATED RADIATION LEVELS

Location	Weekly Exposures Full Occupancy	Type Area	Occupancy Factor	Weekly Exposures	Maximum mR/hr
A	5.8 mR	C	1	5.8 mR	1.1
B	1.3 mR	C	1	1.3 mR	0.2
C	0.6 mR	N	1/8	0.1 mR	0.12
D	1.0 mR	N	1/8	0.2 mR	0.1
E	2.3 mR	N	1/8	0.3 mR	0.3
F	0.1 mR	C	1	0.1 mR	0.02
G	0.8 mR	N	1/8	0.1 mR	0.2
H	0.03 mR	C	1	0.03 mR	0.01
I	0.8-3.0 mR	C	1	0.8-3.0 mR	0.5-1.4
J*	5.0	C	1	5.0 mR	0.5
K**	$<$.01 mR	C	1	$<$.01 mR	$<$.01

* Secondary from 15 MV unit in Room A-197 W=10^5R per week at 1m
**Secondary and primary (U=1/4) from 250 kVp unit in Room A-195
W=20,000 mA-min per week

The radiation level estimates presented in Table II demonstrate that the expected exposure levels adjacent to the proposed teletherapy installation do not exceed 10 mR per week.

Prepared by,

William G. Van de Riet, Ph.D.

William G. Van de Riet, Ph.D.
Certified Radiological Physicist

WGV/jk

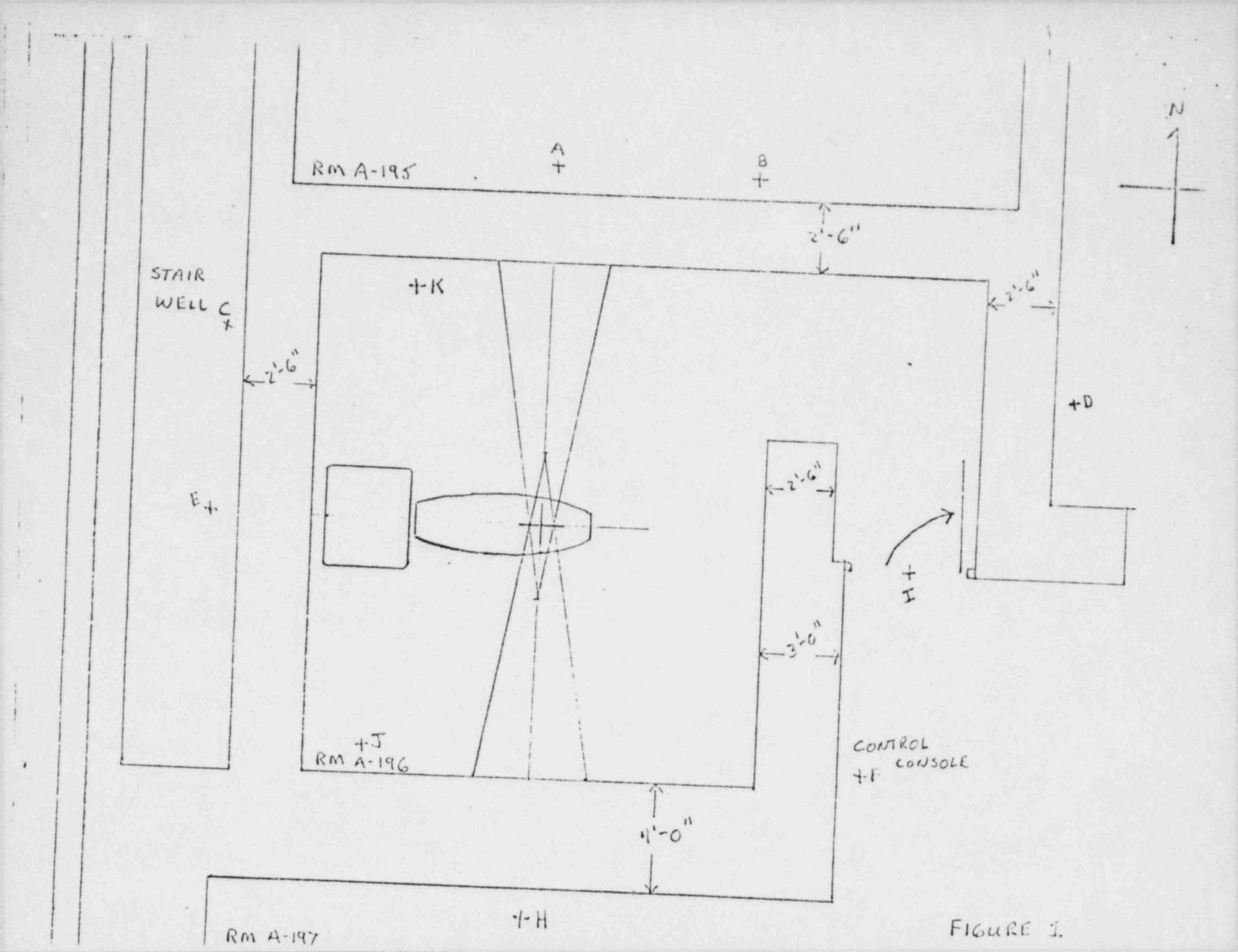

RM A-195
A
B
N
2'-6"
STAIR
WELL C
+K
2'-6"
2'-6"
+D
E
2'-6"
+
I
3'-0"
+J
RM A-196
CONTROL
CONSOLE
+F
4'-0"
+H
RM A-197

FIGURE 1.

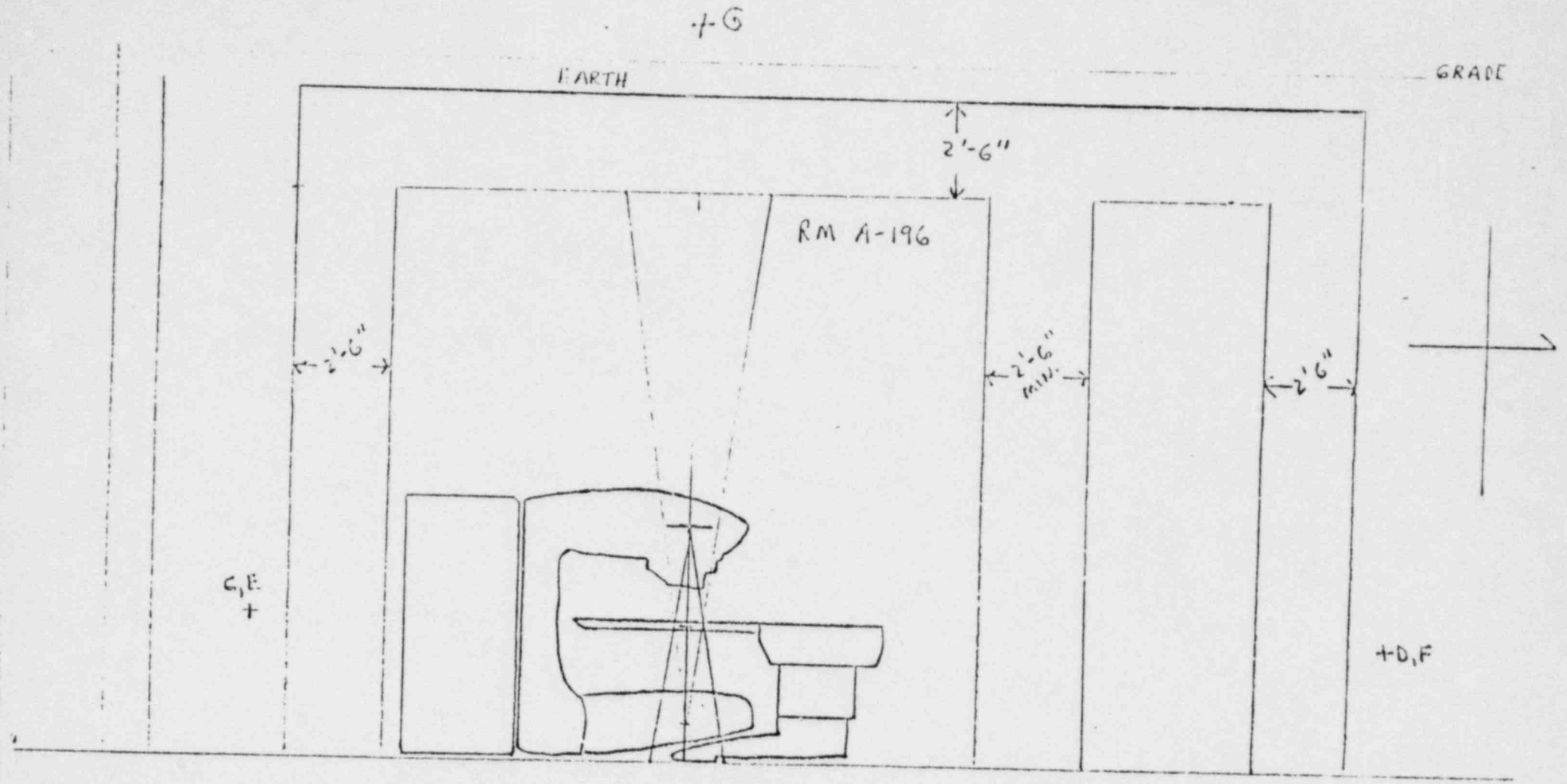


FIGURE 2

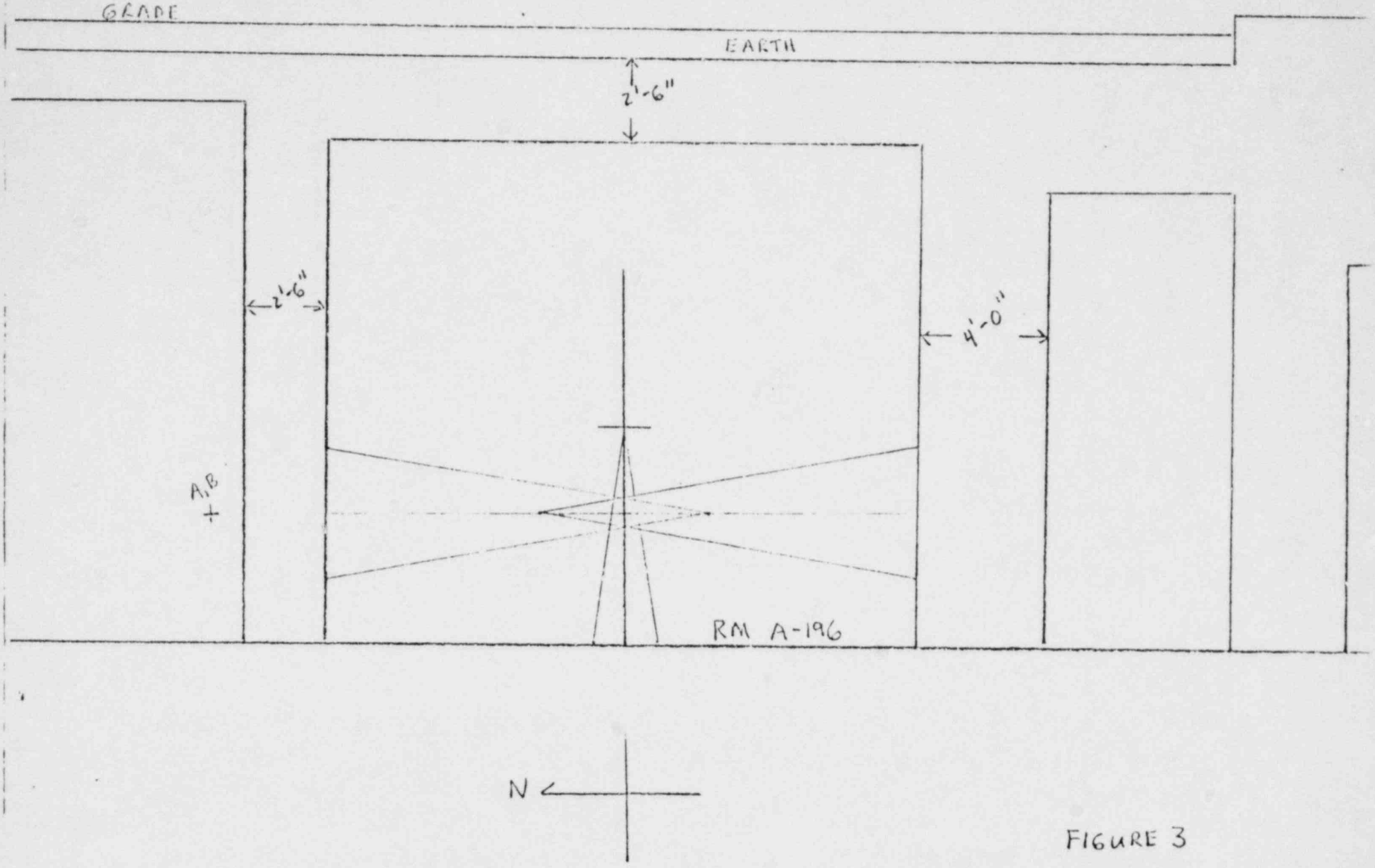


FIGURE 3

1/4" = 1'

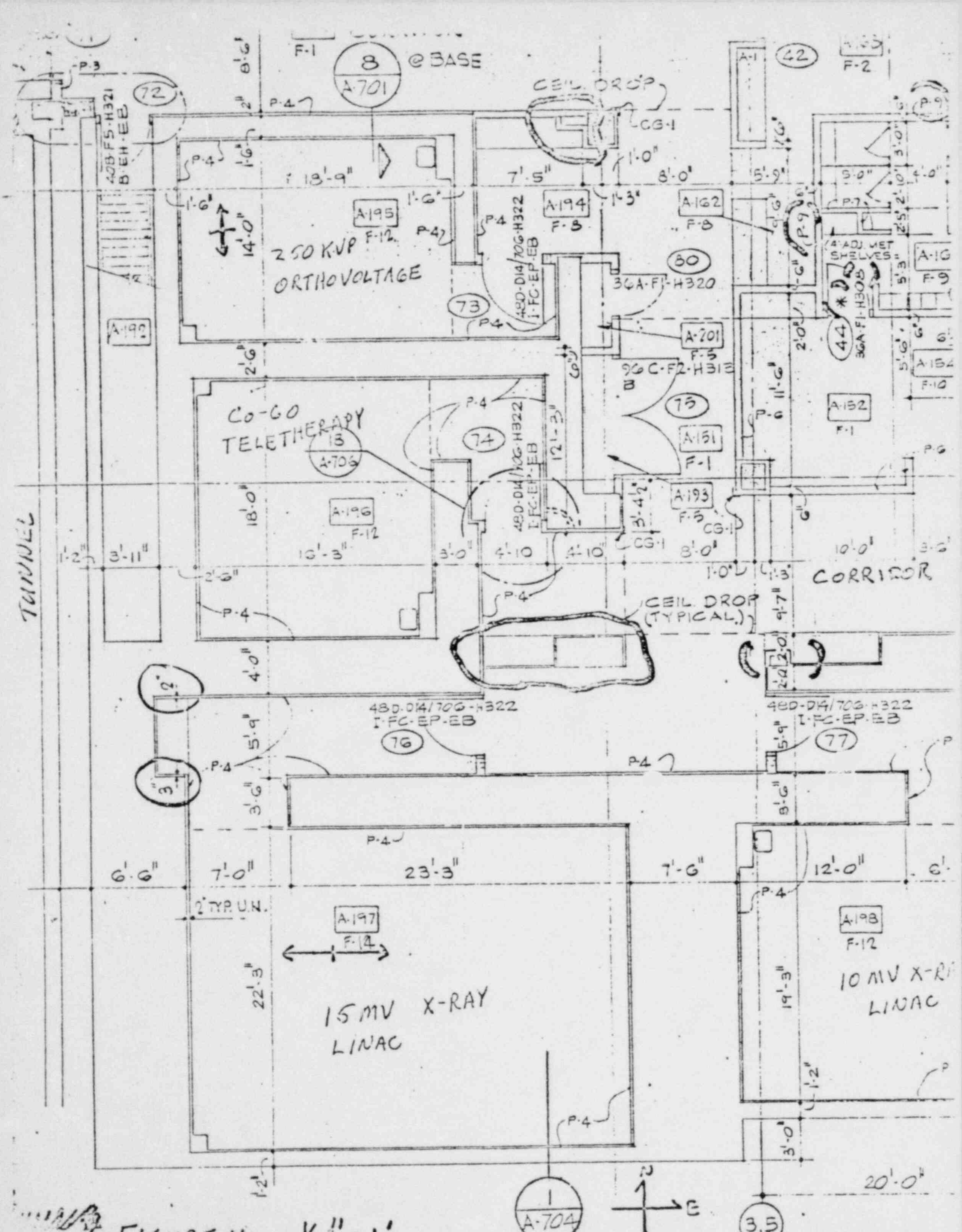


FIGURE 11 1/8" = 1'