

MAGNACHECK INCORPORATED
2125 RIGGS
WARREN MI 48091 13AM

Western Union Mailgram



4-0134508348003 12/13/84 ICS IPMBNGZ CSP CGBB
2 3137564070 MGM TDBN WARREN MI 12-13 1140A EST

030-18632

USNRC REGION III
ATTN: BRUCE MALLET
799 ROOSEVELT RD
GLENELLYN IL 60137

21-19111-02

THIS IS A CONFIRMATION COPY OF A TELEGRAM ADDRESSED TO YOU:

REQUEST INTERIM LICENSE BASED ON PREVIOUS LICENSE NO 21-19111-01 AND
ADMINISTRATIVE MANUAL/OPERATING AND EMERGENCY PROCEDURES WITH NO
CHANGES. LICENSE FEE TO FOLLOW.

DAVID CARDWELL
2125 RIGGS
WARREN MI 48091

11:42 EST

MGMCOMP

U.S. N.R.C.
LIC. FEE MGMT. BRANCH

84 DEC 31 AM 1:43

RECEIVED

RECEIVED BY LFMB	
Date	12/31/84
Log	Dec-19 III
By	8
Orig. To	
Action Compl.	1/2/85

RECEIVED

DEC 14 1984

REGION III

Applicant	11602
Check No.	500-30
Amount, Fee Category	Applicant
Type of Fee	12/31/84
Date Check Rec'd	
Received By	Jackson

CONTROL NO. 77973

8506060326 850520
REG3 LIC30
21-19111-02 PDR

DEC 14 1984

FIGURE 1
EXPOSURE CELL

$$\textcircled{P} = 449 \text{ mR/hr.}$$

* April 15, 1985 application

AMS 3802 (1000 curies) sealed source

$$W = 1100 \text{ RHM}$$

$$B_{\text{sg}} = 5 \times 10^{-1}$$

$$d_{\text{pri}} = 7 \text{ m}$$

Based on 147 lb/cubic ft
licensee has 135 lbs/cubic ft.

$$\textcircled{1} \frac{B_{\text{sg}} W (10^3 \text{ mR/R})}{(d_{\text{pri}})^2} = \frac{(2 \times 10^{-3})(1100 \text{ RHM})(10^3 \text{ mR/R})}{(7)^2 \text{ m}}$$

$$\frac{5.0 \times 10^6 \text{ mR/hr.}}{49 \text{ m}} = 449 \text{ mR/hr Primary radiation N. wall uncontrolled area}$$

$$\frac{B_{\text{sg}} W F (10^3 \text{ mR/R})}{(d_{\text{sec}})^2 (d_{\text{scs}})^2} = \frac{2.5 \alpha B_{\text{sg}} W F}{(d_{\text{sec}})^2 (d_{\text{scs}})^2}$$

$$W = 1100 \text{ RHM}$$

$$B_{\text{sg}} = 2.0 \times 10^{-3} \quad 60 \text{ centimeters}$$

$$d_{\text{sec}} = 6 \text{ m}$$

$$d_{\text{scs}} = 1.03 \text{ m}$$

$$F = 1.6 \times 10^4 \text{ cm}^2$$

$$\alpha = 90^\circ = .9 \times 10^{-3}$$

(over)

PREFERRED
EXPOSURE
AREA

$$2 \frac{1}{2}'$$

$$2'$$

$$2'$$

$$2'$$

PICKER
MODEL
590

ISOTOPE
STORAGE
VAULT
(IR-192, CS-137)

TECHNICS
MODEL 446

$$2$$

$$2'$$

$$2'$$

$$2'$$

Scatter @ 90° N. wall (controlled area)

$$(2) \quad \frac{(2.5)(.9 \times 10^{-3})(2.0 \times 10^{-3})(1100 \text{ RHM})(1.6 \times 10^4 \text{ cm}^2)}{(27)(1.061)} \approx \boxed{2.7 \text{ mR/hr}}$$

Scatter @ 90° N. wall (uncontrolled area)

$$(3) \quad \frac{(2.5)(.0009)(.002)(1100 \text{ RHM})(1.6 \times 10^4)}{(7)^2(1.03)^2} \approx \boxed{1.5 \text{ mR/hr}}$$

Scatter @ 30° N. wall (uncontrolled area)

$$(4) \quad \frac{(2.5)(.006)(.002)(1100 \text{ RHM})(1.6 \times 10^4)}{(7)^2(1.03)^2} \approx \boxed{10 \text{ mR/hr}}$$

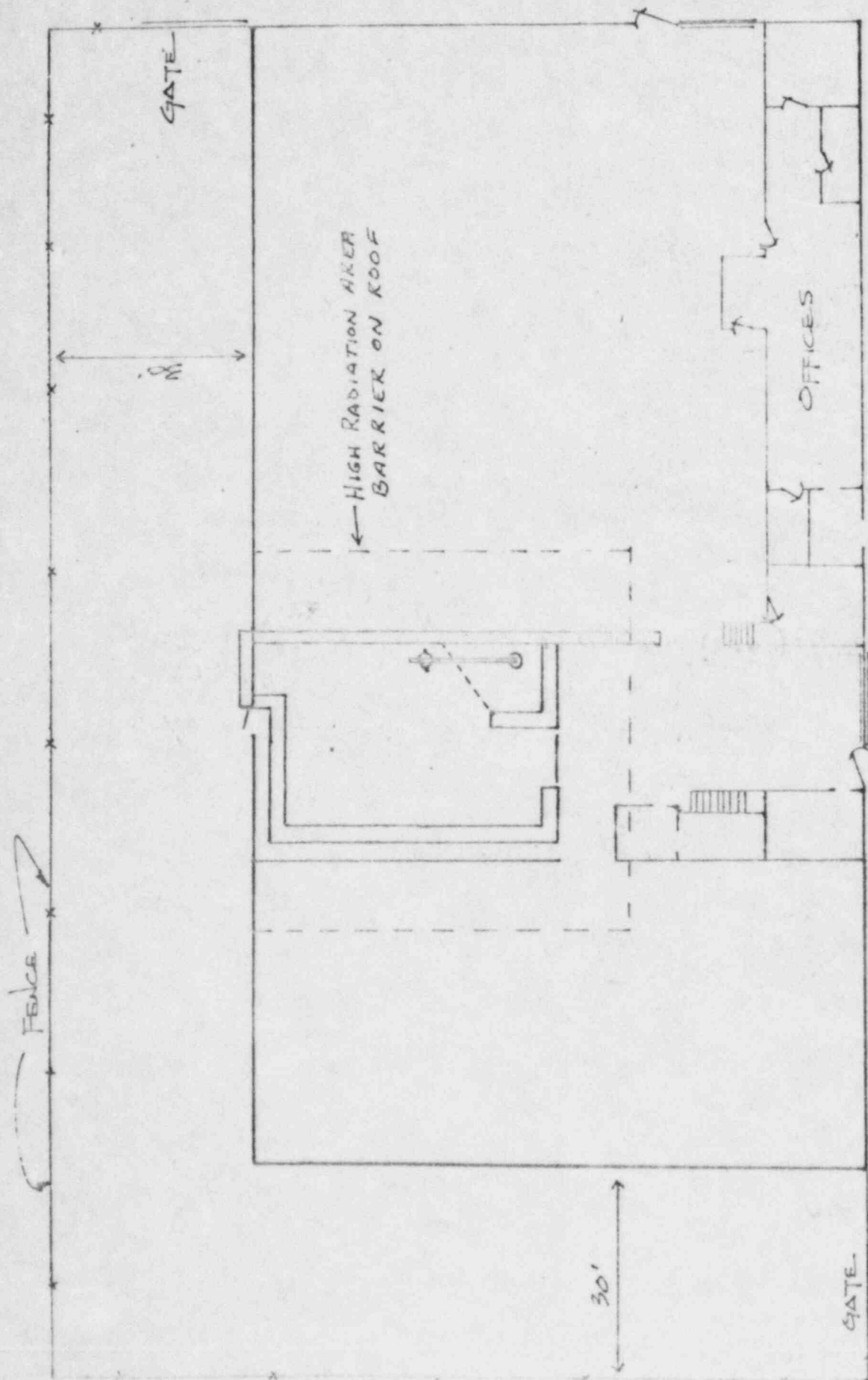
Scatter @ 60° N. wall (uncontrolled area)

$$(5) \quad \frac{(2.5)(.0023)(.002)(11000)(1.6 \times 10^4)}{(7)^2(1.03)^2} \approx \boxed{4 \text{ mR/hr}}$$

Primary rad. S. wall (controlled)

$$(6) \quad \frac{(2 \times 10^{-3})(1100 \text{ RHM})(10^3 \text{ mR/R})}{(2.2)^2} \approx \boxed{4.6 \text{ R/hr}}$$

april 15, 1985 application



MAGNA CHEK, INC.
WARREN, MICHIGAN
MAGNA CHEK-BUILDING AND
SURROUNDING FACILITIES
NO SCALE

Calculation: $462 \text{ Curies} \times 1.1 \text{ RHM/Curie} = \boxed{508 \text{ RHM}}$

① Primary Radiation N. Wall uncontrolled area:

$$\frac{B_{\text{ug}} W (10^3 \text{ mR/R})}{(d_{\text{pri}})^2} = \frac{(5 \times 10^{-1})(508 \text{ RHM})(10^3 \text{ mR/R})}{(7 \text{ m})^2}$$

$$\boxed{\approx 52 \text{ R/hr}}$$

② Scatter 90° N wall (controlled area)

$$\frac{(2.5)(.036)(2.2 \times 10^{-1})(508 \text{ RHM})(1.6 \times 10^4)}{(6)^2 (1.03)^2} \approx \boxed{4 \text{ R/hr}}$$

③ Scatter 90° N. wall (uncontrolled area)

$$\frac{(2.5)(.036)(2.2 \times 10^{-1})(508 \text{ RHM})(1.6 \times 10^4 \text{ cm}^2)}{(8^2)(1.03)^2} \approx \boxed{2 \text{ R/hr}}$$

④ Scatter 60° N. wall (uncontrolled area)

$$\frac{(2.5)(.092)(.22)(508)(1.6 \times 10^4)}{(8 \text{ m})^2 (1.03)^2} \approx \boxed{6 \text{ R/hr}}$$

⑤ Scatter 30° N. Wall (uncontrolled area)

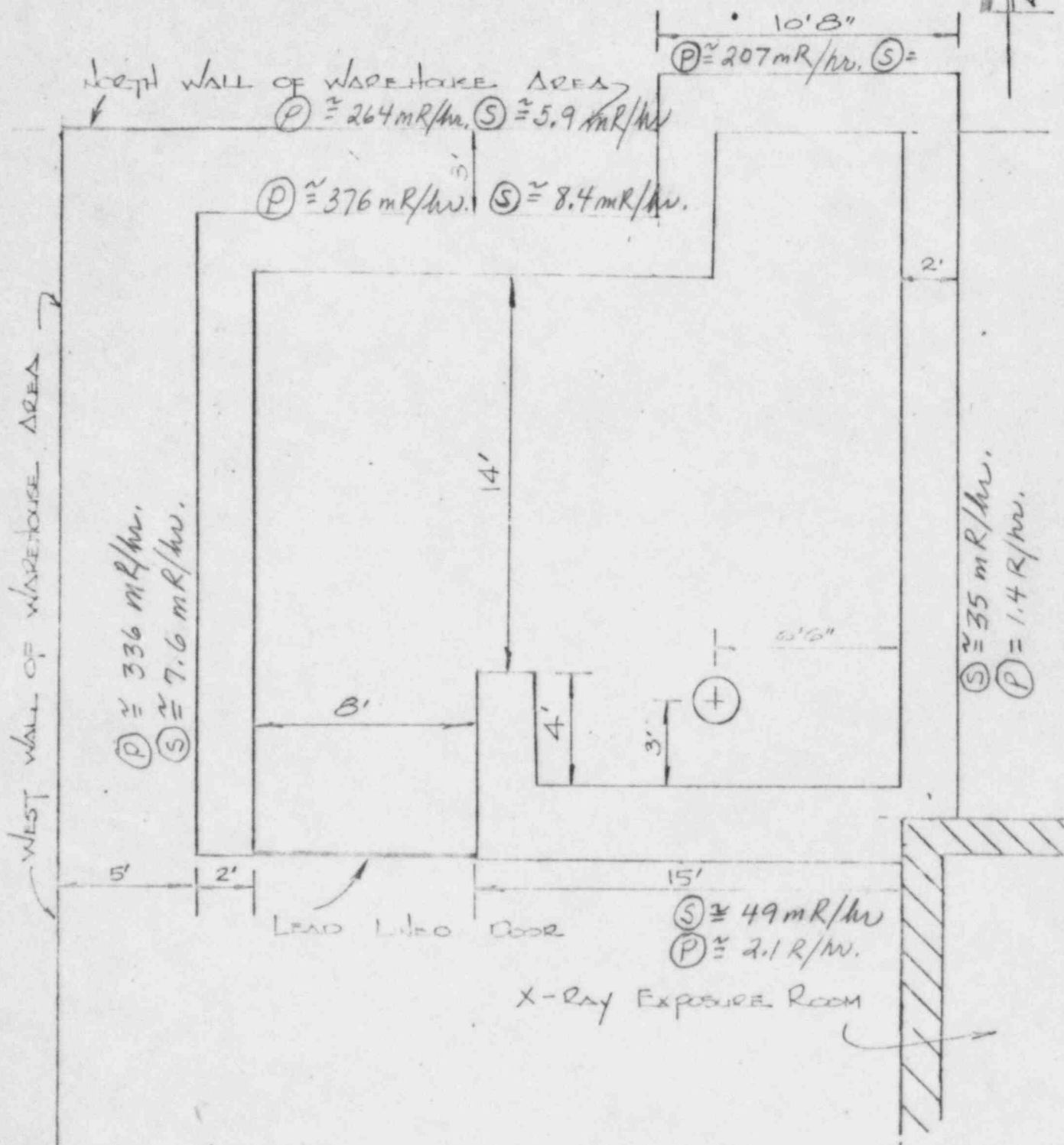
$$\frac{(2.5)(.24)(.22)(508)(1.6 \times 10^4)}{(7)^2 (1.03)^2} \approx \boxed{16 \text{ R/hr}}$$

* Application dated November 21, 1980 drawing.

462 Curies }
508 RHM }

Ⓟ = primary radiation

Ⓢ = Scatter @ 30°



MAGNA CHEL, INC.
WARREN, MICHIGAN
DESCRIPTION OF RADIOGRAPHIC
EXPOSURE AREA

SCALE: 3/16" = 1' 0"

⑧ N. wall of cell (controlled) primary rad.:

$$\frac{(2.0 \times 10^{-3})(508)(10^3 \text{ mR/R})}{(5.2 \text{ m})^2} \approx \boxed{376 \text{ mR/hr}}$$

⑨ N. wall cell (controlled) 30° scatter:

$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4)}{(5.2)^2(1.03)^2} \approx \boxed{8.4 \text{ mR/hr}}$$

⑩ E. wall cell (controlled) primary:

$$\frac{(2.0 \times 10^{-3})(508)(10^3 \text{ mR/R})}{(2.7 \text{ m})^2} \approx \boxed{1.4 \text{ R/hr}}$$

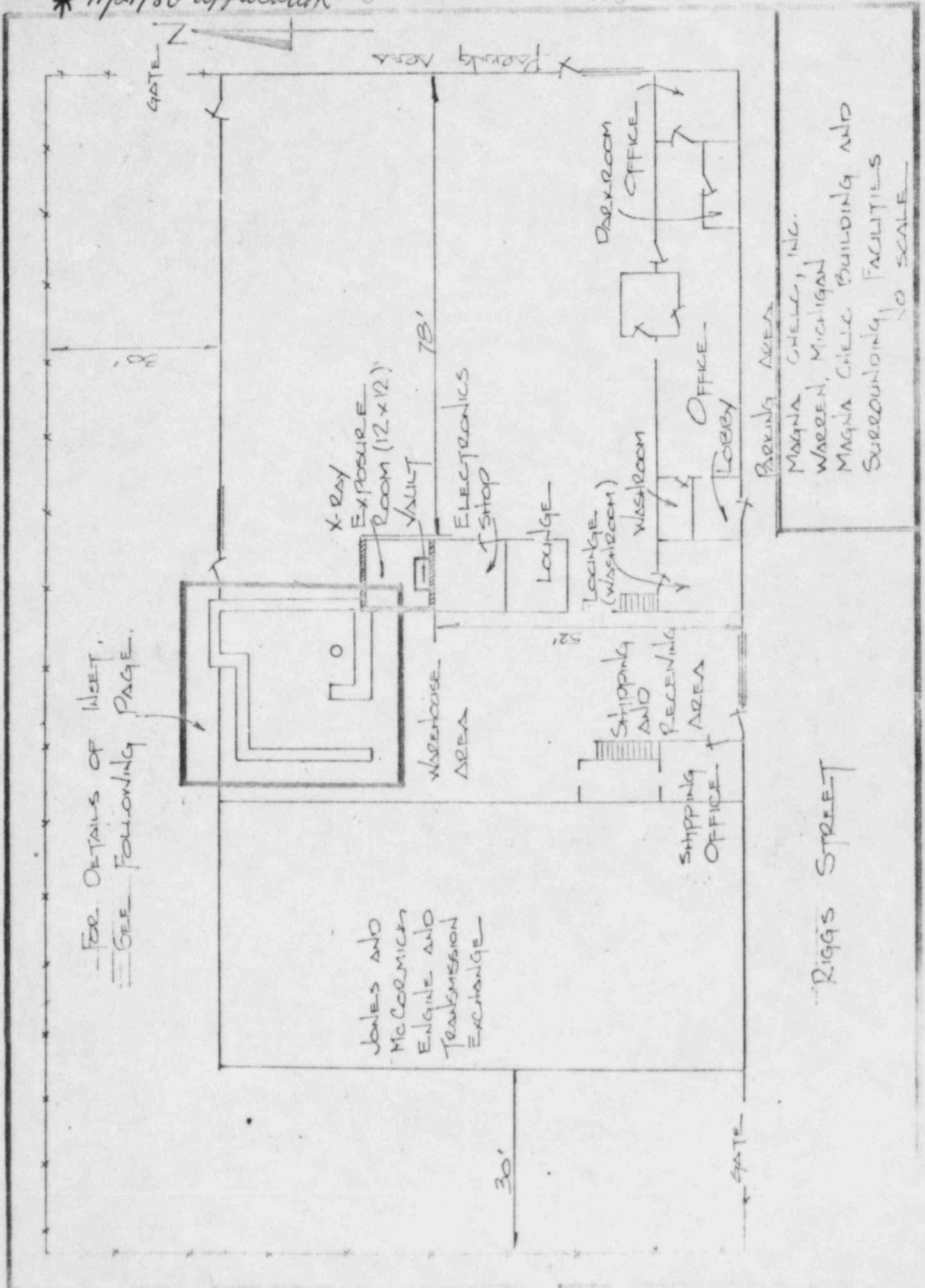
⑪ S. wall cell (controlled) Primary:

$$\frac{(2.0 \times 10^{-3})(508)(10^3 \text{ mR/R})}{(2.2 \text{ m})^2} \approx \boxed{2.1 \text{ R/hr}}$$

⑫ W. wall cell (controlled) Primary:

$$\frac{(2.0 \times 10^{-3})(508)(10^3 \text{ mR/R})}{(5.5)^2} \approx \boxed{336 \text{ mR/hr.}}$$

* 11/21/80 application Figure 1



$$462 \text{ Curies} = 508 \text{ RHM}$$

N. Wall of Warehouse area (uncontrolled)
Primary radiation:

$$\textcircled{1} \quad \frac{B_{\text{wg}} W (10^3 \text{ mR/R})}{(d_{\text{pri}})^2} = \frac{(2.0 \times 10^{-3})(508 \text{ RHM})(10^3 \text{ mR/R})}{(6.2)^2} \approx \boxed{264 \text{ mR/hr}}$$

$$\textcircled{2} \quad \text{Scatter @ } 30^\circ \text{ N. wall of warehouse (uncontrolled)}$$

$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4 \text{ cm}^2)}{(6.2)^2 (1.03 \text{ m})^2} \approx \boxed{5.9 \text{ mR/hr}}$$

$$\textcircled{3} \quad \text{Scatter @ } 30^\circ \text{ S. wall of cell (controlled)}$$

$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4)}{(2.2 \text{ m})^2 (1.03 \text{ m})^2} \approx \boxed{49 \text{ mR/hr}}$$

$$\textcircled{4} \quad \text{Scatter @ } 30^\circ \text{ E. wall of cell}$$

$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4)}{(2.6)^2 (1.03 \text{ m})^2} \approx \boxed{35 \text{ mR/hr}}$$

$$\textcircled{5} \quad \text{Scatter @ } 30^\circ \text{ W. wall of cell}$$

$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4)}{(5.5)^2 (1.03)^2} \approx \boxed{7.6 \text{ mR/hr}}$$

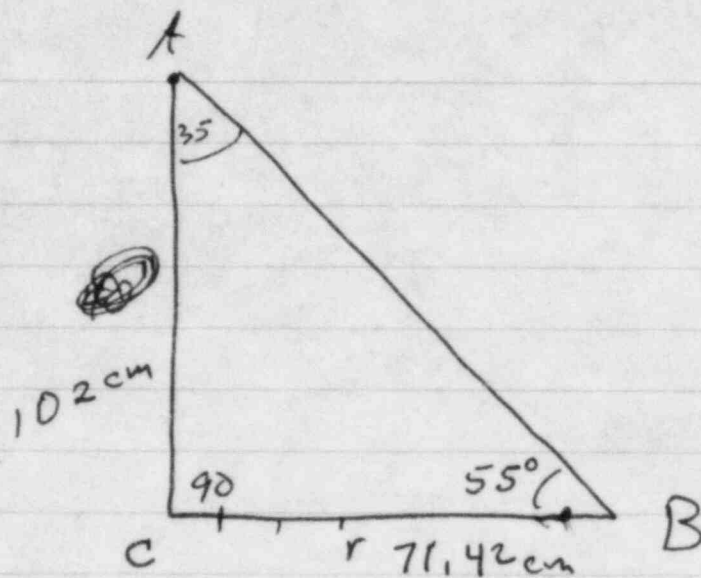
$$\textcircled{6} \quad \text{N. Wall of cell (uncontrolled area) Primary radiation:}$$

$$\frac{(2 \times 10^{-3})(508 \text{ RHM})(10^3 \text{ mR/R})}{(7)^2} \approx \boxed{207 \text{ mR/hr}}$$

N. Wall of Cell 30° scatter (uncontrolled area):

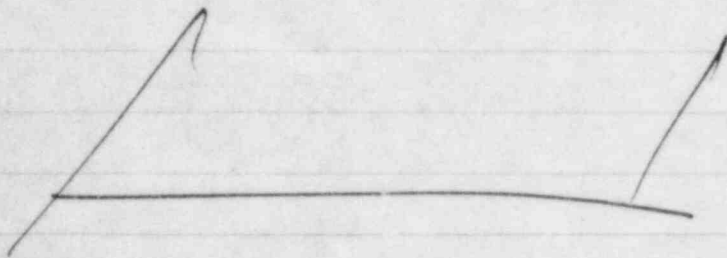
$$\frac{(2.5)(.006)(.002)(508)(1.6 \times 10^4)}{(7)^2 (1.03)^2} \approx \boxed{4.7 \text{ mR/hr}}$$

$\textcircled{7}$



$$\begin{aligned} \sin & \frac{y}{h} = \frac{\text{opp}}{\text{hyp}} \\ \cos & \frac{x}{h} = \frac{\text{adj}}{\text{hyp}} \\ \tan & \frac{y}{x} = \frac{\text{opp}}{\text{adj}} \end{aligned}$$

70 x 70 cm



$$\frac{r}{102 \text{ cm}} = \frac{\text{opp}}{\text{adj}} = \frac{y}{x}$$

$$\tan B = \frac{r}{102 \text{ cm}}$$

$$\tan 35^\circ = \frac{r}{102}$$

$$102 \tan 35 = r$$

$$102 (0.7) = r$$

$$71.42 \text{ cm} = r$$

$$A = \pi r^2$$

$$A = 3.1416 (71.42)^2$$

$$A = 16,017 \text{ cm}^2 \text{ area} = F$$

$$\alpha 90^\circ \text{ at } 1.6 \times 10^4 \text{ cm}^2 = .036$$

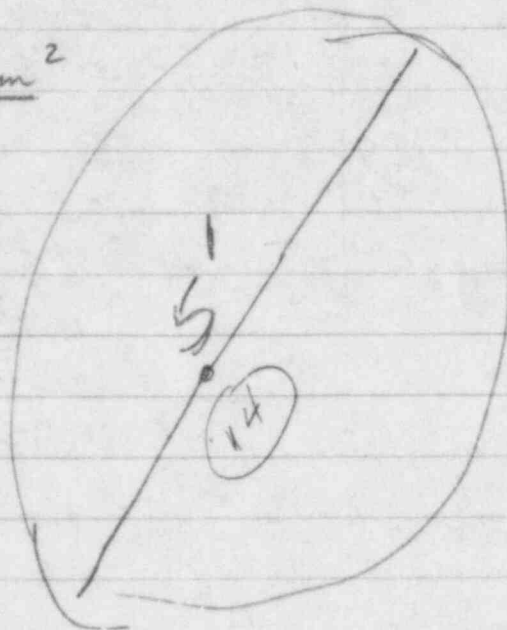
$$\frac{400 \text{ cm}^2}{.9 \times 10^{-3}} = \frac{1.6 \times 10^4 \text{ cm}^2}{X}$$

$$400 X = 14.4$$

$$X = .036$$

$$\alpha 30^\circ = .24$$

$$\alpha 60^\circ = .092$$



$$\frac{(2.5)(.036)(2.2 \times 10^{-1})(1000 \text{ RHM})(1.6 \times 10^4 \text{ cm}^2)}{(6 \text{ m})^2 (1.03 \text{ m})^2}$$

$$8,294.844 \text{ MR/kv}$$

1000

Magna Check - Shielding

Assumptions:

Source = 1,000 RHM Source ht from floor = 40" Beam = 35° from Vert. (cone)
Max. hrs/wk = 30 hrs/wk
Work = $30 \times 1,000 = 30,000$ RHM/wk = (WUT)
Use factor $U=1$; Occupancy factor $T=1$

East, West and South walls face controlled areas, must = 100 mR/wk
North wall faces uncontrolled area, must = 10 mR/hr

WUT = 30,000 RHM @ 1m.

Distance in meters = 15 ft.

from source to occupied area.

Deficiencies:

- (1) Need to submit survey report as required by 4/c. No. 16.
- (2) Prior to authorization for 1,000 Curies:
 - (a) Re-submit shielding evaluation.
 1. detailed calculations of max rad. levels in (restricted & unrestricted) each area adjacent to and above the radiography room. (see sample letter)
- (3) Rotation of Cyclops 0° (Strictly Vertical up & down)
(Confirm)
- (4) How high from floor (is Cyclops fixed at 40")
- (5) Calculate or give Field size at use distance.

Gamma Constant $C_{60} = 13.2 \text{ R/hr @ 1 meter / curie}$

1000 Curies = 13,200 RHM

462 Curies = 6,098 RHM

$$B_{ug} = 5 \times 10^{-1}$$

49	8. ⁰⁰
33	7. ⁰⁰
37	8. ⁰⁰
39	8. ⁰⁰
40	8. ⁰⁰
48	9. ⁰⁰

NCRP publications

P.O. Box 30175

Washington, D.C. 20014

202-657-2652

NCRP Publications

7910 Woodmont ave

Suite 1016

Bethesda, Md. 20814