

FGH

Fields, Griffith, Hubbard
and Associates, Inc.

1141 Hohlfelder Road
Glenview, Illinois 60022
312 835-4433

Certified
Radiation
Physicists

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

Theodore Fields M.S. FACR, CHP
Charles R. Griffith M.S. FACR
Lincoln B. Hubbard Ph.D. MACR, CHP
Michael V. Broadbent Ph.D. MACR
Francis E. Gannon M.S.

October 13, 1984

Radioisotope Licensing Branch
Division of Fuel Cycle and Material Safety
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

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

84

NOV 21

PM 2:26

RECEIVED

Subject: Teletherapy Survey Report of Beloit Memorial Hospital

Dear Sir:

In accordance with conditions of U. S. N.R.C. license # 48-13109-01, the following report is furnished.

All exterior walls and the ceiling have been checked to insure that radiation levels are within established limits. In addition, a complete survey has been performed.

The door interlock, treatment timer, and on-off indicators were checked according to the enclosed protocols. In addition, a drawing of the treatment room is included for your use in checking the orientations and barriers surveyed.

It should be noted that the levels at the treatment door were higher than expected. Since this is a controlled area they do not constitute a hazard to the general public. In addition, the maximum field size of 35 X 35 cm was used with and without the beam stop. It is unlikely that any lateral fields will exceed 20 X 20 or less. Measurements were made with a 20 X 20 for the higher radiation levels found, these are also included. It was originally planned to allow the beam to rotate plus or minus 90 degrees from the beam stop toward the walls. In an effort to reduce the levels at the door to the treatment room it has been decided not to allow the beam to move away from the beam stop toward the wall closest to the door.

A copy of the results of the survey is included for your inspection. Thank you for your time and effort.

Respectfully,

M. V. Broadbent, PhD
M. V. Broadbent, PhD, MACR

DATE	11/21/84
BY	Nov 15 III
EX	8
GROUP	
ACTION	11/21/84

RECEIVED
NOV 08 1984
REGION III

CONTROL NO. 77789

8503220341 850307
REG LIC30
48-13109-01 PDR

FEE EXEMPT

It survey report

FIELDS, GRIFFITH, HUBBARD & ASSOC., INC.

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

PROTOCOL TELETHERAPY TREATMENT TIMING DEVICE, SURVEY

Note: This does not include the "time correction term" evaluation (c.f. ANSI N449.1-1978 §4.14) which is properly part of every calibration and spot check.

The test shall consist of

- i) An accurate stop watch shall be used. Quartz wrist watches are suitable if they are known to have accuracy to 1 part in 100,000.
- ii) Set the treatment timer to a preset time of 1 minute.
- iii) Observe that the treatment room is empty and the beam is pointing in a safe direction as evidenced by survey.
- iv) Activate the beam and at the same time activate the stop watch
- v) At the termination of the exposure stop the stop watch. Exposure termination is to be judged by the reduction of radiation levels caused by the exposure. Excessively slow, incomplete or other abnormal withdrawal of the source are to be noted and investigated.
- vi) Human error and source movement error combines to an accuracy of approximately ± 0.2 seconds at normal illumination levels. Thus, the set time and the measured time must agree within this amount.
- vii) Observe the teletherapy unit control, the teletherapy unit head, and the radiation monitoring device(s) to ascertain that the source is OFF.
- viii) Repeat steps "ii" to "vii" with a time set to 59 seconds to test the accuracy of the seconds timer.
- ix) Without resetting the timer, activate the timer while observing the levels of emitted radiation. Neither the source head indicator or the radiation level indicator should show a source advance.

Units whose behavior fully complies with the items above will be said to have a timer which is "OK" with respect to this survey.

NRC draft licensing guide "for comment" p 37 "(4) Teletherapy treatment timing device. The tests should be sufficient to ensure that the timer is accurate, 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 until the timer is reset."

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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 indicated 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 behavior 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' conditions checks."

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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 behavior fully comply with the items below are designated "OK"

NCRP Report 33, item 4.2.1(d)8: "When the door to the treatment room is opened, the beam 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 returns 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 on 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.

TELETHERAPY SURVEY REPORT
TABLE I

1. INSTITUTION: Name Beloit Memorial Hospital
Address 1969 Hart Road
City Beloit State WI Zip 53511
N.R.C. License # 48-13109-01
2. SURVEYOR: Name M. V. Broadbent, PhD, MACR
Address 2367 Oak Hill Dr.
City Lisle State IL Zip 60532
3. Teletherapy unit: Mfr Picker Model C-9 Serial # 458
Teletherapy Source: Mfr ATC Model AMS-3802 Serial # AMS-22480
4. Date of Source Installation Oct. 12, 1984
5. Date of Survey Oct. 13, 1984
6. Survey Instruments:

Mfr	Model	Cal. Date	Cal. Method
<u>Victoreen</u>	<u>440</u>	<u>5/22/84</u>	<u>Commercial</u>
<u>Victoreen</u>	<u>570</u>	<u>9/13/84</u>	<u>RCL Madison, WI</u>
<u>Victoreen</u>	<u>621 Chamber</u>	<u>9/13/84</u>	<u>RCL Madison, WI</u>
7. Source Strength: Curies 6323 Date Aug 3, 1984
8. Output: R/min 105.5 rads/min at 80 cm cm for 10X10 field
on 10/13/84.
9. Leakage Radiation: See Table II.
10. Beam Orientation Limits & Method of Limitation
Electrically interlocked with mercury & micro switches to either-

1. Point directly at beam stop. <u>360 degree rotation without</u> <u>restriction.</u>	2. Without beam stop. <u>East 90 degrees</u> <u>West 15 degrees North & South 0</u>
--	---
11. Maximum Radiation Levels, Adjacent Areas, Rotation with Beam Stop (see Table IIIA).
12. Maximum Radiation Levels, Adjacent Areas without Beam Stop (See Table IIIB)
13. Check List, Mechanical Functions:

a) Door Interlock	OK (NRCP Standards)	OK/DOOR
b) Source "on-off" indicators; mechanical	OK	OK/UNIT
c) Beam stops functioning properly	Yes	OK/Control
d) Timer functions properly	Yes	

CONTROL NO. 77789

Old Unit: AECL Eldorado 8
Serial No.: 47
Date of Removal: 9/15/84
Removed by: ATC

Old Source: NPI-20-2400
Activity: 2500 Ci as of 8/1/81
Date of Removal: 9/15/84
Removed by: X-Ray Equipment Co.
P.O. Box 2431
Forth Worth, TX 76101

TELETHERAPY HEAD SURVEY

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

Position No.	Radiation Level (mr/hr)
View A	
1	1.3
2	0.8
3	0.8
4	2.8
View B	
5	1.8
6	2.2
7	1.3
8	1.1
View C	
9	1.3
10	1.8
View D	
11	1.8
12	1.6
13	1.5
14	1.8
Average value	1.6
Maximum value	2.8

Date of survey 10/13/84

Instrument used Victoreen 440

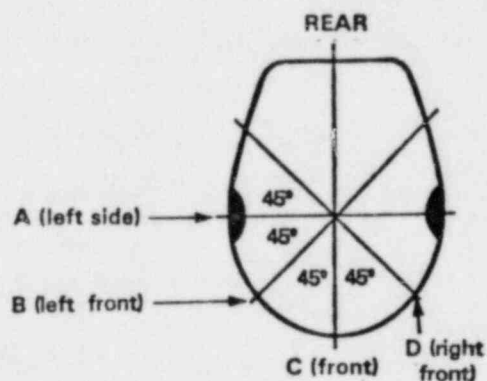
Manufacturer's name & model number of teletherapy source Picker C9

Date of installation 10/12/84

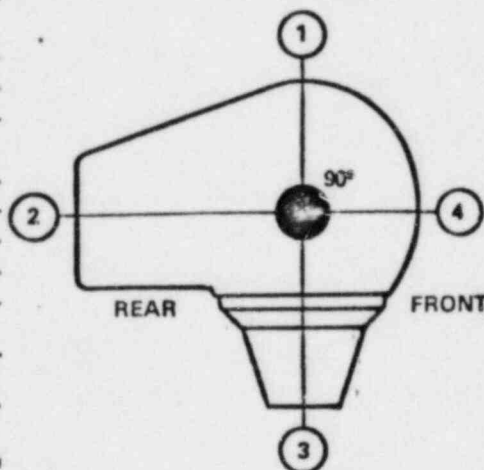
OUTPUT 6,331 ☒ RHM
☐ RMM

Date of output measurement 10/13/84

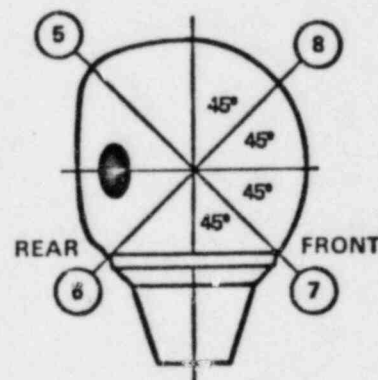
Top View-Showing
orientation
of Views A through D



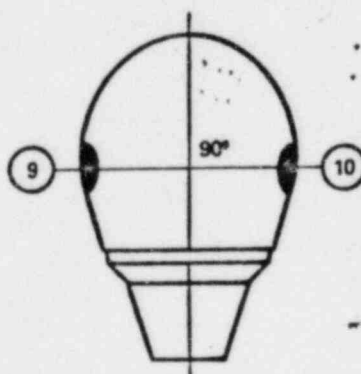
View A-Vertical
from left side



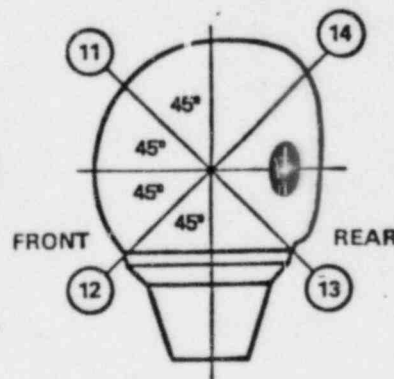
View B-Vertical
from left front



View C-Vertical
from front



View D-Vertical
from right front





Advanced Medical Systems, Inc.

1020 London Road
Cleveland, OH 44110
(216) 692-3268

Beloit Memorial Hospital
1969 West Heart Road
Beloit, WI 53511

CERTIFICATE OF MEASUREMENT COBALT-60 SOURCES

CATALOG NO. AMS-3802
SERIAL NO. AMS-22480

This is to certify that the radioisotope source as identified above was measured at the Advanced Medical Systems, Inc., 1020 London Road Cleveland, Ohio, U.S.A., in such a fashion that the measurement is equivalent to that obtained when the source is installed in a Picker Corporation Catalog Number 6296F 60-Cobalt Beam Therapy Treatment equipment with Catalog Number 3706D beam defining device of 25 cm by 25 cm aperture at a distance of 80 cm.

Under these conditions this source was found to have a radiation output in free air of 7144 roentgens per hour at one meter on 3rd August 1984.

The attached decay table for this radioisotope will be useful in estimating the activity at future dates.

This source Will contain 6323 curies on SEPTEMBER 1st, 1984

Signed: GLENN R. SIBERT

Glenn Sibert
Dated: 10/1/84

The measurement reported is for invoicing purposes only and A.M.S. Inc, assumes no responsibility for results of exposures computed with this value.



Advanced Medical Systems, Inc.

1020 London Road
Cleveland, OH 44110
(216) 692-3268

Beloit Memorial Hospital
1969 West Heart Road
Beloit, WI 53511

CERTIFICATE OF WIPE TESTING OF RADIOISOTOPE SOURCE

This is to certify that the radioisotope source identified as ADVANCED MEDICAL SYSTEMS, INC., Catalog No. AMS- 3802, Serial No. AMS- 22480 Cobalt-60 Therapy Source and to be installed in Picker Model No. 590-G, Serial No. 458 Therapy Unit, was wipe tested on August 3rd, 1984 and found to have .00061 microcurie of removable contamination, as determined by comparison of the wipe with a standard Cobalt-60 source of .0623 microcurie in a Picker Model 2804 Welltype Scintillation Detector and a Picker Model 628433 Spectroscaler.

Signed: GLENN R. SIBERT

A handwritten signature in cursive script that reads 'Glenn Sibert'.

Dated: 10/1/84

X-RAY EQUIPMENT COMPANY

Standard X-Ray Equipment

P. O. Box 2431

Phone 817/336-3461

FORT WORTH, TEXAS 76101

This is to certify that a Cobalt-60 Source:

Model Number: NPI-20-2400W

Serial Number: T-505

Containing 2500 curies as of 8-1-81

and which has been determined by wipe test to be leak free, has been removed from a teletherapy unit described as follows:

Manufacturer: A.E.C.L.

Model Number: Eldorado 8

Serial Number: 47

and is hereby transferred from:

Beloit Memorial Hospital

1969 W Hart Rd., Beloit, WI 53511

License Number: 48-13109-01

TO: X-RAY EQUIPMENT COMPANY

Ft. Worth, Texas 76104

Texas Radioactive Material License Number: TX-5-1485

Gordon Chalk

Gordon Chalk

DATE: 9-15-84

Clude D. Peabody

Clude D. Peabody

DATE: Sept. 15, 1984

2ND FLOOR - DOCTORS
LOUNGE - UNRESTRICTED

1984 ATC C-9 ISOCENTRIC UNIT
BETHLEHEM MEMORIAL HOSPITAL

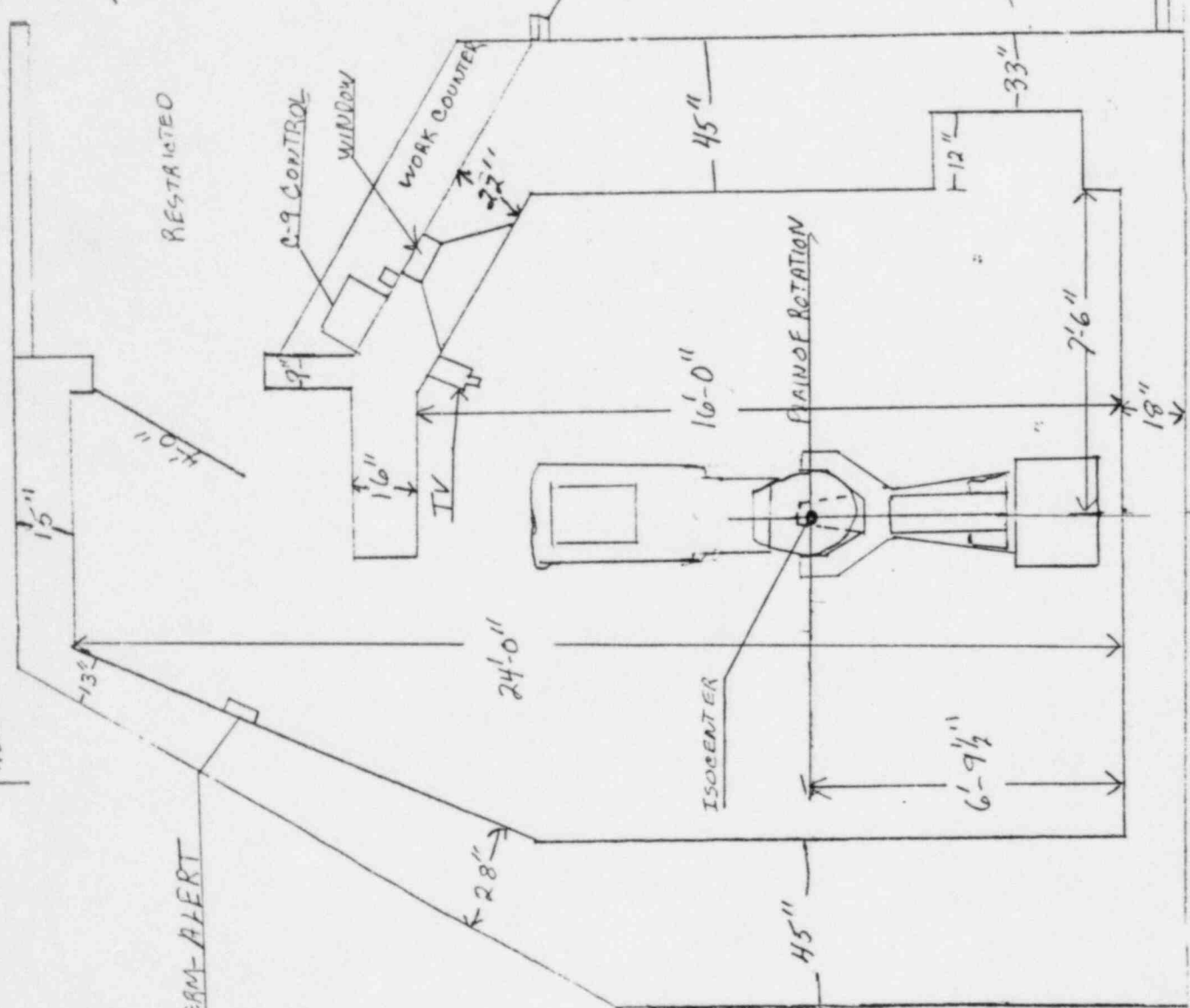
STAFF CORRIDOR
UNRESTRICTED



1. CONCRETE - 147185/CU. FT.
2. FLOOR - ON GRADE - NO BASEMENT.
3. WINDOW 8 x 8 = 22" CONC.
4. DOOR = 12.5MM LEAD.
5. CEILING - 10'-9" HIGH
6. 2ND FLOOR - 39" CONCRETE
6. 2ND FLOOR - SURGICAL DEPT - DOCTORS LOUNGE.
- ULTRASOUND ROOM
- UNRESTRICTED
- 8'-6" x 11'-0"

EXAM ROOM
+ 12'-6" x 14'-0"
SUPERFICIAL THERAPY
UNRESTRICTED

WALL 2' 11"



STAFF CORRIDOR
UNRESTRICTED

STAFF CORRIDOR
UNRESTRICTED

STORAGE
PORTABLE
X-RAY UNIT

ITEM 9a
7-12-84

TABLE III A
(A for rotations unit with beam stop, B for no beam stop)

MAXIMUM EXPOSURE ADJACENT AREAS

A Barrier	B MPD mR/hr	C Type Occ	D Pos. of Max.	E Max mR/hr
North	0.1	C		M
North East	0.1	C	285	0.4
East	0.1	C		M
South	0.01	NC	330	0.28
West	0.01	NC		M
North West	0.01	NC		M
2nd Floor	0.01	NC		M
Window	0.1	C		M
Door	0.1	C	75 105	2.8* 1.4**
Operator	0.1	C	60 to 120	1.5

M = \leq 0.2

Notes;

A. Reference barriers as shown in accompanying drawing.

B. MPD applicable to area

C. Type of Occupancy (C-Controlled; NC-Non-Controlled)

D. and E. See Supplement Tables for reading at all position of beam at each barrier.

*for field size of 35 X 35

**for field size of 20 X 20

TABLE III B
(A for rotations unit with beam stop, B for no beam stop)

MAXIMUM EXPOSURE ADJACENT AREAS

A Barrier	B MPD mR/hr	C Type Occ	D Pos. of Max.	E Max mR/hr
North	0.1	C		M
North East	0.1	C		M
East	0.1	C		M
South	0.01	NC		M
West	0.01	NC		M
North West	0.01	NC		M
2nd Floor	0.01	NC		M
Window	0.1	C		M
Door	0.1	C	105	12 *
			120	1.8**
Operator	0.1	C		M

M = \leq 0.2

Notes;

A. Reference barriers as shown in accompanying drawing.

B. MPD applicable to area

C. Type of Occupancy (C-Controlled; NC-Non-Controlled)

D. and E. See Supplement Tables for reading at all position of beam at each barrier.

*for field size of 35 X 35

**for field size of 20 X 20

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AMERICAN BOARD OF RADIOLOGY
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GLENCOE, ILLINOIS 60022
AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: NORTH

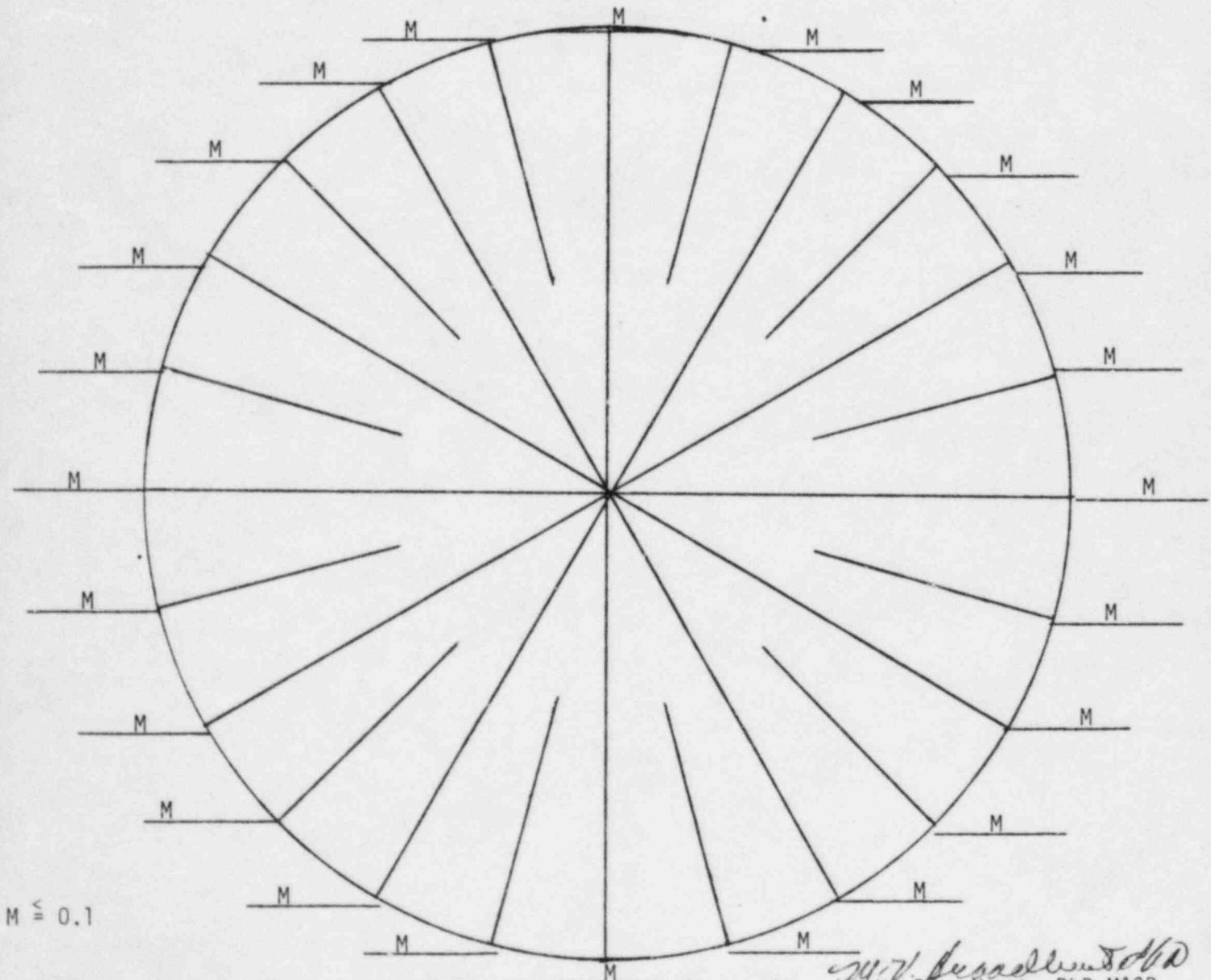
Beam stop is (用) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/ 84 Machine: PICKER C-9 Survey by: M. V. Broadbent, PhD, MACR

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 GLENCOE, ILLINOIS 60022
 AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: NORTH EAST

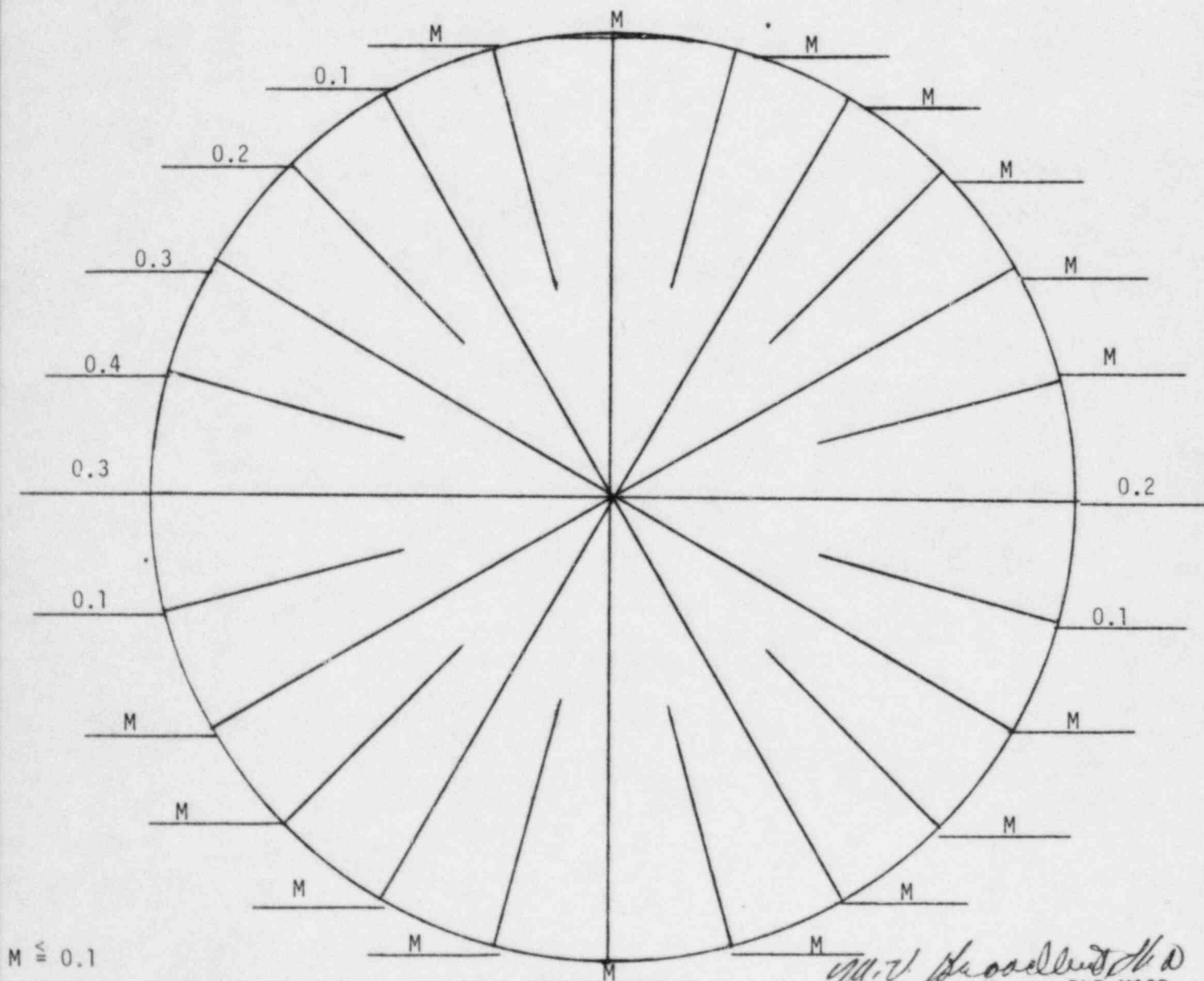
Beam stop is (~~not~~) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



M = 0.1

Date: 10/13/84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: EAST

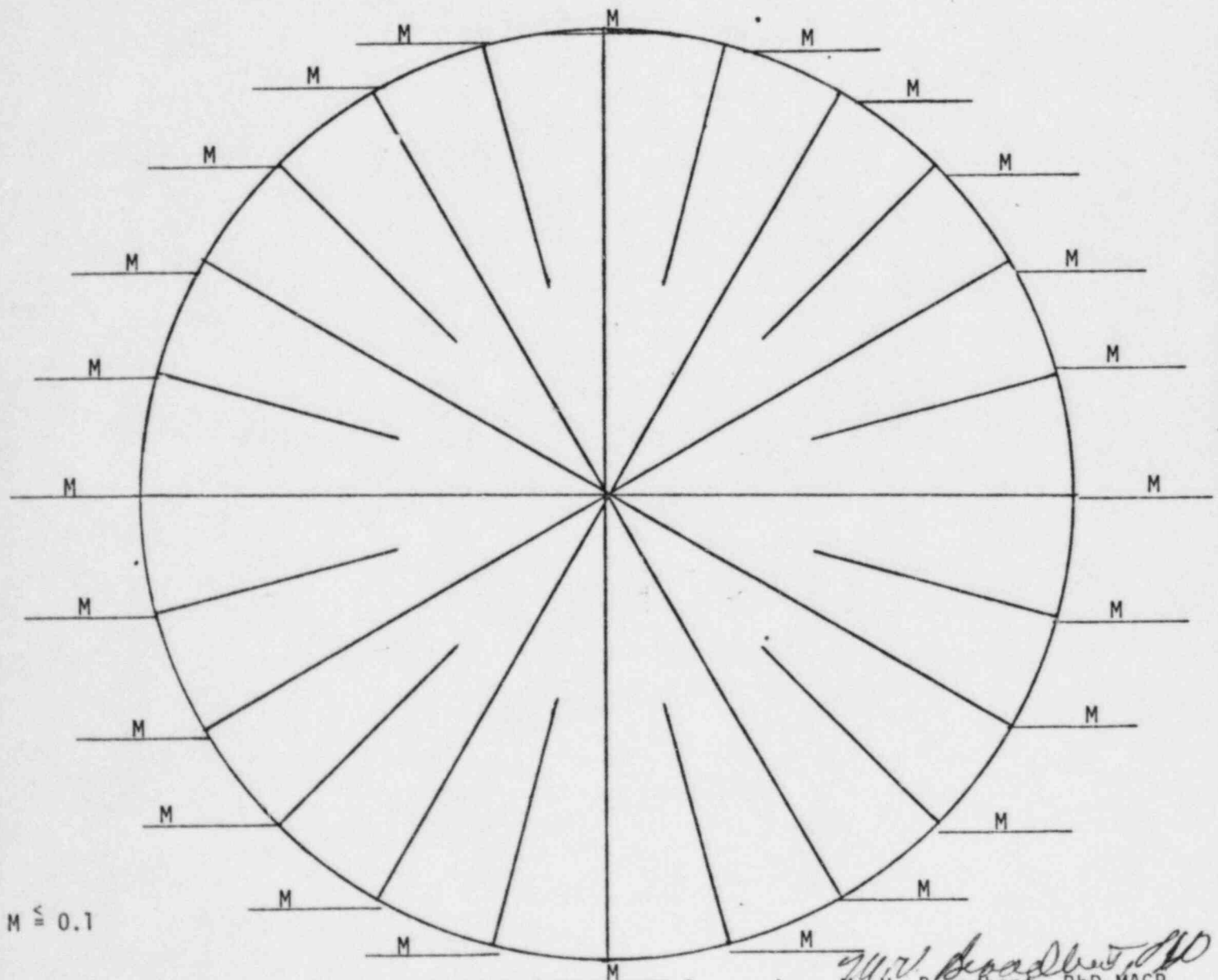
Beam stop is (用) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/ 84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: SOUTH

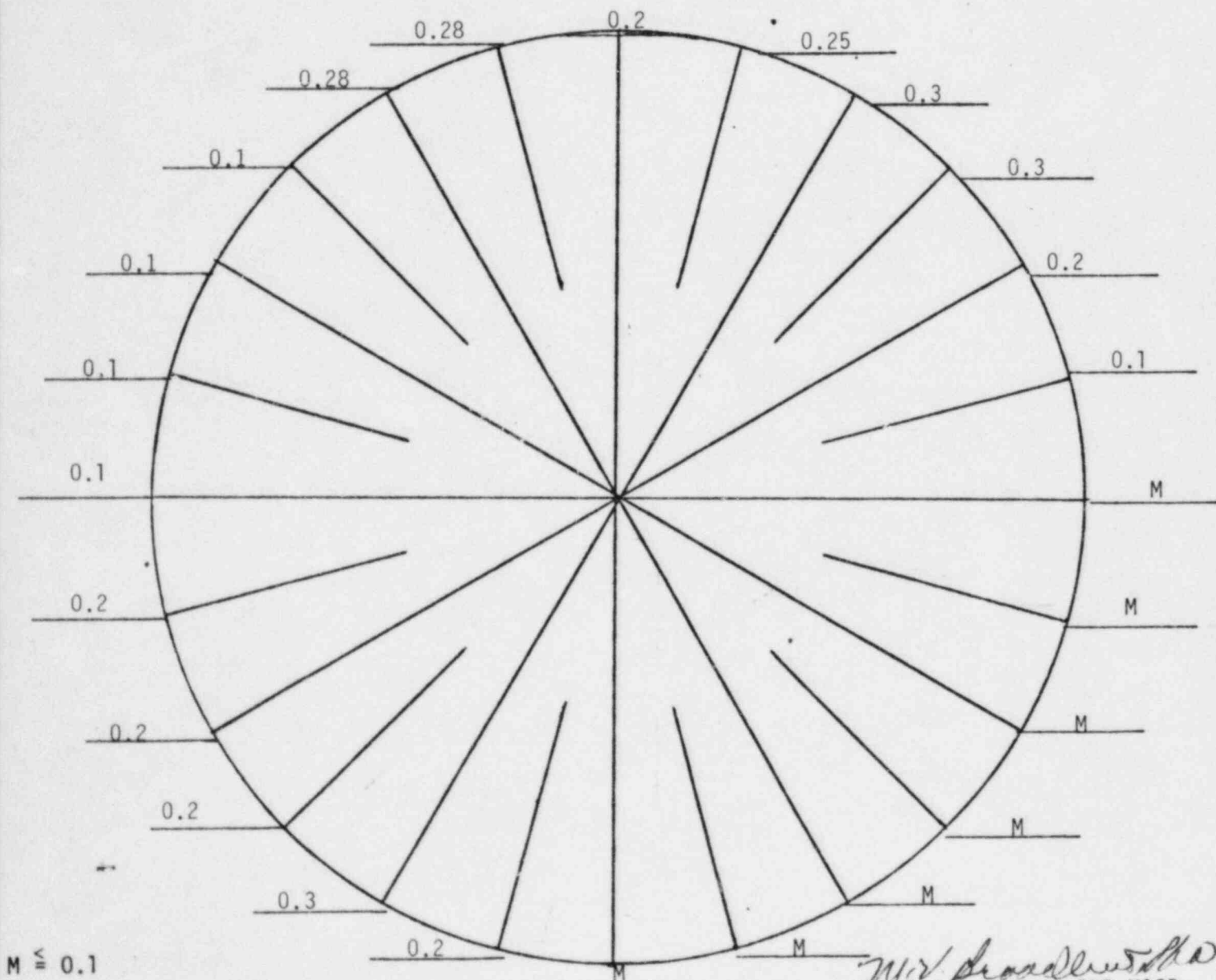
Beam stop is (~~not~~) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/84

Machine: PICKER C-9

Survey by:

M. V. Broadbent, PhD, MACR

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: WEST

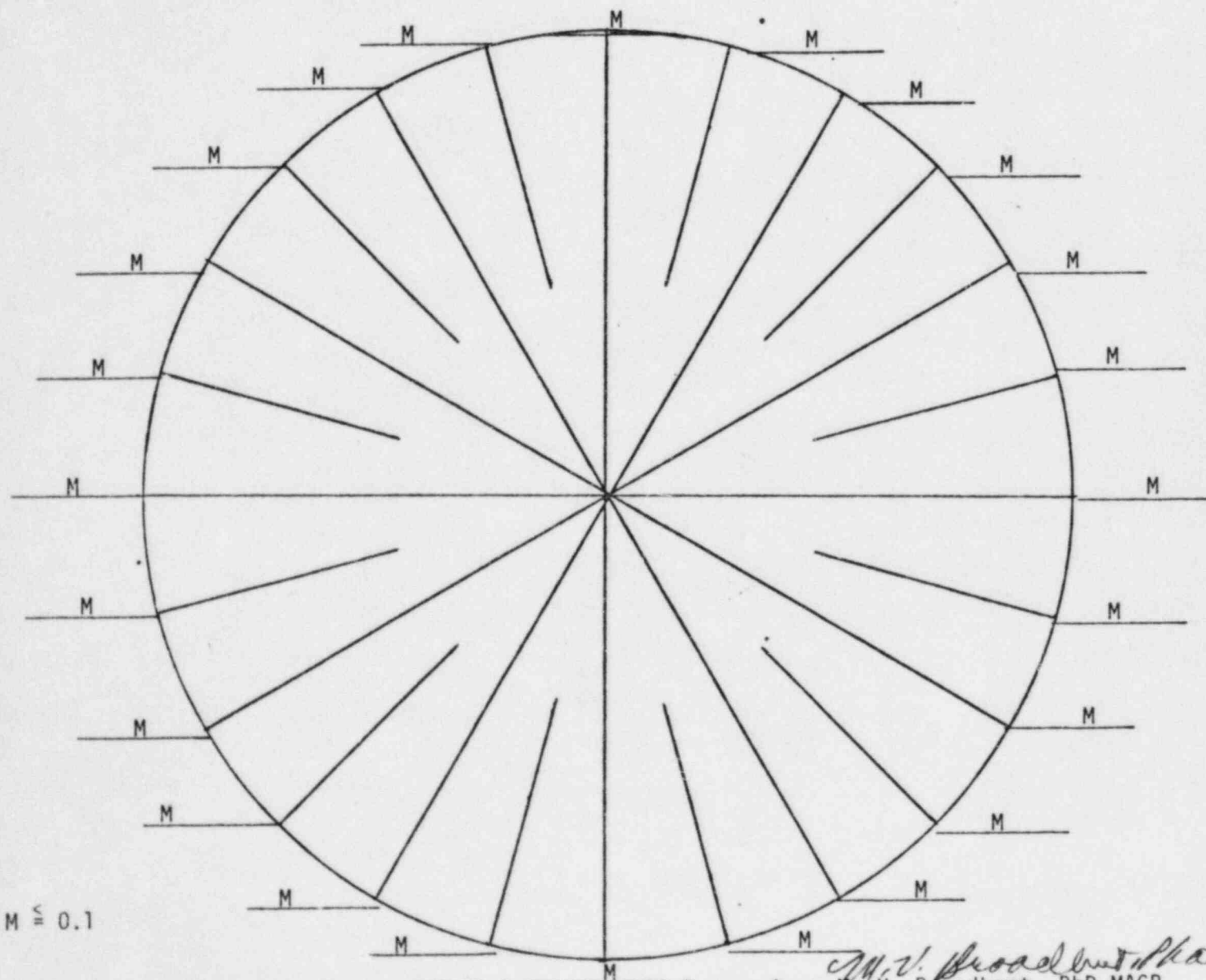
Beam stop is (用) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/ 84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: NORTH WEST

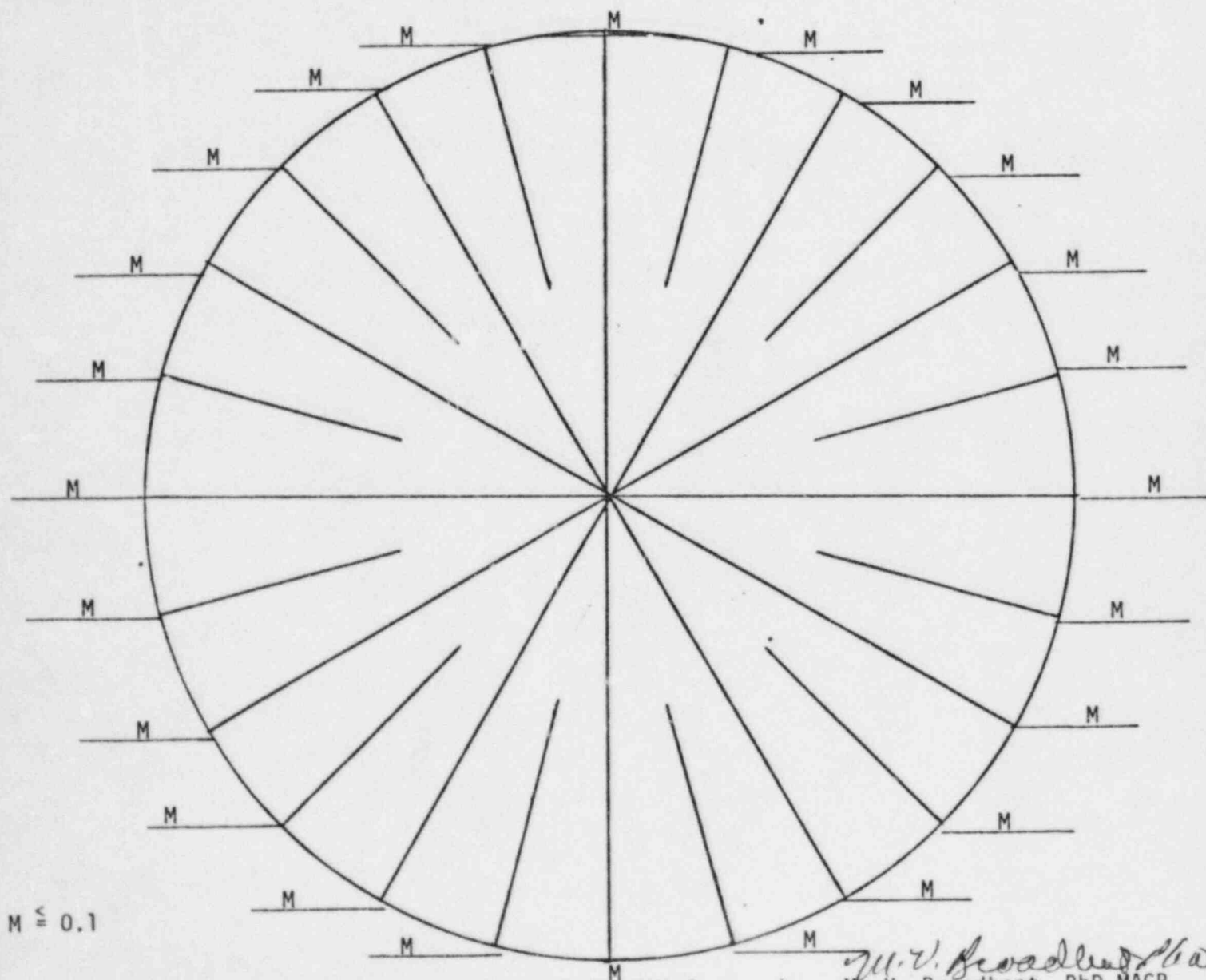
Beam stop is (用) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/ 84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: SECOND FLOOR DRESSING ROOM

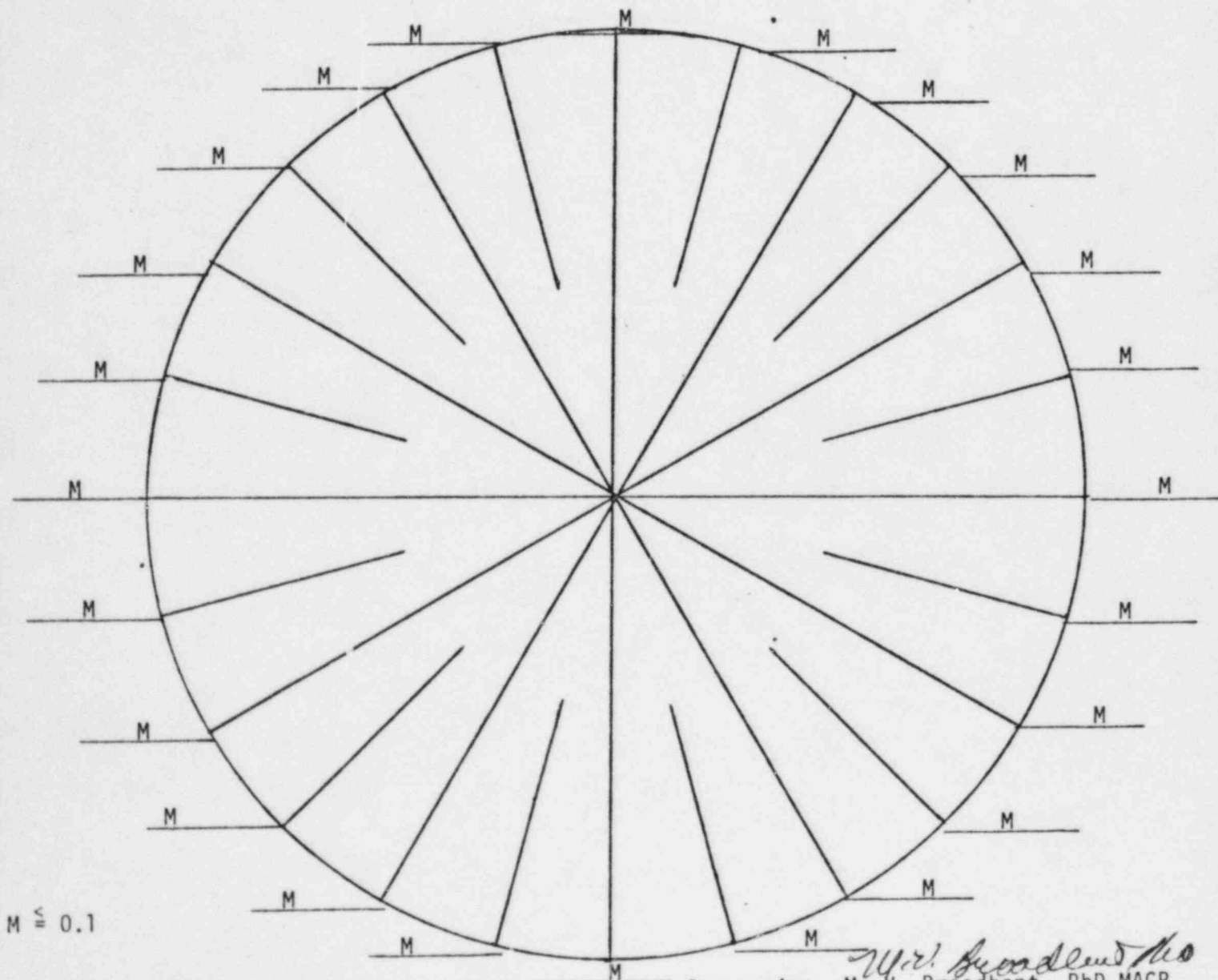
Beam stop is (~~not~~) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/ 84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: WINDOW

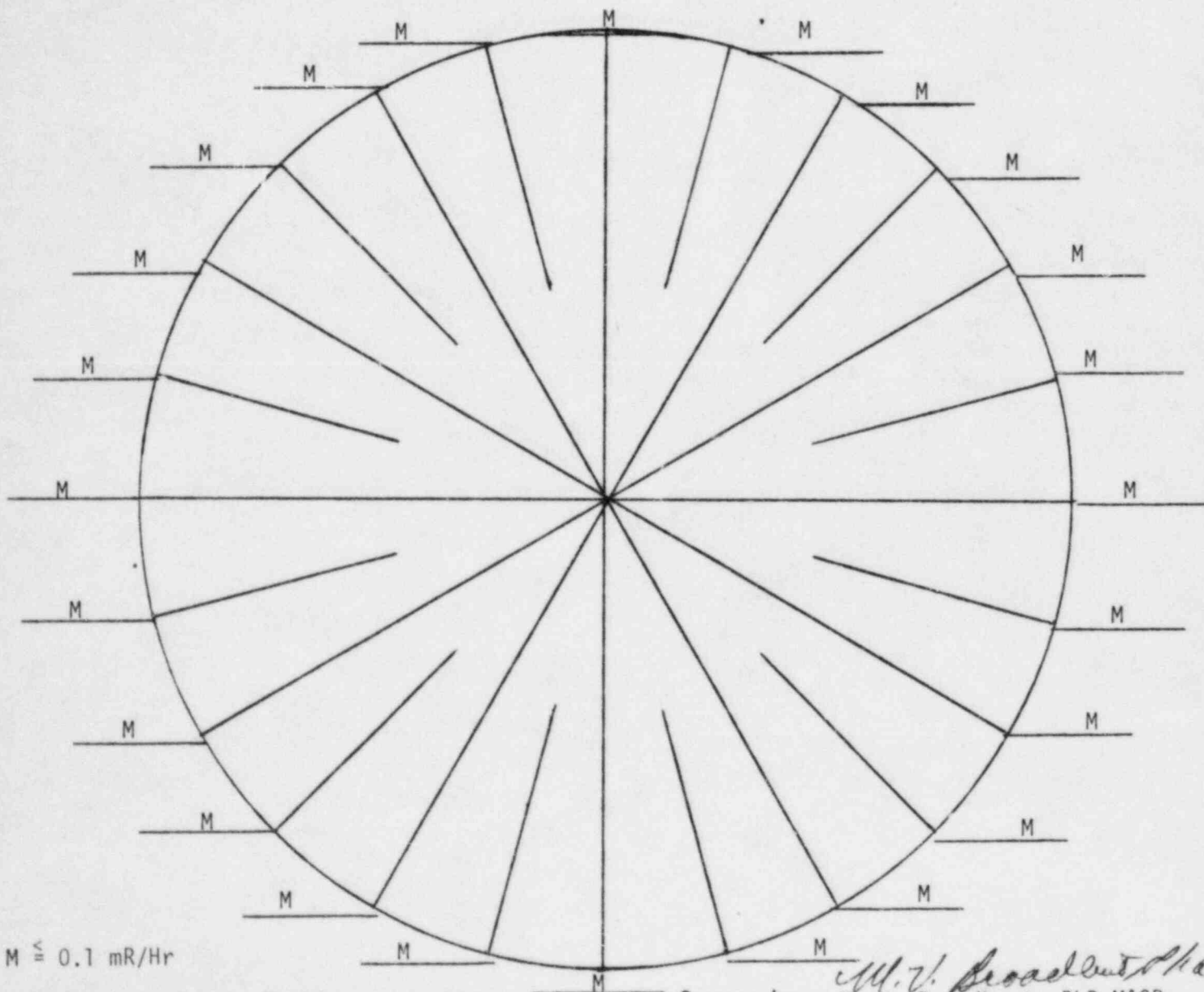
Beam stop is (~~not~~) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



Date: 10/13/84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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 GLENCOE, ILLINOIS 60022
 AREA 312 835-4433

BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: DOOR

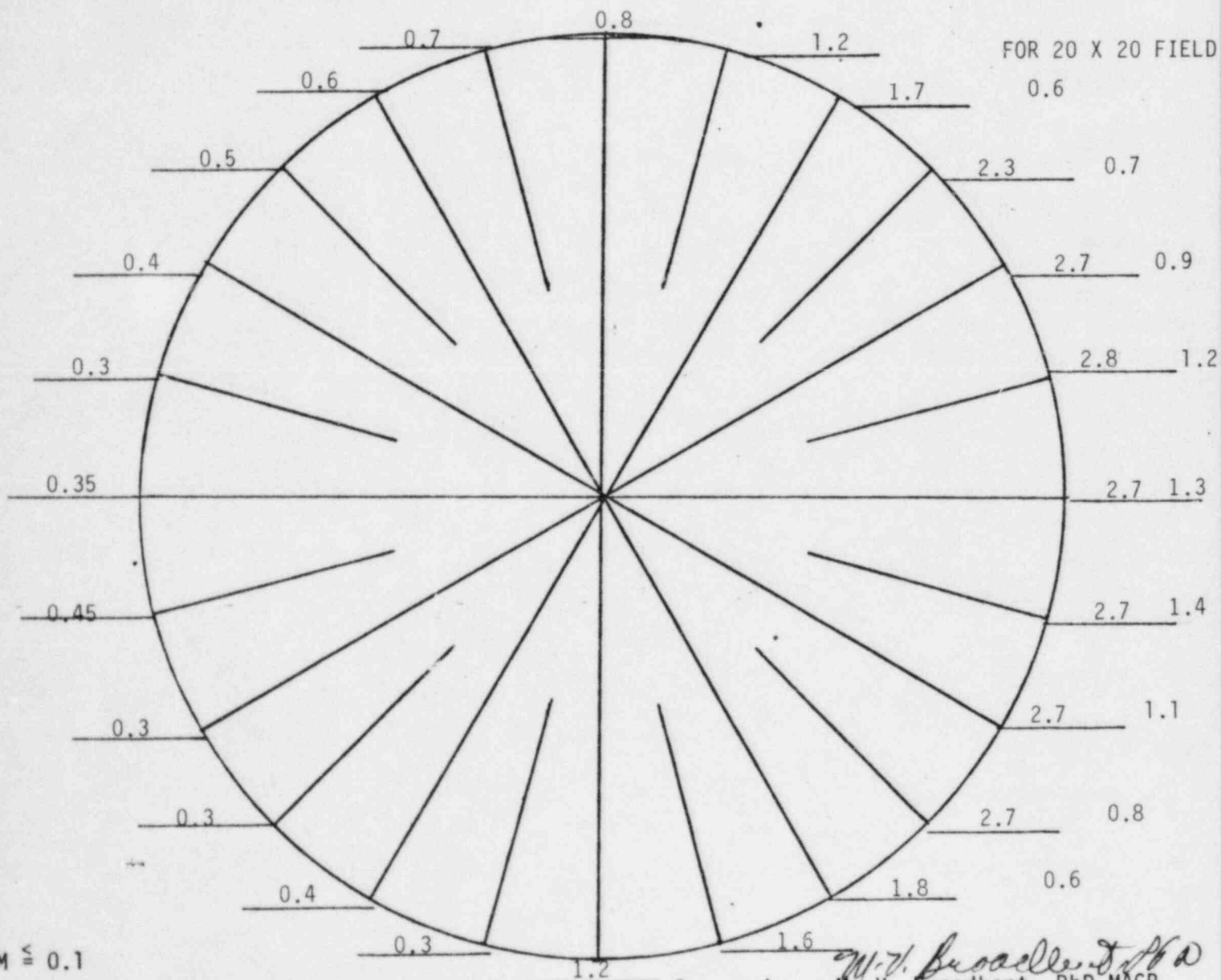
Beam stop is (~~not~~) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



M \leq 0.1

Date: 10/13/84

Machine: PICKER C-9

Survey by: M. V. Broadbent, PhD, MACR

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: OPERATOR

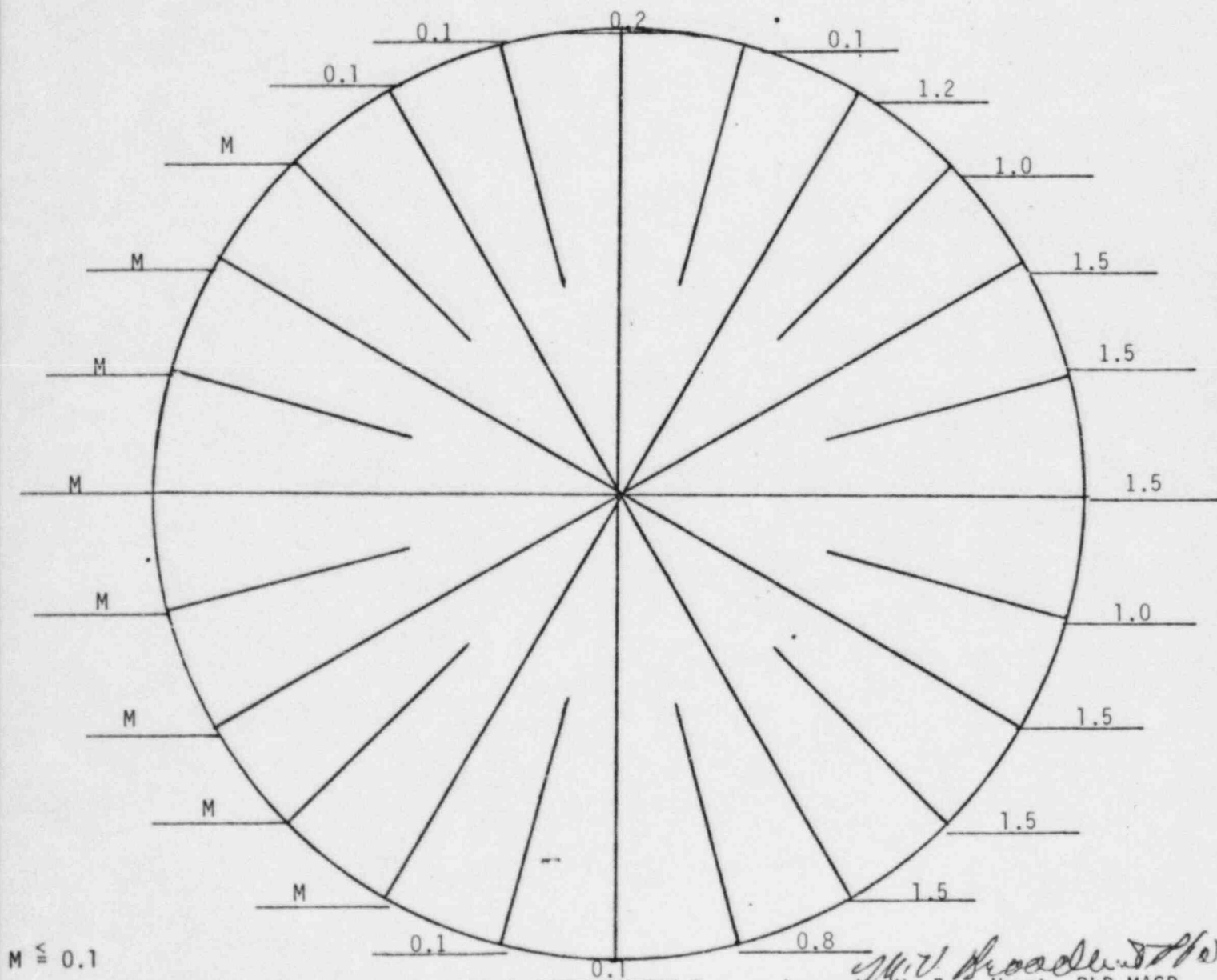
Beam stop is (M) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



M \leq 0.1

Date: 10/17/84

Machine: PICKER C-9

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: North

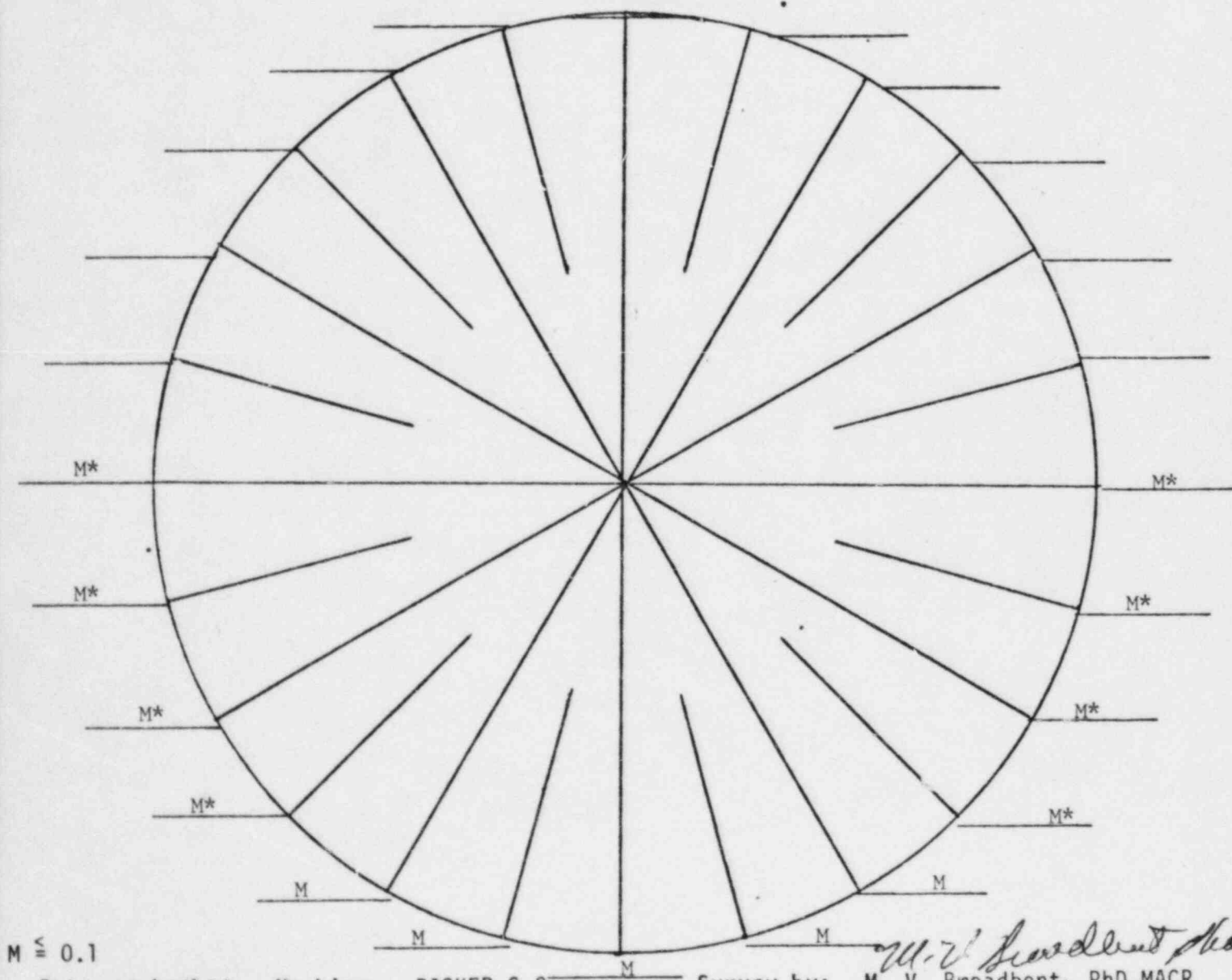
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



$M \leq 0.1$

Date: 10/13/84

Machine: PICKER C-9

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: NORTH EAST

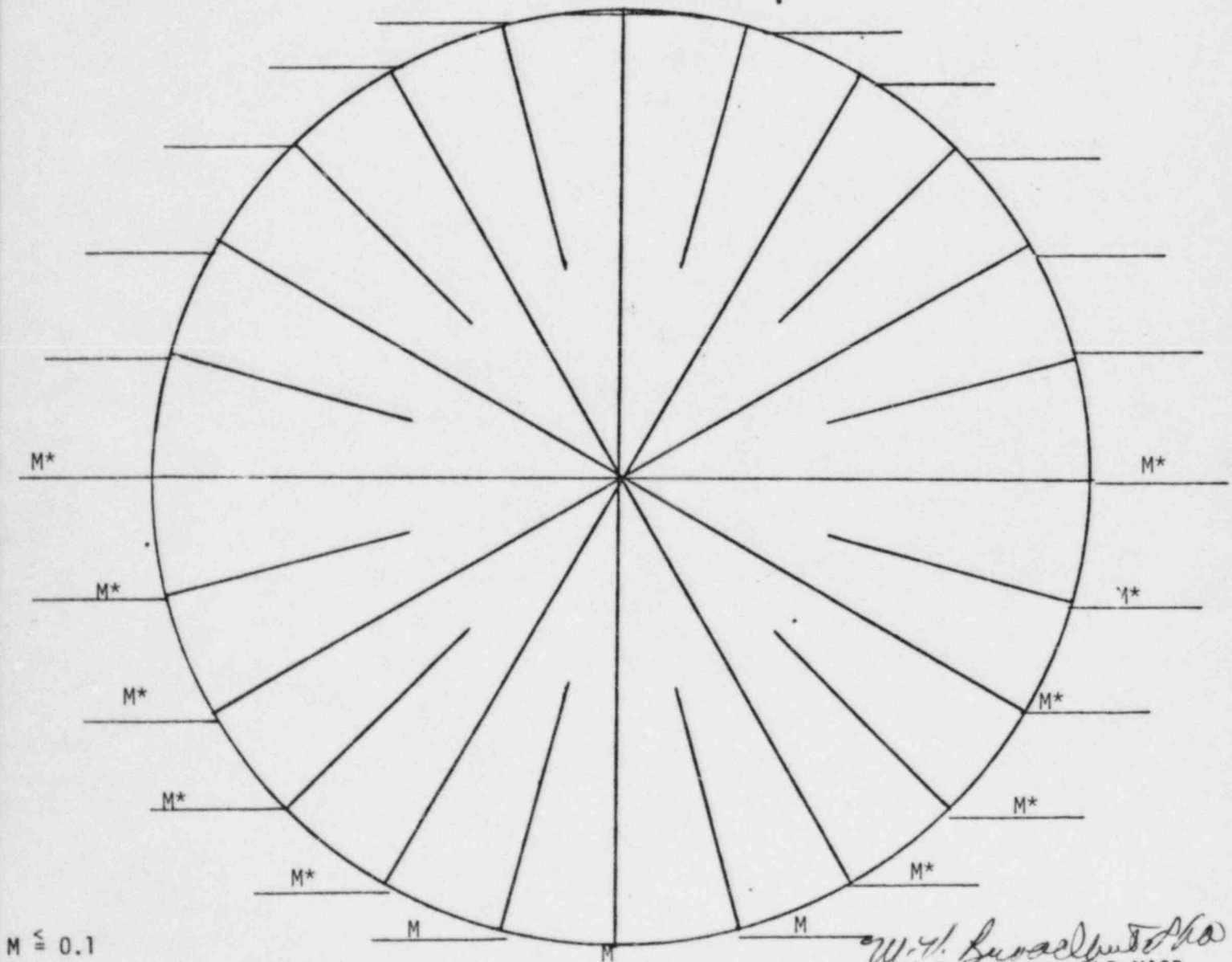
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



$M \leq 0.1$

Date: 10/17/84

Machine: PICKER C-9

Survey by:

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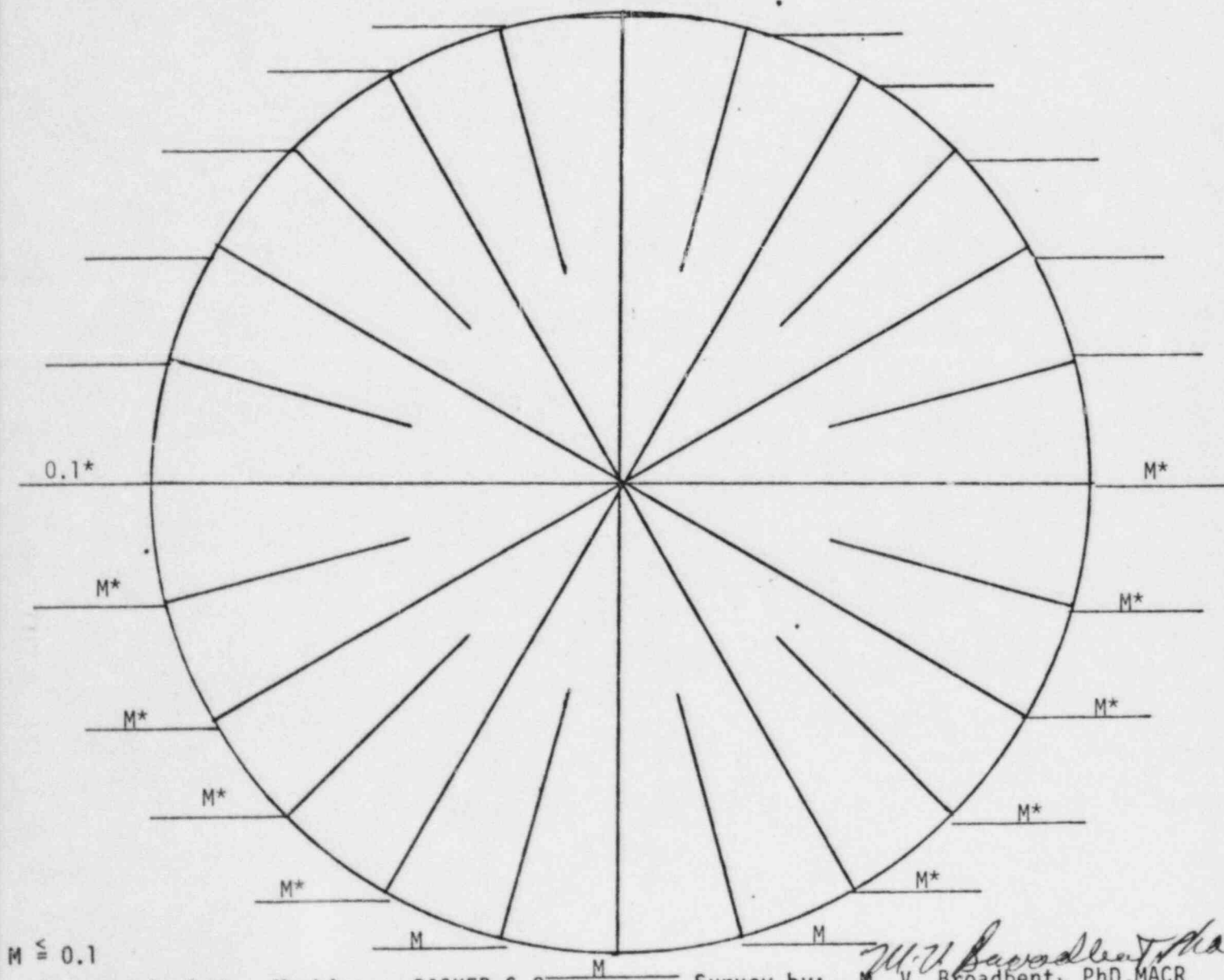
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Exposure for Barrier: EAST

Phantom in the beam except as noted*

Exposure rates are maximum for location.

Beam points in direction indicated by arrows.



Date: 10 / 13 / 84

Machine: PICKER C-9

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: South

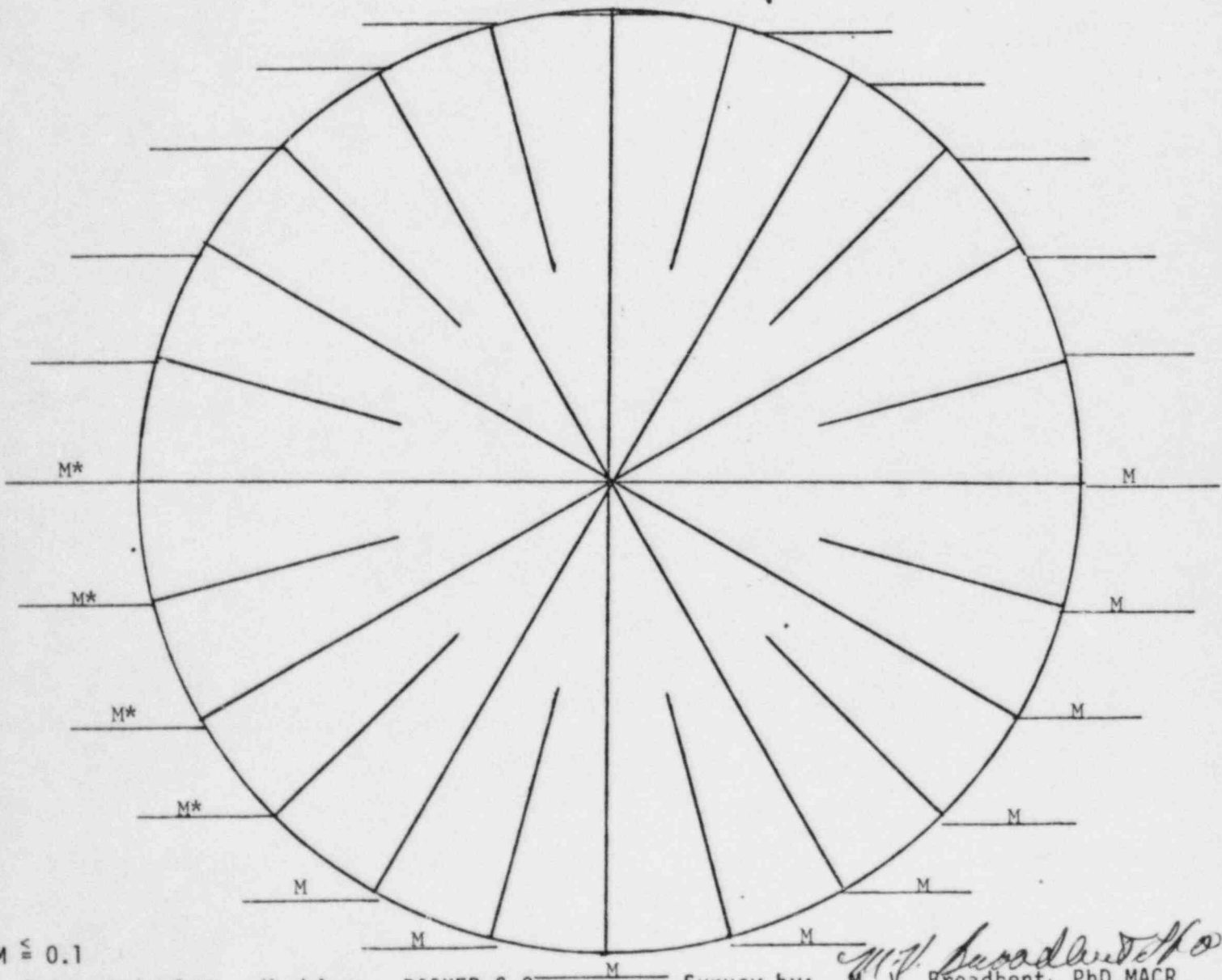
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



$M \leq 0.1$

Date: 10/13/84

Machine: PICKER C-9

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Exposure for Barrier: NORTH WEST

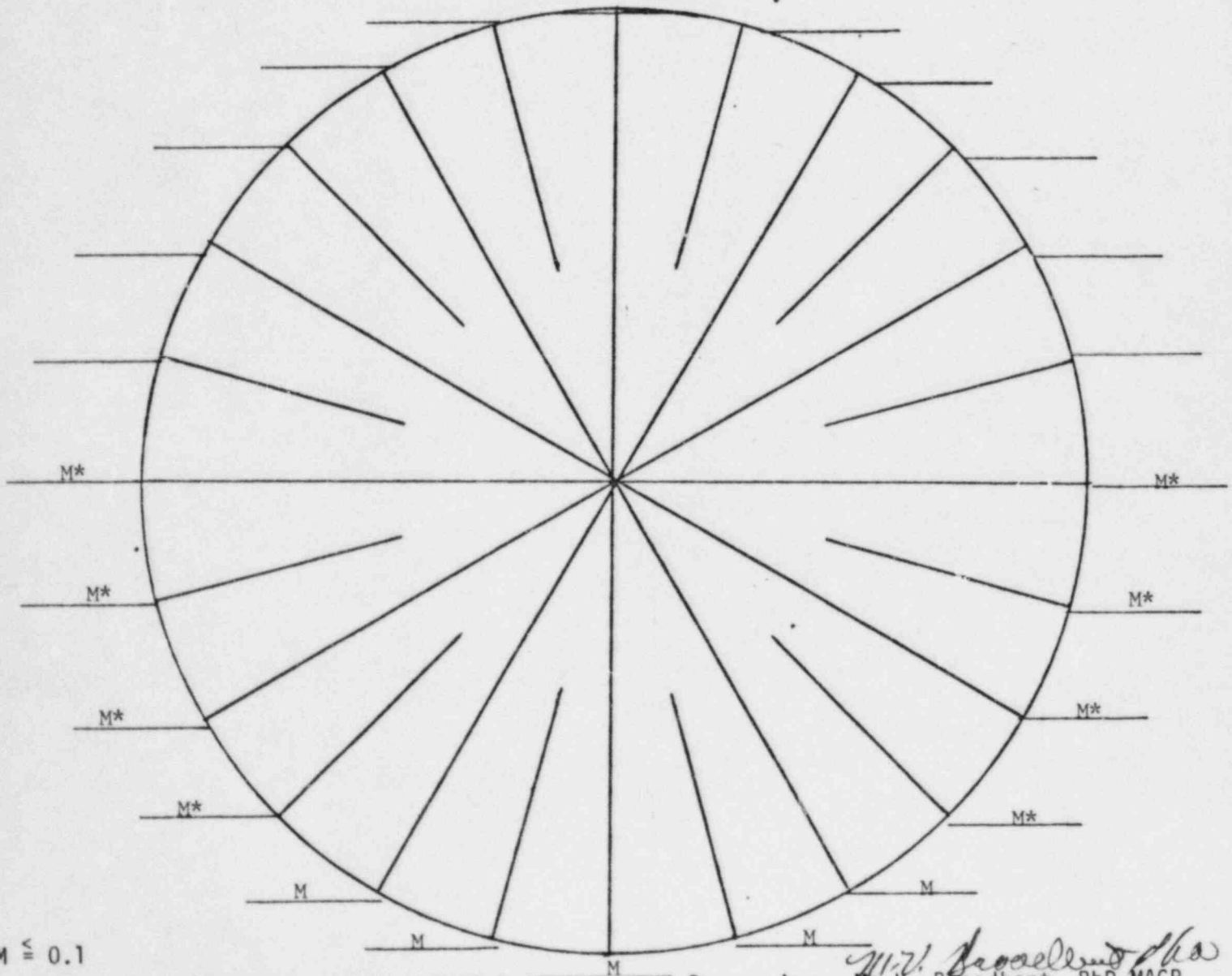
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



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Exposure for Barrier: SECOND FLOOR DRESSING ROOM

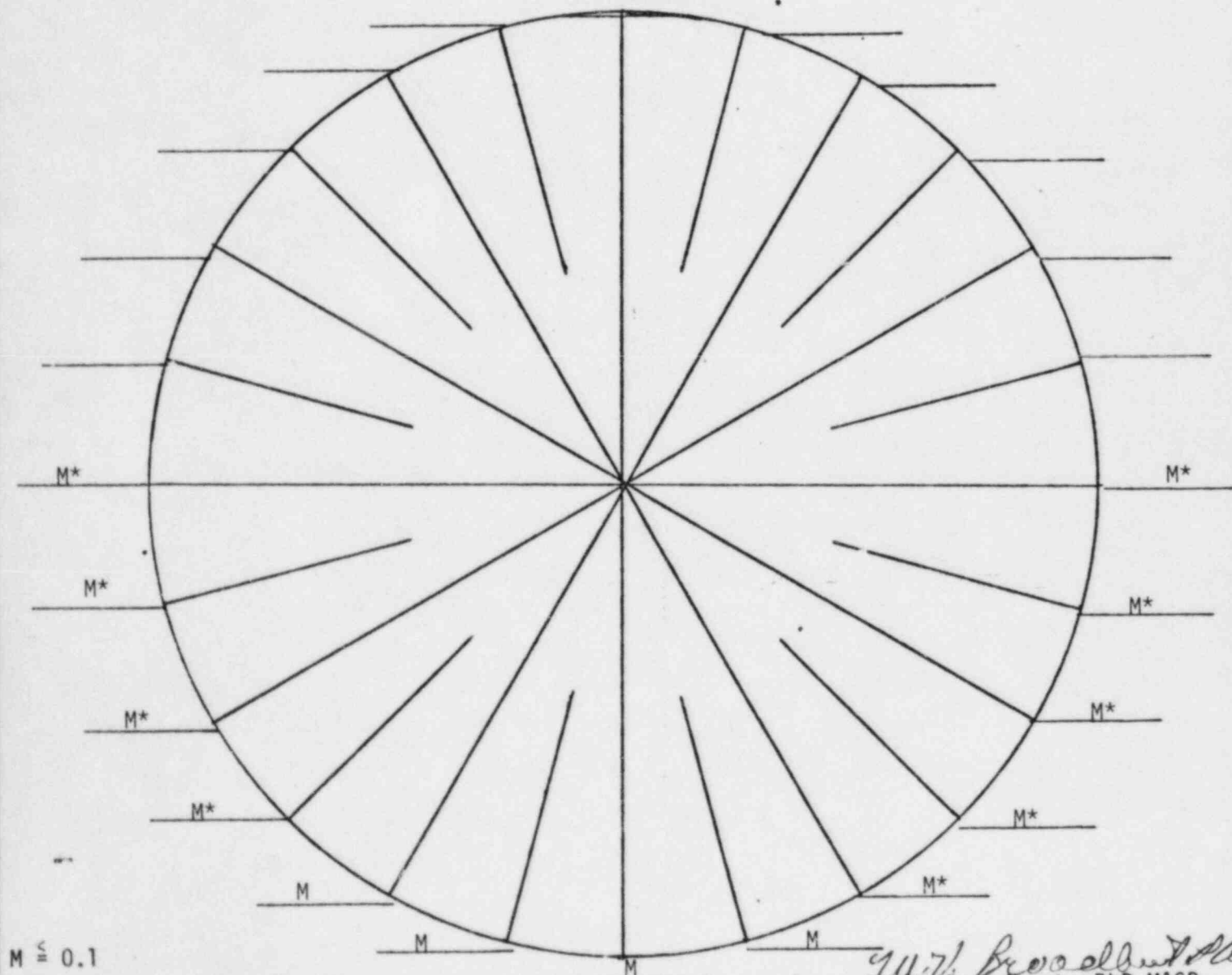
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



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Exposure for Barrier: WINDOW

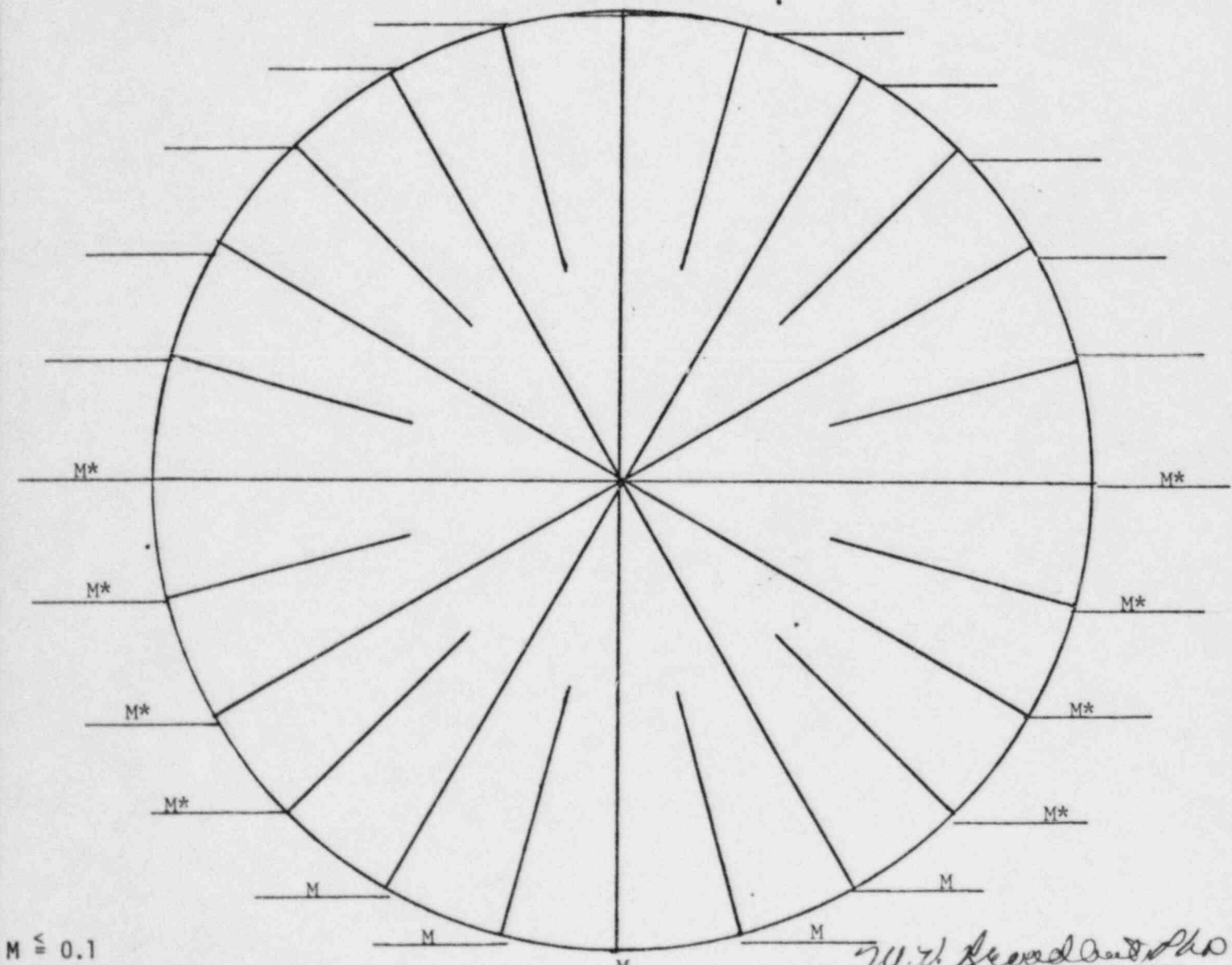
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



$M \leq 0.1$

Date: 10/17/84

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BARRIER SURVEY FOR: BELOIT MEMORIAL HOSPITAL

Exposure for Barrier: DOOR

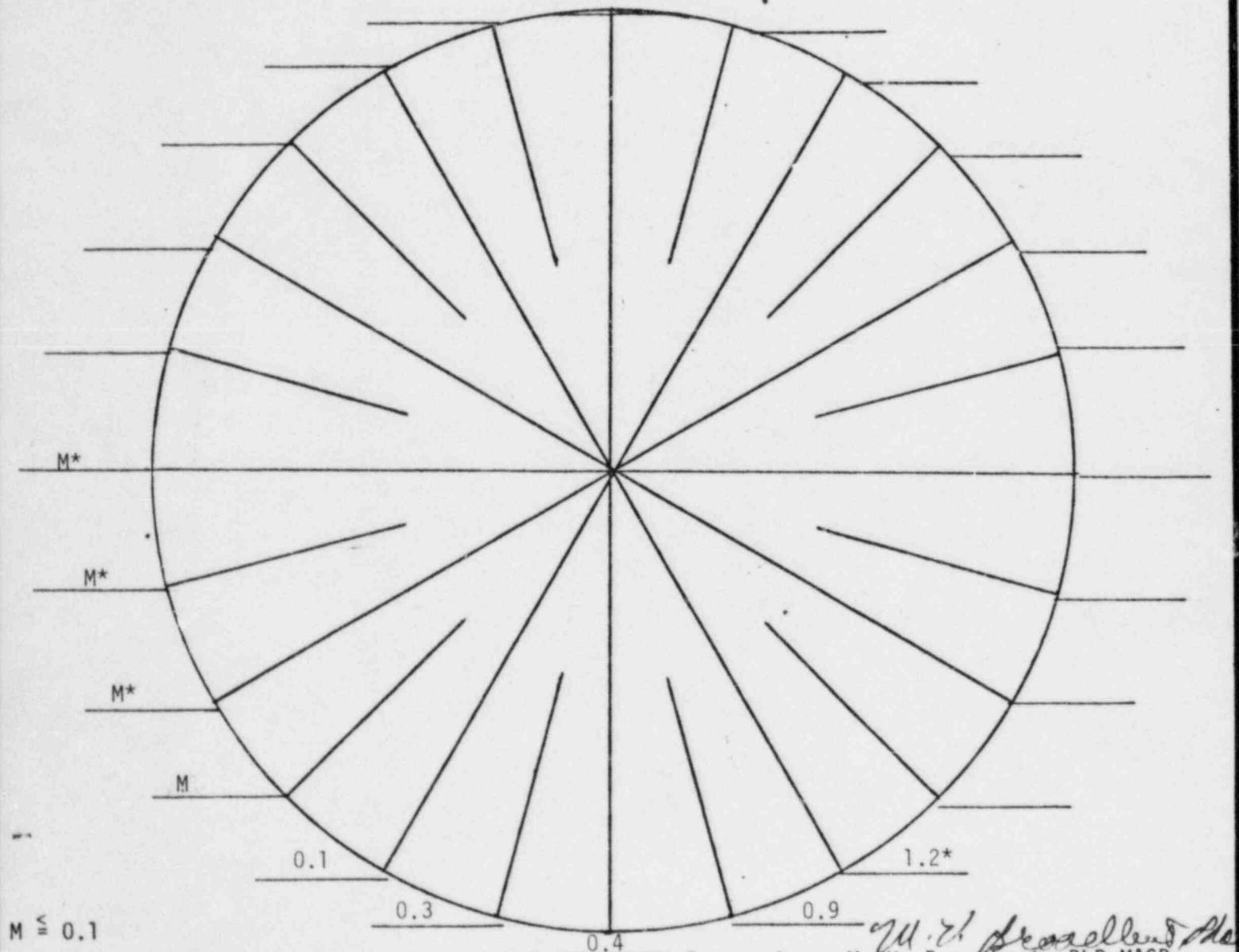
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



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Exposure for Barrier: OPERATOR

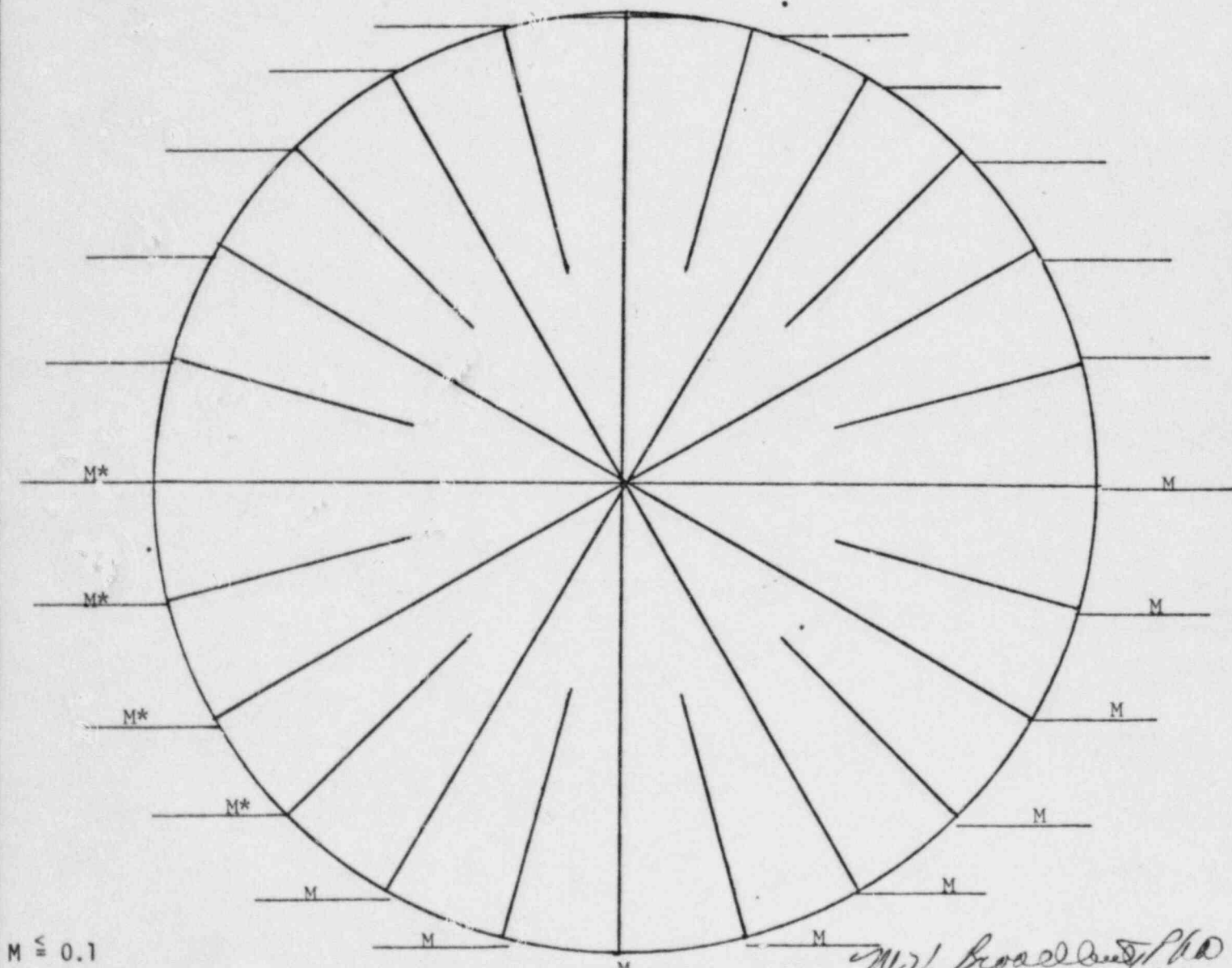
Beam stop is (not) in the beam.

Amounts shown are in mR/hr.

Beam points in direction indicated by arrows.

Phantom in the beam except as noted*

Exposure rates are maximum for location.



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Date: 10/17/84

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