0930 03

960 Code 960

NAVAL SPD LTR.

Commander
Pearl Harbor Naval Shipyard
Box 400
FPO, San Francisco 96610

etc.

Ref: (a) NAVELEX 9900, ser 80-0516, dtd 11 Apr. 1969

Reference (a) request expiration date of subj. lic be amended to chge exp. dte from 30 Apr. 1969 to 30 June 1969 During

Recent ~~telephone~~ fonecon, ref. (b), indicated ~~addition~~ ref (c) fwded ~~was~~ on 17 April. ~~In~~ Since applicatn ~~was~~ had been forwarded, ~~the~~ on 17 th, & and ext. of exp. dte previously request AEC considers application timely filed.

Rm-4407 (MN.-Navy {64779 / 61021}

1- Cpy To Wright, Wm - PMS-383 -

1- Cpy To Mumbert, W. - Code 6222 - CIA

(43 - 61343) Rm-224 Prince

Georges Plaza

Called: NAVSEC - Logistics Code

: NAUSHIPS - Type Desk

Lbr. on Draft
" to Proteus
Guidance given Mrs. Stdg. on Automation Industries

SAN FRANCISCO BAY NAVAL SHIPYARD
VALLEJO, CALIFORNIA 94592

IN REPLY REFER TO:

DEC 2 3 1966

10330
(108)

Recd. 12/29 - checked called Rosati Ou 12/9/67 indicating chgs to clarify - agreed with chgs - forwded to AEC by 1st. End 05163 13/13 Jan 1967

From: Commander, San Francisco Bay Naval Shipyard
To: Director, Division of Materials Licensing (Isotopes Branch)
U. S. Atomic Energy Commission
Washington, D. C. 20545
Via: Commander, Naval Electronics Systems Command (Code 0516)

Subj: AEC Byproduct Material Licenses Nos. 04-00364-09 and 4-364-6; application for consolidation of

Ref: (a) NAVMED P-5055, Radiation Health Protection Manual
(b) Application for renewal of AEC Byproduct Material License No. 4-364-6, 10330(108) of 21 Jan 1965
(c) COMSFRANBAY NAVSHIPYD ltr 10330(108) of 17 June 66 to NAVELEXSYSCOM 05163

Encl: (1) Form AEC-313R, Application for Byproduct Material License and Attachments (original and 3 copies)

1. The merging of the former San Francisco and Mare Island Naval Shipyards into this command, and the ensuing reorganization, has made the consolidation of certain of their AEC Byproduct Material Licenses appear practicable in the interest of effective management control. In this instance, it is requested that a new license be issued consolidating the two which were originally issued to the former commands to authorize possession and use of sources for performing radiography. A single license will achieve consistent control techniques and procedures as well as reduce administrative processing and duplication.

2. In accordance with reference (a), an application for a new license to consolidate and replace subject licenses is forwarded as enclosure (1).

3. This application includes a request for authorization to use the Mare Island Source Positioning Tip with all projectors. The device has been described and approval for its use requested in reference (b), and was subsequently more fully described in reference (c). Comments made in references (b) and (c) in justification of need still apply.

4. The Ionizing Radiation Control Committee has reviewed this application and has recommended approval.

Copy to:
BUMED (Code 74)
NAVELEXSYSCOM (Code 05163)

J. H. MC QUILKIN

Form AEC-313R (9-62)	UNITED STATES ATOMIC ENERGY COMMISSION **APPLICATION FOR BYPRODUCT MATERIAL LICENSE—USE OF SEALED SOURCES IN RADIOGRAPHY**	Form approved. Budget Bureau No. 38-R137

SEE ATTACHED FORM AEC-313R INSTRUCTIONS—USE SUPPLEMENTAL SHEET WHERE NECESSARY

BE SURE ALL ITEMS ARE COMPLETED AND THAT ALL NECESSARY ATTACHMENTS ARE FURNISHED. IF ANY PORTION OF THE APPLICATION IS NOT APPLICABLE SPECIFICALLY SO STATE. DEFICIENT OR INCOMPLETE APPLICATIONS MAY BE RETURNED WITHOUT CONSIDERATION.

1(a) NAME AND ADDRESS OF APPLICANT

COMMANDER,
SAN FRANCISCO BAY NAVAL SHIPYARD
VALLEJO, CALIFORNIA 94592

2. PREVIOUS LICENSE NUMBER(S) *(Indicate if application is for renewal or amendment of an existing byproduct material license.)*

CONSOLIDATION OF LICENSES NOS. 4-364-6(B67) and 04-00364-09

1(b) APPLICANT IS: An individual [X] A partnership [ ] A Corporation [ ] An Unincorporated Association [ ] Other [ ] If applicant is other than an individual, the applicable section on the reverse side must be completed.

3. LOCATION(S) WHERE SEALED SOURCES WILL BE USED AND/OR STORED. *(If use will be made in states other than named in 1(a), they should be listed here.)*

Hunters Point, San Francisco, Calif. 94135, Mare Island, Calif., 94592, and at temporary "field sites" on ships and stations under jurisdiction of the Department of Defense.

4. SEALED SOURCES TO BE USED IN RADIOGRAPHY

BYPRODUCT MATERIAL *(Element and Mass No.)*	SOURCE MODEL NUMBER	NAME OF MANUFACTURER	MAXIMUM ACTIVITY PER SOURCE	NUMBER OF SOURCES
A.	A.	A.	A.	A.
B.	B.	SEE SUPPLEMENTARY SHEET #1 B.	B.	B.
C.	C.	C.	C.	C.

5. RADIOGRAPHIC EXPOSURE DEVICES AND/OR STORAGE CONTAINERS TO BE USED WITH SOURCES LISTED ABOVE

MODEL NUMBER	NAME OF MANUFACTURER *(If custom made, attach complete design specification.)*
A.	A.
B.	SEE SUPPLEMENTARY SHEET #1 B.
C.	C.

6. THE FOLLOWING INFORMATION IS ATTACHED AS A PART OF THIS APPLICATION: *(Check appropriate blocks and attach information called for in the instructions with this form.)*

	Not Applicable	Attached	Previously Submitted
(a) Description of radiographic facilities (Instruction 6-a)	[ ]	[X] Attach. A	[ ] on (DATE)
(b) Description of radiation detection instruments to be used (Instruction 6-b)	[ ]	[X] Attach. B	[ ] on (DATE)
(c) Instrument calibration procedures (Instruction 6-c)	[ ]	[X] Attach. B	[ ] on (DATE)
(d) Personnel monitoring equipment (Instruction 6-d)	[ ]	[X] Attach. B	[ ] on (DATE)
(e) Operating and emergency procedures (Instruction 6-e)	[ ]	[X] Attach. B	[ ] on (DATE)
(f) Training program (Instruction 6-f)	[ ]	[X] Attach. C	[ ] on (DATE)
(g) Internal inspection system or other management control (Instruction 6-g)	[ ]	[X] Attach. D	[ ] on (DATE)
(h) Overall organizational structure (Instruction 6-h)	[ ]	[X] Attach. D	[ ] on (DATE)
(i) Leak testing procedures (Instruction 6-i)	[ ]	[X] Attach. B	[ ] on (DATE)

CERTIFICATE (This item must be completed by applicant)

7. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Applicant Named in Item 1

By: J. H. MC QUILKIN
Rear Admiral, USN
Title of Certifying Official
Shipyard Commander

DATE DEC 23 1968

WARNING.—18 U.S.C., Section 1001, Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

4. Sealed Sources to be used in Radiography

5. Radiographic Exposure Devices and/or Storage Containers to be used with Sources Listed under Item 4

Byproduct Material	Source Model No.	Maximum Activity per Source	Manufacturer	Model No.	Source Changer Model No.
A. Cobalt 60	A-424-4	30	Technical Operations, Inc.	TechOps, Inc., 404 (optionally with MI source positioning tip)	488
B. Cobalt 60	Old # 41036	20	Budd Company	What source now? Budd Co., 52 (optionally with MI source positioning tip) for Tech Ops Camera	1-563
C. Iridium 192	36910 G-1	100	Budd Company General Radioisotope Processing Corp.	Does Yard Own (418) if not what do they use when	
	A-424-1		Technical Operations, Inc.	TechOps, Inc. 490, 524 or 533 (optionally with MI source positioning tip)	414
D. Iridium 192	36910 G-1	50	Budd Company General Radioisotope Processing Corp.		
	A-424-1		Technical Operations, Inc.	TechOps, Inc., 498 (optionally with MI source positioning tip)	414
E. Iridium 192	36910 G-1	10	Budd Company General Radioisotope Processing Corp.		
	A-424-1		Technical Operations, Inc.	TechOps, Inc., 532 (optionally with MI source positioning tip)	414

never heard of this one

normal 41701

25 mc. T.O. Sources.
491 Proj 4364-6
489

Represents Combined Mds. In Both Plans

SUPPLEMENTARY SHEET #1
AEC-313R

ATTACHMENT A

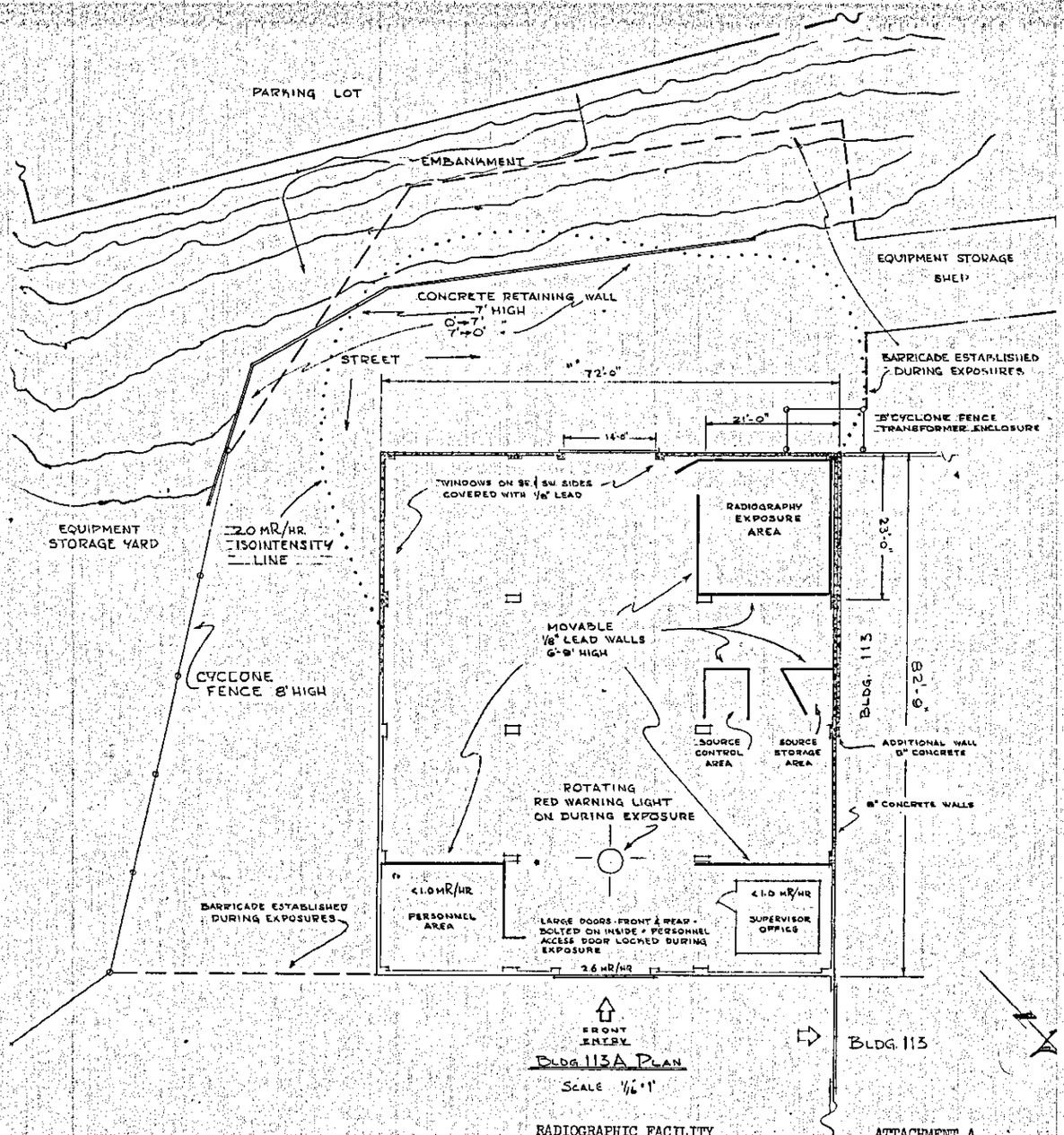
FACILITIES

SUPPLEMENT 1
Hunters Point

SUPPLEMENT 2
Mare Island

ATTACHMENT A
SUPPLEMENT 1

EXISTING RADIOGRAPHIC FACILITY
Building 113A
Hunters Point



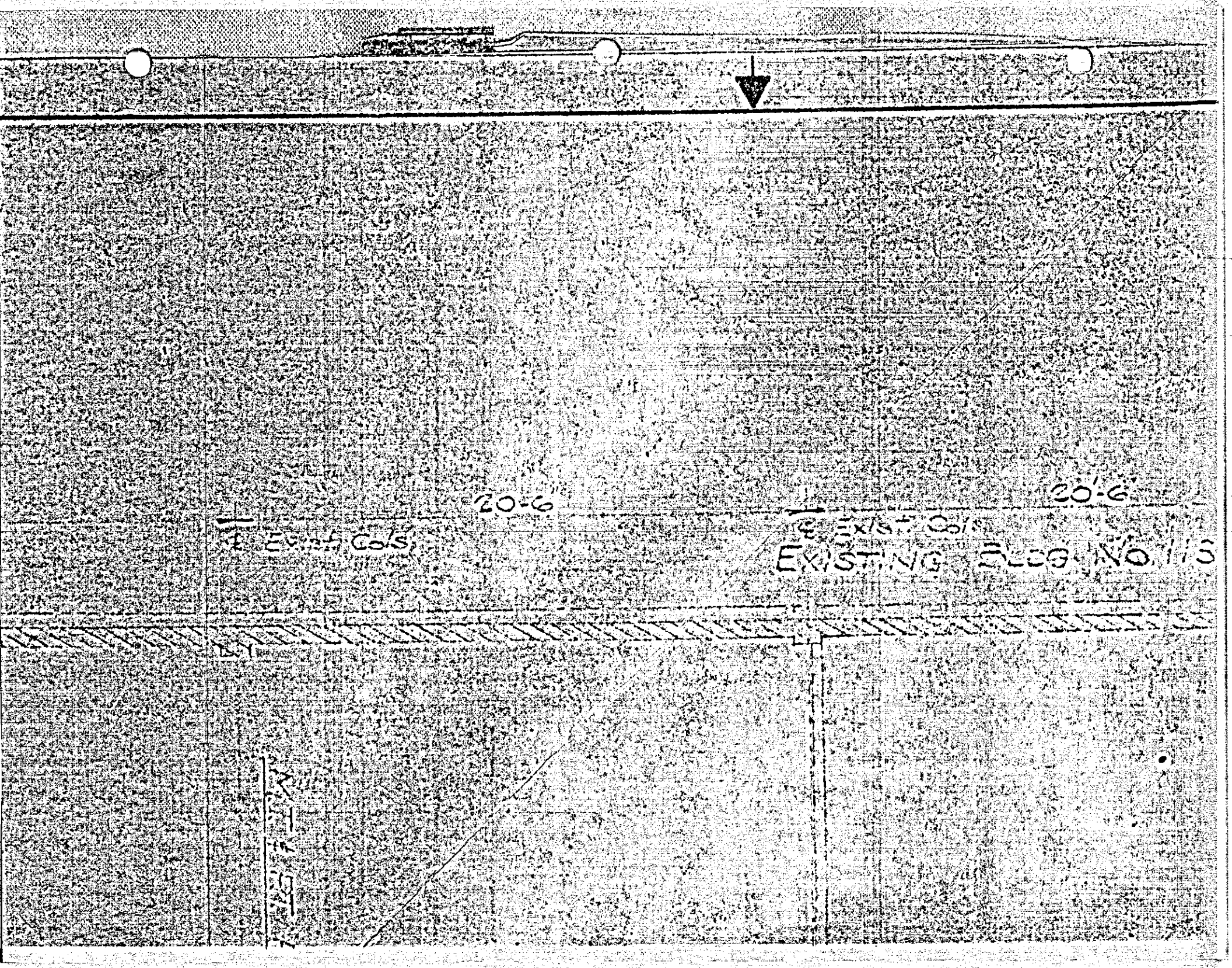
BLDG 113A PLAN

SCALE 1/16" = 1'

RADIOGRAPHIC FACILITY
Bldg. 113A, Hunters Point

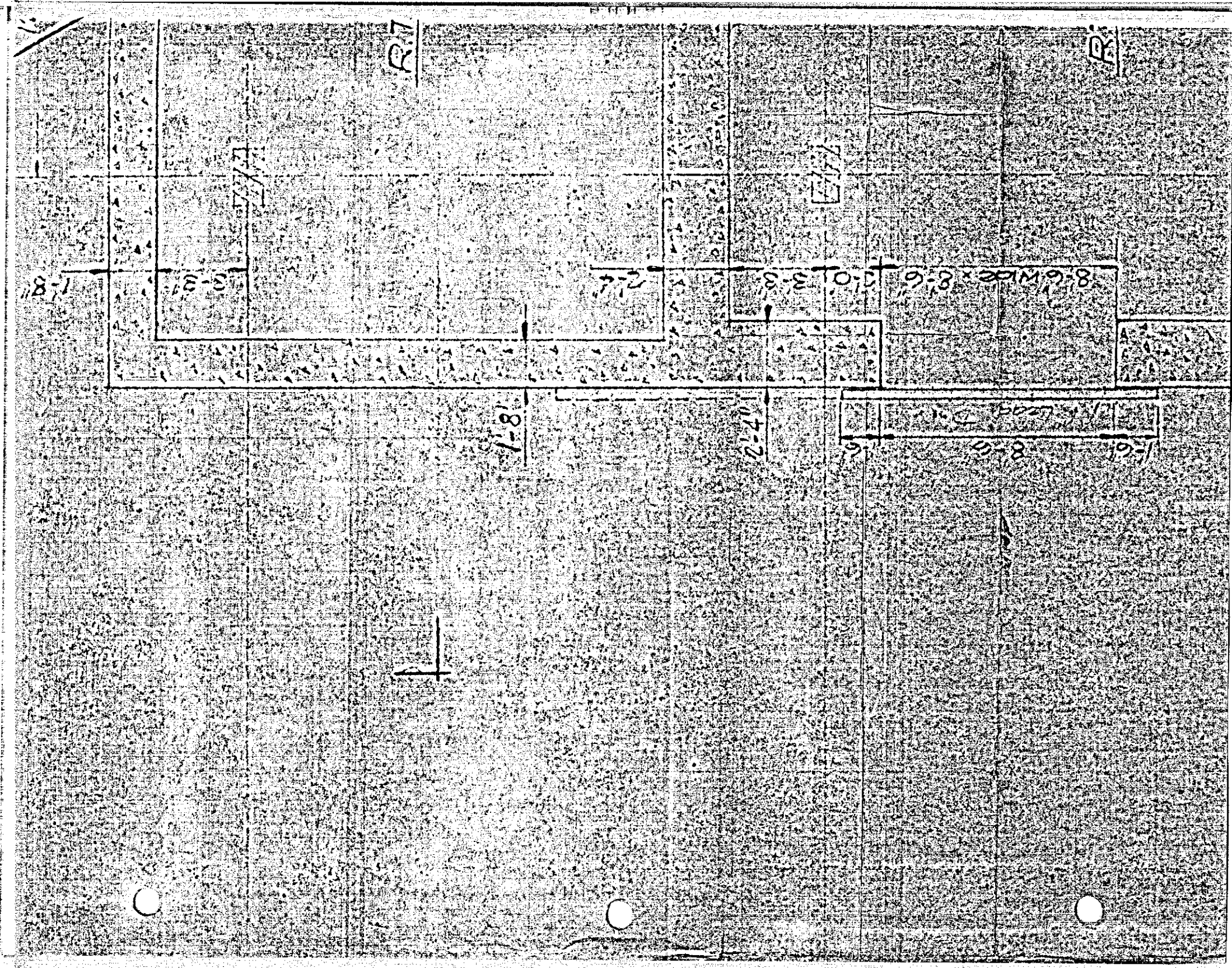
ATTACHMENT A
SUPPLEMENT 1

18'-3"
6'-3"

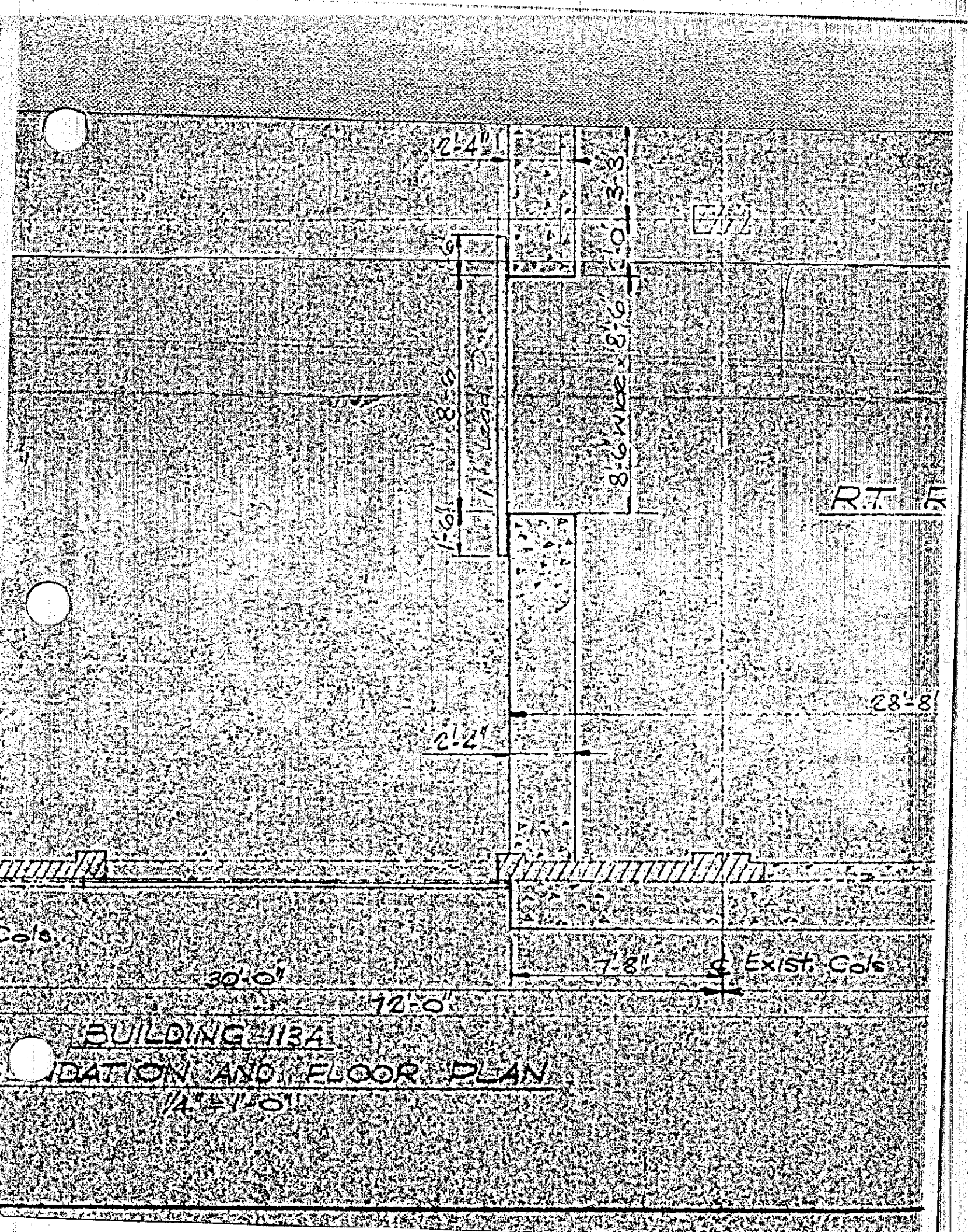

20'-6"
℄ Exist. Cols.
20'-6"
℄ Exist. Cols.
EXISTING BLDG. No. 115

N
23'-6"
Exterior Face
of Exist. Wall
21'-0"

8'-0"
6'-4"
Gate



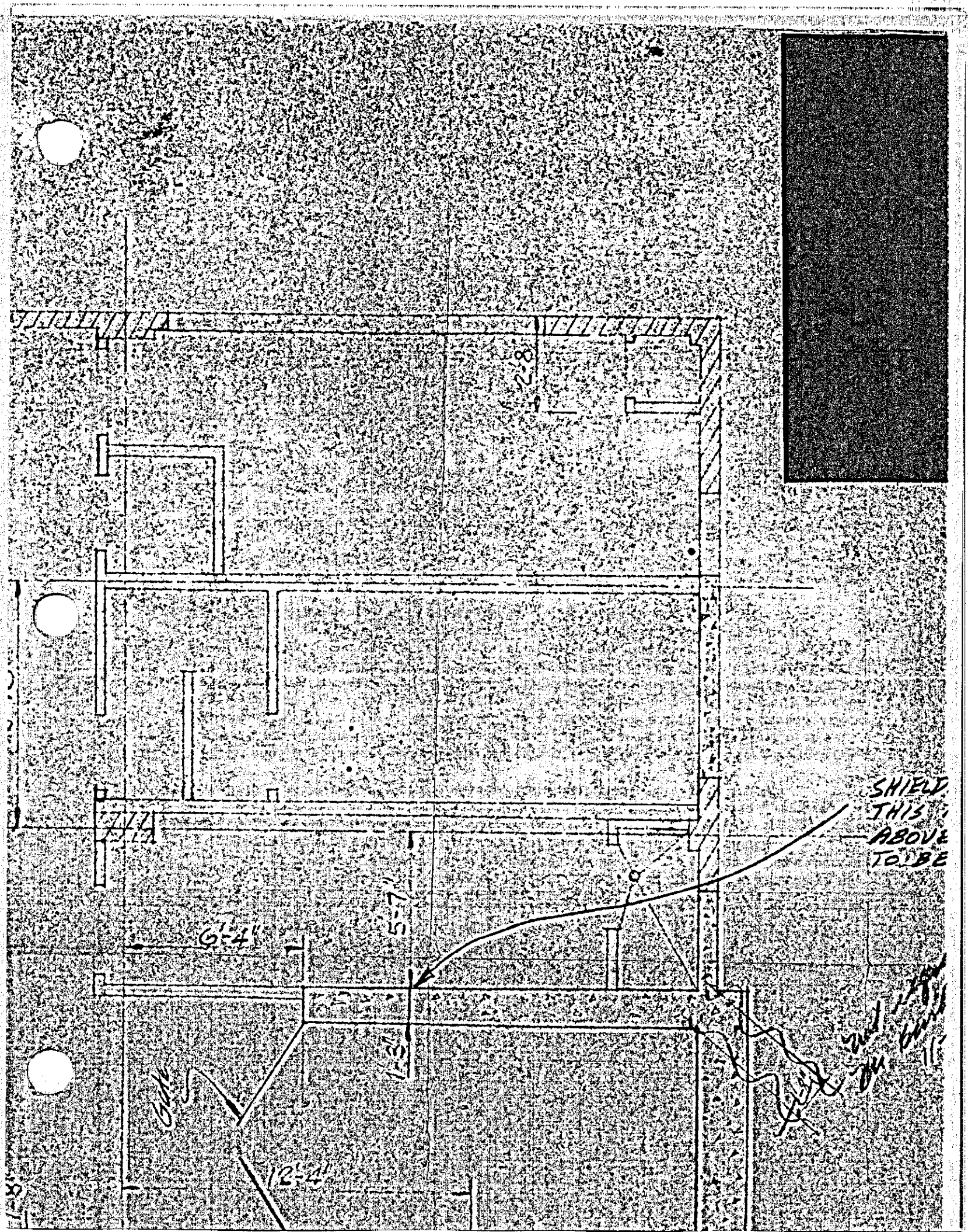
R.7
R.
1'-8"
3'-3"
2'-4"
3'-3"
2'-0"
8'-6" Wide × 8'-6"
1'-8"
2'-4"
9'-1"
8'-6"
9'-1"

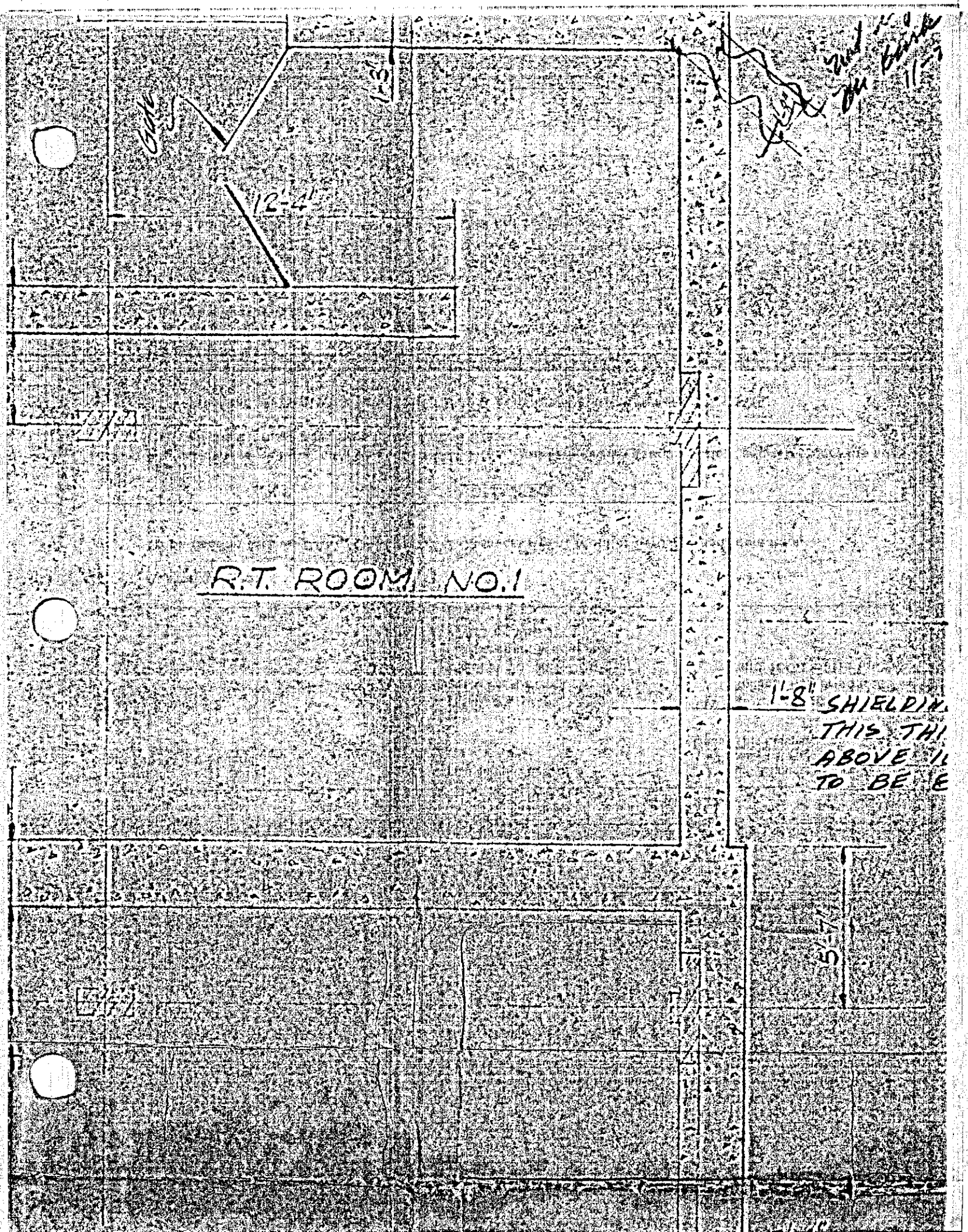


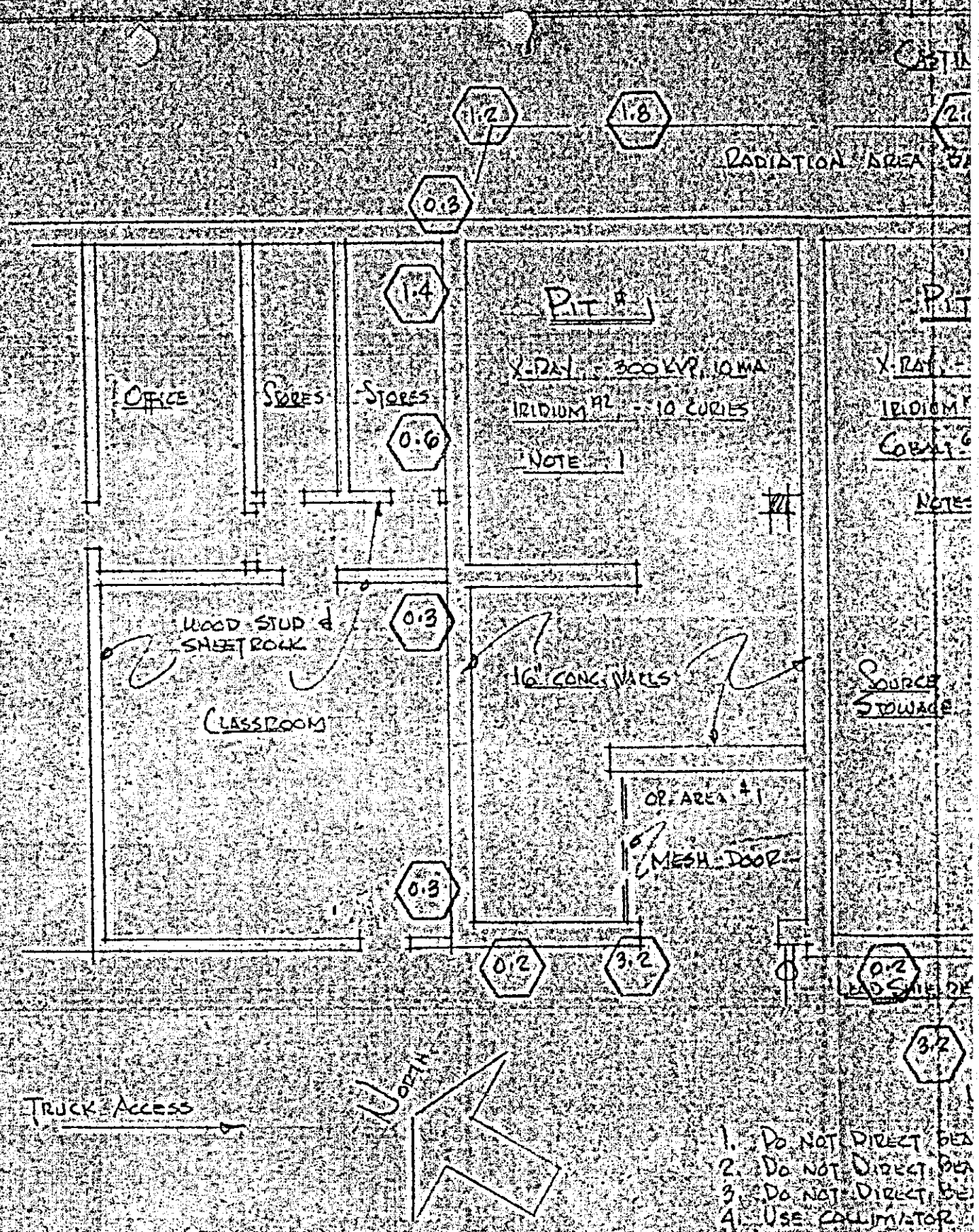
BUILDING 113A

DATION AND FLOOR PLAN

1/4" = 1'-0"


SHIELD
THIS
ABOVE
TO BE
6'-4"
5'-7"
13'-1"
12'-4"

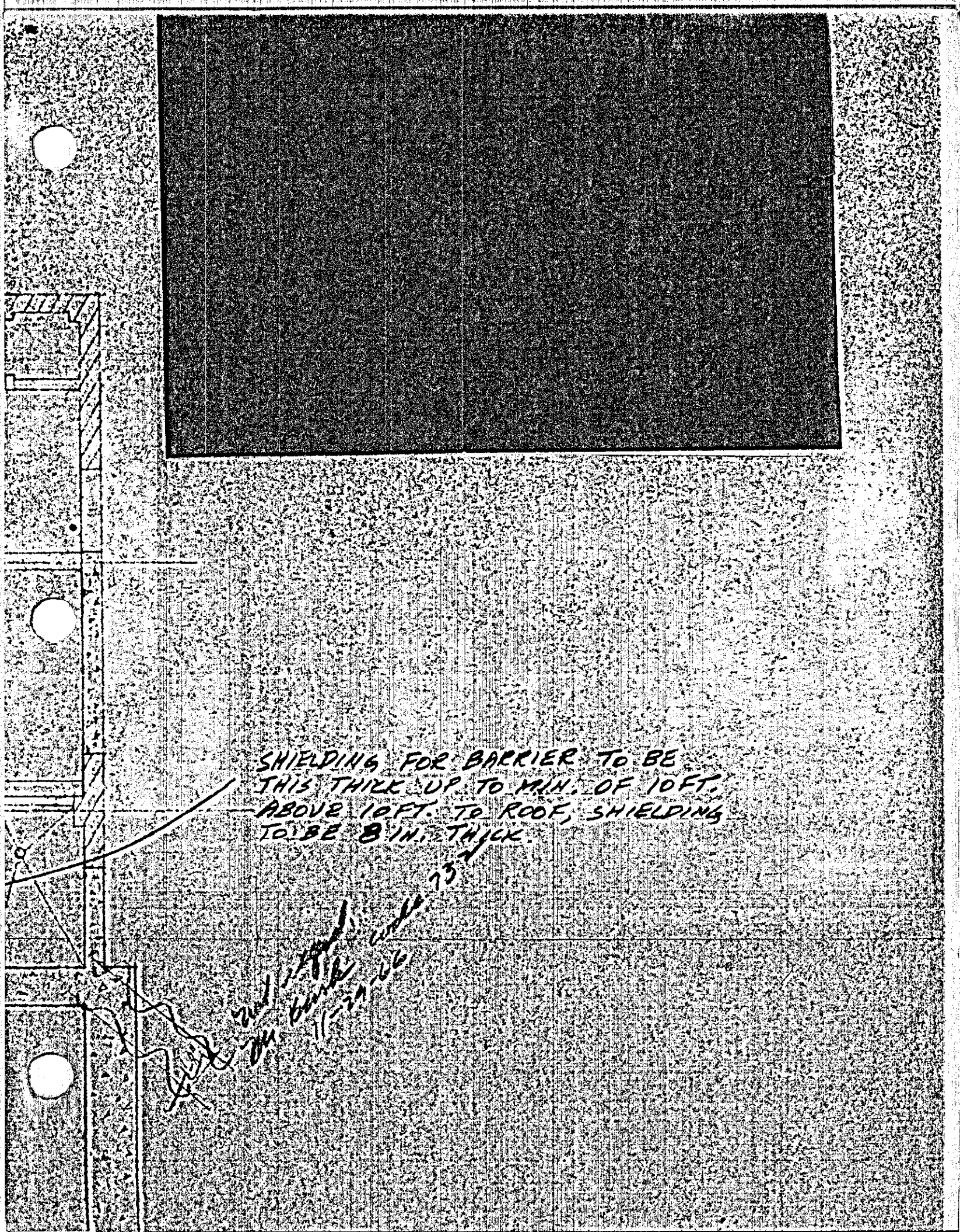

12-4"
R.T. ROOM NO.1
1'-8"
SHIELDIN
THIS THI
ABOVE
TO BE E

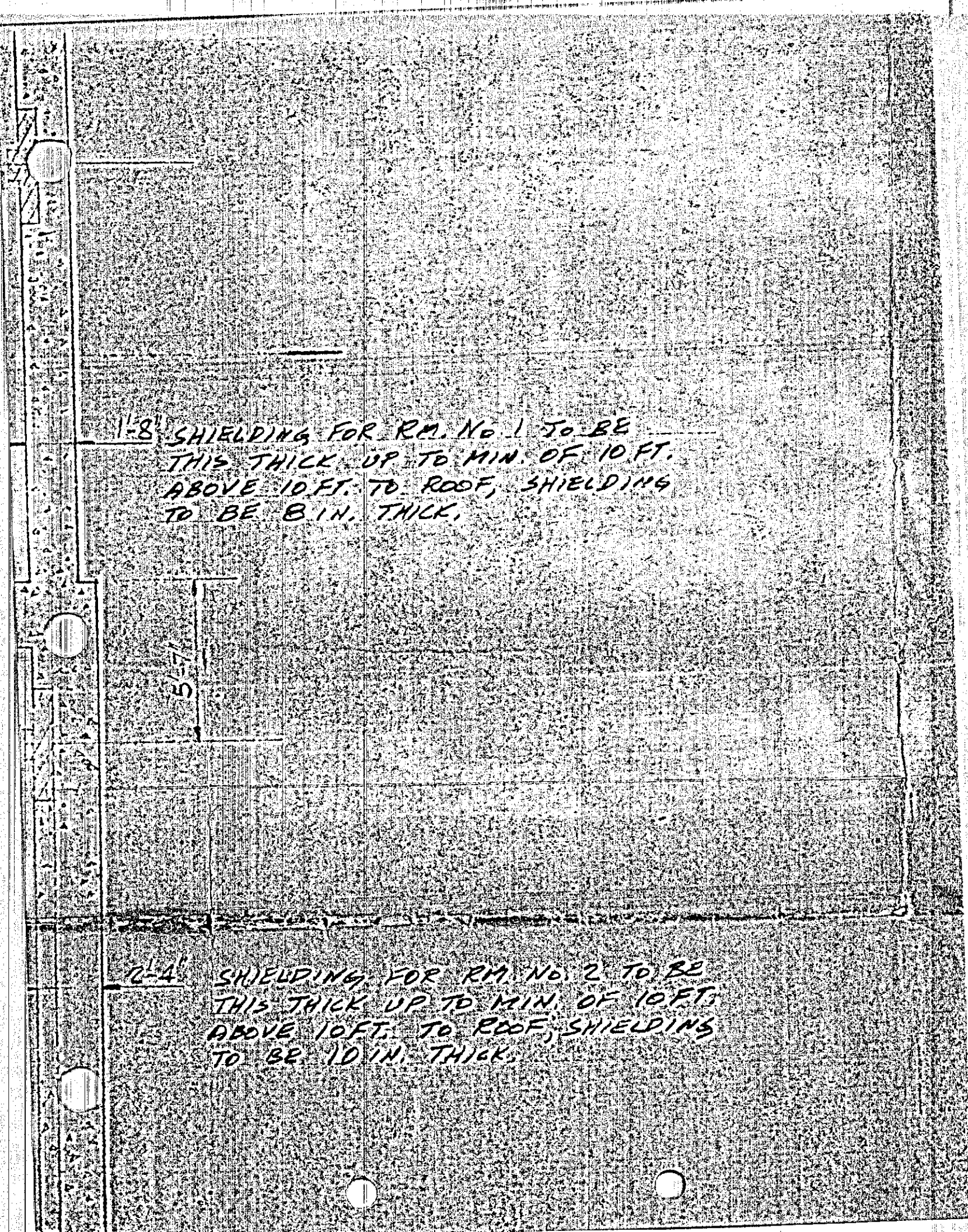

1.2
1.8
RADIATION AREA
0.3
1.4
PIT #1
X-RAY - 300 KVP, 10 MA
IRIDIUM 192 - 10 CURIES
NOTE 1
OFFICE
STORES
STORES
0.6
WOOD STUD & SHEETROCK
0.3
16" CONC. WALLS
CLASSROOM
OP. AREA #1
MESH DOOR
0.3
0.2
3.2
0.2
3.2
TRUCK ACCESS
NORTH
1. DO NOT DIRECT BEA
2. DO NOT DIRECT BEA
3. DO NOT DIRECT BEA
4. USE COLLIMATOR
5. DO
6. USE COLLIMATOR
7. DO
8. MR/HR READING
SOURCE UTILIZ

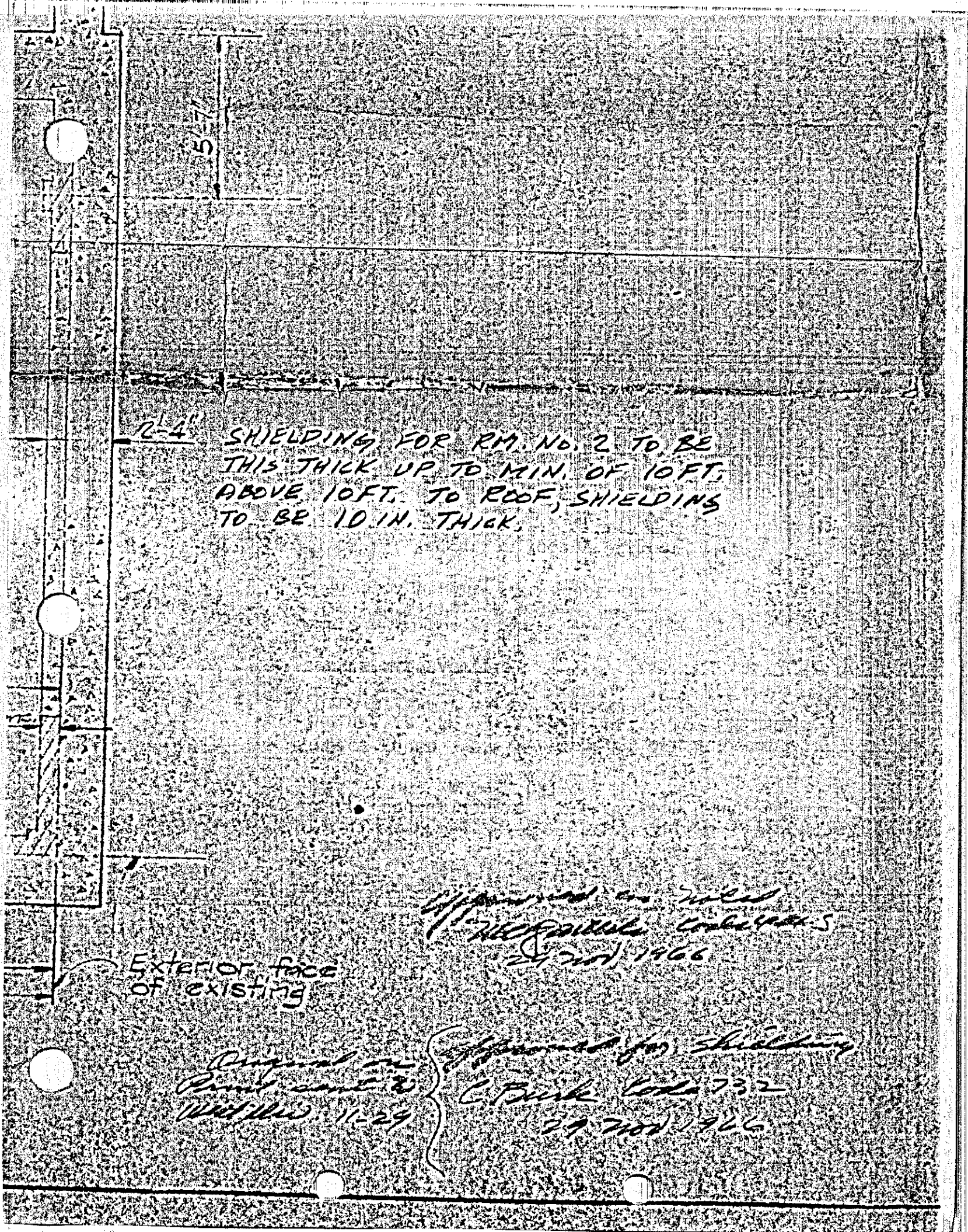
ATTACHMENT A
SUPPLEMENT 1A

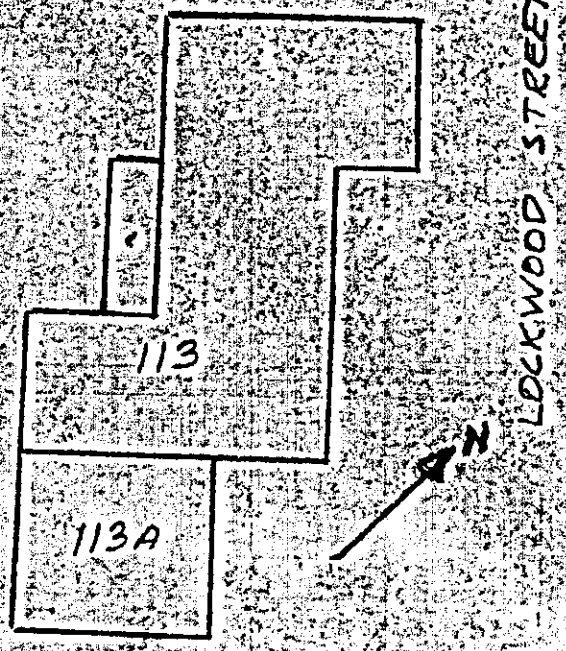
PLAN OF RADIOGRAPHIC TESTING FACILITY
Building 113A
Nondestructive Test Branch, Hunters Point
Quality and Reliability Assurance Department

Scheduled for Completion and Use About 1 June 1967

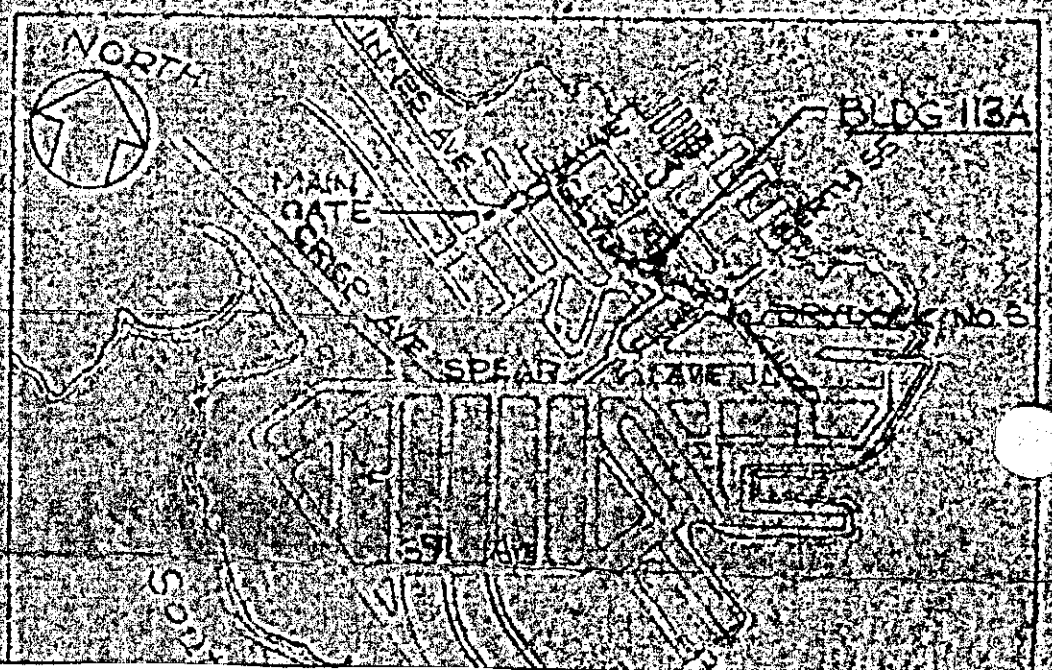

SHIELDING FOR BARRIER TO BE
THIS THICK UP TO MIN. OF 10FT.
ABOVE 10FT. TO ROOF, SHIELDING
TO BE 8 IN. THICK.

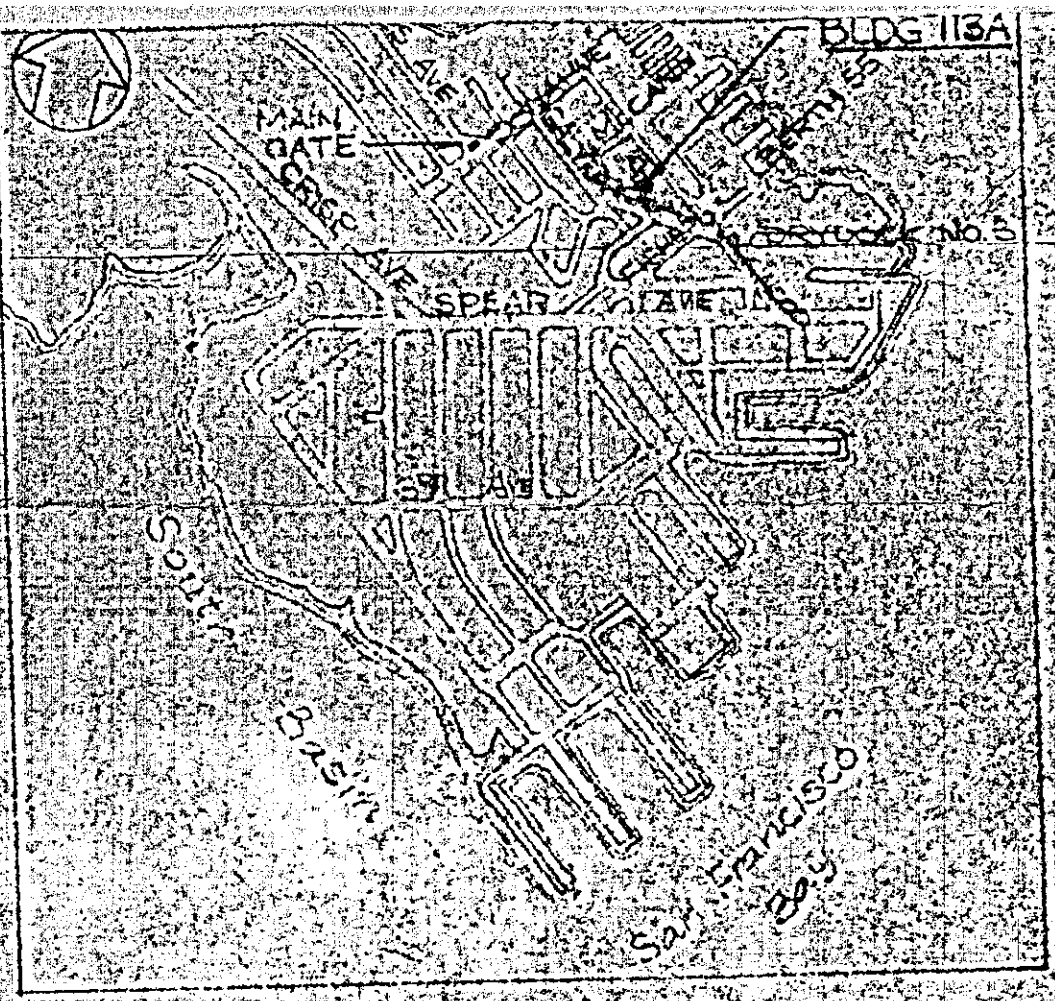

1'-8" SHIELDING FOR RM. NO 1 TO BE THIS THICK UP TO MIN. OF 10 FT. ABOVE 10 FT. TO ROOF, SHIELDING TO BE 8 IN. THICK.
5'-7"
2'-4" SHIELDING FOR RM. NO. 2 TO BE THIS THICK UP TO MIN. OF 10 FT. ABOVE 10 FT. TO ROOF, SHIELDING TO BE 10 IN. THICK.


5'-7"
2'-4"
SHIELDING FOR RM. NO. 2 TO BE THIS THICK UP TO MIN. OF 10 FT. ABOVE 10 FT. TO ROOF, SHIELDING TO BE 10 IN. THICK.
Exterior face of existing
Approved as noted
29 Nov 1966
Original on Print sent to
11-29
Approved for shielding
C Burk Code 732
29 Nov 1966



LOCATION PLAN





VICINITY MAP

Preliminary

C F D DWG NO.	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND WESTERN DIVISION SAN BRUNO, CALIFORNIA
DES. CON'S'N	SAN FRANCISCO BAY NAVAL SHIPYARD
DR. PAV.	
CHK. DIR. UTIL.	
SPEC. DIR. PLAN.	
FIRE	
ENG IN CHG	
DIRECTOR	
APPROVED DATE	SIZE F / CODE IDENT NO. 80091
CFD FOR COMMANDER NFEC	ATTACHMENT A SUPPLEMENT 1A
SATISFACTORY TO	
TITLE DATE	SCALE / SPEC. / NBY / SHEET

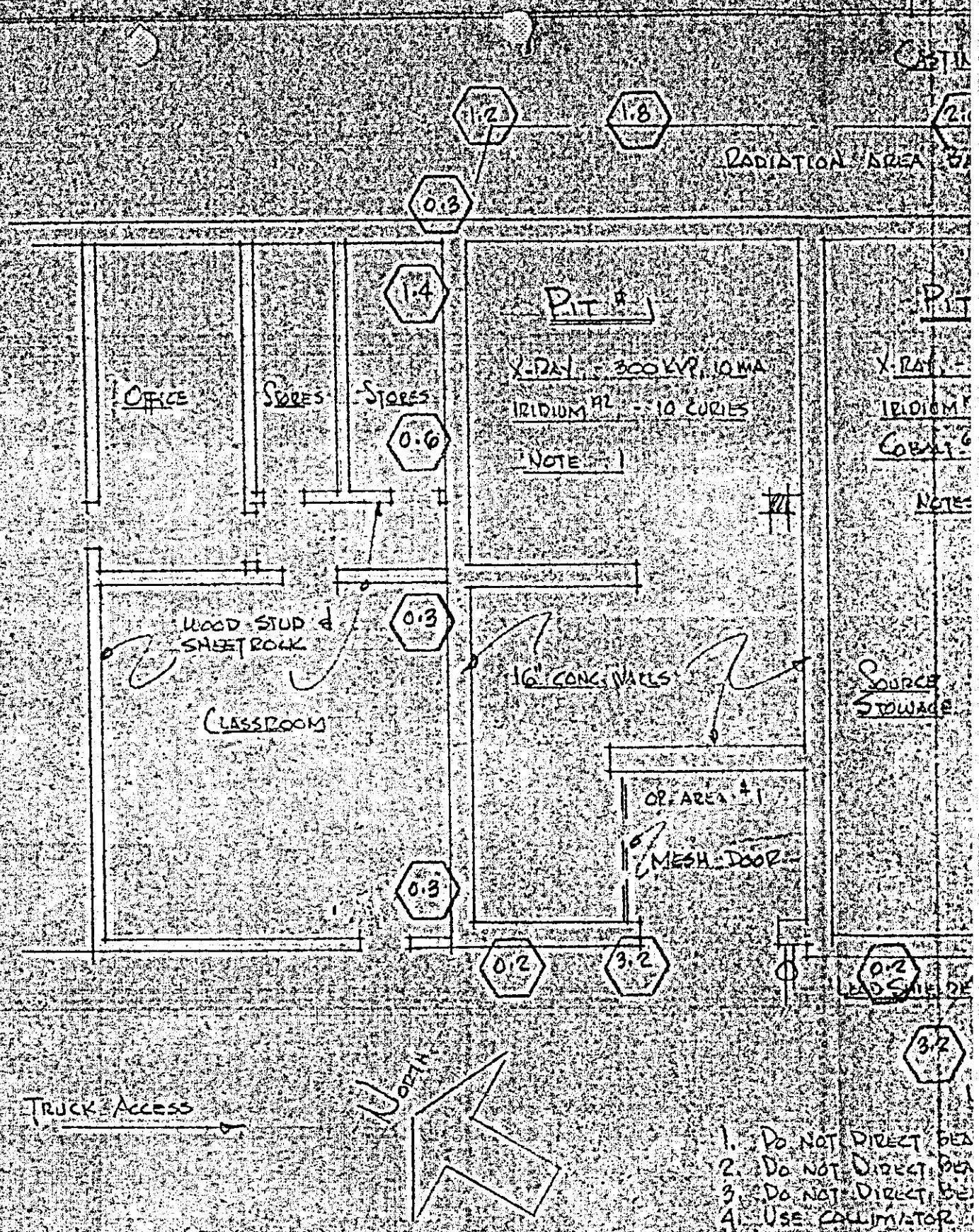
NFD TESTING BLDG 113A

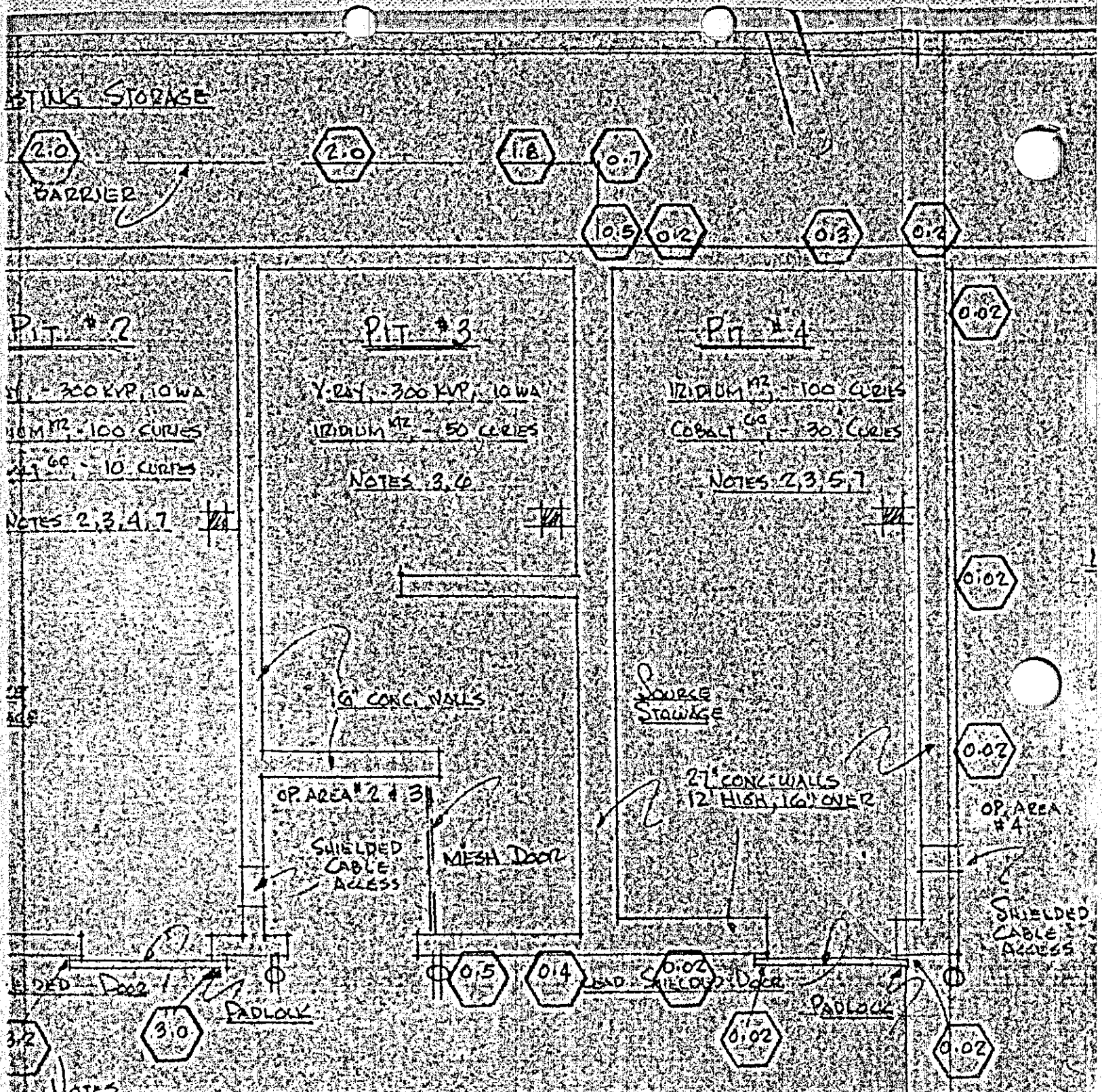
18 NOV 1966

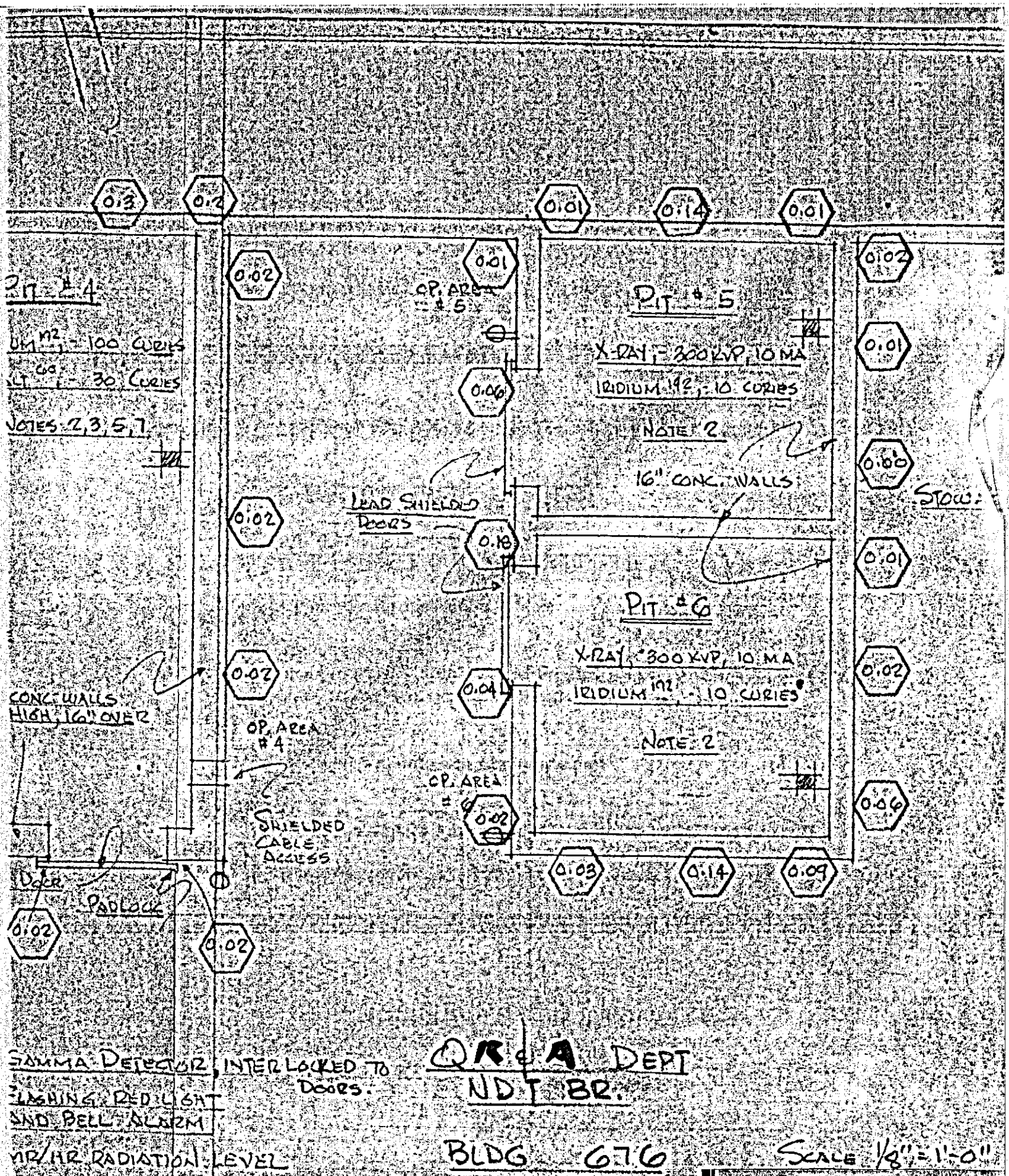
Enclosure (6)

ATTACHMENT A
SUPPLEMENT 2

RADIOGRAPHIC FACILITY
Building 676, Mare Island


1.2
1.8
RADIATION AREA
0.3
1.4
PIT #1
X-RAY - 300 KVP, 10 MA
IRIDIUM 192 - 10 CURIES
NOTE 1
OFFICE
STORES
STORES
0.6
WOOD STUD & SHEETROCK
0.3
16" CONC. WALLS
CLASSROOM
OP. AREA #1
MESH DOOR
0.3
0.2
3.2
0.2
3.2
TRUCK ACCESS
NORTH
1. DO NOT DIRECT BEA
2. DO NOT DIRECT BEA
3. DO NOT DIRECT BEA
4. USE COLLIMATOR
5. DO
6. USE COLLIMATOR
7. DO
8. MR/HR READING
SOURCE UTILIZ


STING STORAGE
2.0
2.0
1.8
0.7
BARRIER
0.5
0.2
0.3
0.2
PIT #2
300 KVP, 10 WA
IRIDIUM 192, 100 CURIES
60, 10 CURIES
NOTES 2,3,4,7
PIT #3
X-RAY, 300 KVP, 10 WA
IRIDIUM 192, 50 CURIES
NOTES 3,6
PIT #4
IRIDIUM 192, 100 CURIES
COBALT 60, 30 CURIES
NOTES 2,3,5,7
0.02
0.02
0.02
0.02
16" CONC. WALLS
SOURCE STORAGE
27" CONC. WALLS
12' HIGH, 16' OVER
OP. AREA #2 & 3
SHIELDED CABLE ACCESS
MESH DOOR
OP. AREA #4
SHIELDED CABLE ACCESS
DED DOOR
PADLOCK
0.5
0.4
LEAD SHIELDED DOOR
PADLOCK
3.2
3.0
0.02
0.02
NOTES
BEAM TOWARD NORTH WALL
BEAM TOWARD DOOR
BEAM ABOVE HORIZONTAL
OR ON COBALT 60, 10 CURIE SOURCE
DO 30 CURIE SOURCE
OR ON IRIDIUM 192, 50 CURIE SOURCE
DO 100 CURIE SOURCE
INGS MADE AT MAXIMUM ALLOWED
LIZATION AS INDICATED.
GAMMA DETECTOR, INTERLOCKED DOOR
FLASHING RED LIGHT AND BELL ALARM
3.7
MR/HR RADIATION LEVEL



ATTACHMENT A

SUPPLEMENT 2

6-9-66

ATTACHMENT B

CONTROL PROCEDURES

EMERGENCY AND OPERATING PROCEDURES

Quality and Reliability Assurance Department Instruction 4730.22

SERIAL NO: _____

SAN FRANCISCO BAY NAVAL SHIPYARD

QUALITY AND RELIABILITY ASSURANCE DIVISION

NONDESTRUCTIVE TEST BRANCH

Q & RA INSTRUCTION 4730.22

ADMINISTRATIVE, OPERATING, AND EMERGENCY PROCEDURES FOR RADIOGRAPHIC PERSONNEL

DECEMBER 1966

APPROVED BY:

J. A. Schoedinger, Jr.

J. A. SCHOEDINGER, JR.
HEAD, NONDESTRUCTIVE TEST BRANCH
MARE ISLAND

A. E. Bergeron

A. E. BERGERON
HEAD, NONDESTRUCTIVE TEST BRANCH
HUNTERS POINT

G. J. Rosati

G. J. ROSATI, CHAIRMAN
IONIZING RADIATION CONTROL COMMITTEE

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SECTION III	DEFINITIONS	6
SECTION IV	REFERENCES	10
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SECTION VI	EQUIPMENT	16
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		SECTION
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FIGURE 10-4	CHART OF DISTANCE VX. INTENSITY (IRIDIUM 192 SOURCES)	X
FIGURE 10-5	CHART OF DISTANCE VX. INTENSITY (25 MC COBALT 60 SOURCE)	X

SECTION I

INTRODUCTION AND GENERAL INFORMATION

1.1. BACKGROUND

1.2. PURPOSE

1.3. SCOPE

1.1. BACKGROUND

1.1.1. THE EXTENSIVE AND RAPIDLY EXPANDING APPLICATION OF IONIZING RADIATION IN VARIOUS MANUFACTURING PROCESSES REQUIRES LOGICAL AND CONSISTENT CONTROL EQUITABLE TO ALL CONCERNED AS TO THE BENEFITS OBTAINED WHILE RECOGNIZING THE SPECIFIC HEALTH HAZARDS WHICH SOCIETY IS WILLING TO ACCEPT IN ORDER TO OBTAIN SUCH BENEFITS.

1.1.2. THE ESTABLISHMENT AND IMPLEMENTATION OF SUCH CONTROLS AS ARE CONSIDERED NECESSARY HAVE BEEN ASSIGNED TO THE ATOMIC ENERGY COMMISSION, (AEC), WHO, THROUGH THEIR DIVISION OF MATERIALS LICENSING, GRANTS LICENSES FOR THE PROCUREMENT AND USE OF RADIOACTIVE BY-PRODUCT MATERIALS TO ACTIVITIES WHO HAVE SHOWN A VALID PURPOSE FOR SUCH MATERIAL AND PRESENTED EVIDENCE OF THEIR ABILITY TO CONFORM TO THE REGULATIONS GOVERNING SAFE USAGE.

1.2. PURPOSE

1.2.1. TO PROVIDE OPERATING AND SUPERVISORY PERSONNEL OF THE NONDESTRUCTIVE TEST BRANCH, AT BOTH HUNTERS POINT AND MARE ISLAND, WITH SPECIFIC INFORMATION, INSTRUCTIONS, AND PROCEDURES WHICH MUST BE FOLLOWED IN ORDER TO ENSURE SAFE AND PROPER HANDLING OF SOURCES OF IONIZING RADIATION USED FOR INDUSTRIAL RADIOGRAPHY.

1.2.2. TO ASSURE COMPLIANCE WITH THOSE REGULATIONS AND DIRECTIONS PROMULGATED BY THE ATOMIC ENERGY COMMISSION AND SAN FRANCISCO BAY NAVAL SHIPYARD IN THE USE OF BY-PRODUCT MATERIALS AND OTHER SOURCES OF IONIZING RADIATION.

1.3. SCOPE

1.3.1. THIS PROCEDURE APPLIES TO ALL INDUSTRIAL OPERATIONS AND ASSOCIATED WORK INVOLVING IONIZING RADIATION FOR PERFORMANCE OF RADIOGRAPHY UNDER THE COGNIZANCE OF THE NONDESTRUCTIVE TEST BRANCH.

1.3.2. IT PRESCRIBES SPECIFIC PERFORMANCE REQUIREMENTS FOR NONDESTRUCTIVE TEST BRANCH PERSONNEL AT HUNTERS POINT AND MARE ISLAND IN THE SAFE USE AND HANDLING OF IONIZING RADIATION, AS WELL AS THE EXTENT OF RESPONSIBILITIES OF SUCH INDIVIDUALS.

SECTION II

ORGANIZATION AND RESPONSIBILITIES

2.1. SHIPYARD COMMANDER

2.2. RADIOLOGICAL PROTECTION OFFICER

2.3. HEAD, NONDESTRUCTIVE TEST BRANCH

2.4. HEAD, TECHNICAL SECTION

2.5. SECTION SUPERVISOR

2.6. RADIOGRAPHIC SHIFT SUPERVISORS

2.7. RADIOGRAPHER-IN-CHARGE

2.8. RADIOGRAPHER AND RADIOGRAPHER'S ASSISTANT

2.9. SUPPLY DEPARTMENT

2.10. MEDICAL DEPARTMENT

2.1. THE SHIPYARD COMMANDER IS THE LICENSEE FOR BYPRODUCT MATERIAL SOURCES OF IONIZING RADIATION USED IN THE INDUSTRIAL RADIOGRAPHY PROGRAM. HE IS RESPONSIBLE FOR ACTION TO ASSURE COMPLIANCE WITH AND IMPLEMENTATION OF U. S. ATOMIC ENERGY COMMISSION AND OTHER FEDERAL REGULATIONS, AS WELL AS DEPARTMENT OF DEFENSE AND DEPARTMENT OF THE NAVY DIRECTIVES CONCERNING THE PROCUREMENT, STORAGE, HANDLING, USE, AND DISPOSAL OF RADIOACTIVE MATERIALS AT, AND BY, SAN FRANCISCO BAY NAVAL SHIPYARD. HE IS FURTHER RESPONSIBLE FOR ESTABLISHING MEASURES TO CONTROL AND REPORT EXPOSURES OF PERSONNEL TO IONIZING RADIATION.

2.2. THE RADIOLOGICAL PROTECTION OFFICER IS RESPONSIBLE FOR ADVISING THE SHIPYARD COMMANDER ON ALL MATTERS PERTAINING TO RADIOLOGICAL SAFETY RELATED TO INDUSTRIAL OPERATIONS. THIS INCLUDES THE HAZARDS OF ALL FORMS OF IONIZING RADIATION WITH WHICH THE SHIPYARD MAY BE INVOLVED, AS WELL AS THE IMPLEMENTATION AND EFFECTIVENESS OF CONTROLS. HE PROVIDES ADVICE AND CONSULTATION TO HEADS OF DEPARTMENTS AND OFFICES, APPROVES TRAINING EXAMINATIONS, AND CERTIFIES, IN RADIATION SAFETY COMPETENCE, RADIOGRAPHERS AND RADIOGRAPHERS' ASSISTANTS PREVIOUSLY NOMINATED BY THE HEAD, NONDESTRUCTIVE TEST BRANCH.

2.3. THE HEAD, NONDESTRUCTIVE TEST BRANCH, IS DIRECTLY RESPONSIBLE FOR THE OVERALL RADIATION PROTECTION PROGRAM IN CONNECTION WITH INDUSTRIAL RADIOGRAPHY PERFORMED BY NONDESTRUCTIVE TEST BRANCH PERSONNEL. INCLUDED ARE: PROVIDING NECESSARY TRAINING; KEEPING PERSONNEL EXPOSURES WITHIN THE RADIATION PROTECTION GUIDE (RPG); MAINTAINING REQUIRED RECORDS AND MAKING THEM AVAILABLE TO AUTHORIZED PERSONNEL SUCH AS THE RADIOLOGICAL PROTECTION OFFICER, IONIZING RADIATION CONTROL COMMITTEE, HEALTH PHYSICS BRANCH, AND REPRESENTATIVES OF THE U. S. ATOMIC ENERGY COMMISSION; PROVIDING ADEQUATE FACILITIES FOR THE SAFE USE OF RADIATION SOURCES; AND COMPLYING WITH ALL PROVISIONS OF THE ATOMIC ENERGY COMMISSION BYPRODUCT MATERIAL LICENSE.

2.4. HE PREPARES FOR SUBMISSION TO THE IONIZING RADIATION CONTROL COMMITTEE THE NONDESTRUCTIVE TEST DRAFT OF INFORMATION TO BE USED IN APPLICATION FOR THE A.E.C. LICENSE, AND AMENDMENTS THERETO, INCLUDING THE ADMINISTRATIVE, OPERATING AND EMERGENCY PROCEDURES FOR RADIOGRAPHY PERSONNEL. HE WILL ASSIST IN THE TRAINING PROGRAM FOR OPERATING PERSONNEL.

2.5. THE RADIOGRAPHY SECTION SUPERVISOR IS RESPONSIBLE FOR THE IMPLEMENTATION OF, AND FOR ENSURING COMPLIANCE WITH, THE RADIOGRAPHIC OPERATING AND ADMINISTRATIVE PROCEDURES. HE ENSURES THE MAINTENANCE OF FACILITIES AND EQUIPMENT TO MEET THE REQUIREMENTS OF THIS DOCUMENT. HE CONTINUOUSLY REVIEWS THE STATE AND NEED OF TRAINING OF OPERATING PERSONNEL. HE ENSURES THAT OPERATIONS ARE CONDUCTED BY CERTIFIED PERSONNEL ONLY.

2.6. RADIOGRAPHIC SHIFT SUPERVISORS SHALL CHECK ALL RADIOGRAPHIC PERSONNEL AT THEIR JOB SITES AT LEAST ONCE PER SHIFT TO ENSURE COMPLIANCE WITH A.E.C. REGULATIONS AND THESE PROCEDURES.

2.7. THE RADIOGRAPHER IN CHARGE AT EACH JOB SITE SHALL PERSONALLY SUPERVISE RADIOGRAPHIC OPERATIONS AND IS DIRECTLY RESPONSIBLE TO THE LICENSEE FOR OPERATING IN COMPLIANCE WITH A. E. C. REGULATIONS AND THESE PROCEDURES.

2.7.1. ONLY CERTIFIED RADIOGRAPHERS AND CERTIFIED RADIOGRAPHERS' ASSISTANTS, UNDER THE PERSONAL SUPERVISION OF A CERTIFIED RADIOGRAPHER, SHALL OPERATE RADIOGRAPHIC SOURCES.

2.8. EACH RADIOGRAPHER AND RADIOGRAPHER'S ASSISTANT IS RESPONSIBLE FOR PERFORMING ALL RADIOGRAPHIC OPERATIONS IN ACCORDANCE WITH A. E. C. REGULATIONS AND THESE PROCEDURES, PROTECTING HIMSELF AND OTHERS FROM EXCESSIVE OR UNNECESSARY EXPOSURE TO IONIZING RADIATION, AND BEING FAMILIAR WITH THESE PROCEDURES, 10 CFR 20, 30 AND 34, AND THE A.E.C. BYPRODUCT MATERIAL LICENSE.

2.9. THE SUPPLY DEPARTMENT WILL RECEIVE AND SHIP RADIATION SOURCES IN ACCORDANCE WITH PERTINENT PROCEDURES, AND WILL PROMPTLY NOTIFY NON-DESTRUCTIVE TEST BRANCH AND HEALTH PHYSICS BRANCH OF THE ARRIVAL OF SOURCES.

2.10. THE MEDICAL DEPARTMENT WILL CONDUCT PHYSICAL EXAMINATIONS OF EMPLOYEES PRIOR TO THEIR ASSIGNMENT TO RADIOGRAPHIC WORK, PERIODICALLY DURING SUCH ASSIGNMENT, AND AT THE TERMINATION OF SUCH ASSIGNMENT; CONDUCT A HEALTH PHYSICS PROGRAM TO PROVIDE DOSIMETRY SERVICES, KEEP RECORDS OF INDIVIDUAL EXPOSURES, REPORT EXPOSURES TO SUPERVISION; ASSIST IN RADIATION SAFETY TRAINING; AND MAINTAIN SURVEILLANCE OVER THE WORKING ENVIRONMENT AND THE COMPLIANCE OF OPERATING PERSONNEL WITH A.E.C. REGULATIONS, THESE PROCEDURES, AND OTHER PERTINENT NAVY REGULATIONS.

SECTION III

DEFINITIONS

3.1. BYPRODUCT MATERIAL - ANY RADIOACTIVE MATERIAL, EXCEPT SPECIAL NUCLEAR MATERIAL, YIELDED IN, OR MADE RADIOACTIVE, BY EXPOSURE TO THE RADIATION INCIDENT TO THE PROCESS OF PRODUCING OR UTILIZING SPECIAL NUCLEAR MATERIAL, FOR EXAMPLE: $COBALT^{60}$ AND $IRIDIUM^{192}$.

3.2. CURIE (CI) - THE UNIT OF ACTIVITY FOR MEASURING THE QUANTITY OF RADIOACTIVE MATERIAL. ONE CURIE (CI) IS THAT AMOUNT OF MATERIAL WHICH YIELDS 3.7×10^{10} DISINTEGRATIONS PER SECOND, OR THE ACTIVITY APPROXIMATELY EQUIVALENT TO THAT OF ONE GRAM OF RADIUM.

3.3. DOSIMETER - A DEVICE FOR MEASURING THE AMOUNT OF EXPOSURE TO IONIZING RADIATION RECEIVED BY AN INDIVIDUAL. THIS INCLUDES FILM BADGES AND SELF-READING POCKET DOSIMETERS.

3.4. GAMMA PROBING - THE NONDESTRUCTIVE TESTING OF MATERIALS BY MEASURING THE PENETRATION OF IONIZING RADIATION AT VARIOUS LOCATIONS USING DETECTORS THAT INDICATE THE RADIATION INTENSITY, SUCH AS A GAMMA SCINTILLATION CRYSTAL CONNECTED TO A RATEMETER.

3.5. HIGH RADIATION AREA - ANY AREA ACCESSIBLE TO PERSONNEL IN WHICH THERE EXISTS RADIATION AT SUCH LEVELS THAT A MAJOR PORTION OF THE BODY COULD RECEIVE IN ANY ONE HOUR A DOSE IN EXCESS OF 100 MR.

3.6. IONIZING RADIATION - INCLUDES RADIATION PRODUCED BY ANY, OR ALL, OF THE FOLLOWING: ALPHA PARTICLES, BETA PARTICLES, GAMMA RAYS AND X-RAYS, REFERRED TO HEREAFTER AS "RADIATION."

3.7. ISODOSE LINE - AN ENCIRCLING LINE, PERIMETER, OR BOUNDARY ALONG WHICH THE RADIATION LEVEL IS CONSTANT.

3.8. MILLIROENTGEN (MR), MILLIROENTGEN EQUIVALENT MAN (MREM) - ARE 1/1000 OF THE VALUE OF (R) AND (REM), RESPECTIVELY.

3.9. MONITORING - THE ACT OF SURVEYING OR MEASURING WITH RADIATION DETECTION INSTRUMENTS THE AMOUNT OF RADIOACTIVITY OR THE RADIATION INTENSITIES PRESENT.

3.10. PERMANENT RADIOGRAPHIC AREAS - FOR PURPOSES OF THIS INSTRUCTION, PERMANENT RADIOGRAPHIC AREAS ARE AT TWO LOCATIONS IN THE SHIPYARD; ONE AREA IN BLDG. #676, MARE ISLAND, AND THE OTHER IN BLDG. #113A AT HUNTERS POINT. BOTH OF THESE LOCATIONS ARE CONSTRUCTED SO THAT RADIOGRAPHY IS PERFORMED IN ROOMS DESIGNATED AS "HIGH RADIATION AREAS" AND THE RADIATION LEVEL DOES NOT EXCEED 2 MR IN ANY ONE HOUR AT THE ENTRANCE DOOR, EXTERIOR WALLS, OR SURROUNDING BARRICADES.

3.11. RADIATION AREA - ANY AREA ACCESSIBLE TO PERSONNEL IN WHICH THERE EXISTS RADIATION AT SUCH LEVELS THAT A MAJOR PORTION OF THE BODY COULD RECEIVE IN ANY ONE HOUR A DOSE IN EXCESS OF TWO MR, OR IN ANY SEVEN CONSECUTIVE DAYS A DOSE IN EXCESS OF 100 MR. THIS INCLUDES "RESTRICTED AREA" AS DEFINED IN A.E.C. REGULATION 10CFR20.3(A)(14).

3.12. RADIATION SIGNS - SIGNS WHICH WARN OF THE PRESENCE OF IONIZING RADIATION, OR MATERIALS THAT EMIT RADIATION. THEY DISPLAY THE CONVENTIONAL THREE-BLADED A.E.C. SYMBOL IN MAGENTA, OR PURPLE, ON A YELLOW BACKGROUND.

3.13. RADIOGRAPHER - ANY INDIVIDUAL WHO PERFORMS, OR WHO IS IN ATTENDANCE AT THE SITE AND PERSONALLY SUPERVISES RADIOGRAPHIC TESTING OPERATIONS, AND WHO IS RESPONSIBLE TO THE LICENSEE FOR ASSURING COMPLIANCE WITH THE REQUIREMENTS OF A.E.C. REGULATIONS, THE CONDITIONS OF THE LICENSE, AND THESE PROCEDURES.

3.14. RADIOGRAPHER'S ASSISTANT - ANY INDIVIDUAL WHO, UNDER THE PERSONAL SUPERVISION OF A RADIOGRAPHER, USES EXPOSURE DEVICES OR SURVEY INSTRUMENTS IN RADIOGRAPHY.

3.15. RADIOGRAPHER'S HELPER - ANY INDIVIDUAL ASSIGNED TO A RADIOGRAPHER FOR THE PURPOSE OF ON-THE-JOB TRAINING FOR QUALIFICATION AS A RADIOGRAPHER'S ASSISTANT.

3.16. RADIOGRAPHIC EXPOSURE DEVICE - ANY DEVICE, (SUCH AS A PROJECTOR), CONTAINING A RADIOGRAPHIC SEALED SOURCE FASTENED THEREIN, IN WHICH THE RADIOGRAPHIC SEALED SOURCE, OR SHIELDING THEREOF, MAY BE MOVED OR OTHERWISE CHANGED FROM A SHIELDED TO AN UNSHIELDED POSITION, WITH RESPECT TO THE SOURCE, FOR PURPOSES OF MAKING A RADIOGRAPHIC EXPOSURE. SEALED SOURCES MAY ALSO BE TRANSPORTED IN THESE DEVICES WHEN APPROPRIATE CONDITIONS SPECIFIED IN THIS PROCEDURE ARE MET.

3.17. RADIOGRAPHY - THE NONDESTRUCTIVE TESTING OF MATERIALS BY THE PRODUCTION OF AN IMAGE ON A RADIATION-SENSITIVE SURFACE, (SUCH AS A PHOTOGRAPHIC FILM), BY THE USE OF SEALED SOURCES CONTAINING RADIOACTIVE MATERIAL, OR A BEAM OF X-RAYS.

3.18. RESTRICTED AREA - ANY AREA ACCESS TO WHICH IS CONTROLLED BY THE NONDESTRUCTIVE TEST BRANCH FOR PURPOSES OF PROTECTION OF INDIVIDUALS FROM EXPOSURE TO RADIATION.

3.19. ROENTGEN (R), ROENTGEN EQUIVALENT MAN (REM). A ROENTGEN IS A MEASURE OF THE IONIZING RADIATION IN AIR PRODUCED BY (X) OR GAMMA RADIATIONS ONLY. A (REM) IS A MEASURE OF DOSE OF ANY IONIZING RADIATION TO BODY TISSUE RELATIVE TO THE ESTIMATED BIOLOGICAL EFFECT OF EXPOSURE OF ONE ROENTGEN OF X-RAY. FOR THE PURPOSE OF THIS MANUAL, ONE (REM) AND ONE (R) ARE IDENTICAL FOR THE REASON THAT THE SEALED SOURCES UTILIZED IN NONDESTRUCTIVE TEST DO NOT PRODUCE ALPHA OR BETA RADIATION OUTSIDE OF THE STAINLESS STEEL CAPSULE.

3.20. SCATTERED RADIATION - THE DEFLECTION OF PRIMARY RAYS AS THEY INTERACT WITH THE ATOMS IN MATERIALS; SUCH AS, AIR, STEEL, CONCRETE, OR LEAD SHIELDS AND MAY EMERGE FROM THE EXPOSED MATERIAL IN ANY DIRECTION. RADIATION SCATTERED IN A FORWARD DIRECTION, (THE DIRECTION OF THE PRIMARY RADIATION), HAS HIGHER ENERGIES THAN THAT SCATTERED IN THE OPPOSITE DIRECTION, (BACKSCATTER).

3.21. SEALED SOURCE - ANY RADIOACTIVE MATERIAL THAT IS ENCASED IN A CAPSULE DESIGNED TO PREVENT LEAKAGE OR ESCAPE OF THE RADIOACTIVE MATERIAL.

3.22. SHIELDING MATERIAL - ANY MATERIAL USED TO ABSORB RADIATION AND, THEREBY, REDUCE ITS AMOUNT OR INTENSITY.

3.23. STORAGE OR SHIPPING CONTAINER - A SHIELDED DEVICE IN WHICH SEALED SOURCES ARE PLACED FOR STORAGE OR TRANSPORTATION.

3.24. SURVEY - THE MEASUREMENT AND RECORDING OF RADIATION INTENSITIES AT VARIOUS LOCATIONS IN AN AREA WHERE IONIZING RADIATION EXISTS.

3.25. SURVEY CHART - AN OUTLINE, OR SKETCH, OF RADIATION LEVELS ASSOCIATED WITH A REPRESENTATIVE RADIOGRAPHIC SITUATION. THE CHARTS ARE DRAWN ON GRAPH PAPER CONTAINED IN A SURVEY LOG BOOK PROVIDED FOR THAT PURPOSE.

3.26. TEMPORARY RADIOGRAPHIC AREAS - ANY AREA, I.E., ABOARD SHIP, A SHOP, AND/OR OTHER LOCATIONS ON THE SHIPYARD, OR ANY SITE UNDER JURISDICTION OF THE DEPARTMENT OF DEFENSE, WHERE RADIOGRAPHY IS BEING PERFORMED, AND THAT DOES NOT CONSTITUTE OR FORM A PART OF A PERMANENT RADIOGRAPHIC AREA. WHILE RADIOGRAPHY IS BEING PERFORMED, THE AREA BECOMES EITHER A RESTRICTED AREA, A RADIATION AREA, OR A HIGH RADIATION AREA. AFTER TEMPORARY RADIOGRAPHY HAS BEEN COMPLETED, AND THE SOURCE, SIGNS, LIGHTS, AND ROPES HAVE BEEN REMOVED, THESE AREAS REVERT TO AN UNRESTRICTED AREA.

3.27. WORKSHEET - A RECORD OF NONDESTRUCTIVE TEST WORK DONE AND TECHNIQUES USED.

SECTION IV

REFERENCES

(A) NAVMED P-5055

(B) CODE OF FEDERAL REGULATIONS, TITLE 10, CHAPTER 1, PARTS 20, 30 AND 34 - (ENCLOSURE (1))

SECTION V

PERSONNEL

5.1. DESIGNATION

5.2. TRAINING

5.3. CERTIFICATION

5.4. EXPOSURE CONTROL

5.1. DESIGNATION

5.1.1. EACH PERSON TO BE CONSIDERED FOR CERTIFICATION AS RADIOGRAPHER OR RADIOGRAPHER'S ASSISTANT MUST SUBMIT TO A MEDICAL EXAMINATION AND BE QUALIFIED FOR RADIATION WORK BY THE MEDICAL OFFICER.

5.1.1.1. IN THE EVENT OF AN ACUTE ILLNESS LASTING A WEEK OR MORE, THE EMPLOYEE MUST SUBMIT TO A MEDICAL EXAMINATION PRIOR TO RETURNING TO DUTY THAT REQUIRES ASSOCIATION WITH/OR OPERATION OF RADIATION SOURCES.

5.1.2. AFTER SATISFACTORILY COMPLETING THE TRAINING AND EXPERIENCE REQUIREMENTS GIVEN BELOW, PROSPECTIVE RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS WILL BE NOMINATED FOR CERTIFICATION OF RADIATION SAFETY COMPETENCE IN WRITING BY THE HEAD, NONDESTRUCTIVE TEST BRANCH TO THE RADIOLOGICAL PROTECTION OFFICER, VERIFYING THE NOMINEES' ABILITY TO OPERATE ALL EQUIPMENT SAFELY.

5.2. TRAINING

5.2.1. PROPER INSTRUCTION AND TRAINING IN ACCORDANCE WITH SHIPYARD TRAINING PLAN TRIM YJ 7008 FSP 6225 303, OR ANY SUCCEEDING DESIGNATIONS OF THIS TRAINING PLAN, WILL BE PROVIDED CODE 130M2 AND 131M2 PERSONNEL WHO WILL BE USERS OF IONIZING RADIATION EQUIPMENT AND SOURCES.

5.2.2. IT WILL BE THE RESPONSIBILITY OF THE RADIOGRAPHIC SECTION SUPERVISOR TO PROVIDE ON-THE-JOB TRAINING TO PERSONNEL WHO ARE TO QUALIFY AS RADIOGRAPHERS.

5.2.3. TO BE CONSIDERED ELIGIBLE FOR CERTIFICATION AS A RADIOGRAPHER, AN EMPLOYEE MUST HAVE SIX MONTHS' EXPERIENCE AS A RADIOGRAPHER'S ASSISTANT IN ADDITION TO THE INSTRUCTION SPECIFIED ABOVE. DURING THIS TIME, THE RADIOGRAPHER'S ASSISTANT WILL BE INSTRUCTED ON THE SAFE OPERATION AND USE OF THE EQUIPMENT, BUT WILL NOT BE PERMITTED TO OPERATE THE RADIATION EQUIPMENT EXCEPT UNDER THE DIRECT SUPERVISION OF A CERTIFIED RADIOGRAPHER.

5.2.4. ONLY PERMANENT EMPLOYEES OF THE NONDESTRUCTIVE TEST BRANCH WILL BE CERTIFIED AS "RADIOGRAPHERS."

5.2.5. TO BE CONSIDERED FOR CERTIFICATION AS A "RADIOGRAPHER'S ASSISTANT" THE EMPLOYEE MUST HAVE WORKED WITH A RADIOGRAPHER AS A HELPER FOR SUFFICIENT TIME TO HAVE RECEIVED INSTRUCTION IN OPERATING PROCEDURES AND REQUIREMENTS. DURING THE PERIOD OF TRAINING, THE HELPER WILL NOT OPERATE SOURCE CONTROLS OR PERFORM MONITORING FOR ESTABLISHMENT OF ISODOSE LINES. HE WILL BE ALLOWED TO MONITOR AFTER THE INITIAL MONITORING IS PERFORMED BY THE RADIOGRAPHER, FOR PURPOSES OF TRAINING.

5.2.6. EACH RADIOGRAPHER MUST HAVE A COPY OF 10CFR20, 10CFR34, THE CURRENT LICENSE, AND THIS INSTRUCTION. EACH RADIOGRAPHER'S ASSISTANT MUST HAVE A COPY OF THIS INSTRUCTION AND ACCESS TO THE CURRENT LICENSE.

5.3. CERTIFICATION

5.3.1. UPON NOMINATION OF INDIVIDUALS FOR CERTIFICATION AS RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS BY THE HEAD, NONDESTRUCTIVE TEST BRANCH, THE RADIOLOGICAL PROTECTION OFFICER WILL CONDUCT WRITTEN AND/OR ORAL EXAMINATIONS, IN ACCORDANCE WITH THE CERTIFICATION PROCEDURE FILED WITH THE A.E.C.

5.3.2. THE RADIOLOGICAL PROTECTION OFFICER WILL NOTIFY THE HEAD, NONDESTRUCTIVE TEST BRANCH, IN WRITING, OF THE RESULTS OF EACH EXAMINATION AND OF THOSE WHO ARE CERTIFIED AS A RESULT OF THE EXAMINATION.

5.3.3. RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS WILL BE PERIODICALLY REINSTRUCTED AND RE-EXAMINED IN ORDER TO MAINTAIN THEIR CERTIFIED STATUS. THIS WILL BE PERFORMED UPON LICENSE RENEWAL, OR ON SIGNIFICANT AMENDMENT, OR BIENNIALLY, WHICHEVER OCCURS FIRST. INSTRUCTION WILL ALSO BE GIVEN AS SIGNIFICANT CHANGES TO 10CFR20 OR 34 BECOME EFFECTIVE.

5.3.4. RECORDS OF CERTIFICATIONS WILL BE KEPT BY THE RADIOLOGICAL PROTECTION OFFICER AND THE HEAD, NONDESTRUCTIVE TEST BRANCH.

5.4. EXPOSURE CONTROL

5.4.1. FILM BADGES

5.4.1.1. AFTER AN EMPLOYEE HAS BEEN QUALIFIED BY THE MEDICAL OFFICER, HE WILL BE ISSUED A RADIATION DETECTION FILM BADGE AND TWO SELF-READING POCKET DOSIMETERS. THE FILM BADGE CONTAINS TWO SPECIAL FILM PACKETS WHICH ARE PROCESSED AND RECORDED BY THE HEALTH PHYSICS BRANCH. THESE FILM BADGES PROVIDE A CUMULATIVE MEASUREMENT OF RADIATION EXPOSURE AND MUST BE WORN ON THE EMPLOYEE AT ALL TIMES WHEN IN A RADIATION AREA.

5.4.1.1.1. A BADGE IS ISSUED TO A SPECIFIC INDIVIDUAL AND WILL BE WORN ONLY BY THAT INDIVIDUAL.

5.4.1.2. THE FILM BADGE WILL BE RETURNED TO THE FILM BADGE BOARD AT THE END OF EACH SHIFT. UNDER NO CIRCUMSTANCES WILL IT BE REMOVED FROM THE SHIPYARD WITHOUT THE PRIOR APPROVAL OF THE HEALTH PHYSICS BRANCH. IT IS IMPORTANT THAT THE BADGE BE KEPT CLOSED, IN GOOD CONDITION, AND AWAY FROM HEAT, PRESSURE, OR MOISTURE.

5.4.1.2.1. IF THE BADGE IS LOST, DROPPED, OR LEFT IN A RADIATION AREA, THE SUPERVISOR OF THE SHIFT WILL BE NOTIFIED IMMEDIATELY AND A REPORT WRITTEN COVERING THE INCIDENT. THE REPORT WILL BE FORWARDED VIA, HEAD, NONDESTRUCTIVE TEST BRANCH, TO THE RADIOLOGICAL PROTECTION OFFICER, WITH A COPY TO THE HEALTH PHYSICS BRANCH.

5.4.2. POCKET DOSIMETERS

5.4.2.1. THE PENCIL-LIKE, DIRECT READING POCKET DOSIMETERS ARE USED FOR A DIRECT RADIATION MEASUREMENT RANGING FROM 0 TO 200 MR SINCE THESE INSTRUMENTS ARE ELECTROSTATICALLY CHARGED, CARE MUST BE TAKEN NOT TO DROP OR ABUSE THEM AS FALSE READINGS MAY OCCUR.

5.4.2.2. THE DOSIMETERS SHALL BE FULLY CHARGED, (SET TO ZERO), AT LEAST ONCE A WEEK, OR WHEN THE READING IS OVER 50 MR.

5.4.2.3. READINGS OF THE DOSIMETERS MUST BE RECORDED DAILY ON THE EXPOSURE/DOSIMETER RECORD CARD WHICH IS ISSUED EACH MONTH TO ALL RADIOGRAPHIC PERSONNEL BY CODE 130M2/131M2. THESE CARDS WILL BE REVIEWED WEEKLY BY THE SHIFT SUPERVISOR AND TURNED IN AT THE END OF EACH MONTH TO THE HEALTH PHYSICS BRANCH.

5.4.2.4. WARNING: THE CARE OF FILM BADGES AND DOSIMETERS ISSUED ARE THE RESPONSIBILITY OF EACH EMPLOYEE RECEIVING SAME. THE CARELESS OR DELIBERATE MISUSE OR PLACEMENT OF SUBJECT DEVICE IN/OR NEAR A RADIATION SOURCE WILL BE CAUSE FOR APPROPRIATE DISCIPLINARY ACTION, INCLUDING DISMISSAL.

5.4.3. EXPOSURE LIMITATIONS

5.4.3.1. THE EXPOSURE LIMITATIONS OF CODE 130M2/131M2 PERSONNEL SHALL BE REGULATED BY THE RADIATION PROTECTION GUIDE, (RPG). THE RPG IS THAT DOSE OF IONIZING RADIATION WHICH, IN THE LIGHT OF PRESENT KNOWLEDGE, MAY BE RECEIVED CONTINUOUSLY WITHOUT CAUSING SIGNIFICANT INJURY, EITHER IMMEDIATE OR DELAYED. SINCE ANY AMOUNT OF RADIATION IS POTENTIALLY HARMFUL, EVERY EFFORT SHOULD BE MADE TO KEEP RADIATION EXPOSURES AS FAR BELOW THE RADIATION PROTECTION GUIDE AS POSSIBLE. THE PRESENT RPG FOR NORMAL INDUSTRIAL WORK IS:

1. 1.25 REM PER CALENDAR QUARTER, OR

2. 3 REM PER CALENDAR QUARTER, PROVIDED FORM AEC-4 HAS BEEN COMPLETED FOR THE INDIVIDUAL, AND HIS EXPOSURE DOES NOT EXCEED 5 X (N-18) REM TOTAL, WHERE (N) EQUALS THE INDIVIDUAL'S AGE AT HIS LAST BIRTHDAY. THE RPG FOR THE HANDS AND FOREARMS, OR FEET AND ANKLES IS 18.75 R PER CALENDAR QUARTER. PERSONS EXPOSED UNDER CONDITION 1., ARE ISSUED GREEN FILM BADGES, AND PERSONS UNDER CONDITION 2., ARE ISSUED RED FILM BADGES.

5.4.3.2. THE FOUR RADIATION EXPOSURE LEVELS ON A WEEKLY BASIS THAT ARE OF PRIME IMPORTANCE TO CODE 130M2/131M2 PERSONNEL ARE:

1. MAXIMUM EXPOSURE NORMALLY PERMITTED WITH A GREEN FILM BADGE - 100 MREM.

2. MAXIMUM EXPOSURE PERMITTED WITH A GREEN FILM BADGE, AND WITH PRIOR NOTIFICATION, IN WRITING, BY THE IMMEDIATE SUPERVISOR TO THE HEALTH PHYSICIST ON FORM (12ND MINS 773) - 300 MREM.

3. MAXIMUM EXPOSURE NORMALLY PERMITTED WITH A RED FILM BADGE - 300 MREM.

4. MAXIMUM EXPOSURE PERMITTED WITH A RED FILM BADGE AND WITH PRIOR NOTIFICATION, IN WRITING, BY THE IMMEDIATE SUPERVISOR TO THE HEALTH PHYSICIST ON FORM (12ND MINS 773) - 800 MREM.

5.4.3.2.1. THE MAXIMUM LEVELS OF RADIATION PERMISSIBLE OUTSIDE OF A RADIATION AREA ARE:

1. 0.1 REM IN ANY SEVEN CONSECUTIVE DAYS.

2. 0.002 REM IN ANY ONE HOUR.

3. 0.005 REM IN ANY TWENTY CONSECUTIVE MINUTES IN ANY HOUR.

SECTION VI

EQUIPMENT

6.1. SEALED SOURCES

6.2. X-RAY MACHINES

6.3. SURVEY INSTRUMENTS

6.4. MISCELLANEOUS PROTECTIVE EQUIPMENT

6. EQUIPMENT

6.1. SEALED SOURCES

6.1.1. ONLY THOSE BYPRODUCT MATERIAL SEALED SOURCES AND EXPOSURE DEVICES NAMED IN THE LICENSE WILL BE USED. THEY SHALL BE USED ONLY FOR PERFORMING INDUSTRIAL RADIOGRAPHY, TRAINING RADIOGRAPHIC PERSONNEL AND CALIBRATING PHOTODOSIMETRIC FILM.

6.1.2. INSTRUCTIONS FOR THE USE OF THESE SOURCES AND DEVICES ARE IN SECTION XIII FOLLOWING.

6.1.3. THE RADIATION FROM STORAGE OR SHIPPING CONTAINERS AND RADIOGRAPHIC EXPOSURE DEVICES MEASURING A MINIMUM OF 4" FROM THE SEALED SOURCE STORAGE POSITION TO ANY EXTERIOR SURFACE OF THE DEVICE MUST NOT BE OVER 200 MR/HR AT ANY EXTERIOR SURFACE OF THE CONTAINER AND 10 MR/HR AT ONE METER, (ABOUT 39 INCHES), FROM ANY EXTERIOR SURFACE. THIS APPLIES TO ALL COBALT^{60} PROJECTORS. RADIOGRAPHIC EXPOSURE DEVICES MEASURING LESS THAN 4" FROM THE SEALED SOURCE STORAGE POSITION TO ANY EXTERIOR SURFACE OF THE DEVICE SHALL HAVE NO RADIATION LEVEL IN EXCESS OF 50 MR/HR AT 6" FROM ANY EXTERIOR SURFACE OF THE DEVICE. IRIDIUM^{192} PROJECTORS FALL IN THIS CATEGORY.

6.1.4. RADIOGRAPHERS ARE RESPONSIBLE FOR THE EQUIPMENT IN THEIR POSSESSION. IF ANY SOURCES ARE NOT PROPERLY LABELED, AS REQUIRED IN SECTION 9.3., THE RADIOGRAPHER WILL NOTIFY THE RADIOGRAPHY SECTION SUPERVISOR, OR THE SHIFT SUPERVISOR. SUCH EQUIPMENT WILL BE RETURNED TO MAINTENANCE FOR PROPER LABELING.

6.1.4.1. SOURCE PROJECTORS ARE IDENTIFIED BY THE NONDESTRUCTIVE TEST BRANCH BY MEANS OF COLORS OR NUMBERS. SOURCES AS RECEIVED ARE IDENTIFIED, IN ADDITION TO THE SERIAL NUMBER ASSIGNED BY THE MANUFACTURER, BY A COLOR OR NUMBER DESIGNATION CORRESPONDING TO THE COLOR OR NUMBER OF THE PROJECTOR IN WHICH EACH IS TO BE USED. SOURCES ARE NOT TO BE TRANSFERRED FROM ONE PROJECTOR TO ANOTHER EXCEPT BY EXPRESS PERMISSION OF THE HEAD, NONDESTRUCTIVE TEST BRANCH. PRIOR TO OR CONCURRENTLY WITH THE INTERCHANGE, HEALTH PHYSICS SHALL BE ADVISED OF SUCH INTERCHANGE.

6.1.5. SEALED SOURCES CONTAINING RADIOISOTOPES OTHER THAN BYPRODUCT MATERIAL, FOR EXAMPLE; RADIUM TEST SOURCES, WILL BE HANDLED UNDER THE SAME PROCEDURES AS BYPRODUCT MATERIALS.

6.2. X-RAY MACHINES

6.2.1. X-RAY MACHINES WILL BE USED FOR THE SAME PURPOSE AND UNDER THE SAME RADIATION PROTECTION PROCEDURES AS SEALED SOURCES.

6.3. SURVEY INSTRUMENTS

6.3.1. THE NONDESTRUCTIVE TEST BRANCH WILL HAVE ONE OF THE FOLLOWING RADIAC SETS AVAILABLE AT ALL TIMES FOR PERFORMING RADIATION SURVEYS AND MONITORING WHEREVER SOURCES ARE BEING HANDLED, STORED, USED OR TRANSPORTED.

1. AN/PDR 18 AND AN/PDR 27

2. EBERLINE MODEL E-500B

3. EBERLINE MODEL E-510G

6.3.2. EACH RADIATION SURVEY INSTRUMENT WILL BE CALIBRATED AT A RADIAC REPAIR FACILITY AT INTERVALS NOT TO EXCEED THREE MONTHS AND AFTER EACH INSTRUMENT SERVICING. THE DATE OF CALIBRATION APPEARS ON THE WORK RECORD CARD IN THE INSTRUMENT STORAGE CASE AND ON A LABEL ATTACHED TO THE INSTRUMENT.

6.3.3. THE OPERATING CONDITION OF THE RADIAC WILL BE CHECKED BEFORE EACH USE. INSTRUMENTS WITH WEAK BATTERIES OR WHOSE OPERABILITY IS IN DOUBT FOR ANY REASON WILL BE CALLED TO THE ATTENTION OF THE SUPERVISOR. THE SUPERVISOR WILL REMOVE ANY IMPROPERLY FUNCTIONING INSTRUMENT FROM SERVICE, APPROPRIATELY MARK IT, AND NOTIFY THE MAINTENANCE SECTION FOR REPLACEMENT OR REPAIR.

6.3.4 RADIACS AN/PDR 27 AND AN/PDR 18 ARE OBTAINED FROM THE RADIAC FACILITY. SPECIFIC INSTRUMENTS ARE EARMARKED FOR USE BY CODE 130M2 AND CODE 131M2 IN ORDER THAT CALIBRATION BE ACCOMPLISHED EVERY THREE MONTHS.

6.3.4.1. RADIACS ARE TO BE OBTAINED FROM THE RADIAC FACILITY ONLY ON TOOL CHECKS ISSUED TO SPECIFIC INDIVIDUALS AUTHORIZED TO DRAW EQUIPMENT FOR SHOP USE.

6.3.5. RADIACS, WHEN FIRST DRAWN BY CODE 130M2 AND 131M2 SHALL BE DELIVERED TO THE MAINTENANCE SECTION FOR CHECKING COMPLETENESS OF PACKAGE, SERIAL NUMBER, CALIBRATION DATE, ETC., PRIOR TO USE.

6.3.6. RADIAC CASES FOR ALL INSTRUMENTS, TOGETHER WITH RELATED GEAR, ARE TO BE RETAINED IN THE CUSTODY OF THE MAINTENANCE SECTION AND SHALL NOT BE AVAILABLE TO OPERATING PERSONNEL. BY THIS ACTION, THE ISOTOPE SOURCE PROVIDED IN AN AN/PDR 27 CASE IS RETAINED IN CUSTODY AND NEVER ISSUED FOR USE IN THE FIELD.

6.3.7. A METAL LOCKER SECURED BY A LOCK WILL BE USED TO PROVIDE STORAGE OF THOSE INSTRUMENTS IN USE BY THE RT SECTION. KEYS AND ACCESS TO THIS LOCKER ARE TO BE LIMITED TO THE RADIOGRAPHIC SUPERVISORS, MAINTENANCE MECHANIC AND BRANCH HEAD.

6.3.8. A LOG BOOK WILL BE MAINTAINED SHOWING USAGE OF RADIACS REMOVED FROM THE STORAGE LOCKER. THE LOG BOOK WILL INDICATE SERIAL

NUMBER OF THE RADIAC, THE DATE AND SHIFT USED, THE RADIOGRAPHER RESPONSIBLE FOR THE INSTRUMENT AND, IF POSSIBLE, THE LOCATION OF ITS USE.

6.3.9. ISSUANCE OF THE RADIACS AND MAINTENANCE OF THE LOG BOOK WILL BE THE RESPONSIBILITY OF THE RADIOGRAPHIC SHIFT SUPERVISOR.

6.3.10. THE AN/PDR 27 IS USED FOR MEASURING GAMMA INTENSITIES OF .5 TO 500 MR/HR. OPERATION OF THE AN/PDR 27 IS AS FOLLOWS:

1. RANGE SWITCH KNOB CONTAINS 6 SETTINGS; OFF, BATT COND, 500, 50, 5, AND .5. THE RANGE IN USE IS ALSO INDICATED BY COLOR CHANGES OF THE METER FACE.

2. METER RANGE SWITCH SHOULD ALWAYS BE IN "OFF" POSITION WHEN METER IS NOT ACTUALLY BEING USED.

3. TURN RANGE SWITCH TO BATT COND. METER READING SHOULD INDICATE THE CENTER LINE MARKED BATT OR TO THE RIGHT OF CENTER LINE. A READING TO THE LEFT OF CENTER LINE INDICATES ALL BATTERIES NEED CHANGING.

4. MAKE ALL READING USING HIGH SCALES FIRST, WORKING DOWN TO APPROPRIATE SCALE WHICH GIVES A READING AS NEAR THE CENTER OF THE SCALE AS POSSIBLE. DO NOT ALLOW A FULL SCALE READING (PEGGED METER) TO REMAIN ON METER FOR ANY LENGTH OF TIME.

5. TOP 2 SCALES, 0 - 500 MR/HR AND 50 MR/HR, USE AN INTERNAL PROBE. (NOTE: 2 TOP SCALES USED TO MEASURE GAMMA ONLY. AN/PDR 27 (J) AND LATER METERS HAVE THE HIGH-RANGE DETECTOR IN THE PROBE.)

6. BOTTOM 2 SCALES, 0 - 5 MR/HR AND 0.5 MR/HR, USE THE EXTERNAL PROBE. (NOTE: ON 2 BOTTOM SCALES REMOVAL OF BETA WINDOW GIVES A COMBINED BETA-GAMMA READING. WITH BETA WINDOW COVERING THE END OF THE PROBE, METER INDICATES GAMM READING ONLY.) THE BETA WINDOW MUST BE CLOSED WHEN MONITORING RADIOGRAPHIC SOURCES OR AREAS.

7. THE LIGHT SWITCH FOR LIGHTING THE METER DIAL IS INCORPORATED IN THE MAIN SWITCH ON SOME INSTRUMENTS AND MOUNTED ON TOP OF THE CASE IN OTHERS.

8. KEEP THE INSTRUMENT WIPED OFF AND CLEAN. THE INSTRUMENT IS SENSITIVE AND MUST NOT BE JARRED. CARRY ON LAP WHEN RIDING IN A VEHICLE.

6.3.10.1. THE RADIUM TEST SOURCE PROVIDED WITH EACH INSTRUMENT WILL BE USED ONLY BY PERSONS DESIGNATED BY THE HEAD, NONDESTRUCTIVE TEST BRANCH, TO DO SHOP CALIBRATION CHECKS OF THE INSTRUMENTS. EACH TEST SOURCE WILL NORMALLY BE KEPT IN ITS RESPECTIVE INSTRUMENT CARRYING CASE IN EITHER BLDG. 676, MARE ISLAND, OR BLDG. 113A, HUNTERS POINT.

6.3.10.2 IF THE TEST SOURCE IS LOST OR NOT RETURNED TO STORAGE, A

SEARCH SHALL BEGIN IMMEDIATELY AND IF NOT FOUND WITHIN A REASONABLE PERIOD OF TIME DURING THE SHIFT, THE SHIFT SUPERVISOR SHALL NOTIFY THE SHIPYARD POLICE AND THE HEALTH PHYSICS BRANCH OR R.P.O.

6.3.10.3. CAUTION - THE TEST SOURCE CONTAINS SEVEN MICROGRAMS OF RADIUM. THIS IS USED TO TEST THE OPERATING CONDITION OF THE INSTRUMENT ONLY. THE RADIUM IS POTENTIALLY DANGEROUS, SINCE IT CAUSES SERIOUS DAMAGE IF INHALED OR SWALLOWED, AND SKIN BURNS MAY RESULT IF THE TEST SAMPLE IS HELD CLOSE TO THE SKIN FOR PROLONGED PERIODS. WHEN USING ANY TEST SAMPLE, HANDLE IT ONLY LONG ENOUGH TO ASCERTAIN THE CONDITION OF THE RADIAC SET, THEN REPLACE IT IN ITS STORAGE COMPARTMENT IN THE CARRYING CASE. IN ORDER TO AVOID LOSS OR DAMAGE OF THE RADIOACTIVE TEST SAMPLE, THE STORAGE CASE IS NOT TO BE TAKEN OUT IN THE FIELD.

6.3.11. THE AN/PDR 18 MEASURES HIGH INTENSITY GAMMA RADIATION OVER FOUR RANGES, 0 TO .5 R/HR, 0 TO 5 R/HR, 0 TO 50 R/HR, AND 0 TO 500 R/HR. THE INSTRUMENT HAS A NINE POSITION, ROTARY SELECTOR SWITCH WHICH IS GEARED TO THE METER DIAL. THE POSITION OF THE SWITCH AT ANY PARTICULAR TIME SHOWS THROUGH AN OPENING IN THE METER FACE. OPERATION OF THE AN/PDR 18 IS AS FOLLOWS:

1. TURN SWITCH TO POSITION (A) AND CHECK BATTERY CONDITION OF FILAMENT BATTERIES: READING SHOULD NOT BE TO LEFT OF "A" MARKER.

2. TURN SWITCH TO (B) POSITION AND CHECK CONDITION OF HIGH VOLTAGE BATTERY: READING SHOULD NOT BE TO THE LEFT OF "B" MARKER.

3. TURN SWITCH TO ZERO POSITION. ZERO READING SHOULD BE OBTAINED ON METER (ADJUST WITH ZERO SET KNOB).

4. TURN SWITCH TO CALIBRATION. READING SHOULD BE AT CALIBRATION MARK. (ADJUST WITH CALIBRATION SET KNOB).

5. MAKE ALL READINGS USING HIGH SCALES FIRST AND WORKING DOWN TO APPROPRIATE SCALES WHICH GIVE A READING AS CLOSE TO THE CENTER OF THE SCALE AS POSSIBLE. DO NOT ALLOW A FULL SCALE READING (PEGGED METER) TO REMAIN FOR ANY LENGTH OF TIME.

6. LIGHT SWITCH FOR NIGHT READING IS LOCATED AT END AND ON TOP OF HANDLE IN SOME INSTRUMENTS AND ON TOP OF CASE IN OTHERS.

6.3.11.1. WARNING - THE AN/PDR 18 CONTAINS A SMALL STRONTIUM^{90} SOURCE WHICH IS BUILT INTO THE INSTRUMENT. THE INSTRUMENT IS NOT TO BE OPENED BY NONDESTRUCTIVE TEST PERSONNEL. IF AN AN/PDR 18 INSTRUMENT IS LOST OR NOT RETURNED TO STORAGE, A SEARCH SHALL BEGIN IMMEDIATELY AND IF NOT FOUND WINTIN A REASONABLE PERIOD OF TIME DURING THE SHIFT, THE SHIFT SUPERVISOR SHALL NOTIFY THE SHIPYARD POLICE AND THE HEALTH PHYSICS BRANCH OR THE RADIOLOGICAL PROTECTION OFFICER.

6.4. MISCELLANEOUS PROTECTIVE EQUIPMENT

6.4.1. RADIATION WARNING SIGNS

6.4.1.1. PERMANENT RADIATION AREAS ARE POSTED WITH STANDARD RADIATION WARNING SIGNS READING: "DANGER - HIGH RADIATION AREA INSIDE - KEEP OUT," AND INCLUDING INFORMATION AS TO ANY LIMITATIONS, SUCH AS SIZE OF SOURCE APPLICABLE TO EACH SPACE THESE LIMITATIONS WILL BE COMPLIED WITH.

6.4.1.2. A SUFFICIENT STOCK OF CLEARLY LEGIBLE SIGNS WILL BE MAINTAINED TO PROVIDE ADEQUATE POSTING AT ALL TEMPORARY RADIATION AREAS. THESE SIGNS WILL BE IN THE STANDARD COLORS OF YELLOW AND MAGENTA, BEAR THE STANDARD RADIATION WARNING SYMBOL, AND THE LEGEND: "CAUTION - HIGH RADIATION AREA INSIDE - KEEP OUT." OTHER INFORMATION MAY BE ADDED AS NEEDED.

6.4.1.3. A SUFFICIENT STOCK OF CLEARLY LEGIBLE SIGNS WILL BE MAINTAINED TO PROVIDE ADEQUATE POSTING OF STORAGE AREAS, VEHICLES, ETC. THESE SIGNS WILL BE IN THE STANDARD COLORS OF YELLOW AND MAGENTA, BEAR THE STANDARD RADIATION WARNING SYMBOL, AND THE LEGEND: "CAUTION - RADIOACTIVE MATERIAL." OTHER INFORMATION MAY BE ADDED AS NEEDED.

6.4.2. BARRICADE EQUIPMENT

6.4.2.1. A SUFFICIENT STOCK OF YELLOW AND MAGENTA ROPE AND PORTABLE STANCHIONS WILL BE MAINTAINED TO PROVIDE FOR ADEQUATE PHYSICAL BARRICADING OF ALL TEMPORARY RADIATION AREAS.

6.4.2.2. A STOCK OF FLASHING RED LIGHTS WILL BE MAINTAINED TO CALL ATTENTION TO AND ILLUMINATE WARNING SIGNS AT TEMPORARY RADIATION AREAS. THE LIGHTS AND BATTERIES ARE SUPPLIED TO NONDESTRUCTIVE TEST BRANCH BY SHOP 06, TOOL ROOM.

6.4.2.3. ROTATING BEACON LIGHTS WILL BE USED TO IDENTIFY THE LOCATION OF A SOURCE AT TEMPORARY RADIATION AREAS.

SECTION VII

RADIOGRAPHIC AREAS

7.1. PERMANENT RADIOGRAPHIC AREAS

7.2. TEMPORARY RADIOGRAPHIC AREAS

7.1. PERMANENT RADIOGRAPHIC AREAS

7.1.1. PERMANENT RADIOGRAPHIC AREAS MUST BE POSTED WITH SIGNS TO INDICATE THAT ONLY AUTHORIZED PERSONS MAY ENTER. ALL ENTRANCES MUST BE PHYSICALLY BLOCKED SO THAT INADVERTENT ENTRY WITHOUT BEING ALERTED IS IMPOSSIBLE DURING AN EXPOSURE. ALL ENTRANCE DOORS TO "HIGH RADIATION AREAS" MUST HAVE INTERLOCKS CONNECTED TO RADIATION ALARMS AND/OR SOURCE OR X-RAY CONTROLS SUCH THAT AN ALARM IS SOUNDED IF AN EXPOSURE IS ATTEMPTED WITH A DOOR OPEN. PARTS OF THE RESTRICTED AREA WHICH DO NOT MEET THE DEFINITION OF RADIATION AREA IN PARAGRAPH 3.11., SUCH AS OFFICES, NEED NOT BE POSTED AS RADIATION AREAS. ENTRANCES TO THE RADIATION AREAS AND SOUCE STORAGE AREAS MUST BEAR ATOMIC ENERGY COMMISSION (AEC) APPROVED WARNING SIGNS. IF PORTIONS OF A RESTRICTED AREA INTERMITTENTLY BECOME RADIATION AREAS, RADIATION SIGNS MUST BE PLACED AT THE PROPER ISODOSE LINES DURING THE TIMES THAT PORTIONS OF A RESTRICTED AREA BECOME RADIATION AREAS. WHEN SUCH AREAS ARE NO LONGER RADIATION AREAS, THE RADIATION SIGNS MUST BE REMOVED OR COVERED BEFORE PERSONNEL WITHOUT FILM BADGES MAY ENTER.

7.1.2. WHILE PERFORMING RADIOGRAPHY, OR OTHERWISE CREATING A RADIATION AREA IN A PERMANENTLY ESTABLISHED RESTRICTED RADIOGRAPHY AREA, THE DOORS SHALL BE SECURED, THE ILLUMINATED WARNING SIGNS AT EACH DOOR SHALL BE ON, AND THE ALARM BELL INTERLOCKED WITH THE DOORS AND RADIATION ALARM AND/OR SOURCE CONTROL SHALL BE IN OPERATION. A WARNING SIGN SHALL BE DISPLAYED IN FRONT OF EACH ENTRANCE TO INDICATE THAT AN EXPOSURE IS BEING MADE.

7.1.3. RADIATION ROOMS IN BLDG. 676, MARE ISLAND, AND BLDG. 113A, HUNTERS POINT, ARE POSTED WITH SIGNS INDICATING THE MAXIMUM INTENSITIES OF RADIATION ALLOWED IN THE INDIVIDUAL ROOMS. SOURCES HAVING A HIGHER ACTIVITY MAY NOT BE USED IN THESE ROOMS UNLESS SPECIFIC APPROVAL IS GIVEN BY THE HEAD, NONDESTRUCTIVE TEST BRANCH, WITH PRIOR NOTIFICATION TO THE RADIOLOGICAL PROTECTION OFFICER AND HEALTH PHYSICS BRANCH.

7.1.3.1. WHEN SOURCES ARE EXPOSED WITHOUT USING A SHIELDED COLLIMATOR (I.E., FOR PANORAMIC EXPOSURES), LEAD-SHIELDING STANDS SHALL BE POSITIONED NEAR THE WALLS AND DOORS FOR REDUCING RADIATION INTENSITIES INTO ADJACENT ROOMS AND AREAS.

7.1.3.2. THE INTERIOR OF ALL THE RADIATION ROOMS IN BLDG. 676, MARE ISLAND, AND BLDG. 113A, HUNTERS POINT, ARE POSTED AS HIGH RADIATION AREAS. NO ONE WILL BE ALLOWED ENTRY INTO THE RADIATION ROOMS UNLESS WEARING A FILM BADGE, EXCEPT AS PERMITTED BY PARAGRAPH 9.2.1.3. THE RADIOGRAPHER RESPONSIBLE FOR THE PARTICULAR RADIATION ROOM HE IS WORKING IN IS THE ONLY ONE WHO MAY GIVE ANYONE PERMISSION TO ENTER THE ROOM AND ONLY AFTER THE SOURCE HAS BEEN SAFELY RETRACTED, SECURED, AND MONITORED BY THE RADIOGRAPHER.

7.2 TEMPORARY RADIOGRAPHIC AREAS

7.2.1. WHEN RADIOGRAPHY IS PERFORMED IN A SHOP, ABOARD SHIP, OR OTHER TEMPORARY AREA, THE PROCEDURES FOR POSTING AN AREA, AS OUTLINED IN SECTION IX, SHALL BE FOLLOWED. PERSONNEL PROTECTIVE MEASURES SHALL BE CAREFULLY FOLLOWED AS WILL ALL SAFETY MEASURES CONTAINED IN THIS PROCEDURE.

7.2.2. NOTIFICATION

7.2.2.1. A TELETYPE WILL BE SENT BY NDT TO ALL STATIONS AND SHIPS WHERE RADIOGRAPHY IS TO BE PERFORMED, AND TO RESPONSIBLE SHIP SUPERINTENDENTS. THIS TELETYPE WILL DESCRIBE THE LOCATION (ON BOARD SHIP BY FRAME, DECK, AND PT AND STBD), TIME AND DATE THAT RADIOGRAPHY WILL BE ACCOMPLISHED. THE TELETYPE IS DISTRIBUTED DURING DAY SHIFTS PRECEDING ALL NIGHT SHIFT RADIOGRAPHY.

7.2.2.2. BEFORE ANY RADIOGRAPHY IS PERFORMED ABOARD COMMISSIONED SHIPS OR SHIPS IN SERVICE, THE RADIOGRAPHER WILL CONTACT THE DECK WATCH AND INFORM HIM OF THE FOLLOWING:

A. THE AREA THAT IS TO BE RADIOGRAPHED.

B. LENGTH OF TIME THE AREA WILL BE RESTRICTED TO ALL PERSONNEL.

C. LOCATION OF THE ISODOSE LINE.

THE RADIOGRAPHER WILL THEN REQUEST THE DECK WATCH TO NOTIFY ALL SHIPBOARD PERSONNEL (BY SHIP'S INTERCOM) THAT RADIOGRAPHY IS TO BE PERFORMED AT A DESIGNATED AREA AND ALL PERSONNEL SHALL OBSERVE THE POSTED RADIATION SIGNS AND REMAIN CLEAR OF SUCH AREAS UNTIL GIVEN THE "ALL-CLEAR". IF THE SHIP'S INTERCOM IS INOPERATIVE, THE RADIOGRAPHER SHALL NOT PROCEED WITH THE EXPOSURE UNTIL THE DECK WATCH HAS VERBALLY NOTIFIED COGNIZANT PERSONNEL ABOARD SHIP.

SECTION VIII

RECEIPT, TRANSPORTATION, AND SHIPMENT OF SOURCES

8.1. RECEIPT

8.2. TRANSPORTATION

8.3. LEAK TEST

8.4. SHIPMENT

8.5. RECORDS

8.1. RECEIPT OF SOURCES

8.1.1. WHEN SOURCES ARE RECEIVED BY THE SUPPLY DEPARTMENT THEY WILL NOTIFY THE HEALTH PHYSICS BRANCH AND NONDESTRUCTIVE TEST BRANCH OF THEIR ARRIVAL.

8.1.2. THE HEALTH PHYSICS BRANCH, OR TRAINED SUPPLY DEPARTMENT PERSONNEL, WILL MONITOR THE PACKAGE FOR COMPLIANCE WITH ICC REGULATIONS, AND AFFIX THE SIGNED CERTIFICATE OF CLEARANCE. THEY WILL THEN NOTIFY THE NONDESTRUCTIVE TEST BRANCH THAT THE SOURCES ARE READY TO BE PICKED UP.

8.1.3. UPON RECEIPT OF THE SOURCES, NONDESTRUCTIVE TEST BRANCH WILL MONITOR CONTAINERS AND RECORD THE SOURCE DATA, AS OUTLINED IN PARAGRAPH 8.5.

8.1.4. SOURCES SHALL BE LEAK TESTED IN ACCORDANCE WITH PARAGRAPH 8.3 WHEN RECEIVED OR SHIPPED, AND AT SIX-MONTH INTERVALS. THEY SHALL NOT BE USED OR OTHERWISE HANDLED UNTIL RELEASED BY HEALTH PHYSICS AFTER DETERMINING THAT THE WIPE TEST RESULT INDICATES AN ABSENCE OF CONTAMINATION.

8.1.5. SAFETY PRECAUTIONS SATISFACTORY TO THE HEALTH PHYSICS REPRESENTATIVE SHALL BE TAKEN. THESE INCLUDE, WHEN NECESSARY, RUBBER GLOVES, CONTAINERS FOR STOWAGE OF CONTAMINATED WIPES, TIME LIMITATIONS, AND USE OF HANDLING TONGS.

8.1.6. LEAK TESTS SHALL ALSO BE MADE WHENEVER IT IS SUSPECTED THAT HANDLING EQUIPMENT HAS BECOME CONTAMINATED.

8.2. TRANSPORTATION OF SOURCES

8.2.1. TRANSPORTATION WITHIN THE SHIPYARD

8.2.1.1. SOURCES ASSIGNED TO THE NDT BRANCH SHALL BE TRANSPORTED WITHIN THE SHIPYARD ONLY BY NDT PERSONNEL, IN ACCORDANCE WITH THE PROCEDURES IN PARAGRAPH 8.2.1.2 TO 8.2.1.6. THE SUPPLY DEPARTMENT, COMMON CARRIERS, OR PUBLIC WORKS TRANSPORTATION BRANCH MAY ALSO TRANSPORT SOURCES ON THE SHIPYARD, PROVIDED: THAT THESE SOURCES ARE PACKAGED AND LABELED IN ACCORDANCE WITH ICC SPECIFICATIONS.

8.2.1.2. SOURCES SHALL BE TRANSPORTED ONLY WHEN IN EITHER AN APPROVED PROJECTOR OR AN APPROVED STORAGE AND SHIPPING CONTAINER. SOURCES IN PROJECTORS SHALL BE SECURED IN PLACE BY MEANS OF THE SOURCE PLUG, AND PROJECTOR CONTROLS SHALL BE LOCKED. SOURCES IN STORAGE AND SHIPPING CONTAINERS SHALL BE SECURED IN PLACE BY HOLD DOWN RODS, AND CONTAINERS SHALL HAVE THE COVER BOLTED IN PLACE.

8.2.1.3. SOURCE PROJECTORS AND CONTROLS, AND SOURCE CONTAINERS, SHALL

BE SECURED IN OR ON THE VEHICLE WITH LINE AND BLOCKING IN SUCH A MANNER THAT ACCIDENTAL BUMPING AND NORMAL TRANSPORTATION MOVEMENT WILL NOT CAUSE SHIFTING OF THE LOAD DURING SUCH TRANSPORTATION. NO FLAMMABLES OR EXPLOSIVES SHALL BE CARRIED IN THE SAME VEHICLE.

8.2.1.4. EACH PROJECTOR OR CONTAINER SHALL BE PLACED IN THE VEHICLE AT LEAST THREE FEET FROM THE PASSENGER COMPARTMENT, AND SUCH THAT THE DRIVER AND PASSENGER(S) WILL NOT BE EXPOSED TO MORE THAN 2 MREM IN ANY ONE HOUR, UNLESS BOTH ARE WEARING FILM BADGES, AND THAT THE RADIATION LEVEL AT THE OUTER SURFACE OF THE VEHICLE WILL NOT EXCEED 200 MREM/HR, NOR EXCEED 10 MREM/HR AT ONE METER FROM THE SURFACE OF THE VEHICLE.

8.2.1.5. A CERTIFIED RADIOGRAPHER SHALL ACCOMPANY EACH SHIPMENT, WITH APPROVED SURVEY INSTRUMENTATION. THE RADIOGRAPHER IS RESPONSIBLE FOR MONITORING THE VEHICLE AND SHIPMENT, AND ASSURING THAT THE SHIPMENT IS PROPERLY SECURED.

8.2.1.6. VEHICLES TRANSPORTING SOURCE PROJECTORS OR CONTAINERS SHALL BE POSTED WITH CLEARLY LEGIBLE STANDARD RADIATION WARNING SIGNS, BEARING THE LEGEND: "CAUTION (OR DANGER) - RADIOACTIVE MATERIAL". AT LEAST FOUR SIGNS SHALL BE USED; ONE ON EACH SIDE, ONE ON THE REAR, AND ONE ON THE FRONT.

8.2.2. TRANSPORTATION OFF THE SHIPYARD

8.2.2.1. ALL SOURCES TRANSPORTED BEYOND THE LIMITS OF THE SHIPYARD SHALL BE IN COMPLIANCE WITH THE SPECIFIC REGULATIONS OF ICC, FAA, DOD OR COAST GUARD, AS APPROPRIATE.

8.2.2.2. NO SOURCE SHALL BE REMOVED FROM THE SHIPYARD BY NDT PERSONNEL WITHOUT SPECIFIC APPROVAL AND INSTRUCTION FROM THE HEAD NDT BRANCH, AFTER NOTIFICATION OF CODES 108 AND 732 OR 733.

8.2.2.3. WHEN REMOVAL OF SOURCES FROM THE SHIPYARD BY NDT PERSONNEL IS APPROVED:

8.2.2.3.1. ONLY SOURCES CONTAINED IN PROJECTORS OR SHIPPING CONTAINERS LABELED AS MEETING ICC SPECIFICATIONS WILL BE PERMITTED TO BE TRANSPORTED OFF THE SHIPYARD. WHEN VEHICLES ASSIGNED TO NDT ARE TO BE USED FOR TRANSPORTATION, THEY WILL BE SPECIFICALLY DESIGNATED BY THE BRANCH HEAD.

8.2.2.3.2. AFTER SELECTING THE SOURCE TO BE TRANSPORTED, THE RADIOGRAPHER SHALL FILL IN THE NECESSARY INFORMATION IN THE APPLICABLE ISOTOPE LOG BOOK STATING THE TIME, DATE AND DESTINATION OF THE SOURCE. UPON RETURN OF THE SOURCE, THE APPROPRIATE RETURNED-SIGN-OFF BLOCK OF THE LOG BOOK SHALL BE FILLED IN BY THE RADIOGRAPHER.

8.2.2.3.3. THE RADIOGRAPHER SHALL THEN MONITOR THE SOURCE PROJECTOR TO VERIFY THE SAFE LIMITS AS STATED IN PARAGRAPH 6.1.3.

8.2.2.3.4. THE PROJECTOR SHALL BE LOCKED AND THE CABLE AND SOURCE TUBE DISCONNECTED. THE SHIPPING PLUG AND THE STORAGE COVER SHALL BE SECURELY IN PLACE. THE PROJECTOR SHALL THEN BE PLACED IN A BOX, FOOT LOCKER, OR OTHER SUITABLE CONTAINER AS PRESCRIBED BY THE MAINTENANCE SECTION WITH ALL THE ACCOMPANYING EQUIPMENT (I.E., CABLES, SOURCE TUBES, ETC.) AND SHALL BE SECURED SO AS TO PREVENT ANY MOVEMENT WHILE IN TRANSIT. THE FOOT LOCKER OR BOX SHALL BE LOCKED WITH THE KEY IN THE POSSESSION OF THE RADIOGRAPHER FOR THE PURPOSE OF KEEPING UNAUTHORIZED PERSONNEL FROM TAMPERING WITH THE EQUIPMENT. THE FOOT LOCKER OR BOX SHALL BE SUITABLY LABELED WITH AN APPROPRIATELY COMPLETED ICC RED RADIOACTIVE LABEL, AND ALSO ON ALL SIDES WITH SIGNS: "CAUTION (OR DANGER) - RADIOACTIVE MATERIAL".

8.2.2.3.5. THE CONTAINER SHALL THEN BE PLACED ON THE REAR BED OF THE VEHICLE AS FAR AS POSSIBLE FROM THE CAB AND SECURED WITH LINE AND BLOCKING IN SUCH A MANNER THAT ACCIDENTAL BUMPING AND NORMAL TRANSPORTATION MOVEMENT WILL NOT CAUSE SHIFTING OF THE CONTAINER DURING SUCH TRANSPORTATION.

8.2.2.3.6. THE RADIOGRAPHER RESPONSIBLE FOR THE SOURCE WILL MONITOR THE TRUCK AFTER LOADING THE CONTAINER TO INSURE THAT THE RADIATION LEVEL MEETS THE FOLLOWING REQUIREMENTS:

A. 10 MILLIROETGENS PER HOUR AT ONE (1) METER FROM ANY EXTERNAL SURFACE OF THE TRANSPORTING VEHICLE.

B. 2 MILLIROENTGENS PER HOUR IN ANY AREA IN THE VEHICLE OCCUPIED BY THE DRIVER OR ANY OTHER PERSON.

8.2.2.3.7. AN AN/PDR 18 AND AN/PDR 27 RADIACS OR EITHER EBERLINE E-500B OR E-510G MUST ACCOMPANY THE SOURCE AT ALL TIMES.

8.2.2.3.8 THE VEHICLE USED FOR TRANSPORTING THE SOURCES OFF THE SHIPYARD SHALL BE POSTED WITH CLEARLY LEGIBLE SIGNS DISPLAYING THE WORD "RADIOACTIVE" IN BLACK LETTERS 4" HIGH AND ABOUT A 5/8" STROKE ON A YELLOW BACKGROUND. FOUR SIGNS WILL BE USED; ONE ON EACH SIDE, ONE ON THE FRONT AND ONE ON THE REAR. THE SIGNS SHALL BE COVERED OR REMOVED WHEN THE VEHICLE IS NOT CARRYING RADIOACTIVE MATERIAL.

8.2.2.3.9. THERE SHALL ALWAYS BE AT LEAST TWO OCCUPANTS IN THE VEHICLE WHEN TRANSPORTING SOURCES. ONE OF THE OCCUPANTS MUST BE A CURRENTLY CERTIFIED RADIOGRAPHER.

8.2.2.3.10. ALL OCCUPANTS OF THE VEHICLE CONVEYING THE SOURCE SHALL BE REQUIRED TO WEAR FILM BADGES AND DOSIMETERS.

8.2.2.3.11. IF THE SOURCE IS TO BE SHIPPED BY MILITARY AIR TRANSPORT, THE ESCORT RADIOGRAPHER WILL NOTIFY THE AIR TRANSPORT PERSONNEL OF THE CONTENTS OF THE CONTAINER AND SUPERVISE ANY LOADING AND UNLOADING OF THE CONTAINER AT THE AIR TERMINAL.

8.2.2.3.12. IN THE EVENT OF A TRANSPORTATION ACCIDENT, THE REQUIREMENTS OF PARAGRAPH 14.3 SHALL BE ADHERED TO

8.2.2.3.13. IF THE SOURCE IS TO BE SHIPPED BY COMMERCIAL AIR TRANSPORT, THE RESPONSIBLE RADIOGRAPHER SHALL MAKE THE PROPER ARRANGEMENTS FOR ESCORT AND DELIVERY OF THE SOURCE TO THE AIR CARRIER AND SHALL TAKE CUSTODY OF THE SOURCE FROM THE AIR CARRIER AT THE DESTINATION AND ESCORT IT TO POINT OF USE.

8.3 LEAK TEST

8.3.1. THE LEAK TEST IS PERFORMED EITHER BY AEC LICENSED CONTRACTOR OR IN THE FOLLOWING MANNER BY NONDESTRUCTIVE TEST AND HEALTH PHYSICS PERSONNEL. THE SOURCE WILL BE OPERATED BY NONDESTRUCTIVE TEST BRANCH AND THE RADIATION AND CONTAMINATION MEASUREMENTS WILL BE MADE BY HEALTH PHYSICS, USING INSTRUMENTATION CAPABLE OF DETECTING 0.005 MICROCURIES OF RADIOACTIVE MATERIAL. RECORDS OF LEAK TESTS WILL BE KEPT BY THE HEALTH PHYSICS IN UNITS OF MICROCURIES.

8.3.2. BEFORE ANY LEAK TESTING IS DONE, THE RADIOGRAPHIC AREA USED WILL BE CLEARED OF PERSONNEL, AND ALL ENTRANCES SECURED AND POSTED WITH RADIATION SIGNS, FLASHING LIGHTS, ETC. THERE WILL BE NO SMOKING OR EATING LUNCHES IN THIS AREA. ALL CONTROL CABLES, BOXES AND CONNECTIONS SHALL BE INSPECTED FOR WEAR OR MALFUNCTION AND REPLACED, IF NECESSARY.

8.3.3. A SPECIAL WIPE TEST TOOL HAS BEEN DESIGNED FOR PERFORMING LEAK TESTS ON INDUSTRIAL RADIOGRAPHY SOURCES. THIS TOOL FACILITATES POSITIVE CONTROL OF THE SOURCES WHILE THEY ARE BEING WIPED FOR DETECTION OF LEAKS. IT IS ADAPTABLE TO BOTH IRIDIUM^{192} AND COBALT^{60} PROJECTORS AND SHIPPING CONTAINERS, AND IT IS DESIGNED TO WIPE THE SOURCE EITHER PRIOR TO PLACING THE LATTER IN THE PROJECTOR, OR WHEN IT IS ALREADY IN THE PROJECTOR. THE CAPABILITY OF PERFORMING A LEAK TEST ON A SOURCE PRIOR TO ITS INSERTION INTO A SOURCE PROJECTOR ELIMINATES THE POSSIBILITY OF THE SPREAD OF ANY POSSIBLE CONTAMINATION FROM A CONTAMINATED SOURCE AS RECEIVED.

8.3.4. DESCRIPTION OF WIPE TEST TOOL. (SEE PHOTOGRAPHS, FIGURES 8-1 AND 8-2.)

A. PLUG, 1", 18 NPT ALUMINUM.

B. DUMMY SOURCE. (NOT LABELED IS A 1" I.D. SLEEVE THAT IS ATTACHED TO SHIPPING CONTAINER.)

C. 1/2" COPPER TUBING. (NOT LABELED IS THE KNURLED WIPING CHAMBER, 2-1/4", 20 NPT BRASS.)

D. 1" THICK FOAM PLASTIC DISC.

E. 7/8" TUBULAR GAUZE, STOCK #LF6510-200-7013.

F. 1/2" COPPER TUBING.

G. 1" ALUMINUM ATTACHMENT TO PROJECTOR CAMERA.

NOTE: THE 1" SLEEVE (BETWEEN "B" AND "C") AND THE PROJECTOR ATTACHMENT "G" MAY VARY WITH MANUFACTURER. IF THE WIPE TEST SHOWS CONTAMINATION, THE WIPES, THE SOURCE, AND THE ASSOCIATED EQUIPMENT WILL BE ISOLATED IN A MANNER SATISFACTORY TO THE HEALTH PHYSICS REPRESENTATIVE UNTIL INSTRUCTIONS ARE RECEIVED FROM THE RADIOLOGICAL PROTECTION OFFICER, WHO SHALL BE PROMPTLY NOTIFIED.

8.3.5. THE PROCEDURE IS AS FOLLOWS:

A. NEW SOURCES, LEAK TESTING ON RECEIPT.

(1) THE LONG END OF THE WIPE TEST TOOL, AS SHOWN IN FIGURE 8-1, IS ATTACHED TO AN EMPTY PROJECTOR BY MEANS OF THE THREADED CONNECTION (G), A 1" THICK FOAM PLASTIC (SEMI-RIGID) DISC WITH A 3/8" HOLE IN THE CENTER THROUGH WHICH A 4" LONG STRIP OF 7/8" TUBULAR GUAZE, (STOCK NO. LF-6510-200-7013), IS INSERTED AND FOLDED BACK IN SUCH A MANNER AS TO COVER THE DISC, (D) AND (E). THE CHAMBER IS CLOSED BY SCREWING THE TWO SECTIONS (C) AND (F) TOGETHER. (THE WIPING PRESSURE ON THE SOURCE CAPSULE IS PROPORTIONAL TO THE DEGREE OF CLOSURE OF THE CHAMBER.)

(2) THE PLUG (A) IS REMOVED AND THE TELEFLEX CABLE IS RUN THROUGH AND OUT THREE TO FOUR INCHES BEYOND THE END OF THE TOOL. THE CABLE IS ATTACHED TO THE SOURCE CAPSULE (IN SHIPPING CONTAINER) AND THE SLEEVE ON END (C) IS ATTACHED TO THE SHIPPING CONTAINER AND THE CONTAINER FLAPS CLOSED. LEAD SHIELDING IS ERECTED AROUND THE CABLE AND TOOL BETWEEN THE SHIPPING CONTAINER AND PROJECTOR. THE SOURCE IS THEN PULLED BACK AND FORTH THROUGH THE GAUZE-COVERED FOAM PLASTIC DISC AND RETURNED TO THE SHIPPING CONTAINER.

(3) THE CHAMBER IS DISASSEMBLED, THE GAUZE REMOVED AND COUNTED IN A NAI WELL CRYSTAL. THIS IS DONE BY WADDING THE GAUZE INTO A 15MM DIAMETER LUSTERIOD TEST TUBE AND PLACING IT IN THE SHIELDED WELL. IF NO SOURCE LEAKAGE IS INDICATED, THE SOURCE CAPSULE IS THEN PLACED IN THE PROJECTOR.

B. LEAK TESTING OLD SOURCES.

(1) OLD SOURCES ARE WIPED BY ATTACHING THE LONG END (F) - (FIGURE 8-1), OF THE TOOL TO THE IRIDIUM OR COBALT PROJECTOR. THE SHORT END (C) IS PLUGGED BY (A), THE GAUZE-COVERED FOAM PLASTIC DISC IS INSERTED IN THE CHAMBER, AS DESCRIBED IN SUBPARAGRAPH "A" ABOVE, THE SOURCE IS WORKED IN AND OUT THROUGH THE CHAMBER AND RETURNED TO THE PROJECTOR. THE GAUZE IS THEN COUNTED AS ABOVE. THE SOURCE PLUG ON THE

PROJECTOR IS THEN WIPE TESTED BY WIPING IT WITH A FILTER PAPER DISC AND MEASURING THE ACTIVITY ON THE DISC AS GIVEN IN "A(3)" ABOVE.

C. WARNING. WHEN REMOVING THE GAUZE FROM THE CHAMBER AFTER IT HAS BEEN EXPOSED TO THE SOURCE, PERSONNEL WILL WEAR PROTECTIVE GLOVES. THE GLOVES WILL BE GIVEN TO HEALTH PHYSICS FOR DECONTAMINATION.

8.3.6. IF THE LEAK TEST INDICATES EXCESSIVE CONTAMINATION, (I.E. MORE THAN 0.005 MICROCURIES), THE FOLLOWING ACTIONS WILL BE TAKEN:

8.3.6.1. THE RADIOLOGICAL PROTECTION OFFICER WILL RELEASE THE EQUIPMENT FOR DECONTAMINATION AS SOON AS POSSIBLE AND PRESCRIBE DISPOSITION INSTRUCTIONS FOR THE SOURCE. HE WILL ALSO ARRANGE FOR REPORTING TO THE ATOMIC ENERGY COMMISSION WHERE NECESSARY.

8.3.6.2. DECONTAMINATION OF EQUIPMENT WILL BE BY A PROCEDURE APPROVED BY THE IONIZING RADIATION CONTROL COMMITTEE. IF A SUITABLE APPROVED PROCEDURE IS NOT AVAILABLE, THE RADIOLOGICAL PROTECTION OFFICER WILL PRESCRIBE A PROCEDURE AFTER CONSULTATION WITH HEALTH PHYSICS AND NONDESTRUCTIVE TEST BRANCH PERSONNEL.

8.4 RECEIVING AND SHIPPING OF SOURCES

8.4.1. THE PROCEDURE FOR CHANGING THE IRIDIUM^{192} SOURCES FOR SHIPPING AND RECEIVING IS AS FOLLOWS:

8.4.1.1. AFTER SETTING UP THE PROJECTOR AS FOR AN EXPOSURE, OMITTING THE SOURCE POSITION TIP, PLACE THE STORAGE CONTAINER NEARBY AND REMOVE THE COVER BY CUTTING THE SEALS AND UNSCREWING THE FOUR BOLTS. POSITION THE STORAGE CONTAINER HORIZONTALLY FOR OPTIMUM EASE OF PERFORMANCE.

8.4.1.2. UNSCREW AND REMOVE THE CAP HOLD DOWN ROD FROM THE EMPTY CHANNEL. OPEN THE COUPLER ASSEMBLY TO MAKE A POSITIVE VISUAL CHECK BEFORE CONTINUING.

8.4.1.3. CLOSE COUPLER ASSEMBLY AND SCREW ON THE SOURCE TUBE FROM THE PROJECTOR AND CRANK THE SOURCE ALL THE WAY INTO THE EMPTY CHANNEL OF THE STORAGE CONTAINER. CHECK THIS OPERATION WITH YOUR SURVEY INSTRUMENT.

8.4.1.4. OPEN THE COUPLER ASSEMBLY AND SEPARATE THE DRIVE CABLE FROM THE SOURCE CONNECTOR. NOTE OR RECORD THE SOURCE SERIAL NUMBER AT THIS TIME.

8.4.1.5. UNSCREW THE SOURCE TUBE, REPLACE THE CAP, HOLD DOWN ROD AND SECURE THE COUPLER ASSEMBLY CLOSED. MARK OR TAG THE CHANNEL CONTAINING THE OLD SOURCE TO AVOID A POSSIBLE MIX-UP.

8.4.1.6. THE PROCEDURE FOR ATTACHING A NEW SOURCE TO THE DRIVE CABLE IS ESSENTIALLY THE SAME AS THE PROCEDURE DESCRIBED IN PARAGRAPH 8.4.1.1. AND SUCCEEDING PARAGRAPHS.

8.4.1.7. ALWAYS SNAP THE COUPLER ASSEMBLY CLOSED FOR ALL SOURCE MOVEMENTS.

8.4.2. SAFETY. DURING THE PROCESS OF TRANSFERRING SOURCES, OBSERVE THE SAME PRECAUTIONS WITH RESPECT TO MONITORING ACTIVITY AND RESTRICTING PERSONNEL AS EMPLOYED IN NORMAL RADIOGRAPHIC OPERATIONS.

8.4.3. THE "RADIOACTIVE MATERIAL" LABEL ON THE CONTAINER SHALL BE FILLED OUT BY NONDESTRUCTIVE TEST PERSONNEL. A HEALTH PHYSICS REPRESENTATIVE WILL VERIFY THE SUITABILITY OF THE PACKAGE FOR SHIPMENT AND WILL CERTIFY IT. THE SOURCE MAY THEN BE DELIVERED TO SUPPLY DEPARTMENT FOR SHIPMENT.

8.5. RECORDS

8.5.1. HEALTH PHYSICS BRANCH WILL MAKE A RECORD OF THE SHIPMENT SHOWING DATE, NATURE, AND QUANTITY OF THE MATERIAL, ITS SOURCE, MONITORING RESULTS, CONSIGNEE, LICENSE AND CONTRACT NUMBERS, IF ANY.

8.5.2. THE NONDESTRUCTIVE TEST BRANCH WILL MAINTAIN A CURRENT RECORD OF ALL RECEIPTS, STORAGE, AND SHIPMENT OF SOURCES. ALSO RECORDED WILL BE A CURRENT LOG OF THE SOURCE LOCATION, AGE, ASSIGNED COLOR CODE, ID NUMBER, ETC. A COPY OF THE CURRENT LICENSE AND ANY REVISIONS TO IT SHALL BE RECORDED AND KEPT ON FILE FOR REVIEW BY THE HEALTH PHYSICS BRANCH OR THE RADIOLOGICAL PROTECTION OFFICER.

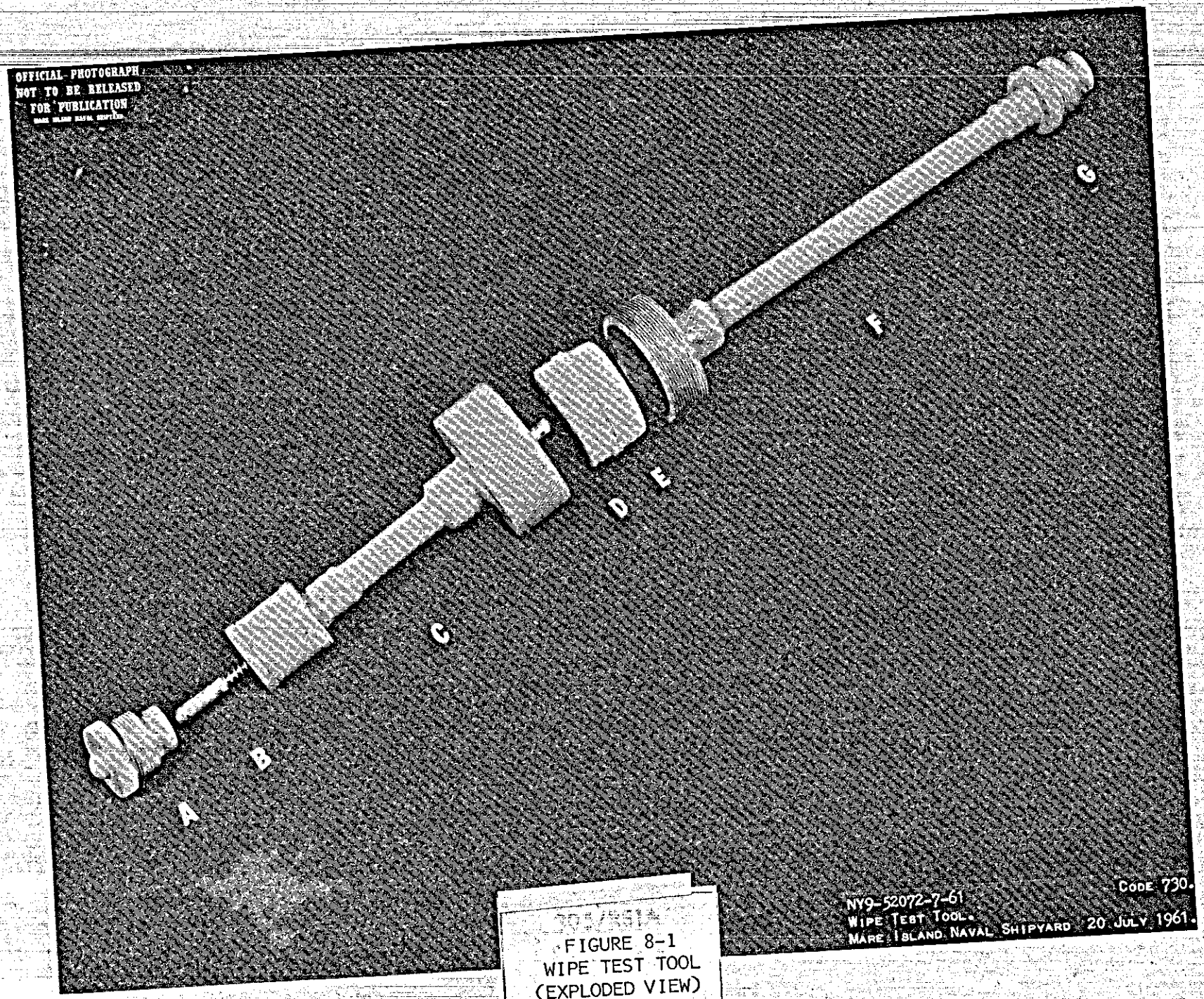

FIGURE 8-1
WIPE TEST TOOL
(EXPLODED VIEW)

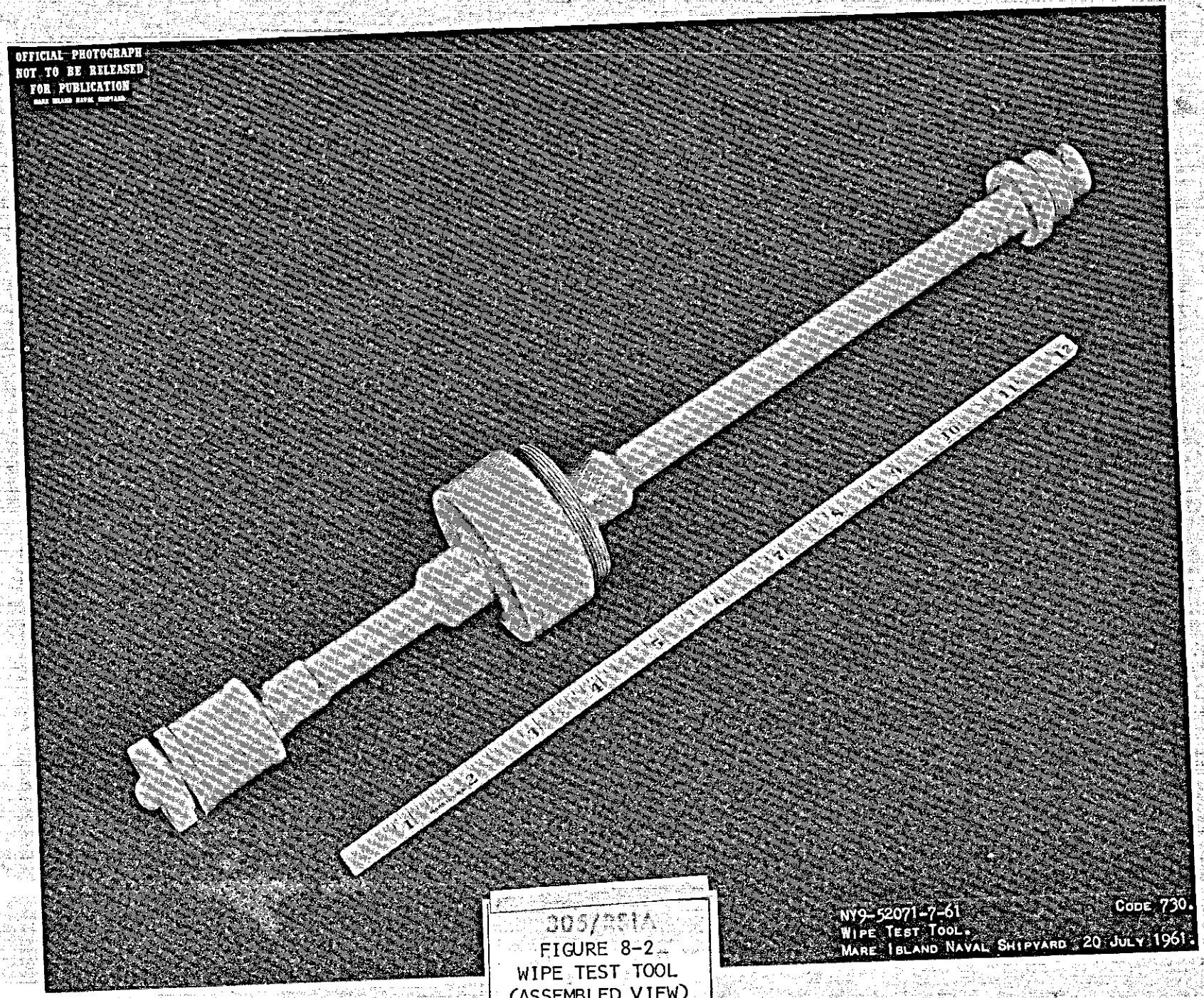

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FIGURE 8-2
WIPE TEST TOOL
(ASSEMBLED VIEW)

SECTION IX

POSTING, RESTRICTING, AND LABELING

9.1. POSTING TEMPORARY RADIATION AREAS

9.2. RESTRICTING ENTRY TO RADIATION AREAS

9.3. LABELING RADIOACTIVE MATERIAL

9.1. POSTING TEMPORARY RADIATION AREAS

9.1.1. ALL TEMPORARY RADIATION AREAS SHALL BE POSTED WITH APPROPRIATE RADIATION SIGNS, FLASHING RED LIGHTS AND YELLOW ROPE BY NDT PERSONNEL. A ROTATING RED BEACON SHALL BE POSITIONED AS CLOSE AS POSSIBLE TO THE POSITION OF THE EXPOSED SOURCE.

9.1.1.1. ON COMMISSIONED SHIPS OR SHIPS IN SERVICE, ALL ACCESS AREAS TO THE RADIATION AREA (I.E., PASSAGEWAYS, COMPARTMENT DOORS, ETC.) SHALL BE ROPED OFF AT THE 2 MR/HR OR LESSER ISODOSE LINE AND APPROPRIATE SIGNS POSTED. IN ADDITION, A BATTERY-OPERATED FLASHING RED LIGHT SHOULD BE PLACED, IF POSSIBLE, AT THE SAME LEVEL AS THE RADIATION SIGN AND WITHIN A YARD, AT ANY INTERIOR ACCESS AREAS THAT CANNOT BE OBSERVED OR CONTROLLED BY THE RADIOGRAPHER OR ASSISTANT RADIOGRAPHER.

9.1.2. THE POSTING AND BARRICADING OF THE RADIATION AREA AND ACCESSES TO IT AS DESCRIBED ABOVE SHALL BE ACCOMPLISHED PRIOR TO EXPOSURE OF THE SOURCE, UNDER THE DIRECTION OF THE RADIOGRAPHER-IN-CHARGE.

9.1.3. IT WILL BE THE RADIOGRAPHER'S DUTY TO ASCERTAIN THAT THE MONITORING AND THE PLACING OF BARRIERS, LIGHTS, SIGNS, ETC., ARE ACCOMPLISHED AS DESCRIBED IN SECTION 10.1. HE WILL ALSO ENTER A SKETCH OF THE AREA IN THE SURVEY LOG BOOK, (PARAGRAPH 12.3.)

9.1.4. IF THE CONBINED TOTAL EXPOSURE TIME IN ANY GIVEN AREA IS NOT MORE THAN 20 MINUTES IN ANY ONE HOUR, THE ISODOSE LINE WILL BE ESTABLISHED AT THE 5 MR/HR LEVEL. IF THE COMBINED TOTAL IS OVER 20 MINUTES, THE ISODOSE LINE WILL BE ESTABLISHED AT THE 2 MR/HR LEVEL.

9.1.5. THE APPROPRIATE SIGNS, LIGHTS, AND ROPES WILL BE PLACED AT STRATEGIC POINTS ALONG THE ISODOSE LINE AND, PARTICULARLY, AT ALL POSSIBLE ENTRANCES TO THE AREA PRIOR TO EXPOSING ANY RADIATION.

9.1.6. UPON COMPLETION OF POSTING THE ISODOSE LINE, POSTED AREA SHALL BE THOROUGHLY CHECKED TO MAKE SURE THERE IS NO ONE IN THE AREA, OR IN A HIDDEN RECESS, THAT MAY HAVE BEEN OVERLOOKED.

9.1.7. UPON COMPLETION OF THE AREA CHECK, THE EXPOSURE MAY BE STARTED. DURING THIS EXPOSURE THE AREA SHALL BE MONITORED AND BARRIERS RELOCATED TO CONFORM TO THE TRUE 2 MR OR 5 MR IN ANY ONE HOUR ISODOSE LINE, AS INDICATED BY THE READING OBTAINED WITH AN AN/PDR 27 RADIAC SET OR EQUIVALENT SPECIFIED IN PARAGRAPH 6.3.

9.1.8. THE RADIAC READINGS AND ISODOSE LINE SHALL BE INCLUDED IN THE SKETCH OF THE SURVEY LOG BOOK.

9.2. RESTRICTING ENTRY TO RADIATION AREAS

9.2.1. PERMANENT RADIOGRAPHY AREAS

9.2.1.1. NO ONE WILL BE PERMITTED TO ENTER WHILE A SOURCE IS EXPOSED.

9.2.1.2. PERSONNEL ENTERING DURING WORK OPERATIONS MUST WEAR PROPER DOSIMETRIC DEVICES.

9.2.1.3. FOR PURPOSES OF INSPECTION, ETC., PERSONNEL WITHOUT DOSIMETRY MAY ENTER IF SOURCES ARE REMOVED OR SHIELDED SUCH THAT THE AREA MEETS THE REQUIREMENTS OF AN UNRESTRICTED AREA.

9.2.2. TEMPORARY RADIOGRAPHIC AREAS

9.2.2.1. WHEN RADIOGRAPHIC WORK IS BEING DONE IN THE FIELD, NO ONE WILL BE PERMITTED TO ENTER A ROPED-OFF RADIATION AREA; EXCEPT THAT PERSONNEL MAY ENTER THE ROPED-OFF AREA BETWEEN EXPOSURES WITH THE CONSENT OF THE RADIOGRAPHER-IN-CHARGE FOR EACH SPECIFIC ENTRY. THE RADIOGRAPHER AND ASSISTANTS WILL STAND GUARD SO AS TO CONTROL ENTRANCE THROUGH AT LEAST THE TWO MAJOR ACCESSES TO THE HIGH RADIATION AREA DURING EXPOSURES TO INSURE THAT PERSONNEL DO NOT ENTER THE RADIATION AREA. IF ANY PERSON PERSISTS IN ENTERING THE POSTED AREA, SECURE THE SOURCE UNTIL SUCH PERSON LEAVES. MAKE A WRITTEN REPORT TO THE SUPERVISOR GIVING DATE, TIME, NAME OF PERSON, HIS SHOP, BADGE NUMBER, ETC., AND THE TIME LOST. IN WARNING PEOPLE AWAY, DO NOT MAKE EXAGGERATED STATEMENTS CONCERNING THE INTENSITY OF THE RADIATION PRESENT, OR THE PERIL INVOLVED.

9.3. LABELING RADIOACTIVE MATERIAL

9.3.1. EACH DEVICE CONTAINING A SEALED SOURCE SHALL BE CLEARLY LABELED WITH THE STANDARD RADIATION WARNING SYMBOL - THE WORDS "CAUTION OR DANGER - RADIOACTIVE MATERIAL" AND THE DATE OF MEASUREMENT AND THE QUANTITY OF THE SPECIFIC ISOTOPE.

9.3.2. ALL SHIPPING DEVICES SHALL CARRY LABELS READING: "CAUTION OR DANGER - RADIOACTIVE MATERIAL" AND SHALL CLEARLY STATE THE ISOTOPE CONTAINED, QUANTITY, AND DATE MEASURED.

SECTION X

PHYSICAL RADIATION SURVEYS

10.1. DURING EXPOSURE

10.2. AFTER EXPOSURE

10.3. PRIOR TO STORAGE OF PROJECTOR

10.4. VEHICLE

10.1. PHYSICAL RADIATION SURVEYS MADE DURING RADIOGRAPHIC EXPOSURES

10.1.1. A CALIBRATED AND OPERABLE RADIATION SURVEY INSTRUMENT, AS DESCRIBED IN PARAGRAPH 6.3.1., MUST BE USED AT EACH SITE WHERE RADIOGRAPHY IS BEING PERFORMED. IF THE INSTRUMENT IS PAST THE SCHEDULED CALIBRATION DATE, AS SHOWN ON THE LABEL ATTACHED, THE BATTERIES ARE LOW, OR IT IS OTHERWISE OF DOUBTFUL RELIABILITY, IT WILL BE IMMEDIATELY EXCHANGED FOR A SATISFACTORY INSTRUMENT.

10.1.2. A SURVEY SHALL BE MADE DURING EACH EXPOSURE IN A TEMPORARY RADIOGRAPHIC AREA TO ENSURE THAT THE RADIATION INTENSITY AT THE BARRICADE IS NOT OVER 2 MR/HR, OR NOT OVER 5 MR/HR IF THE EXPOSURE TIME IS NOT OVER 20 MINUTES PER HOUR.

10.1.3. PERMANENT RADIOGRAPHY AREAS ARE SHIELDED SUCH THAT THE RADIATION INTENSITY OUTSIDE THE WALLS SHOULD NOT EXCEED 2 MR/HR. SURVEYS SHOULD BE MADE WHEN UNUSUAL EXPOSURE CONDITIONS ARE USED, AND ANY INTENSITIES ABOVE THIS LIMIT REPORTED TO SUPERVISION FOR CORRECTIVE ACTION, I.E., ERECTION OF BARRICADES.

10.1.4. PHYSICAL RADIATION SURVEYS ARE MADE AS FOLLOWS:

10.1.4.1. DETERMINE THE AREA TO BE BARRICADED FROM FIGURES 10-3, 10-4, 10-5, OR AS APPROPRIATE.

10.1.4.2. ROPE OFF AND POST THIS AREA.

10.1.4.3. EXPOSE THE SOURCE IN ACCORDANCE WITH SECTION XIII.

10.1.4.4. SURVEY THE BARRICADES USING SURVEY INSTRUMENT TO DETERMINE RADIATION INTENSITIES.

10.1.4.5. RE-ADJUST BARRICADES, AS NECESSARY, TO ENCLOSE MINIMUM AREA NECESSARY TO MAINTAIN LIMITS GIVEN IN PARAGRAPH 10.1.2., ABOVE.

10.1.4.6. A RECORD OF THESE SURVEYS MUST BE MAINTAINED, AS REQUIRED BY SECTION XII.

10.1.4.7. IF MORE THAN ONE EXPOSURE IS MADE IN THE SAME AREA AND THERE IS NO CHANGE IN EXPOSURE CONDITIONS THAT WOULD AFFECT THE ISODOSE LINES, IT IS NOT NECESSARY TO RE-SURVEY THE AREA. THE WORK SHEET SHOULD INDICATE THE EXPOSURE CONDITIONS AND THE BASIC SURVEY THAT APPLIES.

10.2. PHYSICAL RADIATION SURVEYS MADE AFTER EACH EXPOSURE

10.2.1. RETURN THE SOURCE TO THE PROJECTOR, AS DESCRIBED IN PARAGRAPH 13.1.12.

10.2.2. APPROACH THE PROJECTOR WITH A SURVEY INSTRUMENT TURNED TO ITS LOWEST SCALE, OBSERVING TO ASSURE THAT RADIATION CONDITIONS ARE NORMAL. CHANGE TO HIGHER SCALES AS NECESSARY. MAKE THE FINAL READING WITH THE INSTRUMENT PROBE AT THE SOURCE TUBE CONNECTION STANDING TO ONE SIDE TO AVOID EXPOSURE IF THE SOURCE IS NOT PROPERLY HOUSED.

10.2.3. IF THE SOURCE IS IN A SAFE CONDITION - PROCEED. IF NOT, AND THE SOURCE CANNOT BE HOUSED BY REPEATED CRANKING, NOTIFY SUPERVISION.

10.3. PHYSICAL RADIATION SURVEYS MADE PRIOR TO RETURNING PROJECTOR TO STORAGE

10.3.1. AFTER DETERMINING THAT SOURCE IS IN SAFE CONDITION, AS GIVEN IN PARAGRAPH 10.2., ABOVE, REMOVE SOURCE TUBE AND INSTALL SAFETY PLUG.

10.3.2. RETURN PROJECTOR TO STORAGE AREA.

10.3.3. USE SURVEY INSTRUMENT TO MEASURE RADIATION INTENSITIES EMITTED FROM PROJECTOR. IF GREATER THAN LIMITS GIVEN IN PARAGRAPH 6.1., NOTIFY SUPERVISION.

10.4. PHYSICAL RADIATION SURVEY OF VEHICLE USED TO TRANSPORT SOURCES

10.4.1. A RADIATION SURVEY OF THE VEHICLE USED TO TRANSPORT SOURCES WILL BE MADE AFTER THE SOURCE IS LOADED AND SECURED. RADIATION INTENSITIES OUTSIDE THE VEHICLE MUST NOT EXCEED 10 MR/HR AT ONE METER. THE RADIATION INTENSITY AT THE DRIVER'S OR PASSENGER'S POSITION MUST NOT EXCEED 2 MR/HR. PERSONNEL WITHOUT FILM BADGES AND DOSIMETERS MAY NOT ENTER THE VEHICLE.

10.4.2. IF RADIATION INTENSITIES EXCEED THE ABOVE LEVELS, THE SOURCE PROJECTOR MUST BE RE-POSITIONED OR ADDITIONAL SHIELDING MUST BE EMPLOYED.

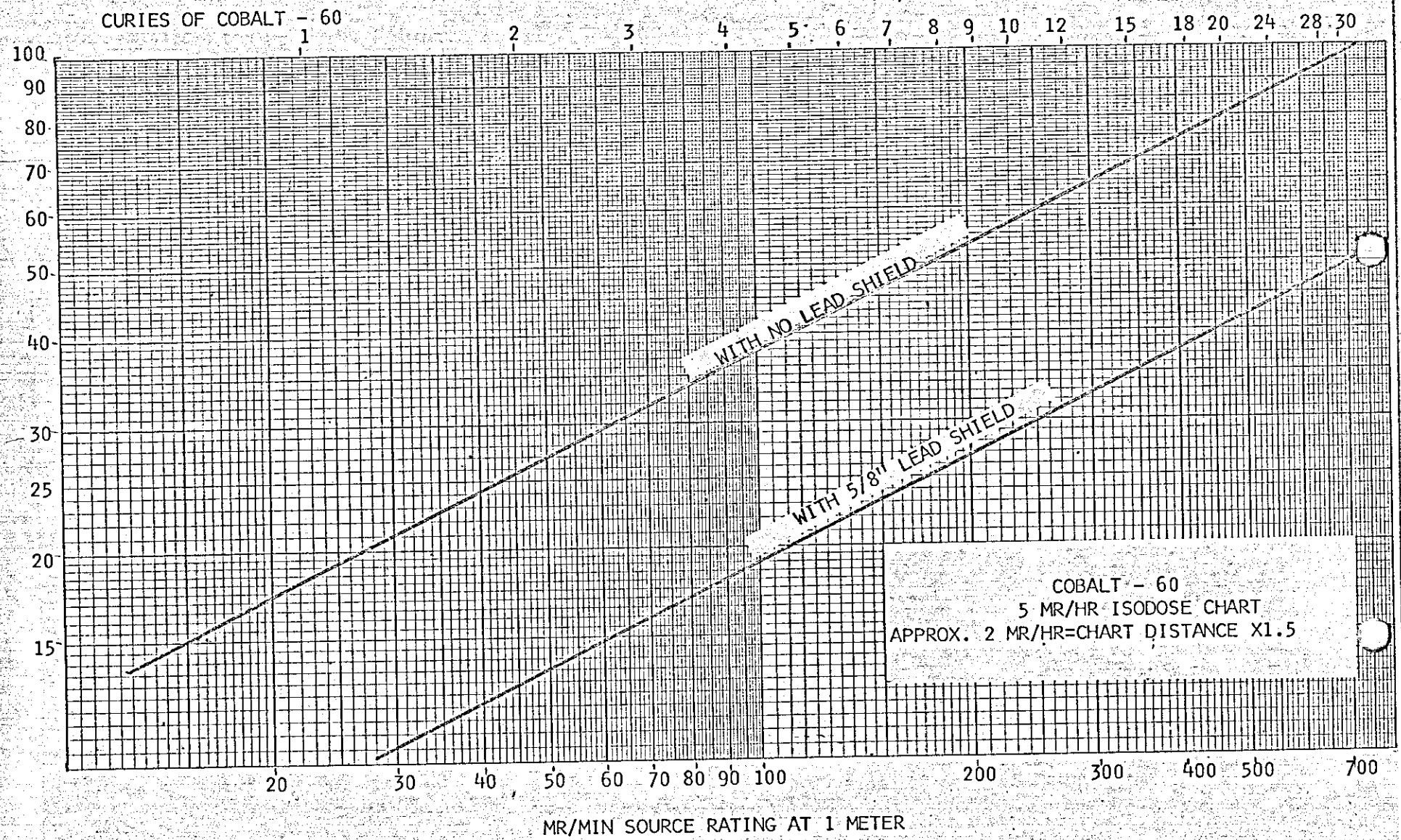

CURIES OF COBALT - 60
1
2
3
4
5
6
7
8
9
10
12
15
18
20
24
28
30
100
90
80
70
60
50
40
30
25
20
15
WITH NO LEAD SHIELD
WITH 5/8" LEAD SHIELD
COBALT - 60
5 MR/HR ISODOSE CHART
APPROX. 2 MR/HR=CHART DISTANCE X1.5
20
30
40
50
60
70
80
90
100
200
300
400
500
700
MR/MIN SOURCE RATING AT 1 METER

FIGURE 10-3

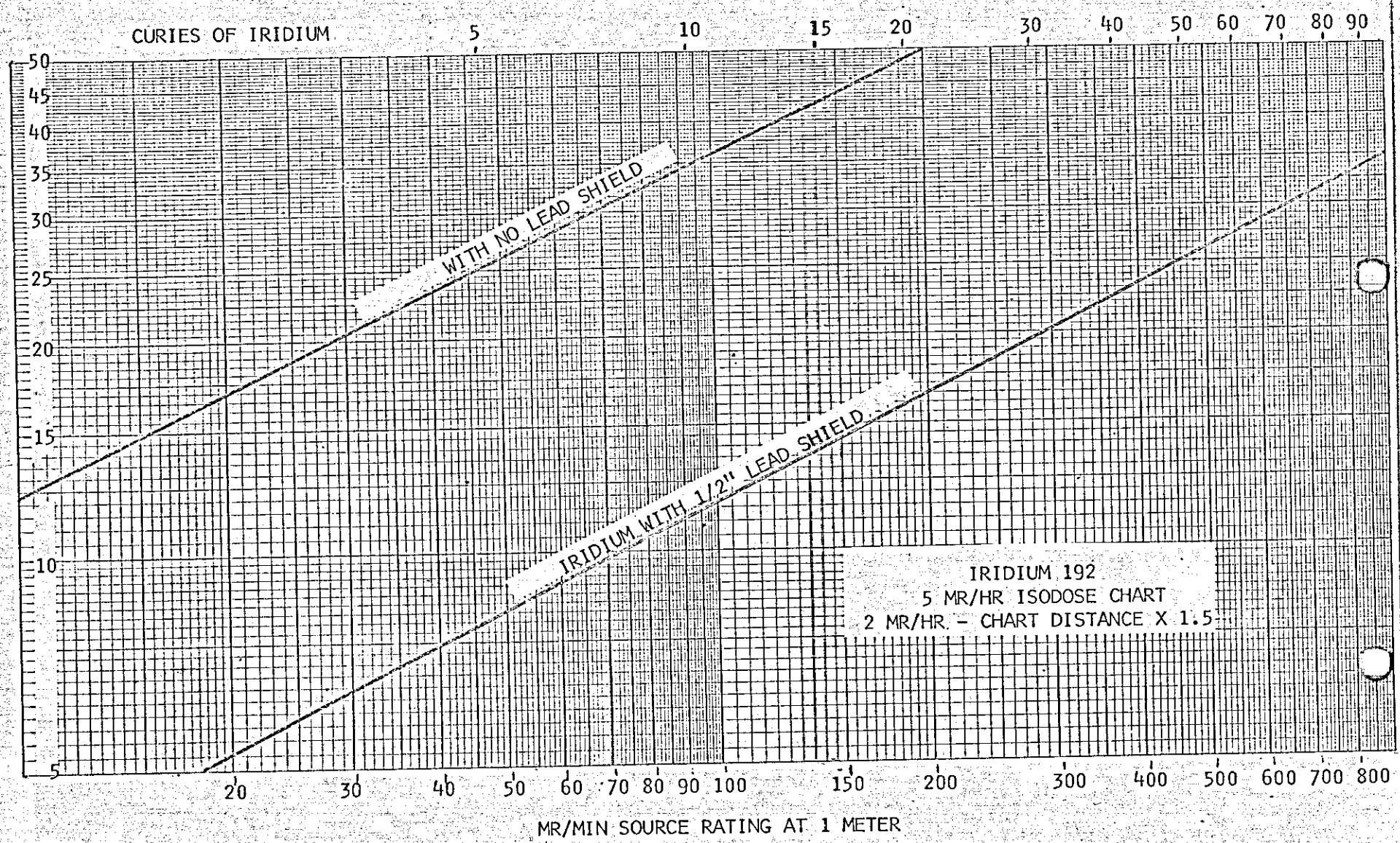

CURIES OF IRIDIUM
5
10
15
20
30
40
50
60
70
80
90
50
45
40
35
30
25
20
15
10
5
WITH NO LEAD SHIELD
IRIDIUM WITH 1/2" LEAD SHIELD
IRIDIUM 192
5 MR/HR ISODOSE CHART
2 MR/HR. - CHART DISTANCE X 1.5
20
30
40
50
60
70
80
90
100
150
200
300
400
500
600
700
800
MR/MIN SOURCE RATING AT 1 METER

FIGURE 10-4

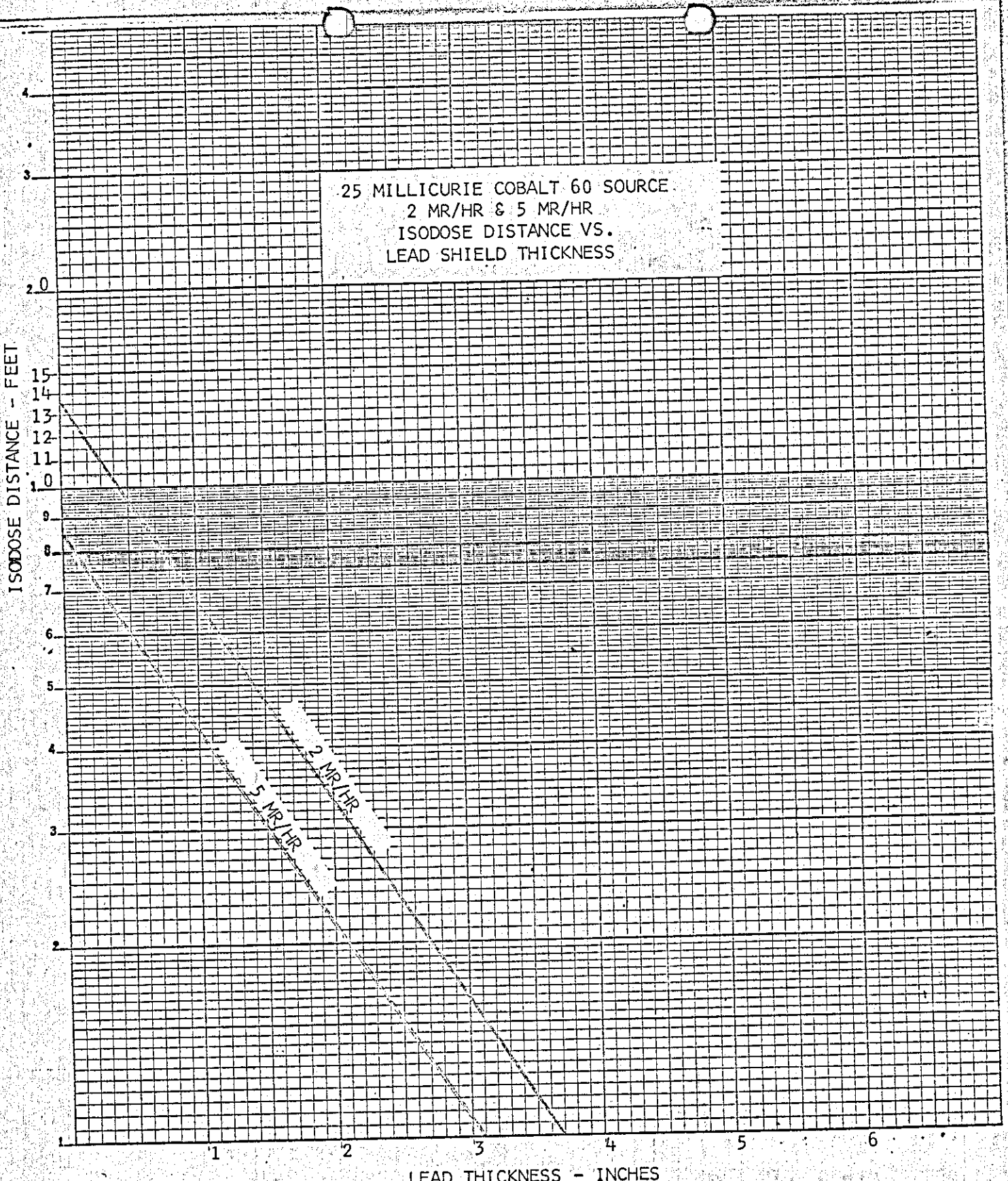

25 MILLICURIE COBALT 60 SOURCE
2 MR/HR & 5 MR/HR
ISODOSE DISTANCE VS.
LEAD SHIELD THICKNESS
ISODOSE DISTANCE - FEET
LEAD THICKNESS - INCHES
2 MR/HR
5 MR/HR
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 10-5

SECTION XI

SECURITY OF SOURCES

4730 22

11.1. THE SAFETY PLUG WHICH IS ON THE END OF THE SOURCE PROJECTOR OPPOSITE THE CONTROL UNIT WILL BE SECURED IN PLACE AT ALL TIME EXCEPT WHEN THE RADIOGRAPHER IS MAKING AN EXPOSURE OR SERIES OF EXPOSURES IN ONE LOCATION. THIS IS ESPECIALLY IMPORTANT WHEN MOVING OR TRANSPORTING THE SOURCE FROM ONE LOCATION TO ANOTHER. AFTER THE RADIATION AREA HAS BEEN CLEARED OF PERSONNEL AND THE AREA ROPED OFF WITH SIGNS AND FLASHING LIGHTS, THE SAFETY PLUG SHALL BE REMOVED AND THE SOURCE CARRIER TUBING INSERTED AND SECURED IN PREPARATION FOR AN EXPOSURE.

11.2. EACH SOURCE PROJECTOR IS PROVIDED WITH A SAFETY LOCK ON THE CONTROL HANDLE. THE CONTROL HANDLE WILL BE KEPT LOCKED AT ALL TIMES EXCEPT WHEN ACTUALLY EXPOSING THE SOURCE. THE RADIOGRAPHER WILL CHECK TO ASSURE THAT THE CONTROL HANDLE IS LOCKED AT THE TIME THAT HE OBTAINS THE SOURCE PROJECTOR AND WILL NOT REMOVE THE LOCK FROM THE CONTROL HANDLE UNTIL HE IS READY TO EXPOSE THE SOURCE. IMMEDIATELY AFTER RETRACTING THE SOURCE HE WILL REPLACE THE LOCK ON THE HANDLE AND TAKE THE PRECAUTIONS NOTED IN PARAGRAPH 10.2.2. IN ADDITION TO THESE PRECAUTIONS, THE RADIOGRAPHER WILL INSURE THAT THE CONTROL HANDLE IS LOCKED BEFORE REMOVING THE SAFETY PLUG AND ATTACHING THE CARRIER TUBE. THE RADIOGRAPHER USING THE SOURCE IS SIGNED OUT FOR THE SOURCE AND THE KEY TO THE SOURCE CONTROL LOCK. IF THE KEY IS LOST HE WILL REPORT THE INCIDENT TO THE SHIFT SUPERVISOR IMMEDIATELY. AT THE END OF EACH SHIFT, PRIOR TO RETURNING THE SOURCE PROJECTOR TO ITS NORMAL STOWAGE LOCATION, THE RADIOGRAPHER WILL MONITOR THE SOURCE PROJECTOR FOR CONFORMANCE OF RADIATION LEVELS, AS ESTABLISHED IN SECTION 10.3. AND ASSURE THAT THE SOURCE PROJECTOR AND ITS ACCESSORIES ARE IN GOOD WORKING ORDER.

11.3. BEFORE THE RADIOGRAPHER ACCEPTS THE SOURCE PROJECTOR HE WILL CHECK THE CONTROL BOX, LOCK, CONTROL CABLES, AND CARRIER TUBE, TO ASCERTAIN THAT IT IS IN GOOD OPERATING CONDITION. A CRIMPED OR WORN CABLE OR TUBE COULD CAUSE THE SOURCE TO HANG-UP AND CREATE AN EMERGENCY SITUATION.

11.4. EXPOSURE DEVICES WILL NEVER BE LEFT UNATTENDED OUTSIDE A LOCKED STORAGE AREA.

11.5. WHENEVER ANY SOURCE IS BEING MOVED, (WHETHER IN TRANSIT OR BETWEEN EXPOSURES), THE CABLES SHALL BE WRAPPED AROUND THE SOURCE PROJECTOR. THIS WILL HELP TO PREVENT ACCIDENTAL DAMAGE TO THE CABLE AND CABLE CONTROL HANDLE.

11.6. A QUARTERLY PHYSICAL INVENTORY WILL BE MADE OF ALL RADIO-ISOTOPE SOURCES AND REPORTED TO THE RADIOLOGICAL PROTECTION OFFICER.

SECTION XII

RECORDS

12.1. WORK SHEETS

12.2. UTILIZATION LOGS

12.3. SURVEY LOG BOOKS

12.1. WORK SHEETS

12.1.1. A WORK SHEET IS ISSUED FOR EACH JOB, DETAILING THE TYPE OF EXPOSURE TO BE MADE. THIS WORK SHEET WILL BE USED TO RECORD THE PERTINENT DATA FOR EACH EXPOSURE, INCLUDING THE SOURCE USED, DATE, TIME AND LOCATION OF EXPOSURE, DURATION OF EXPOSURE, RADIOGRAPHER-IN-CHARGE, SURVEY LOG BOOK NUMBER AND PAGE IN WHICH THE PHYSICAL RADIATION SURVEY IS RECORDED.

12.1.2. IF ALL CONDITIONS ARE SIMILAR TO A PREVIOUS OPERATION, A PRE-EXISTING SURVEY CHART MAY BE REFERENCED BY GIVING THE SURVEY LOG BOOK NUMBER AND PAGE ON WHICH IT APPEARS, NOTING ANY CHANGES IN CONDITION ON THE WORK SHEET.

12.2. UTILIZATION LOGS

12.2.1. A UTILIZATION LOG BOOK SHALL BE KEPT, RECORDING THE USAGE OF EACH SOURCE. EACH RADIOGRAPHER IS RESPONSIBLE FOR RECORDING THE DATA REQUIRED FOR EACH SOURCE ISSUED TO HIM.

12.2.2. THE UTILIZATION LOG SHALL INCLUDE THE FOLLOWING INFORMATION FOR EACH SOURCE:

A. ISOTOPE, SERIAL NUMBER AND ASSIGNED COLOR OR NUMBER.

B. MODEL AND SERIAL NUMBER OF PROJECTOR.

C. STRENGTH OF SOURCE AT TIME USED.

D. RADIOGRAPHER TO WHOM ASSIGNED, AND DATE AND TIME OF ISSUE AND RETURN.

E. EVIDENCE OF SURVEY OF RADIATION INTENSITIES EMITTED BY PROJECTOR IN STORAGE CONDITION TO INDICATE SOURCE IN SHIELDED POSITION.

12.2.3. DATA AS TO LOCATION OF USE, RESULTS OF PHYSICAL RADIATION SURVEYS, ETC., APPEAR ON THE WORK SHEET AND IN THE SURVEY LOG BOOKS.

12.3. SURVEY LOG BOOKS

12.3.1. THE RESULTS OF PHYSICAL RADIATION SURVEYS MADE AT THE PERIMETER OF RADIOGRAPHIC RADIATION AREAS ARE RECORDED IN PERMANENT SURVEY LOG BOOKS.

12.3.2. FOR EACH DIFFERENT EXPOSURE CONDITION, A CHART IS DRAWN APPROXIMATELY TO SCALE, SHOWING THE MAIN PHYSICAL FEATURES OF THE AREA, THE LOCATION OF THE TEST OBJECT, THE PROJECTOR, THE SOURCE WHEN EXPOSED, THE CONTROLS, THE 2MR/HR OR 5 MR/HR ISODOSE LINE, AS APPROPRIATE, THE LOCATION OF BARRICADES AND GUARDS, ETC.

12.3.3. EACH CHART WILL BE SIGNED BY THE RADIOGRAPHER WHO MAKES IT.

12.3.4. CHARTS MAY BE RE-USED FOR SIMILAR EXPOSURES BY REFERENCING THEM BY BOOK AND PAGE NUMBER ON THE WORK SHEET.

SECTION XIII

OPERATING INSTRUCTIONS

13.1. IRIDIUM ^{192} EXPOSURE DEVICES

13.2. COBALT ^{60} EXPOSURE DEVICES

13.3. RADIUM

13.4. X-RAY MACHINE

13.5. ENTERING CONTAMINATED RADIATION AREAS

13.1. IRIDIUM ^{192} EXPOSURE DEVICES

13.1.1. IRIDIUM ^{192} SOURCES ARE USED IN THE FOLLOWING PROJECTORS, EQUIPPED OPTIONALLY WITH THE MI SOURCE POSITIONING TIP:

MODEL NO:	MAXIMUM SOURCE SIZE: (CURIES)
T/O 490, 524, 533	100
T/O 498	50
T/O 532	10

13.1.2. ALL PROJECTORS AND RELATED EQUIPMENT USED SHALL BE MONITORED AT THE BEGINNING AND END OF EACH SHIFT TO DETECT ANY POSSIBLE OCCURRENCE OF EXCESSIVE RADIATION.

13.1.3. CHECK THE AN/PDR 27 RADIAC SET, OR EQUIVALENT, IN ACCORDANCE WITH SECTION 6.3. TURN ON SWITCH, SET SCALE AND APPROACH THE PROJECTOR TO BE USED AND CHECK THE RADIATION LEVEL. REMOVE THE PROJECTOR FROM STORAGE AREA AND EXAMINE CONTROL CABLES, SOURCE TUBES, SAFETY PLUG, OR "LOCK", ETC. MONITOR THE ENTIRE LENGTH OF THE SOURCE TUBES AT ZERO AND NINETY DEGREES. ASCERTAIN THAT EVERYTHING IS IN WORKING ORDER BEFORE PROCEEDING WITH ASSIGNMENT. DO NOT REMAIN NEAR SOURCE PROJECTOR ANY LONGER THAN NECESSARY. MAINTAIN AS GREAT A DISTANCE AS POSSIBLE FROM THE SOURCE, AT ALL TIMES IN ORDER TO MINIMIZE UNNECESSARY EXPOSURE.

13.1.4. LOCATE THE PROJECTOR AT THE DESIRED DISTANCE FROM THE OBJECT TO BE RADIOGRAPHED.

13.1.5. LOCATE THE CONTROL UNIT AT THE MAXIMUM DISTANCE (25 FEET) FROM THE PROJECTOR. WHENEVER POSSIBLE, IT SHALL BE LOCATED BEHIND A PROTECTIVE SHIELD.

13.1.6. SECURE THE SOURCE POSITIONING TIP IN THE DESIRED POSITION AND DISTANCE FROM THE OBJECT TO BE RADIOGRAPHED. ATTACH ONE, TWO OR THREE LENGTHS OF SOURCE TUBES, AS NEEDED, TO REACH THE PROJECTOR. THE SOURCE TUBES SHOULD BE LAID OUT AS STRAIGHT AS POSSIBLE AVOIDING BENDS, AND PARTICULARLY BENDS OF SHARP RADIUS. SECURE THE COLLIMATOR (DIRECTIONAL LEAD SHIELD) TO THE SOURCE POSITIONING TIP. PLACE THE LEAD LETTERS, FILM, ETC., ON THE OBJECT TO BE RADIOGRAPHED.

13.1.7. PRIOR TO EXPOSING THE SOURCE, ESTABLISH AREA SECURITY IN ACCORDANCE WITH INSTRUCTIONS IN PARAGRAPH 9.1. SURROUND THE ITEM BEING RADIOGRAPHED, WHEN POSSIBLE, WITH PORTABLE LEAD SCREENS TO MINIMIZE THE AMOUNT OF STRAY RADIATION. UNLOCK AND REMOVE THE SAFETY PLUG MAKING CERTAIN THE SOURCE IS CONTAINED SAFELY WITHIN THE PROJECTOR, CONNECT THE SOURCE TUBE TO THE PROJECTOR. UNLOCK THE CONTROL HANDLE.

13.1.8. THE SOURCE IS ATTACHED TO THE CONTROL CABLE BY MEANS OF A SMALL SOCKET FITTING ACTUATED BY A SPRING.

CRANKING THE CONTROL HANDLE IN A COUNTER CLOCKWISE DIRECTION MOVES THE SOURCE OUT OF THE PROJECTOR THROUGH THE SOURCE TUBES INTO THE SOURCE POSITIONING TIP. UNDUE PRESSURE IN EITHER DIRECTION COULD DAMAGE THE CONNECTION AND EVEN RELEASE THE SOURCE FROM THE CABLE, THEREFORE, IT IS IMPORTANT THAT YOU DO NOT FORCE THE CRANK. IF THE SOURCE BECOMES DISCONNECTED FROM THE CONTROL CABLE, IT CAN SOMETIMES BE RE-CONNECTED BY REPEATED CRANKING. IF, HOWEVER, IT CANNOT BE RE-CONNECTED IN THIS MANNER, MAINTAIN SECURITY OF THE AREA AND CONTACT YOUR SUPERVISOR IMMEDIATELY.

13.1.9. IF UNDUE RESISTANCE IS ENCOUNTERED WHILE MOVING THE SOURCE INTO THE EXPOSURE POSITION, RETURN THE SOURCE TO THE PROJECTOR AND CORRECT THE CAUSE OF THE RESISTANCE. DO NOT ATTEMPT TO FORCE THE SOURCE BEYOND THE RESISTANCE.

13.1.10. IF UNDUE RESISTANCE IS ENCOUNTERED WHILE RETURNING THE SOURCE TO THE PROJECTOR UPON COMPLETION OF AN EXPOSURE, REVERSE THE DIRECTION OF THE CRANKING UNTIL THE UNIT OPERATES SMOOTHLY. IF, AFTER A FEW REVERSALS, CRANKING IS STILL DIFFICULT, MAINTAIN THE AREA SECURITY AND CONTACT THE SUPERVISOR. HE WILL DETERMINE THE STEPS TO BE TAKEN, SUCH AS ISOLATING THE SOURCE, TAKING OTHER CONTROL MEASURES AND MAKING THE PROPER NOTIFICATIONS PROMPTLY.

13.1.11. DURING AN EXPOSURE ALL PERSONNEL WILL RETREAT TO A SAFE DISTANCE AND ACT AS GUARDS AT AT LEAST THE TWO MAJOR ACCESSES. THEY MUST BE ALERT AT ALL TIMES TO PREVENT ANYONE FROM STRAYING INTO THE RADIATION AREA (SEE PARAGRAPH 9.2.2.). THIS IS IN ADDITION TO THE PROCEDURE DESCRIBED IN PARAGRAPHS 9.1 AND 9.2.

13.1.12. UPON COMPLETION OF AN EXPOSURE, RETURN THE SOURCE TO THE PROJECTOR BY TURNING THE HAND CRANK CLOCKWISE UNTIL A SLIGHT RESISTANCE IS NOTICED. LOCK THE CONTROL HANDLE. MONITOR THE PROJECTOR AS INSTRUCTED IN PARAGRAPH 10.2.

13.1.13. UPON COMPLETION OF THE ASSIGNMENT, AND THE ABOVE SAFETY CHECK, REMOVE SOURCE TUBE AND INSERT SAFETY PLUG, DISMANTLE THE SET-UP, RETURN EQUIPMENT AND PROJECTOR TO STORAGE AREA. (SEE PARAGRAPH 10.3.)

13.2. COBALT ^{60} EXPOSURE DEVICES

13.2.1. COBALT ^{60} SOURCES IN THE FOLLOWING PROJECTORS WILL BE OPERATED IN ACCORDANCE WITH THE INSTRUCTIONS FOR IRIDIUM ^{192} PROJECTORS, PARAGRAPH 13.1.:

MODEL NO:	MAXIMUM SOURCE SIZE (CURIES):
T/O 491	10

13.2.2. COBALT ^{60} SOURCES IN THE FOLLOWING PROJECTORS WILL BE USED ONLY IN THE HIGH ENERGY (COBALT) ROOM IN BLDG. #676 (MI), IN BLDG. 113A (HP), AND IN OTHER LOCATIONS UNDER PROCEDURES AND CONDITIONS PREVIOUSLY APPROVED BY HEALTH PHYSICS BRANCH.

MODEL NO:	MAXIMUM SOURCE SIZE: (CURIES)
T/O 404	30
BUDD 52	20

13.2.2.1. ALL SAFETY PRECAUTIONS OUTLINED IN SECTION XI AND SECTION VII MUST BE OBSERVED.

13.2.2.2. ALL INTERLOCKS AND SAFETY ALARMS PROVIDED FOR THESE UNITS MUST BE OPERATIVE WHEN UNITS ARE IN USE, AS OUTLINED IN SECTION VII.

13.2.2.3. THE 20 CURIE COBALT ^{60} SOURCE IN THE BUDD #52 PROJECTOR IS NOT TO BE USED WITH THE PANORAMIC PROJECTOR WITHOUT THE CONSENT OF THE HEAD OF THE BRANCH AND THEN ONLY UNDER THE DIRECT SUPERVISION OF THE SUPERVISOR.

13.2.2.4. THE ALUMINUM PORT WINDOW OF THE 30 CURIE COBALT ^{60} SOURCE IN THE T/O 404 PROJECTOR MUST NOT BE REMOVED FROM THESE PROJECTORS AT ANY TIME, EXCEPT TO INSTALL THE SOURCE TUBES, AND THEN ONLY UNDER THE DIRECT SUPERVISION OF THE SUPERVISOR.

13.2.2.5. THE SAFETY LOCK ON THE CONTROLS FOR THESE UNITS WILL BE KEPT LOCKED WHEN NOT IN USE.

13.3. RADIUM

13.3.1. THE 2 MCI AND 5 MCI RADIUM SOURCES ARE USED FOR CALIBRATION OF THE "RADAC" RADIATION MEASUREMENT INSTRUMENT. THESE SOURCES ARE STORED IN A SHIELDED ROOM IN BLDG. #676, MARE ISLAND, AND BLDG. 113A, HUNTERS POINT, RESPECTIVELY, AND ARE SURROUNDED WITH SUITABLE LEAD SHIELDING. THEY ARE NOT TO BE REMOVED FROM THE STORED CONDITION NOR FROM THE BUILDING EXCEPT BY SPECIFIC APPROVAL OF THE HEAD, NONDESTRUCTIVE TEST BRANCH. EXTREME CAUTION WILL BE EXERCISED IN HANDLING EACH SOURCE, DUE TO THE CONTAMINATION POTENTIAL PRESENTED IF IT IS DAMAGED.

13.4. X-RAY MACHINES

13.4.1. ONLY CERTIFIED RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS WILL OPERATE THE X-RAY MACHINES.

13.4.2. THE X-RAY ROOMS (#5 AND #6) IN BLDG. #676 AT MARE ISLAND ARE PRIMARILY FOR X-RAY MACHINE USAGE; HOWEVER, A MAXIMUM OF 10 CURIES OF IRIDIUM ^{192} MAY ALSO BE USED IN THESE ROOMS. WHEN OPERATING X-RAY MACHINES

OR ISOTOPES IN THESE ROOMS OR IN BLDG. 113A AT HUNTERS POINT, ALL RADIATION SAFETY REGULATIONS OUTLINED IN PARAGRAPH 7.1 OF THIS INSTRUCTION SHALL BE OBSERVED.

13.4.3. WHEN OPERATING PORTABLE MACHINES THROUGHOUT THE SHIPYARD, ALL RADIATION SAFETY REGULATIONS OUTLINED IN SECTION VII, AND SECTION IX OF THIS INSTRUCTION SHALL BE OBSERVED.

13.4.4. WHEN OPERATING THE X-RAY MACHINE FOR FLUOROSCOPY, THE RADIATION CAUTION SIGNS, ROPES, RED FLASHER LIGHTS, AND BARRIERS ARE TO BE IN PLACE BEFORE BEGINNING OPERATIONS.

13.4.4.1. AFTER CHECKING POWER CONNECTIONS AND REMOTE CONTROL SWITCH, THE MOTOR SWITCH OF THE X-RAY UNIT SHOULD BE TURNED "ON" AND THE TIMER SET TO MAXIMUM, AUTO-TRANSFORMER SET TO APPROXIMATELY 55 KVP FOR 1" THICKNESS POLYETHYLENE SHEETS, OR 40 TO 50 KVP FOR 1/4" TO 1/2" THICKNESSES. THE MILLIAMP CONTROL SHOULD BE SET FOR 5 MA'S WITH THE REMOTE CONTROL ADJUSTMENT IN THE CENTER POSITION. THE RHEOSTAT SHOULD BE FULLY OUT.

13.4.4.2. THE UNIT IS EQUIPPED WITH REMOTE CONTROL CONTAINING "OFF-ON" SWITCH AND X-RAY TUBE FILAMENT CONTROL. A FOOT SWITCH, WHICH ALSO OPERATES RED LIGHTS AT EACH END OF THE VIEWING TABLE IS CONNECTED IN SERIES WITH THE "OFF-ON" X-RAY SWITCH.

13.4.4.3. THE X-RAY TUBE PORT AND VIEWING TABLE ARE LEAD-SHIELDED SO THAT RADIATION IN AREAS TO BE OCCUPIED BY PERSONNEL DURING OPERATIONS IS WELL WITHIN SAFE LIMITS.

13.4.4.4. ALL PERSONNEL OBSERVING OR ASSISTING IN FLUOROSCOPY WILL BE CONFINED TO THE AREA IN FRONT OF THE VIEWING TABLE BY ROPE BARRIERS.

13.4.4.5. ASSISTANTS WHO HANDLE POLYETHYLENE ARE ASSIGNED THE DUTY OF SECURING THE ROPE BARRIER AND SOUNDING THE "ALL CLEAR" FOR FLUOROSCOPE RADIOGRAPHER. THE RADIOGRAPHER WILL NOT START THE MACHINE UNTIL HEARING THE "ALL CLEAR." HE WILL THEN CALL OUT: "X-RAY ON." UPON COMPLETION OF THE SCAN, HE WILL SOUND: "X-RAY OFF." DURING THE INTERVAL THAT THE X-RAY MACHINE IS TURNED ON, ALL PERSONNEL WILL MAN THEIR ASSIGNED STATIONS.

13.4.4.6. UPON COMPLETION OF ASSIGNMENT, SECURE ALL BARRIERS, LIGHTS, AND SWITCHES.

13.5. <u>PROCEDURE FOR ENTERING A CONTAMINATED RADIATION AREA, SUCH AS THE REACTOR COMPARTMENT OF AN OPERATING NUCLEAR-POWERED SUBMARINE</u>.

13.5.1. THE RADIOLOGICAL CONTROL BRANCH, CODE 136R, SHALL BE NOTIFIED AT LEAST FOUR HOURS PRIOR TO THE BEGINNING OF THE SHIFT ON WHICH THE BOARDING IS TO OCCUR.

13.5.2. RADIATION SAFETY CLEARANCE AND INSTRUCTIONS FOR RADIATION PROTECTION SHALL BE OBTAINED FROM THE RADIOLOGICAL CONTROL BRANCH.

13.5.3. PROTECTIVE CLOTHING SHALL BE CHECKED OUT OF SHOP 06 ON THE RADCON BARGE.

13.5.4. OBTAIN RADIATION EXPOSURE RECORD CARD, IBM L52769, FROM THE ATTENDING RADCON PERSONNEL, WHO WILL SEE THAT THE TOP LINE IS CORRECTLY AND LEGIBLY FILLED OUT.

13.5.5 PRESENT THE RADIATION EXPOSURE CARD TO THE RADIATION MONITOR BEFORE ENTERING RADIATION AREA FOR ISSUE OF DOSIMETERS.

SECTION XIV

EMERGENCY PROCEDURES

14.1. OVEREXPOSURE

14.2. UNCONTROLLED SOURCE

14.3. TRANSPORTATION ACCIDENTS

14.4. FIRE

14.5. PERSONS TO BE NOTIFIED

14.1. OVEREXPOSURE

14.1.1. WHENEVER THE DOSIMETER INDICATES AN EXPOSURE OF 100 MR, OR MORE, IN ANY ONE DAY, THE OPERATOR WILL IMMEDIATELY CEASE OPERATIONS AND CONTACT HIS SUPERVISOR. WHEN THE ACCUMULATED READINGS FOR ANY ONE CALENDAR WEEK ARE 100 MR, THIS FACT SHALL BE REPORTED TO THE SUPERVISOR.

14.1.2. WHEN AN ACTUAL OR SUSPECTED OVEREXPOSURE, (EXPOSURE IN EXCESS OF THE LEVELS ESTABLISHED IN SECTION 5.4.3.), OCCURS, THE SUPERVISOR WILL:

14.1.2.1. IMMEDIATELY MAKE A DETAILED REPORT OF ALL CIRCUMSTANCES AND CONDITIONS CONTRIBUTING TO THE INCIDENT.

14.1.2.2. SUBMIT THE FILM BADGE AND DOSIMETER READING TO HEALTH PHYSICS AND THE COMPLETED REPORT TO THE HEAD, NONDESTRUCTIVE TEST BRANCH, WITHOUT DELAY. A COPY OF THIS REPORT WILL BE FORWARDED TO CODE 108 AND HEALTH PHYSICS, EXPEDITIOUSLY.

14.1.3. PERSONNEL RECORDS OF EXPOSURE ARE MAINTAINED BY THE HEALTH PHYSICS BRANCH, WHO WILL:

14.1.3.1. REPORT TO THE HEAD, NONDESTRUCTIVE TEST BRANCH, WHEN THE EXPOSURE LEVEL OF ANY PERSON EXCEEDS THOSE ESTABLISHED IN SECTION 5.4.3.

14.1.3.2. PROVIDE IMMEDIATE EXPOSURE RESULTS WHEN REQUESTED BY HEAD, NONDESTRUCTIVE TEST BRANCH, FOR EVALUATION OF A SUSPECTED PERSONNEL OVEREXPOSURE.

14.2. UNCONTROLLED SOURCE

14.2.1. A SOURCE IS CONSIDERED TO BE UNCONTROLLED IN ANY INCIDENT OR SITUATION INVOLVING POSSIBLE EXPOSURE OF PERSONNEL WHEN NORMAL CONTROL CANNOT BE RESTORED BY ROUTINE OPERATING TECHNIQUES OR PROCEDURES. THIS INCLUDES CONDITIONS WHERE SOURCES CANNOT BE RETURNED TO THEIR SAFE POSITION BY OPERATION OF THE CONTROL HANDLE; LOST INSTRUMENTS CONTAINING CALIBRATION SOURCES (VIZ., AN/PDR 18).

14.2.2. WHENEVER A SOURCE BECOMES UNCONTROLLED, THE RADIOGRAPHER'S ASSISTANT WILL MAINTAIN THE SECURITY OF THE ENTIRE AREA AROUND THE SOURCE AND THE RADIOGRAPHER WILL NOTIFY HIS SUPERVISOR IMMEDIATELY AFTER STABILIZING THE SITUATION AND PRIOR TO INSTITUTING CORRECTIVE MEASURES.

14.2.3. THE SUPERVISOR CALLED TO THE SCENE WILL BRING ANY ADDITIONAL RADIAC INSTRUMENTATION NEEDED.

14.2.4. THE SUPERVISOR WILL NOTIFY THE SENIOR SUPERVISOR OR THE HEAD, NONDESTRUCTIVE TEST BRANCH, IMMEDIATELY. HE IN TURN WILL NOTIFY

IMMEDIATELY EITHER CODE 108, 732, OR 733. PHONE NUMBERS ARE LISTED IN PARAGRAPH 14.5.

14.2.5. CONFIRMING WRITTEN REPORTS WILL BE FORWARDED SUBSEQUENTLY.

14.3. TRANSPORTATION ACCIDENTS

14.3.1. IN THE EVENT THAT AN ACCIDENT OCCURS TO THE VEHICLE TRANSPORTING A SOURCE CONTAINER OR PROJECTOR SUCH THAT EITHER IS DISLODGED FROM THE TRUCK, THE RADIOGRAPHER SHALL:

14.2.1.1. MONITOR THE CONTAINER OR PROJECTOR TO DETERMINE THAT ACCEPTABLE EXTERNAL RADIATION LEVELS EXIST.

14.3.1.2. IF MONITORING INDICATES THAT THE SOURCE HAS BEEN DISLODGED FROM ITS SAFE LOCATION, HE SHALL ESTABLISH SAFE RADIATION LEVEL LINES AND APPROPRIATELY POST SAME. HE WILL ALSO PROVIDE ADEQUATE GUARDS AT THESE PERIMETERS TO INSURE THAT NO VIOLATION OF THE RESTRICTED AREA WILL OCCUR.

14.3.1.3. AFTER SECURING THE ACCIDENT AREA AND THE POSTING OF GUARDS, HE SHALL NOTIFY HIS IMMEDIATE SUPERVISOR. THE SUPERVISOR WILL NOTIFY THE SENIOR SUPERVISOR OR THE HEAD, NONDESTRUCTIVE TEST BRANCH WHO WILL IN TURN NOTIFY CODE 108, 732 OR 733, AS APPROPRIATE. PHONE NUMBERS ARE LISTED IN PARAGRAPH 14.5.

14.3.1.4. IF AN ACCIDENT SHOULD OCCUR OUTSIDE OF THE SHIPYARD WHILE ENROUTE TO ANOTHER ACTIVITY, THE RADIOGRAPHER SHALL FOLLOW THE SAME PROCEDURE AS STATED ABOVE WITH THE FOLLOWING EXCEPTIONS:

14.3.1.4.1. IF MONITORING INDICATES THAT THE SOURCE HAS BEEN DISLODGED FROM ITS SAFE LOCATION, THE RADIOGRAPHER SHALL ESTABLISH SAFE RADIATION LEVEL LINES AND IF POSSIBLE, APPROPRIATELY POST SAME. HE SHALL THEN NOTIFY THE SECURITY FORCE ARRIVING AT THE ACCIDENT OF THE RADIATION HAZARD INVOLVED AND SEEK THEIR ASSISTANCE IN CONTROLLING THE RADIATION AREA.

14.3.1.4.2. AFTER SECURING THE ACCIDENT AREA AND THE POSTING OF GUARDS, THE RADIOGRAPHER SHALL NOTIFY OR ASK THE SECURITY FORCE TO NOTIFY HIS IMMEDIATE SUPERVISOR.

14.4. FIRE

14.4.1. IN THE EVENT OF A FIRE IN A RADIATION AREA, THE RADIOGRAPHER WILL SECURE THE SOURCE INTO THE PROJECTOR AND ATTACH THE LOCK TO THE CONTROL HANDLE. THE SOURCE PROJECTOR SHALL THEN BE REMOVED FROM THE FIRE AREA. IMMEDIATELY NOTIFY THE FIRE PROTECTION BRANCH THAT THE SOURCE IS SECURED AND SAFELY REMOVED. IF THE SOURCE CANNOT BE RECOVERED DUE TO THE FIRE HAZARD, THE RADIOGRAPHER WILL REMAIN AT THE SCENE TO NOTIFY

THE FIRE PROTECTION BRANCH PERSONNEL OF THE LOCATION AND EXTENT OF THE HAZARD. THE RADIOGRAPHER'S ASSISTANT WILL IMMEDIATELY NOTIFY THE SUPERVISOR, THE SUPERVISOR WILL NOTIFY ONE OF THE INDIVIDUALS LISTED IN PARAGRAPH 14.5.1. AS TO THE SITUATION. HEALTH PHYSICS BRANCH WILL MONITOR AND LOG EXPOSURES OF FIREFIGHTING PERSONNEL. THE RADIOLOGICAL PROTECTION OFFICER, OR HIS REPRESENTATIVE, WILL BE PRESENT TO FURNISH ADVICE CONCERNING MEANS TO AVOID SPREADING OF CONTAMINATION AND TO RECOVER THE EXPOSED SOURCE.

14.5. PERSONS TO BE NOTIFIED

14.5.1. THE FOLLOWING IS A LIST OF NAMES AND PHONE NUMBERS OF PERSONS WHO MAY BE CALLED:

NAME	HOME TELEPHONE NO.	MARE ISLAND NO.
J. A. SCHOEDINGER, JR.	226-5445 (NAPA)	646-4316
R. H. PARNESS	689-8268 (CONCORD)	646-2224
C. E. SMITH	643-5510 (VALLEJO)	646-4235
S. R. BILLINGS	642-1423 (VALLEJO)	646-4235
W. DUFF	644-2013 (VALLEJO)	646-4235

		HUNTERS POINT NO.
A. E. BERGERON	584-8634 (SFRANCISCO)	824-3207
D. KEATING	871-8949 (BRISBANE)	824-3138
J. TERRON	756-0773 (SSFRANCISCO)	824-3267
P. ARMENTROUT	583-8124 (SSFRANCISCO)	824-3267

14.5.1.1. UPON RECEIVING NOTIFICATION OF ANY OF THE ABOVE SITUATIONS, THE HEAD, NONDESTRUCTIVE TEST BRANCH, OR IN HIS ABSENCE, THE SENIOR SUPERVISOR, WILL IMMEDIATELY NOTIFY EITHER THE HEALTH PHYSICIST, (CODE 732 OR 733 AS APPROPRIATE), NORMALLY CALLED FIRST, OR THE RADIOLOGICAL PROTECTION OFFICER, (CODE 108). THIS NOTIFICATION WILL BE MADE PRIOR TO INSTITUTING CORRECTIVE MEASURES, AND DETERMINATION OF THE NEED FOR FURTHER ASSISTANCE CAN THEN BE MADE. THE SHIPYARD WATCH OFFICER WILL ALSO BE NOTIFIED.

14.5.1.2. THE TELEPHONE NUMBERS ARE:

NAME AND TITLE	HOME TELEPHONE NO.	SHIPYARD NO.
G. J. ROSATI, RADIOLOGICAL PROTECTION OFFICER	935-6068 (WALNUT CREEK)	646-2458
CHAPMAN BURK, HEALTH PHYSICIST	232-7232 (EL CERRITO)	646-2485
ELMON ELMORE, HEALTH PHYSICIST	755-9471 (DALY CITY)	824-2707
SHIPYARD WATCH OFFICER (MI)		646-4222
SHIPYARD WATCH OFFICER (HP)		824-2888

SECTION XV

ENCLOSURES

15.1. THESE ENCLOSURES ARE INCLUDED IN THIS DOCUMENT FOR THE CONVENIENCE OF THE NONDESTRUCTIVE TEST BRANCH PERSONNEL AND SHALL NOT BE CONSIDERED AS A PART OF THIS DOCUMENT

15.1.1. CODE OF FEDERAL REGULATIONS, TITLE 10, CHAPTER 1, PARTS 20, 30, AND 34.

15.1.2. A COPY OF THE CURRENT LICENSE

ATTACHMENT C

TRAINING AND EXPERIENCE

SUPPLEMENT 1
Training Program

SUPPLEMENT 2
Certification Examination

ATTACHMENT C
SUPPLEMENT 1

Training Program

SAN FRANCISCO BAY NAVAL SHIPYARD

RADIATION SAFETY TRAINING PROGRAM
for
RADIOGRAPHERS AND RADIOGRAPHERS' ASSISTANTS

I. PRELIMINARY TRAINING FOR RADIOGRAPHER'S ASSISTANT

A. Classroom Instruction -- 13 hours

1. Fundamentals of Radiation Protection

   a. Characteristics of radiation
   b. Units of dose and radioactivity
   c. Hazards of excessive exposure
   d. Levels from licensed material
   e. Methods of controlling exposure -- time, distance, shielding
   f. Methods of controlling contamination

2. Radiation Detection Instruments

   a. Operation
   b. Calibration and function check
   c. Limitations
   d. Types
   e. Value to radiation safety
   f. Interpretation of readings
   g. Survey techniques
   h. Use of film badges and pocket dosimeters

3. Exposure Devices and Storage Containers

   a. Construction features
   b. Operation and leak testing
   c. Detection and correction of malfunctions
   d. Radiation intensities and limits during operation
   e. Security
   f. Storage precautions
   g. Emergency action

4. Operating and Emergency Procedures

   a. General information and responsibilities
   b. Personnel radiation protection
   c. Radiographic operations and records
   d. Receipt and shipment of sources
   e. Emergency procedures
   f. Radiographic operating instructions

      (1) Byproduct material (radioisotope) sealed source exposure devices
      (2) X-ray machines

ATTACHMENT "C"
SUPPLEMENT 1

B. On-the-job instruction and training under a certified radiographer for at least two weeks

II. PRELIMINARY TRAINING FOR RADIOGRAPHERS

A. Classroom Instruction -- 20 hours

1. Fundamentals of Radiation Protection

   a. Characteristics of radiation
   b. Units of dose and radioactivity
   c. Hazards of excessive exposure
   d. Levels from licensed material
   e. Methods of controlling exposure -- time, distance, shielding
   f. Methods of controlling contamination

2. Radiation Detection Instruments

   a. Operation
   b. Calibration and function check
   c. Limitations
   d. Types
   e. Value to radiation safety
   f. Interpretation of readings
   g. Survey techniques
   h. Use of film badges and pocket dosimeters

3. Restricted and Radiation Areas

   a. Control of access
   b. Posting
   c. Radiation intensities at perimeters
   d. Security
   e. Warning signs, lights, alarms

4. Records and Control of Sources

   a. Receiving and returning sources
   b. Inventory
   c. Utilization logs
   d. Work Sheets and Survey Charts

5. 10 CFR 20, 30, 34

6. Exposure Devices and Storage Containers

   a. Construction features
   b. Operation and leak testing
   c. Detection and correction of malfunctions
   d. Radiation intensities and limits during operation
   e. Security
   f. Storage precautions
   g. Emergency action

7. AEC License terms and conditions

a. Byproduct material permitted
b. Form of byproduct material
c. Amount of radioactivity permitted
d. Uses for which authorized
e. Leak test procedure authorized
f. Other conditions

8. Operating and Emergency Procedures

a. General information and responsibilities
b. Personnel radiation protection
c. Radiographic operations and records
d. Receipt and shipment of sources
e. Emergency procedures
f. Radiographic operating instructions

(1) Byproduct material (radioisotope) sealed source exposure devices
(2) X-ray machines

B. On-the-job instruction and training under a certified radiographer for at least six months

III. PERIODIC TRAINING OF CERTIFIED RADIOGRAPHERS

A. Classroom Instruction -- 12 hours

1. Refresher instruction of subjects listed in II-A above, at license renewal or biennially, whichever occurs first.

B. Instruction in applicable amendments to AEC regulations or the license, as they become effective.

NOTE: It will be determined by personal observation and/or written examination that the users thoroughly understand the above, and are competent to use newly added instruments and equipment.

IV. PROCEDURES FOR DETERMINING QUALIFICATION

A. Radiographers' Assistants

1. Satisfactory completion of training listed in Part I above

2. Radiography supervisor's observation of trainee's attitude, understanding, and training performance, and recommendation to the Branch Head.

3. Nomination of eligible and competent trainees by the NDT Branch Head to the Radiological Protection Officer for certification examination.

4. Completion of the Radiation Safety Examination for Radiographer Assistant (Annex A) with a score of 75% or more, attendance at the following critique, and written notification of certification of radiation safety competence by the Radiological Protection Officer.

B. Radiographers

1. Satisfactory completion of training listed in Part II above.

2. Radiography Supervisors' observation and evaluation of radiographers assistants' competence in handling and use of equipment. The handling procedures and techniques which are required of the trainee are:

   a. Operation of all licensed exposure devices and leak testing equipment
   b. Operation of instrumentation and protective devices
   c. Radiation surveys and posting
   d. Interpretation of readings
   e. Operation of the exposure room radiation alarm systems

3. Recommend competent and eligible radiographers assistants to the Branch Head based on their ability to apply radiation safety practices effectively in using the equipment as demonstrated by:

   a. Understanding of AEC regulations, the AEC license, and the Operating and Emergency Procedures
   b. Understanding of the principles of radiation control and safety.
   c. Judgment under simulated emergency situations

4. Nomination of eligible and competent radiographers assistants by the NDT Branch Head to the Radiological Protection Officer for certification examination.

5. Completion of the Radiation Safety Examination for radiographers (Annex A and Annex B) with a score of 75% or more, attendance at the critique following, and written notification of certification of radiation safety competence by the Radiological Protection Officer.

ATTACHMENT C
SUPPLEMENT 2

CERTIFICATION EXAMINATION

ANNEX A - RADIOGRAPHER ASSISTANT
ANNEX A & B - RADIOGRAPHER

GRADE_____ DATE_____

NUMBER WRONG ____ NAME_____

BADGE NO._____

EXAMINATION FOR CERTIFICATION

OF

RADIOGRAPHERS ASSISTANTS

ANNEX A

RADIOGRAPHERS

ANNEX B

1966

ATTACHMENT "C"
SUPPLEMENT 2

ANNEX A

1. Read each question carefully.
2. Review its list of answers.
3. Select the statement that best answers the question.
   THERE IS ONLY ONE CORRECT ANSWER TO EACH QUESTION.
4. On the answer sheet, mark the letter "X" within the parentheses which indicates the best answer for the question.

DO NOT WRITE ON THIS EXAMINATION

1. Each radiographer and radiographer's assistant is responsible for:

   a. performing all radiographic operations in accordance with AEC regulations and Quality and Reliability Assurance Department Instruction ~~4730.11~~ 4730.22 procedures.
   b. protecting himself and others from excessive or unnecessary exposure to ionizing radiation.
   c. being familiar with the license and 10 CFR 20, 30, and 34.
   d. being familiar with the Operating and Emergency Procedures, Q&RA Department Instruction ~~4730.11~~. 4730.22
   e. all of the above.

2. The person responsible to the licensee for assuring compliance with AEC regulations and Q&RA Department instruction ~~4730.11~~ 4730.22 procedures is the

   a. Health Physicist
   b. Radiological Protection Officer.
   c. Radiographer in charge at each job site.
   d. Shipyard Commander.

3. The Supervisor (Radiography) is responsible for

   a. implementation of the radiographic operating and emergency procedures.
   b. maintenance of facilities and equipment.
   c. supervision of training of operating personnel.
   d. assuring that operations are conducted by certified personnel only.
   e. all of the above.

4. One of the primary purposes of Q&RA Department Instruction ~~4730.11~~ 4730.22 is to

   a. provide an administrative document for record purposes.
   b. provide specific procedures which must be followed to insure safe handling of sources.
   c. provide a guide for administrative supervisor personnel.
   d. provide compliance with directives issued in connection with production scheduling.

5. Ionizing radiation includes any or all of the following:

a. alpha, beta, gamma and X rays
b. alpha, beta, gamma and microwave (rf) radiation
c. alpha, beta, gamma and delta rays.
d. all radiation in the electromagnetic spectrum.

6. Byproduct material licenses are granted to activities which have

a. an urgent need and have presented financial justification and responsibility.
b. no specific need, but have shown that it would be useful.
c. shown a valid need for such material and presented evidence of their ability to conform to the regulations governing such usage.
d. no need or desire, but are required to meet Systems Command directives.

7. Of the following statements, which honestly describes the way your operations are actually carried out, compared with Q&PA Department Inst. ~~4730.11?~~ 4730.22

a. Generally the same but much variance in details.
b. Exactly the same in every detail.
c. Almost the same in every detail.
d. Seldom the same.
e. I'm chicken, and prefer not to answer.

8. The roentgen (R) is

a. equal to 1/1000 of the basic unit of measurement of accumulated dose.
b. the basic unit used when recording film badge exposures.
c. a measure of the ionizing radiation in air produced by X- or gamma radiation only.
d. all of the above.
e. none of the above.

9. Which of the following agencies grants licenses to the Shipyard for the procurement and usage of radioactive byproduct materials after receiving evidence of ability to conform to the regulations governing such usages?

a. Office of the Secretary, Department of the Navy.
b. Naval Electronic Systems Command.
c. U. S. Atomic Energy Commission.
d. Radiological Coordinator, State of California.

10. Each radiographer's assistant must be familiar with

a. Q&RA Dept. Inst. ~~4730.11~~ 4730.22
b. the license.
c. 10 CFR 20, 30, and 34.
d. all of the above.

11. The individual directly responsible for overall radiation protection in connection with industrial radiography performed by NDT personnel is

a. the Radiological Protection Officer.
b. Head of Operations Section, NDT Branch.
c. Head of Technical Section, NDT Branch.
d. Head of the NDT Branch.

12. Who is responsible for certifying radiation safety competence of Radiographer and Radiographer Assistant nominees?

a. Health Physicist.
b. Quality Control Manager.
c. Production Officer.
d. Radiological Protection Officer.

13. To which of the following work, under the cognizance of the NDT Branch does Q&RA Dept. Inst. ~~4730.11~~ 4730.22 Operating and Emergency Procedures apply?

a. All industrial operations involving Quality & Reliability Assurance.
b. All industrial operations and work requiring conformance to Mil Specs.
c. Handling of sources of ionizing radiation used for industrial radiography.
d. All test procedures.

14. The licensee or applicant responsible to the U. S. Atomic Energy Commission and NavElexSysCom for the proper conduct of the industrial radiography program is

a. the Radiological Protection Officer.
b. the radiographer
c. the Shipyard Commander (Commanding Officer of the Shipyard).
d. the Head of the Nondestructive Test Branch.

15. The correct technique for monitoring a projector after each exposure is completed requires that a final reading be made with the instrument probe at the

a. control handle of the projector.
b. top of the projector.
c. sides of the projector.
d. source tube connection (front) of the projector.

16. In order to make sure a source is in the safe position, you should

a. ask your supervisor.
b. observe the lights on the control mechanism.
c. approach the projector with a survey instrument.
d. try to remember where it is.

17. What is the sequence of actions to be taken in event of a fire in a Radiation Area if the source can be recovered? (Use the number 1 for the first, 2 for the second, etc., and X if not applicable.)

(2) a. The source projector shall be removed from the fire area.
(3) b. Immediately notify the fire protection branch to disregard posted warnings.
(4) c. Contact your supervisor.
(1) d. The radiographer will secure the source into the projector, and attach the lock to the control handle.

18. A source is considered to be uncontrolled in any incident or situation when

a. you cannot crank the source out with pressure on the handle.
b. normal control cannot be restored by routine operating techniques or procedures.
c. a cable or tube is crimped or worn.
d. the survey instrument reads 5 mR/hr.

19. An accumulated dosimeter reading of 100 mR within any one calendar week

a. shall be reported to the supervisor
b. shall be considered legal evidence of technical overexposure.
c. requires no notification.
d. requires notification of the AEC within 30 days.

20. In the case of an exposure of 100 mR in any one day, indicated by a dosimeter, the operator will

a. continue operations and contact his supervisor by the end of the shift.
b. immediately cease operations and contact his supervisor.
c. cease operations and recharge his dosimeter.
d. Write a memo or report to Health Physics in person with his film badge.

21. Procedure for entering a contaminated Radiation Area, such as the reactor compartment of an operating nuclear-powered submarine –

a. Radiation safety clearance and instructions will be obtained from the Radiological Control Division.
b. A radiation exposure record card will be obtained from the supervisor.
c. Protective clothing shall be checked out of Shop 06.
d. All of the above.

22. When operating portable X-ray machines throughout the Shipyard

a. the radiation safety regulations concerning posting do not apply.
b. all radiation safety regulations must be applied less rigidly.
c. no specific radiation safety regulations apply, since X ray is not licensed by the AEC.
d. the radiation safety regulations applying to posting areas will be observed.

23. A "worksheet" is

a. an unofficial document used by the radiographers to record receipts and transfers of sealed sources.
b. used to record the pertinent data for each exposure, including the source used, date, time, and location of exposure, duration of exposure, radiographer-in-charge, and survey log book number and page in which the physical radiation survey is recorded.
c. a record of radiation intensities at various locations in an area where ionizing radiation exists.
d. a record of individual exposures.

24. To minimize the amount of stray radiation, you should

a. secure the area.
b. place the isodose line at 2 mR/hr level.
c. surround the item being radiographed, when possible, with portable lead screens.
d. leave the area.

25. When using the cobalt-60 source projector in permanent radiographic areas, you must be sure that

a. It is used with the panoramic projector.
b. the aluminum port window has been removed.
c. all interlocks and safety alarms are operative.
d. all of the above.

26. The 30-curie cobalt-60 source may be removed from the high-energy room of Building 676 only with the consent and approval of

a. the Radiological Protection Officer.
b. the Supervisor of Radiography.
c. the Head of NDT Branch.
d. the Health Physics Branch.

27. X-ray machines shall be operated by

a. those who have taken the prescribed training course.
b. all competent NDT personnel.
c. certified Radiographers and Radiographers' Assistants only.
d. Health Physics personnel and certified Radiographers and Assistants.

28. The fluoroscope radiographer will not start the X ray until

a. he is told to do so.
b. all barriers, lights, and switches are secured.
c. the milli-amp control is turned off.
d. given the "all clear" by competent assistants.

29. The Radiographer shall not proceed with exposure aboard commissioned ships until

a. he has notified the Deck Watch of the area to be radiographed, the length of time personnel are to be restricted from the area, and the location of the isodose line.
b. the Deck Watch has notified shipboard personnel by intercom that radiography is to be performed and to remain clear of such radiation areas until given the all-clear.
c. all access areas are roped off with appropriate signs and flashing red lights and the two major accesses at least are under direct visual observation of the radiographer and his assistants.
d. all of the above.

30. Posting of the Radiation Area shall be accomplished

a. prior to exposure of the source under the direction of the Radiographer-in-Charge.
b. by the Health Physics Branch at the beginning of each shift.
c. according to BUSHIPS Inst. 4000.92.
d. for permanent Radiation Areas only.

31. If the combined total source exposure time in any given area is more than 20 minutes in any one hour, an isodose line (Radiation Area perimeter) will be established at the

a. 5 mR/hr level.
b. 2 mR/hr level.
c. 10 mR/hr level.
d. none of the above.

32. The source in each temporary radiography area will have

a. a rotating red beacon as near as possible.
b. High Radiation warning sign placed adjacent to it.
c. a source license number identification placque.
d. a flashing red light on top of the projector.

33. When an unauthorized person crosses the barrier to an NDT Radiation Area in the field you should

a. check to see that such person has a film badge in his possession.
b. ask the Radiographer (or Assistants) standing guard to forcibly eject him.
c. secure the source until such person leaves. Make a written report to the supervisor, giving data, time, name of person, his shop, badge number, etc.
d. speak to him about the intensity of the radiation present and the perils involved. You should exaggerate slightly to impress him.

34. The control handle on each source container will be kept locked at all times except

a. when the safety plug is secured in place.
b. when actually exposing the source.
c. while attaching the carrier tube.
d. all of the above.

35. During the actual exposure of a source, all radiographic personnel will

a. monitor the source projector continuously, and stay at a distance of at least 500 feet.
b. leave the area until the Radiographer gives the "all clear."
c. stand guard at all access areas to the maximum extent possible during exposure to insure that personnel do not enter the Radiation Area.
d. operate the control switches and lock the control handle.

36. If a wipe test shows contamination, all wipes, the source, and associated equipment will be

a. isolated in a manner satisfactory to the Health Physics representative until further instructions are received from the Radiological Protection Officer, who shall be promptly notified.
b. turned over to the Supply Department for immediate disposal to an AEC-licensed contractor.
c. decontaminated by NDT Branch personnel and returned to service when work schedule permits.
d. none of the above.

37. All Temporary Radiation Areas shall be posted with

a. flashing yellow lights and red ropes.
b. appropriate radiation sign and flashing red light.
c. appropriate radiation signs, flashing red light, and yellow and magenta rope.
d. the conventional DoD "ATOM" signs.

38. When transporting sources within the SHIPYARD, which of the following <u>is not</u> necessary?

a. Posting four sides of the transporting vehicle with "Caution (or Danger) Radioactive Material" signs.
b. Placement of source container on vehicle at greatest distance from the driver and securing to prevent shifting.
c. Notification of the Shipyard Police Branch of the route and making a survey.
d. Having proper radiacs and monitoring after loading.

39. The special wipe test tool is designed

a. to wipe the source either prior to placing it in the projector or when it is already in the projector.
b. to be used when control of a source is lost.
c. to wipe the source prior to placing it in the projector.
d. none of the above.

40. Sources shall be wipe tested

a. every three months or when servicing is done in connection with receipt and shipment.
b. when received or shipped, and at five-month intervals.
c. every three months unless they have been wipe tested by the manufacturer 30 days prior to receipt or when contamination is suspected.
d. at least monthly or when an incident occurs.

41. Persons issued a red film badge are normally permitted to receive industrial radiation exposures of

a. 300 mrem per week.
b. 5 R per calendar quarter.
c. 1.25 R per week with prior notification on Form 12ND MINS 773.
d. All of the above.

42. The Radiation Protection Guide (RPG) is that dose of ionizing radiation which

a. may be received continuously without causing significant injury.
b. can cause severe damage to the body if continuously received.
c. personnel are regularly expected to receive in the normal course of work.
d. has no operating significance related to health protection.

43. Sources are not to be transferred from one projector to another except by permission of the

a. Radiological Protection Officer.
b. Head, NDT Branch with notification to the Health Physics Branch.
c. Ionizing Radiation Control Committee.
d. Shipyard Commander.

44. Which of the following is not the reason why extreme caution must be exercised in handling radium sources such as the AN/PDR-27 test sample and the 2 mg Radiac calibration source?

a. Because serious internal effects can result from inhalation or eating the source material if it escapes from the container.
b. Because of the contamination potential presented if damaged.
c. Because potentially serious skin effects can result from prolonged contact.
d. Because it is byproduct material licensed by the AEC.

45. When a radiation level over 500 mR/hr is to be measured, which of the following instruments should be used?

a. CP-95
b. AN/PDR-27
c. AN/PDR-18 or Eberline E-500B or E-510G
d. AN/PDR-56

46. Which of the following radiation survey and monitoring instrumentation will always accompany radiation sources when in use or being transported?

a. AN/PDR-18 only.
b. AN/PDR-27 only.
c. AN/PDR-18 and AN/PDR-27, or E-500B, or E-510G
d. AN/PDR-49 or equivalent.

47. Each radiation survey instrument (Radiac) will be

a. calibrated at intervals not to exceed 3 months.
b. calibrated after each instrument servicing.
c. checked for proper operating condition before each use.
d. all of the above.

48. While performing radiography wipe testing and exchange of sources in a permanently established radiography area

a. signs must be posted to indicate that only authorized persons may enter.
b. all entrances must be physically blocked so that inadvertent entry is impossible during an exposure.
c. interlocks connected to radiation alarms and/or source of X-ray controls such that an alarm is sounded if an exposure is attempted with a door open.
d. all of the above.

49. When sources arere ceived by the Supply Department, they will notify the Health Physics Branch and the NDT Branch of their arrival as appropriate. Monitoring will be performed by

a. Health Physics Branch or trained Supply Department personnel.
b. NDT Branch personnel
c. Health Physics Branch personnel.
d. Radiological Protection Officer in conjunction with Health Physics Branch.

50. Persons issued a green film badge are not permitted to receive industrial ionizing radiation exposure in excess of

a. 1.25 R per calendar quarter.
b. 100 mrem per week.
c. 300 mrem per week with prior notification on form 12ND MINS 774
d. all of the above.

51. Dosimeters shall be

a. charged each day and the readings recorded each day.
b. charged at least once a week or when the reading is over 50 mR and the readings recorded daily.
c. charged when it is out of range and readings recorded weekly.
d. read only by the Health Physics Branch and the readings made a part of the official dose history.

52. A film badge

a. may be opened if there is reason to believe that it is faulty.
b. is issued to a specific individual and will be worn only by that individual.
c. which is lost, dropped or left in a Radiation Area should be reported at the end of the month.
d. can readily detect internal exposure as well as external exposure.

53. Any area accessible to personnel in which there exists radiation at such levels that a major portion of the body could receive a dose in excess of 2 mR in any one hour or a dose in excess of 100 mR in any seven consecutive days is described as a

a. "Restricted Area."
b. "High Radiation Area."
c. "Radiation Area."
d. "Radiography Exclusion Area."

54. A film badge must be worn

a. at all times.
b. at all times when in a Radiation Area
c. only when a "shot" is being made.
d. when going aboard all ships.

55. To be considered for certification as a Radiographer, which of the following is <u>not</u> required?

a. Perform radiographic film interpretation with competence for 6 months.
b. Six months' experience as a Radiographer's Assistant.
c. Receive instruction and examination on Parts 20 and 34, the license conditions, and Q&RA Dept. Inst. ~~4730.11~~. 4730.22
d. Demonstrate competency in handling of sources and related tools under the supervision of a certified Radiographer.

56. Each person to be considered for certification as a Radiographer or Radiographer's Assistant must

a. have six months' experience in the operation of radiation detection instruments.
b. submit to a medical examination and be qualified for radiation work by the Medical Officer.
c. have received training in administrative procedures.
d. understand the hazards that may exist in operating a nuclear reactor.

57. A "sealed source" is any radioactive material that is encased in a capsule designed to

a. prevent leakage or escape of the radioactive material.
b. moderate the radiation present.
c. deflect primary rays as they interact with atoms in materials.
d. all of the above.

58. Pocket dosimeters are devices designed to

a. protect wearers from harmful effects of radiation.
b. detect contamination on all body surfaces.
c. measure the amount of exposure to penetrating ionizing radiation received by an individual.
d. provide monthly cumulative radiation measurement of the environment.

59. Radiation signs, which warn of the presence of ionizing radiation or materials that emit radiation, display

a. a three-bladed symbol on a red and white background.
b. a three-bladed symbol on a magenta, or purple, background.
c. a three-bladed symbol on a yellow background and the word "Atom" in purple or magenta.
d. a three-bladed symbol in magenta or purple on a yellow background.

60. A film badge is a device designed to be worn by an individual for the prime purpose of

a. providing cumulative measurement of his radiation exposure.
b. preventing exposure.
c. permitting admission to Radiation Areas.
d. none of the above.

61. The measurement and recording of radiation intensities at various locations in an area where ionizing radiation exists is called

a. operational dosimetry
b. a survey.
c. scattered radiation logging.
d. a spot check.

62. "High Radiation Area" is any area accessible to personnel where radiation levels are such that a major portion of the body could receive in one hour a dose in excess of

a. 100 mR
b. 500 mR
c. 200 mR
d. 50 mR.

63. The radioisotopes used in radiography are classified for licensing purposes as:

a. source materials.
b. special nuclear materials.
c. byproduct materials.
d. seismic-sensitive materials.

64. One curie (Ci) is

a. radiation, based on the energy absorbed by the material the rays pass through (8.4×10^{-8} ergs/second).
b. that amount of radioactive material which yields 3.7×10^{10} atomic disintegrations per second. This activity is approximately equivalent to that of one gram of radium.
c. radiation intensity in terms of air ionization (6.2×10^{12} ion pairs/cm).
d. none of the above.

ANNEX B

1. Radioactive material from unsealed sources can enter the body by

   a. inhalation
   b. ingestion or swallowing
   c. through breaks in the skin or even absorption through the skin
   d. all of the above.

2. "Isotopes" may be defined as

   a. an atom containing the same total number of neutrons and protons
   b. a molecule containing three atoms.
   c. two nuclei of the same element which have different masses
   d. the only elements that are radioactive and cause ionization.

3. If radiation level is 10 mR/hr at 10 feet from a source, the radiation level at 20 feet will be

   a. 20 mR/hr
   b. 5 mR/hr
   c. 2.5 mR/hr
   d. 100 mR/hr.

4. Which of the following illustrates the best means of protection from external radiation exposure?

   a. Controlling working time, distance from the source, and shielding.
   b. Advising the supervisor and Shipyard Police of the schedule of exposures.
   c. Controlling the intensity and energy of each exposure source.
   d. Protective clothing, respirator, and gloves.

5. A radiographer must have received copies of

   a. 10 CFR 34 and 10 CFR 20
   b. the AEC license
   c. Q&RA Dept Inst ~~4730.11~~ 4730.22
   d. All of the above.

6. Utilization logs showing the make and model number of the exposure device, the identity of the Radiographer to whom assigned, and the site and dates of use shall be kept for

   a. each Radiographer
   b. each projector
   c. each sealed source
   d. none of these.

7. No person may act as a Radiographer or as a Radiographer's Assistant unless he wears

   a. at least a film badge at all times during radiographic operations
   b. at least a film badge only when the source is exposed
   c. a film badge and pocket dosimeter at all times during radiographic operations
   d. a film badge and pocket dosimeter only when a source is exposed.

8. Radiac instrumentation required by 10 CFR 34 shall have a range of

a. 50 mR/hr to 5 R/hr
b. 2 mR/hr to 1 R/hr.
c. 10 mR/hr to 3 R/hr
d. 20 mR/hr to 1 R/hr.

9. The maximum permissible radiation level at any exterior surface of a storage container for sealed sources cannot exceed

a. 100 mR/hr
b. 200 mR/hr
c. 2 mR/hr
d. 800 mR/hr

10. Any individual in attendance at the site where a sealed source is being used, who personally supervises radiographic operations, is called a

a. supervisor of radiography
b. NDT guard
c. Radiographer
d. Radiographer's Assistant.

11. A physical radiation survey shall be made to determine the shielded source has been returned to shielded condition

a. when called for by the AEC
b. upon request from the Radiological Protection Officer
c. after each exposure during a radiographic operation and prior to securing the exposure device and storage container
d. weekly.

12. The leak test of a sealed source shall be capable of detecting radioactive contamination of

a. 5 microcuries or more
b. .5 microcuries or more
c. .05 microcuries or more
d. .005 microcuries or more.

13. Locked radiographic exposure devices and storage containers containing licensed materials shall be

a. checked periodically by the Police Branch
b. monitored daily by Health Physics Branch
c. physically secured against removal or tampering by unauthorized personnel
d. disposed of as soon as possible by AEC-licensed contractor.

14. An individual who, under the personal supervision of a radiographer, uses a radiographic exposure device in radiography is a

a. supervised Radiographer
b. radiographic apprentice
c. Radiographer's Assistant
d. NDT trainee.

ANNEX B

15. Radiographic exposure devices having a radius of less than 4" shall have no radiation level in excess of

a. 25 mR/hr at 12" from any surface
b. 50 mR/hr at 10" from any surface
c. 50 mR/hr at 6" from any exterior surface
d. 210 mR/hr at 0" from any surface.

16. A film badge shall be

a. assigned to everyone in the NDT Branch
b. assigned on Monday, Wednesday, and Friday by the Health Physics Branch
c. assigned only to individuals who request it
d. assigned to and worn by only one person.

17. An employee involved in an exposure to radiation which must be reported to the AEC must also be

a. ordered to show cause why he should not be reprimanded
b. notified by the licensee in writing of the nature and extent of exposure
c. given a period of hospitalization under observation
d. carefully instructed in filling out reports of future incidents.

18. Radiation levels in unrestricted areas shall not exceed

a. 5 mrem in any one hour or 500 mrem in any 7 consecutive days
b. 2 mrem in any one hour or 100 mrem in any 7 consecutive days
c. .5 mrem in any one hour or 50 mrem in any 7 consecutive days
d. None of the above apply; no radiation levels are permitted in unrestricted areas.

19. All individuals working in a restricted area shall

a. be informed of the occurrence of radioactive materials or radiation in the area
b. be instructed in safety problems, precautions, and applicable provisions of AEC regulations and licenses
c. be advised of radiation exposure reports, on their request
d. all of the above.

20. Each AEC licensee shall maintain records of

a. radiation exposure of all individuals for whom personnel monitoring is required
b. results of surveys
c. results of leak tests
d. all of the above.

21. An individual will not be permitted to receive a whole-body exposure of as much as 1-1/4 rem per calendar quarter if his age is under

a. 25 years
b. 18 years
c. 16 years
d. 21 years.

22. The official record of an individual's dose is derived by

a. calculating his potential exposure
b. estimating how much time he spent in a Radiation Area
c. reading his film badge
d. interpreting a radiac reading.

23. A former employee may receive, under provisions of 10 CFR 20, a report of his exposure from each licensee by

a. requesting it from the licensee
b. filing a claim for it
c. taking no particular action
d. none of the above.

24. Records concerning licensed byproduct materials must be kept to show

a. effectiveness compared with previous sources
b. changes in weight and shape
c. receipt, transfer and disposal
d. none of the above.

25. With regard to byproduct material licenses, the AEC may

a. inspect the material, premises and related facilities and records
b. require appropriate tests of the material, facilities and detection equipment
c. revoke, suspend, or modify the license; or withhold or recall the byproduct material for violations of the license
d. all of the above.

26. The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing, repair, tagging, opening or any other modification of any sealed source shall be performed by

a. Health Physics Branch personnel
b. only those persons specifically authorized by the AEC to do so
c. The Radiological Protection Officer
d. any NDT Branch personnel.

27. Quality and Reliability Assurance Department INSTR ~~4730.11~~ 4730.22 is

a. not a legal requirement
b. provided mainly for supervisor personnel
c. a condition of the license
d. to be amended by the Production Officer

28. External exposure to ionizing radiation is harmful to humans because

a. it makes them radioactive
b. it ionizes the air around them, making breathing difficult
c. it damages cells inside the body
d. it is contagious.

29. A radiography source may be used in any projector

a. in which it fits
b. named in the license as corresponding to it
c. approved by a supervisor
d. none of the above.

30. Applications for byproduct material licenses are approved if the user

a. has an authorized purpose
b. is qualified by training and experience to use the material
c. has facilities and equipment adequate to protect health
d. all of the above.

31. A licensee must immediately notify the AEC by telephone and telegraph of any incident wherein a byproduct material source in his possession has caused or threatens to cause an individual to receive a whole-body exposure of

a. 25 rems or more
b. 5 rems or more
c. 3 rems
d. 1-$\frac{1}{4}$ rems.

32. The licensee is required to report to the AEC in writing within 30 days, any exposure of individual to radiation in excess of limits in 10 CFR 20 or the license. Such report must describe

a. the extent of exposure of persons
b. the levels of radiation involved
c. cause of the exposure and corrective measures taken
d. all of the above.

33. The person directly responsible to the licensee for assuring compliance with Parts 30 and 34 and the conditions of the license is the

a. Health Physicist
b. Radiological Protection Officer
c. radiographer
d. Shipyard Commander.

34. A one-hour exposure of an individual to gamma radiation intensity of 20 R/hr would cause

a. mild radiation sickness to some
b. obvious blood count changes
c. no detectable effects
d. death to half exposed.

35. A sign bearing the conventional radiation caution colors and symbol, and the words "Caution High Radiation Area" describes an area where radiation levels are such that in any one hour a major portion of the body could receive a dose in excess of

a. 50 mrem
b. 5 mrem
c. 100 mrem
d. 2 mrem.

36. The AN/PDR-27 radiac can detect

a. any kind of radiation
b. alpha radiation
c. gamma radiation only
d. beta and gamma radiation.

37. The LD/50 (median lethal dose where half of those exposed die) for ionizing radiation exposure of human beings is

a. about 800 mrem
b. unknown
c. about 500 rem
d. 5,000 rem.

38. An acute exposure is one that

a. is received by the whole body only
b. does extensive damage to the whole body only
c. is repeated at regular intervals continuously over a long period of time
d. is received within a short space of time.

39. Ionization means

a. conversion of gamma rays into a pair of subatomic particles - an electron and a positron

b. knocking an electron out of its orbit around the nucleus of an atom, leaving the remainder of the atom with a positive charge
c. disintegration of radioactive nuclei
d. the emission of fast moving particles or rays by nuclei.

40. Gamma radiation emitted from sealed radioactive sources in use on this Shipyard

a. has very high penetrating power similar to X-rays and presents the principal health hazard
b. is the principal source of internal health hazard
c. has limited penetrating power so that few escape the source capsule
d. has none of the above properties.

41. A person convicted of willful violation of any provisions of the Atomic Energy Act or any regulation or order thereunder

a. may be punished only be fine
b. may not be punished
c. may be punished by fine and/or imprisonment
d. may be punished only by imprisonment.

42. If you were told by a military or civilian supervisor, other than your immediate supervisor, to omit a safety precaution or to perform a potentially unsafe act, you would

a. comply and make a report to your supervisor
b. refer him to your supervisor
c. refuse to comply
d. comply and say nothing.

43. Byproduct material may be used for purposes other than those specified in the license if

a. strict safety precautions are observed, and Health Physics Branch is notified
b. the use is approved by the supervisor
c. all of the above measures are taken
d. you want to lose your certification quickly.

44. Leak tests (wipe tests) of radiography sources may be made

a. only as described in Q&RA INST ~~4730.11~~ 4730.22
b. by any competent radiographic personnel
c. by any NDT Branch supervisor
d. only on the graveyard shift.

45. A gamma radiation level of 1.6 R/hr is produced at 3 feet from a 1-curie cobalt-60 capsule. If a man remains 6 feet from a 10-curie cobalt-60 source for 2 hours, his approximate radiation dose is

a. 0.4 rem
b. 0.8 rem
c. 16 rem
d. 8 rem.

46. If a shield of 1/8" lead will cut the radiation to half its original value, 1/4" lead shield will

a. cut it to 1/16th of its original value
b. have no further effect
c. cut it to practically nothing
d. cut it to 1/4 of its original value.

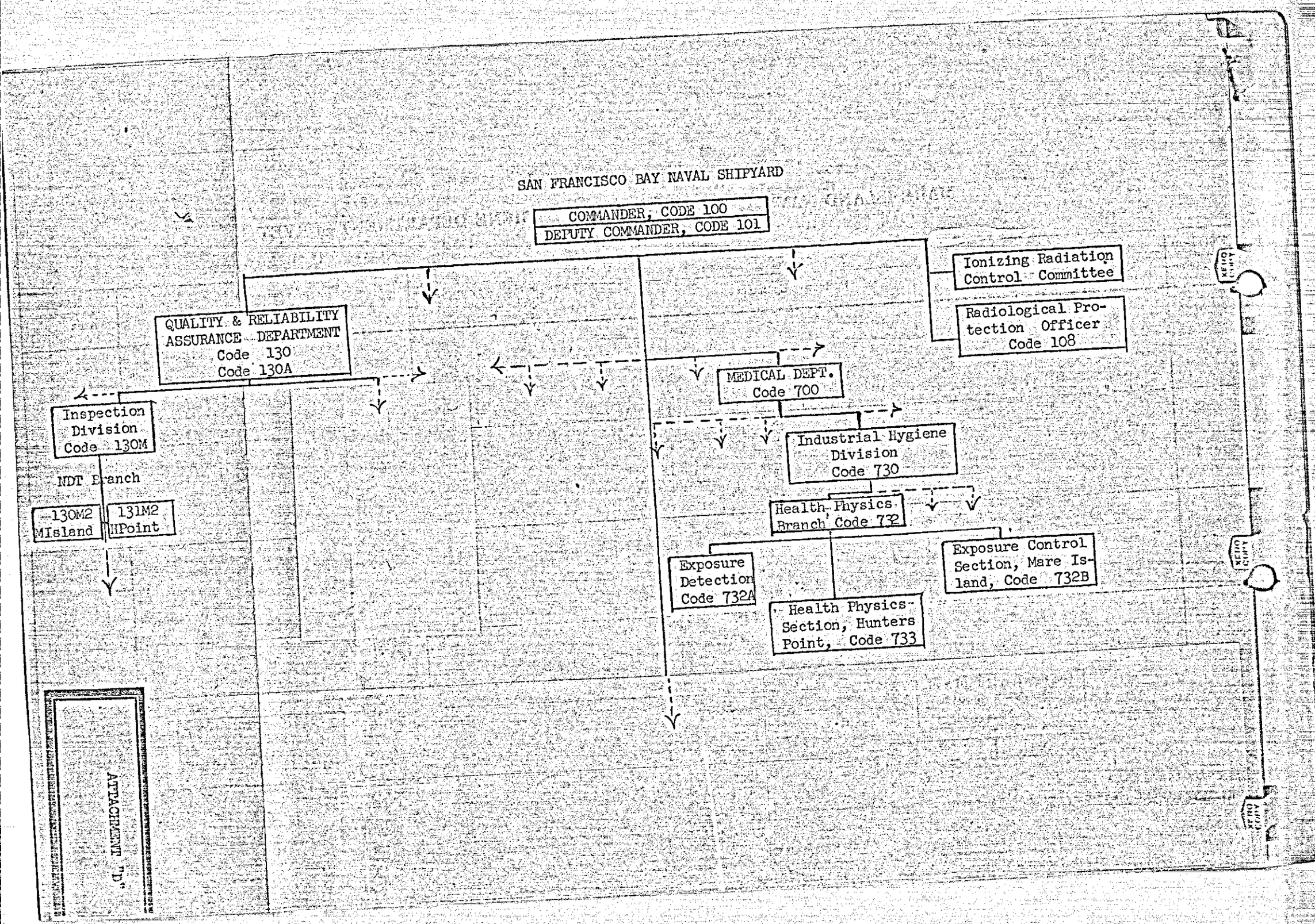
47. The radiation intensity of one curie of iridium-192 at a distance of 1 meter may be taken as

a. 100 mR/hr
b. 0.55 R/hr
c. 5.5 R/hr
d. 55.5 mR/hr.

ATTACHMENT D

INTERNAL INSPECTION SYSTEM

SAN FRANCISCO BAY NAVAL SHIPYARD



ATTACHMENT "D"

SAN FRANCISCO BAY NAVAL SHIPYARD is headquartered at Vallejo, California, and consists of the geographical areas of Mare Island, Vallejo, California, and Hunters Point, San Francisco, California. The official mission of the Shipyard is to provide logistic support for assigned ships and surface craft; to perform authorized work in connection with construction, conversion, overhaul, repair, alteration, drydocking, and outfitting of ships and craft, as assigned; to perform manufacturing, research, development, and test work, as assigned; and to provide services and material to other activities and units as directed by competent authority.

San Francisco Bay Naval Shipyard is under the command of an officer with the title Commander, San Francisco Bay Naval Shipyard, ordered by the Navy Department to command the Shipyard.

RADIOLOGICAL PROTECTION OFFICER, Code 108. As staff consultant to the Shipyard Commander, the Radiological Protection Officer is responsible for advising and reporting on all matters pertaining to radiological safety related to industrial operations. This includes the hazards of all forms of ionizing radiation with which the Shipyard may be involved, as well as the implementation and effectiveness of controls. He is available to Heads of Departments and Offices for advice and consultation, and for such special assignments as the Commander or the Deputy Commander may make. He is Chairman of the Shipyard Ionizing Radiation Control Committee, and serves as liaison officer between the Shipyard and the Atomic Energy Commission, and is custodian of AEC licenses issued to the Shipyard and all related records.

He exercises surveillance over training of personnel and compliance with Shipyard and AEC regulations, and certifies users of sources of ionizing radiation as to radiation safety competence.

The above responsibilities do not apply to work under the cognizance of the Nuclear Power Superintendent nor to sources involved in weapons programs, disasters or extreme emergencies which are covered in the Shipyard Disaster Control Plan.

MEDICAL OFFICER, Code 700. The Medical Officer is responsible to the Shipyard Commander for organization and administration of the Medical Department, providing medical care to personnel, hygiene and sanitation control.

INDUSTRIAL HYGIENE DIVISION, Code 730. Responsible to the Medical Officer for carrying out a comprehensive industrial hygiene program, including the detection, identification, evaluation and formulation of controls for all potentially hazardous occupational exposures of personnel to toxic chemical agents, harmful physical agents, infectious biological agents, and comfort factors.

Health Physics Branch, Code 732.

1. Detects, evaluates, and formulates controls for all occupational exposures of personnel to ionizing radiation.

2. Performs personnel dosimetry and maintains records for internal and external exposure.

3. Performs environmental background radioactivity survey.

4. Provides for contamination control by advising on method and performance of personnel and equipment decontamination, waste disposal, type of required protective equipment and maintenance of an inventory of radioactive sources used on the Shipyard.

5. Exercises surveillance over all monitoring for adequacy on the Shipyard by making routine and special surveys of operations and processes, by inspection of shops and industrial areas, ships, laboratories, and offices, where ionizing radiation exposures may occur.

NOTE: The above functions do not include those specifically assigned to the Nuclear Power Superintendent.

QUALITY AND RELIABILITY ASSURANCE, Code 130. The Quality and Reliability Assurance Officer is responsible to the Shipyard Commander for the organization, administration, and supervision of the Quality and Reliability Assurance Department, and for such other work as may be assigned by the Shipyard Commander.

The NDT Branches, Codes 130M2 (Mare Island) and 131M2 (Hunters Point) are components of the Inspection Division of the Quality and Reliability Assurance Department. The specific delegation of authority and responsibility for conducting the radiographic testing program is contained in Attachment B.

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