NRC Form 313 I
(12-81)
10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

1. APPLICATION FOR:
(Check and/or complete as appropriate)

	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
X	c. RENEWAL OF: LICENSE NUMBER 29-01022-07

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*
US Army Research and Development Command
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(201) 544-5292

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION
Anthony S. Kirkwood, RPO
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(201) 544-5292

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)* *(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)*
ATTN: DRDEL-SS-H
Fort Monmouth, NJ 07703

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*
Building 401, Evans Area
Fort Monmouth, NJ 07703

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	Radioactive materials are to be used by or	under the direct supervision of
b.	individuals designated by the Radiation Co	ntrol Committee, Mr. Anthony S. Kirkwood,
c.	Chairman. See Supplement A.	

7. RADIATION PROTECTION OFFICER
Anthony S. Kirkwood, RPO
Scott L. Davis, Alternate RPO

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.
See Supplement H

8. LICENSED MATERIAL

LINE NO.	ELEMENT AND MASS NUMBER A	CHEMICAL AND/OR PHYSICAL FORM B	NAME OF MANUFACTURER AND MODEL NUMBER (If Sealed Source) C — See Supplement B	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D
(1)	Cobalt 60 Source #1	Sealed sources	General Electric Co. Dwg. 985C515	
(2)				
(3)	Cobalt 60 Source #2	Sealed sources		
(4)				

&2

DESCRIBE USE OF LICENSED MATERIAL E

(1)	(1). For use in a custom designed irradiator facility for irradiation studies and
(2)	for instrument calibration.
(3)	(2). Picker Source number 2, is in permanent storage.
(4)	

EE/2

Information in this record was deleted in accordance with the Freedom of Information Act, exemptions 2+6
FOIA- 2006-0238

NRC FORM 313 I (12-81)

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	Source No. 1 (225 Ci)	See Supplement C	
(2)	Source No. 2 (698 Ci)	Edlow Lead Co. Columbus, Ohio	BE Permit No. 1462
(3)		See Supplement C	
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	See Supplement D					
(2)						
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☐ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

☒ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

See Supplement E

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☒ (1) FILM BADGE	See Supplement F	☒ MONTHLY
☐ (2) THERMOLUMINESCENCE DOSIMETER *(TLD)*		☐ QUARTERLY
☐ (3) OTHER *(Specify)*: ______		☐ OTHER *(Specify)*: ______

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☒ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS *(Include filtration, if any)*, ETC.
☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING *(fixed and/or temporary)*, ETC.
☒ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

See Supplement C

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED In accordance with Army Regulation 385-11 and instructions provided by AMCCOM, Army Agency responsible for waste disposal.

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit. See Supplement G

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc. See Supplement H.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used. See Supplement H.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, 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.

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.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* N/A	b. CERTIFYING OFFICIAL *(Signature)* Ronald W Kaese
	c. NAME *(Type or print)* RONALD W. KAESE
(1) LICENSE FEE CATEGORY:	d. TITLE Chief, Safety Office, USA ERADCOM
(2) LICENSE FEE ENCLOSED: $	e. DATE 22 May 1984

NRC FORM 313 I (12-81) GPO 886-426

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TABLE OF CONTENTS

NRC FORM 313 (I)

SUPPLEMENT A

INDIVIDUALS WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIALS

SUPPLEMENT A

SUBJECT: Individuals Who Will Use or Directly Supervise the Use of Licensed Materials
REFERENCE: NRC FORM 313 (I), Item 6

1. The use of radioactive material authorized by this license shall be limited to:

a. The Radiological Protection Officer (RPO) and Alternate RPO.

b. Individuals approved by the Radiation Control Committee (RCC).

(1) ERADCOM employees stationed at Ft. Monmouth.

(2) Non-ERADCOM employees working at Ft. Monmouth on ERADCOM research, development, and/or test programs.

2. The RCC will consist of persons working in the positions indicated below. From time to time different individuals will work in these positions.

a. ERADCOM Radiation Protection Officer at Fort Monmouth, also serves as Chairman.
Commander's Representative, Fort Monmouth.
Commander's Representative, Headquarters, ERADCOM
One (1) Representative from CSTAL.
Two (2) Representatives from ETDL.
One (1) Representative from EWL.
One (1) Representative from TSA.

b. The Radiation Control Committee shall consist of individuals with training and experience necessary to manage the radiological needs of the US Army, ERADCOM, Ft. Monmouth, New Jersey. Additional members may be appointed as necessary.

3. Before granting approval for an applicant to use radioactive materials the committee evaluates the applicants to insure they have the appropriate:

a. Experience with radiation and radioactive material.

b. Training, in the principles and practices of radiation protection, radioactivity measurement standardization and monitoring techniques of instruments, mathematics and calculations, basic to the use and measurement of radioactivity, and biological effects of radiation.

c. Familiarity with pertinent regulations and procedures.

d. To be approved by the RCC as an operator of the in-air irradiation facility, a person must have at least the following amount of training or experience.

Subject	Amount of Trng.	Type Trng.
Interaction of Radiation with Matter	2 hrs.	Lecture &/or Trng. Film
Biological Effects of Radiation	1 hr.	"
Basic Radiation Safety Criteria	4 hrs.	"
Dosimetry	1 hr.	"
Radiation Detection and Instrumentation	1 hr.	"
Radiation Protective Measures	2 hrs.	"

Above evaluated on previous training, experience and/or completion of the ERADCOM Annual Radiation Training Program. (See Enclosure 1 & 2, for outline of the programs for 1982 and 1983).

Radiation Emergencies	2 hrs.	Lecture &/or Trng. Film
Familiarization with NRC license 29-01022-07		Lecture
Familiarization with Physical Plant of Irradiator	2 hrs.	Lecture
Operation & Maintenance of Facility (instruction)	2 hrs.	Hands off on Job trng.
Operation & Maintenance of Facility (Practical Operation)	2 hrs.	Operation of facility under direct supervision

The above requirements are met by one-to-one instruction and observation from the Radiation Facility Supervisor or his designated representative.

TRAINING FOR RADIATION WORKERS
June 1 - 12:30
June 3 - (8:30)

I	WELCOMING REMARKS 12:30 - 12:40 (8:30 - 8:40)	Mr. Ronald W. Kaese, Chief, Safety, HQ ERADCOM
II	LECTURE	Dr. Stanley Kronenberg
	TOPIC	Radiation Protection I a. Types Of Radiation b. Measuring Radiation c. Isotopes, Radioactivity d. Shielding, Distance And Avoiding Ingestion Of Radioactive Isotopes
	BREAK	10 Minutes (Coffee and Doughnuts)
III	LECTURE 1:30 - 2:00 (9:30 - 10:00)	Mr. Ron W. Kaese, Chief, Safety, HQ, ERADCOM Dr. Stanley Kronenberg Radiation Protection II a. Techniques of Radiation Surveillance 1. Film Badges 2. Dosimeters 3. Survey Meters b. NRC Federal and other regulations governing possession, use, storage and disposal of Radiation material.
IV	VIDEO 2:05 - 2:40 (10:05 - 10:40)	A. Working With Radiation and Protecting Yourself. B. Working With Radiation and Protecting the Unborn
V	LECTURE 2:40 - 3:10 (10:40 - 11:10)	Risks From Occupational Radiation Exposure. Dr. Johnson D. Choppala, Health Physicist, HQ ERADCOM
VI	TEST 3:15 - 3:30 (11:15 - 11:30)	
VII	CLOSING REMARKS AND CERTIFICATES 3:45 - 4:00 (11:45 - 12:00)	Mr. Ronald W. Kaese, Chief, Safety HQ ERADCOM

Encl 1

1983

Annual Radiation Training and Review

I. Welcome & Remarks — * Health Physicist, ERADCOM

II. Lecture, Radiological Health I. — *

a. History.
b. Atomic theory.
c. Types of radiation.
d. Units of radiation measurements.
e. Interaction of radiation with matter.
f. Biological effects of radiation.

Break

III. Lecture, Radiological Health II. — *

a. Risks from occupational radiation exposure.
b. Regulatory organizations.
c. Radiation monitoring, personnel/public.
d. Operational surveillance.
e. Instrument calibration.
f. Nuclear waste and storage.

Break

IV. Radiology and Civil Defense — Dr. Stanley Kronenberg

V. Test

VI. Closing remarks. — *

Encl 2

SUPPLEMENT B

DRAWINGS OF SOURCES

Supplement B

SUBJECT: Cobalt 60 Sealed Sources

1. Reference: Form NRC 313, Item 8C.

2. Sealed source drawings are attached in figures B1, B2, and B3, for details of construction of sources.

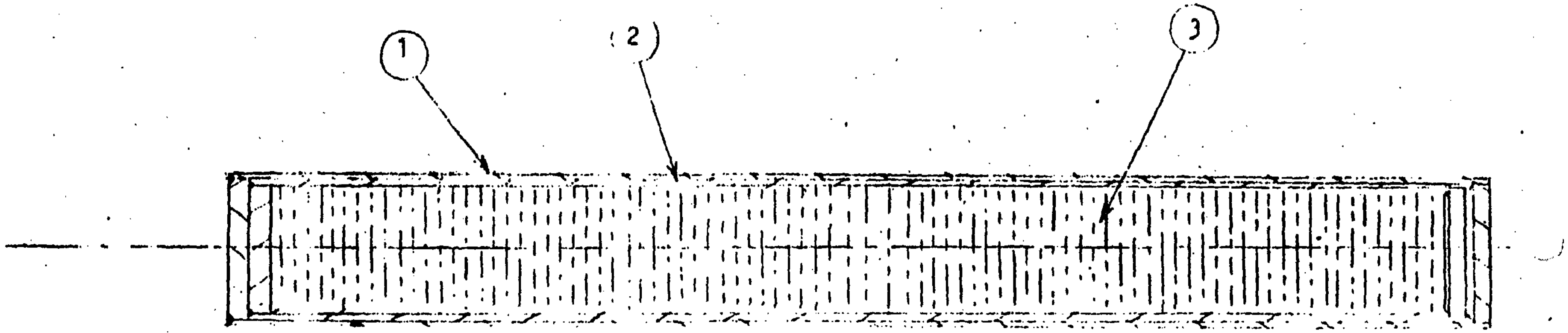
3. The manufacturer of Source 1, is USRC. The design of the source is as specified in General Electric drawing, 985C515.

4. The manufacturer of Source 2, is Picker Corp. The design of the source is as specified in Picker Corporation drawing, dated 3 May 1962, and titled "Brookhaven Proposal # 1".

5. Source activity as of 29 April 1984:

   a. Source No. 1, 225 Ci

   b. Source No. 2, 698 Ci



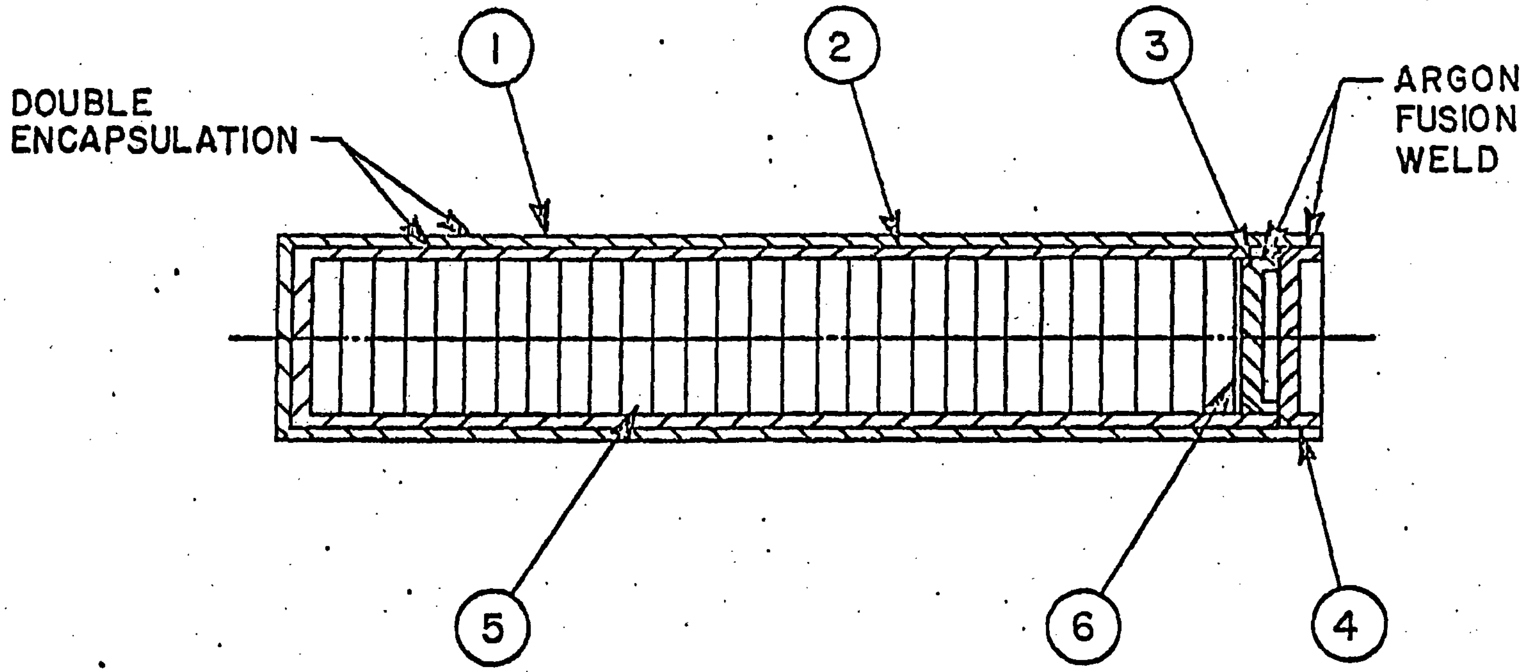
1. Outer Can, Type 347 Stainless Steel

2. Inner Can, Type 347 Stainless Steel

3. Cobalt-60 Standard Wafers

Source is doubly encapsulated by welding. Outside dimensions of external capsule is 0.935 inch outside diameter by 7.570 inch long. Capsule walls are 0.035 inch thick.

Figure B-1.



1. OUTER CAN, 304L STAINLESS STEEL
2. INNER CAN " " "
3. INNER CAP " " "
4. OUTER CAP " " "
5. WAFER, NICKEL PLATED COBALT
6. SPRING, 020 DIA WIRE STAINLESS STEEL

FIG B-3 COBALT 60 SEALED SOURCE [ ] Ex 2

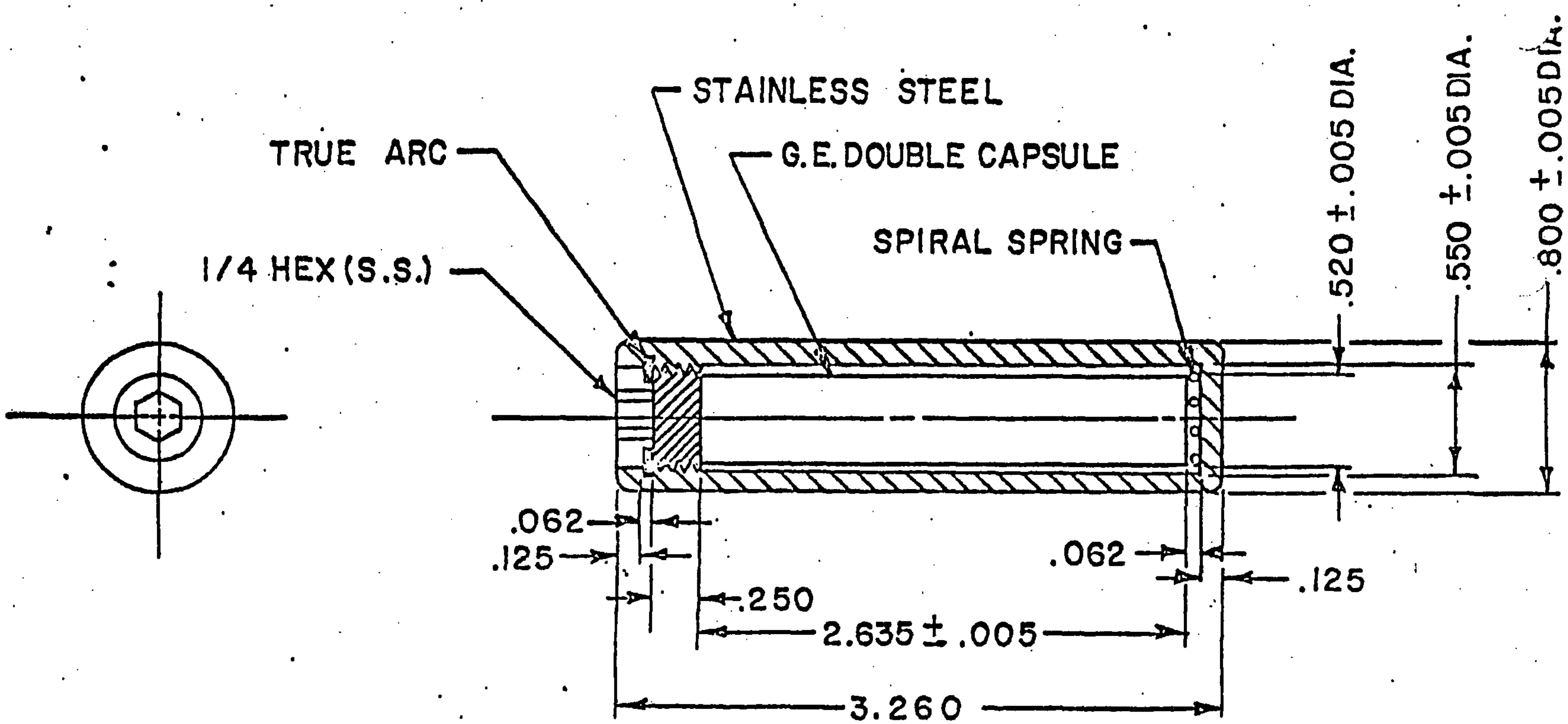


Fig. B-4 . OUTER CAPSULE FOR [ ] (Source 1)

ξ2

1789

SUPPLEMENT C

STORAGE OF SEALED SOURCES AND FACILITIES AND EQUIPMENT

Supplement C

NRC 313, Items 9A,B,C and 13 a,b,c

The following facilities and containers are described:

I. [ ] - Isotope Storage Vault

II. [ ] Ex 2

III. Underground Vault

I. Material Storage Vault, [ ] Ex 2 (Sketch on page C-4)

Drawing, Fig. C-1, shows the radioactive material storage vault. This building is used to store radioactive materials and radioactive waste.

II. [ ] Ex 2 (Sketch on page C-5)

Drawing, Fig. C-2, shows the decontamination room and processing room located in [ ] Ex 2 The processing room is provided with remote handling equipment, glove box, and ventilated hood (100 linear feet per minute across opening when half open). Cover-alls, surgical caps and gloves, and booties are also available in various sizes. All work surfaces are stainless steel designed to contain spills.

The decontamination room contains a shower, sink, absorbent paper with waterproof backing, and decontamination chemicals. Sewage is stored in an underground tank and the controls for dilution, before permitting it to enter regular sewage, are located in the processing room.

Lead bricks are available for shielding radioactive materials while under hood, in glove box, or on other work surfaces, or for temporary storage while waiting use.

III. Underground Vault

1. The location of the underground area, consisting of the Vault Console and Exposure Room, in relation to the remainder of [ ] is shown in Fig. C-3. Ex 2

2. The Vault Exposure Room (see Fig. C-4 & C-5) was designed for the use of a [ ] cobalt-60 sealed source. Ex 2 The figures show the 18" thick wall that extends the maze 5'4" into the Vault Exposure Room. Interlocking ferrite bricks were used in the construction of the wall. The ferrite block used on each side of the Zinc Bromide Window in the wall, between Vault Console and Exposure Room, is also shown in the same figures.

3. Fig. C-6 shows the relative locations of the various alarm sensors, a warning light that is lit when either source is "up" and other pertinent components. Other warning lights that are lit when either source is "up" are located on top of the earth mound (Fig. C-5), in the hall at the top of the stairs, and on the control console.

4. The components shown in Fig. C-7 and C-8 and the pneumatic and electrical systems (see Fig. C-9 & C-10) make up the storage and use device for the . The Shield and Rise Tube Adapter of the Rise Tube Assembly shown in Fig. C-8 fits into the plug well, Item 3 of Fig. C-7. The Rise Tube Assembly is held in place by a Plug Plate that fits over the shoulder of the Shield and Rise Tube Adapter and the top of the Primary Source Storage Shield. The Plug Plate is held down by nuts screwed onto the stainless steel lugs (see item 4 of Fig. C-7). The Rise Tube Extension is screwed and bolted onto the top of the Rise Tube. (Fig. C-8).

5. An assembly which raises the lead storage plug for the source (shown in Fig. C-8b) is mounted on the wall containing the zinc bromide window. After a 10-second warning period, the motor-driven spool raises the plug. A magnetic clutch releases to lower the plug.

6. The electrical control system schematic is shown in Fig. C-10. The electrical interlock system will cause the source and its shielding plug, to be lowered into its Source Storage Shield if:

a. The maze door is opened,

b. The zinc bromide in the observation window is low.

c. The radiation level in the Console Room is above 1.0 mR/hr or the monitor is off, or,

d. The remote control switch in the Exposure Room or the main control switch in the control room, are switched to the "down" position.

e. An electrical power failure occurs.

f. The wooden barrier, past the lead door, is in the vertical position.

g. If the electrical lock on the lead door is open.

The connection TB 4-5 (Fig. C-10) was closed when the system was tested with a dummy source; however, now this connection is open so that the sources cannot be raised from inside the Exposure Room.

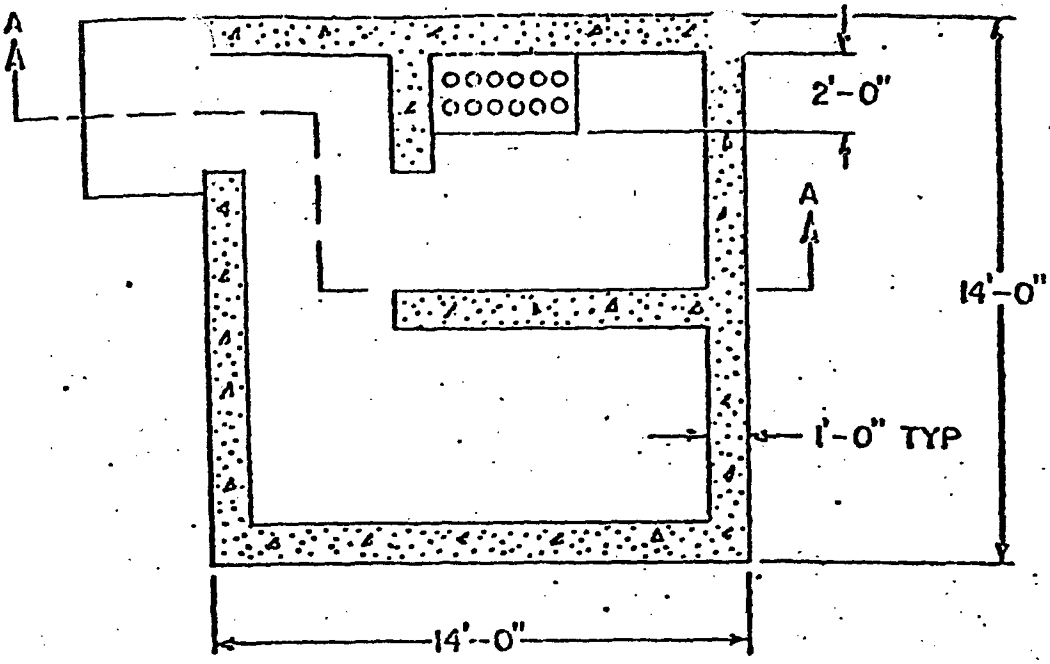
7. A pair of Argonne Type D-8 Slave manipulators (see Fig. C-5) is installed to move the equipment located in the Exposure Room while the operator is in the Control Room.

8. The sump in the Exosure Room is connected to the radioactive waste dilution system in Building S-45. (Described on Page C-1)

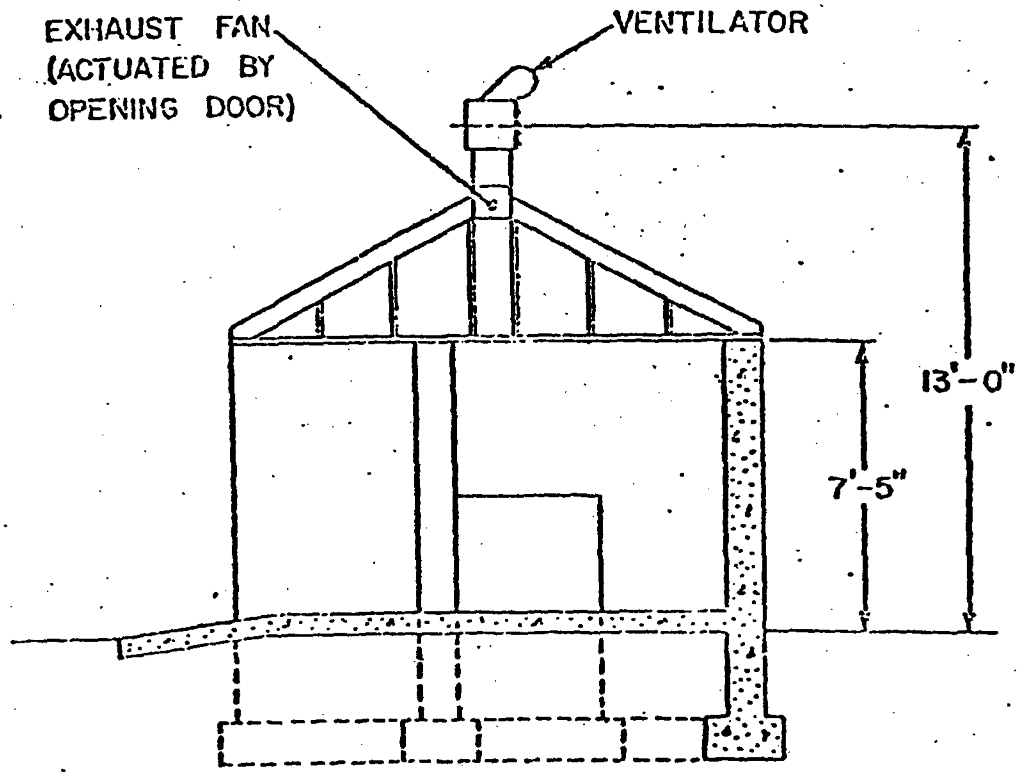
9. An alarm bell rings if the radiation level in the Console Room goes above 1.0 mR/hr. The alarm bell is audible throughout Building 401.

10. The pneumatic control system is shown in Fig. C-9. The hand operated valves (in the Console Room) in the up line, allow either or both sources to be raised for use when the system is in operation.

11. The components shown in Figure C-11 make up the storage/shipping container for Source Number 2 (698 Ci), which is in permanent storage.



FLOOR PLAN



SECTION A-A

82 FIG. C-1 [ ] RADIOACTIVE STORAGE VAULT, EVANS AREA

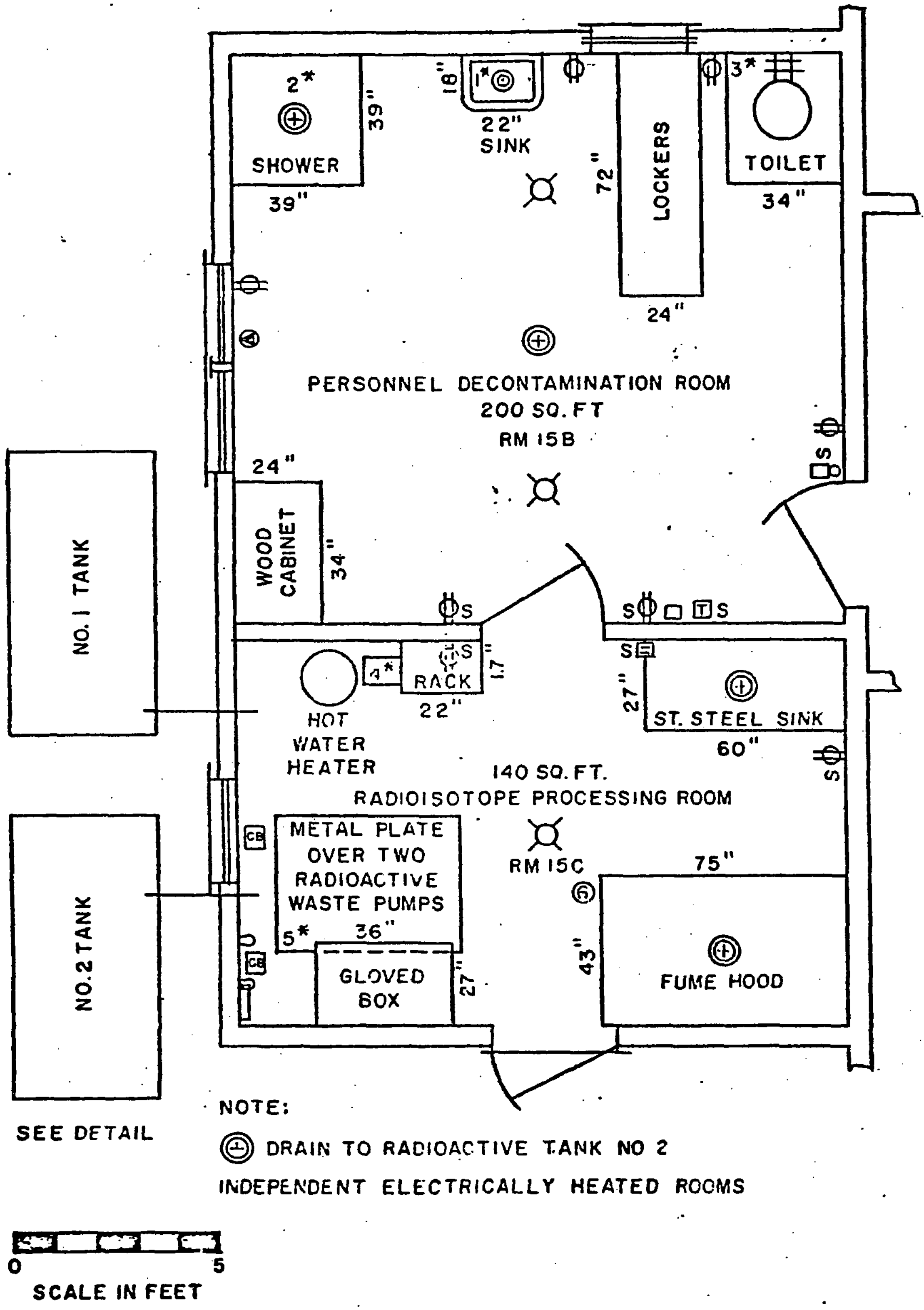


FIG. C-2 . DECONTAMINATION AND PROCESSING ROOMS, [ ] EVANS AREA S2

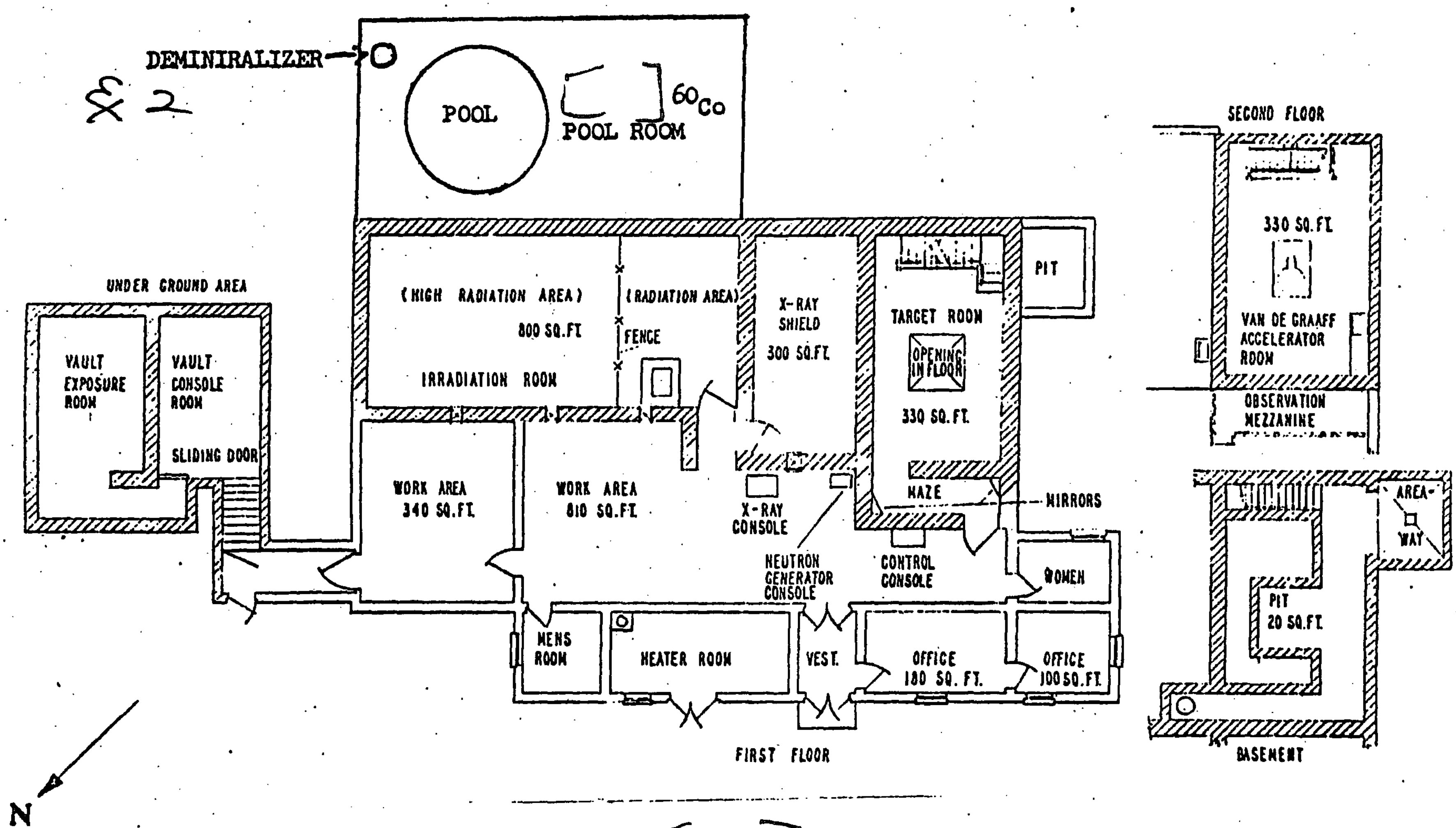


Fig. C-3. [ ] EVANS AREA

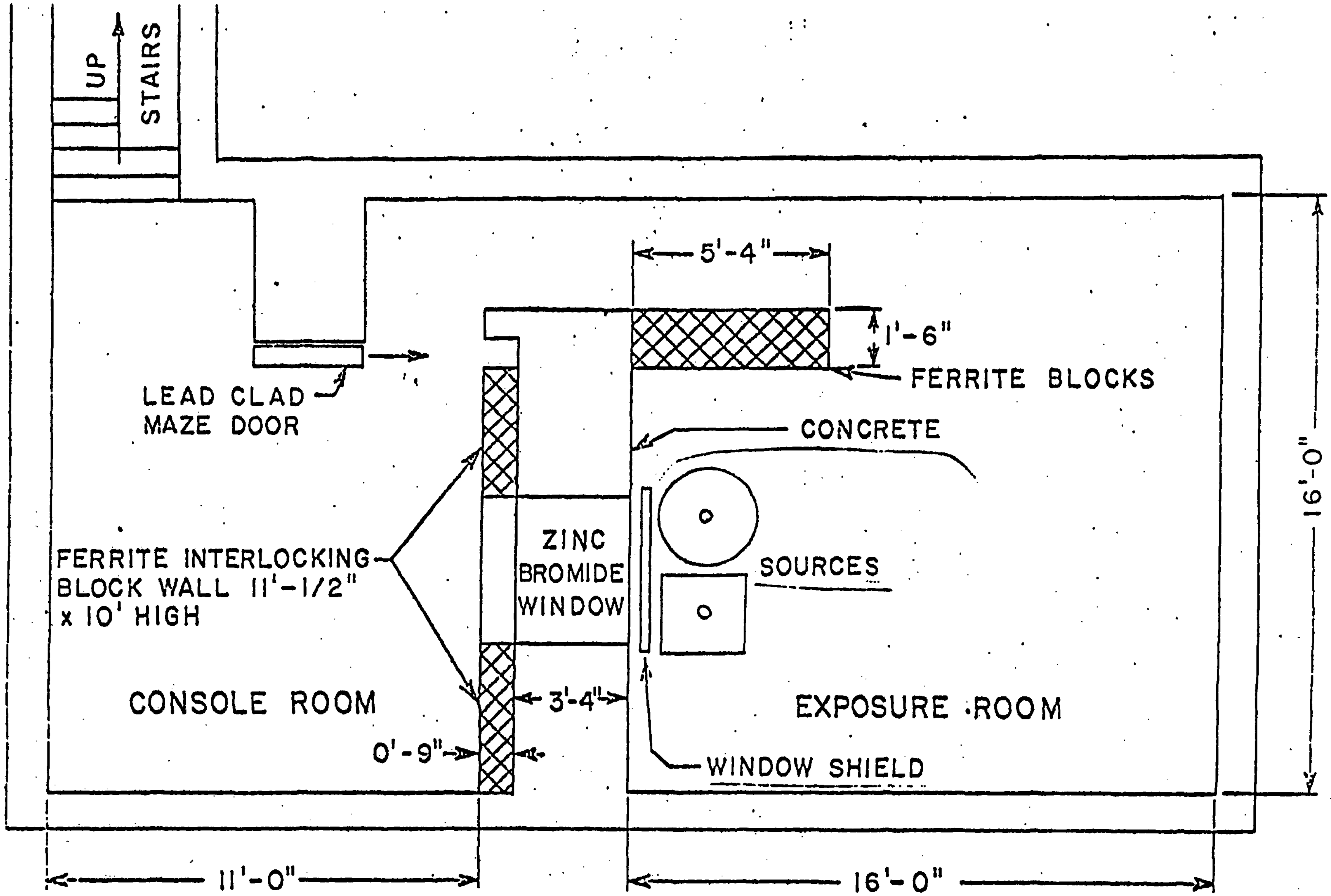


FIG. C-4. PLAN VIEW UNDERGROUND VAULT

SCALE ¼" = 1' - 0"

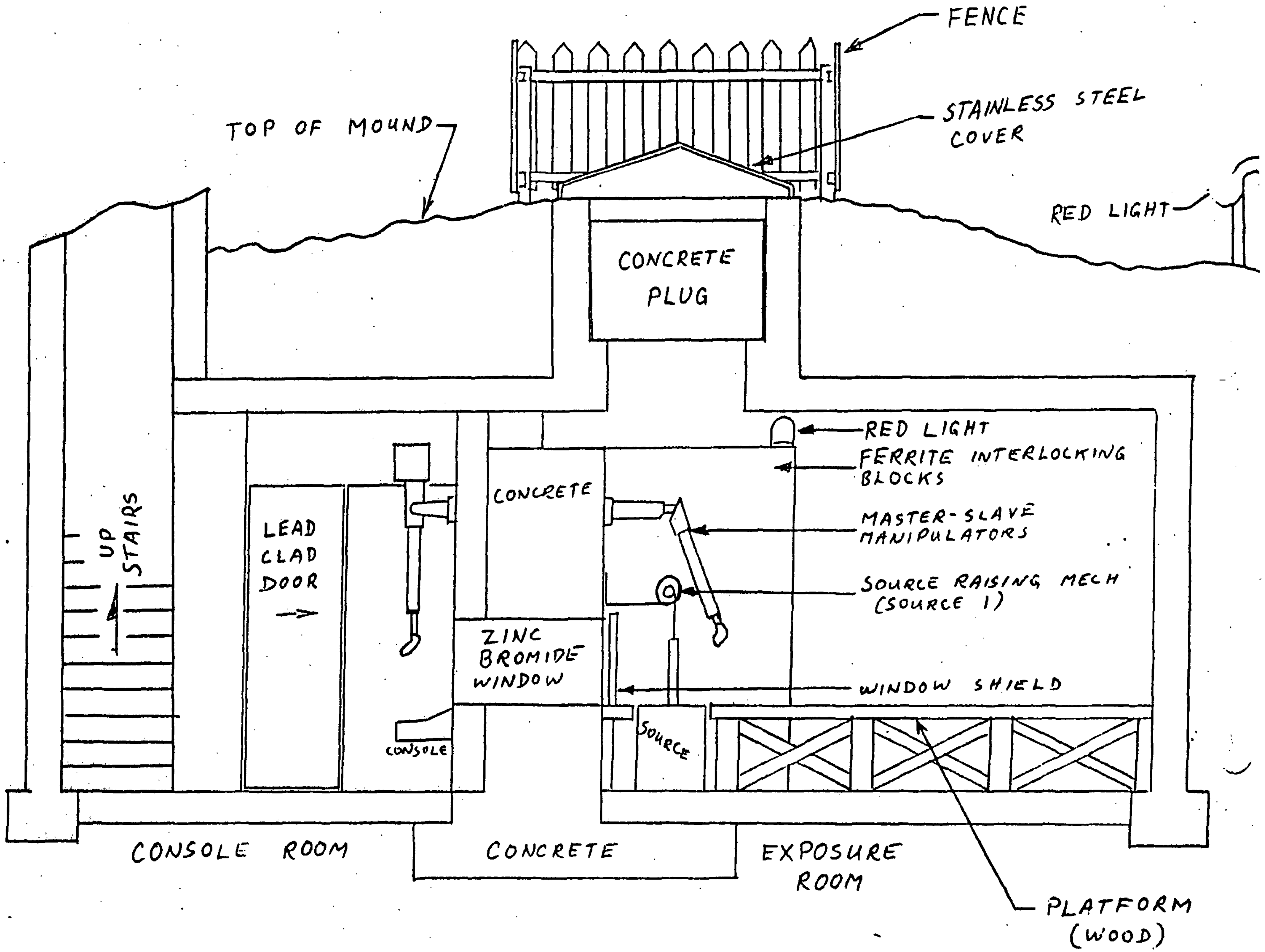
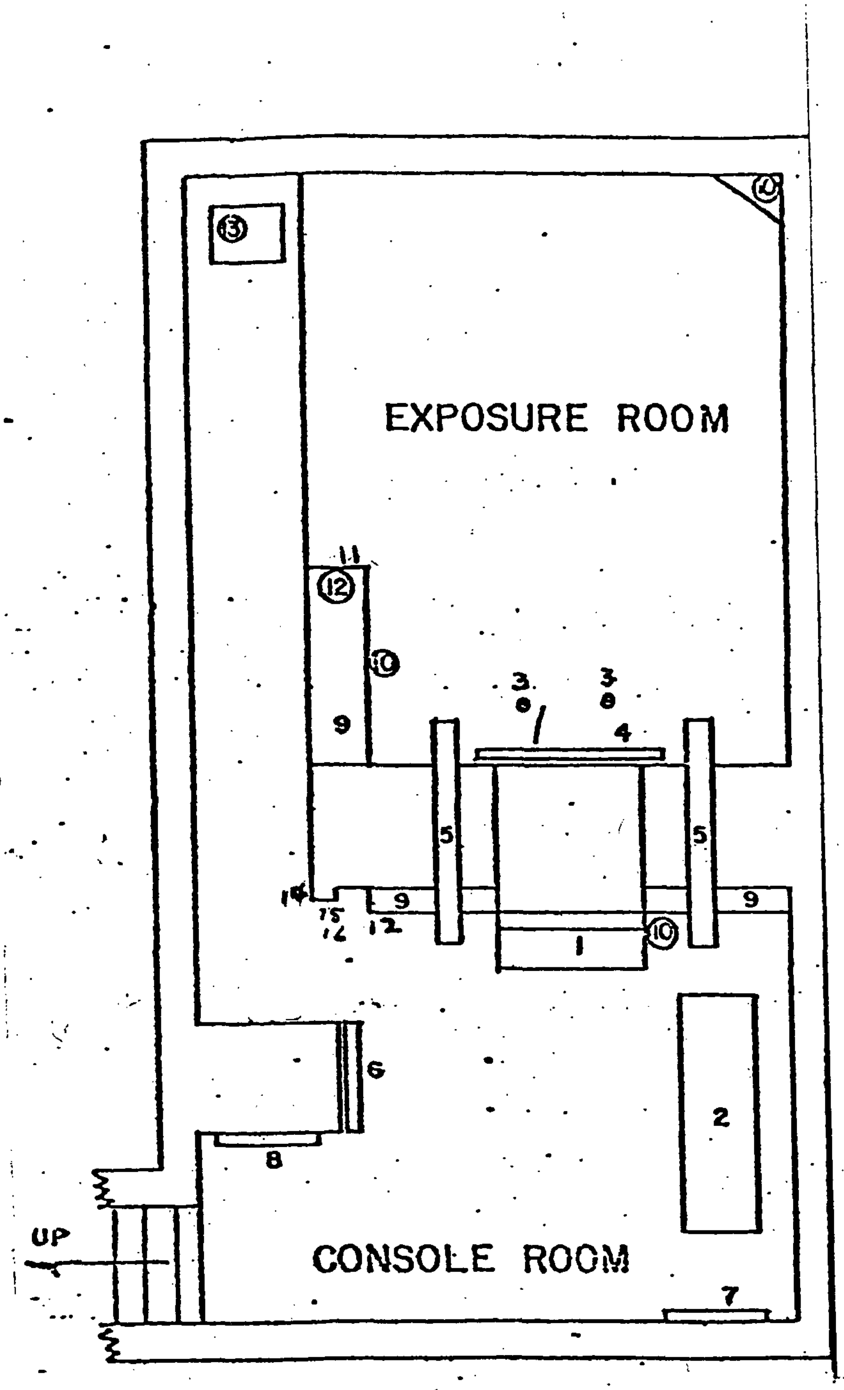


FIG. C-5 ELEVATION VIEW UNDERGROUND VAULT



1. CONTROL CONSOLE
2. MONITOR CONSOLE
3. SOURCE POSITION
4. WINDOW SHIELD
5. SLAVE MANIPULATORS
6. MAZE DOOR (lead lined)
7. PNEUMATIC CONTROL SYSTEM
8. ELECTRICAL PANEL
9. FERRITE INTERLOCKING BLOCK
10. RADIATION ALARM SYSTEM
11. MANUAL EMERGENCY SWITCH
12. WARNING LIGHT
13. SUMP PUMP
14. WOODEN BARRIER WITH SWITCH
15. MAZE DOOR SWITCH
16. MAZE DOOR ELECTRIC LOCK WITH SWITCH

FIG. C-6 UNDERGROUND VAULT INSTRUMENTATION

SCALE $\frac{3}{16}$" = 1'

1. AISI 1/4" TYPE 316 STAINLESS STEEL (ANNEALED, PICKLED & OILED)
2. STAINLESS STEEL ARC WELDING (ALL WELDING)
3. PLUG WELL 3" I.D. X 12 $\frac{1}{2}$" DEEP
4. STAINLESS STEEL LUGS FOR PLUG PLATE
5. 1" DIA. STAINLESS STEEL RODS
6. LIFTING HOLES
7. THREADED PLATE
8. BASE MOUNTING
9. PLUG PLATE

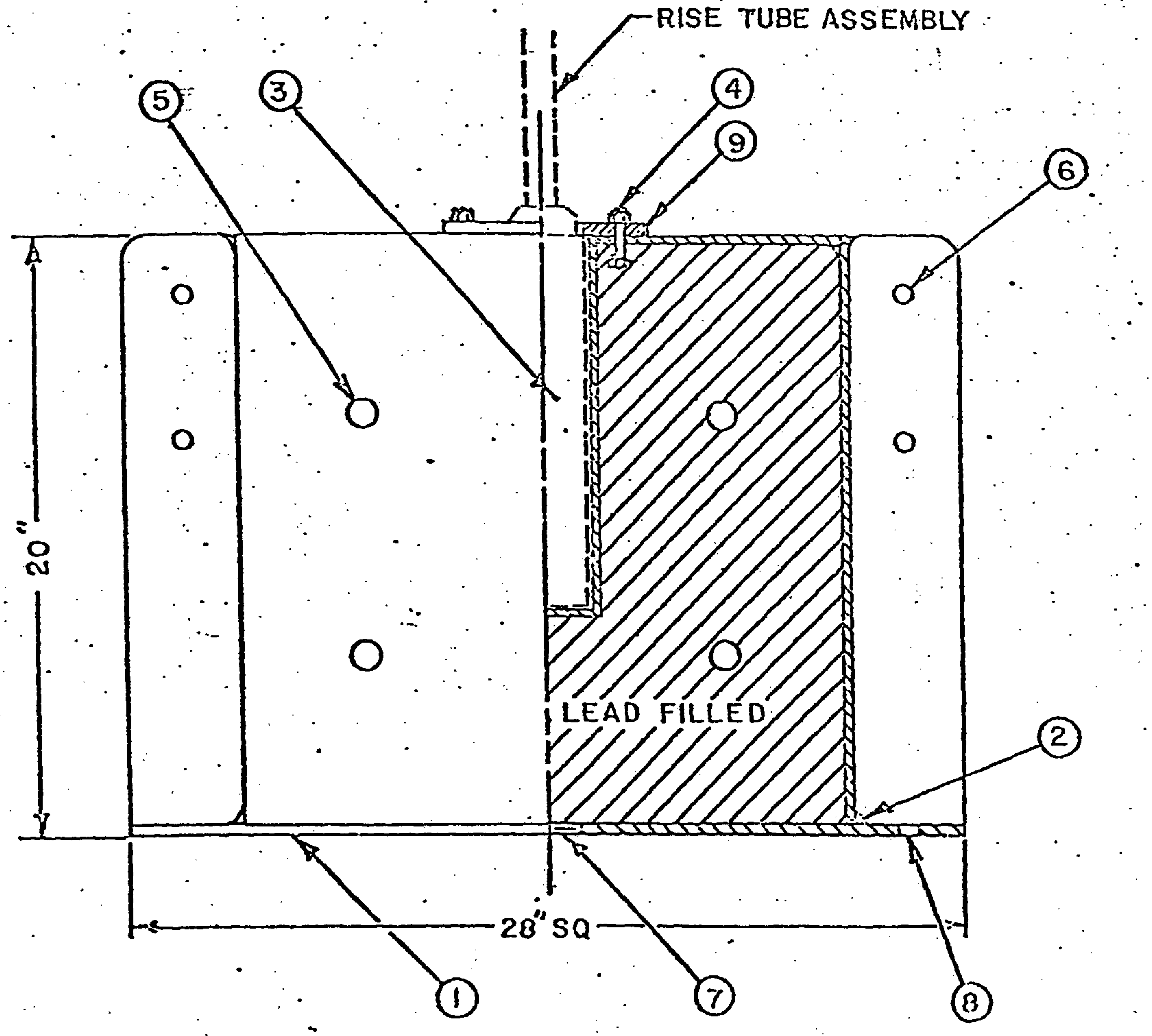


FIG. C-7 , PRIMARY SOURCE STORAGE SHIELD
SOURCE 1

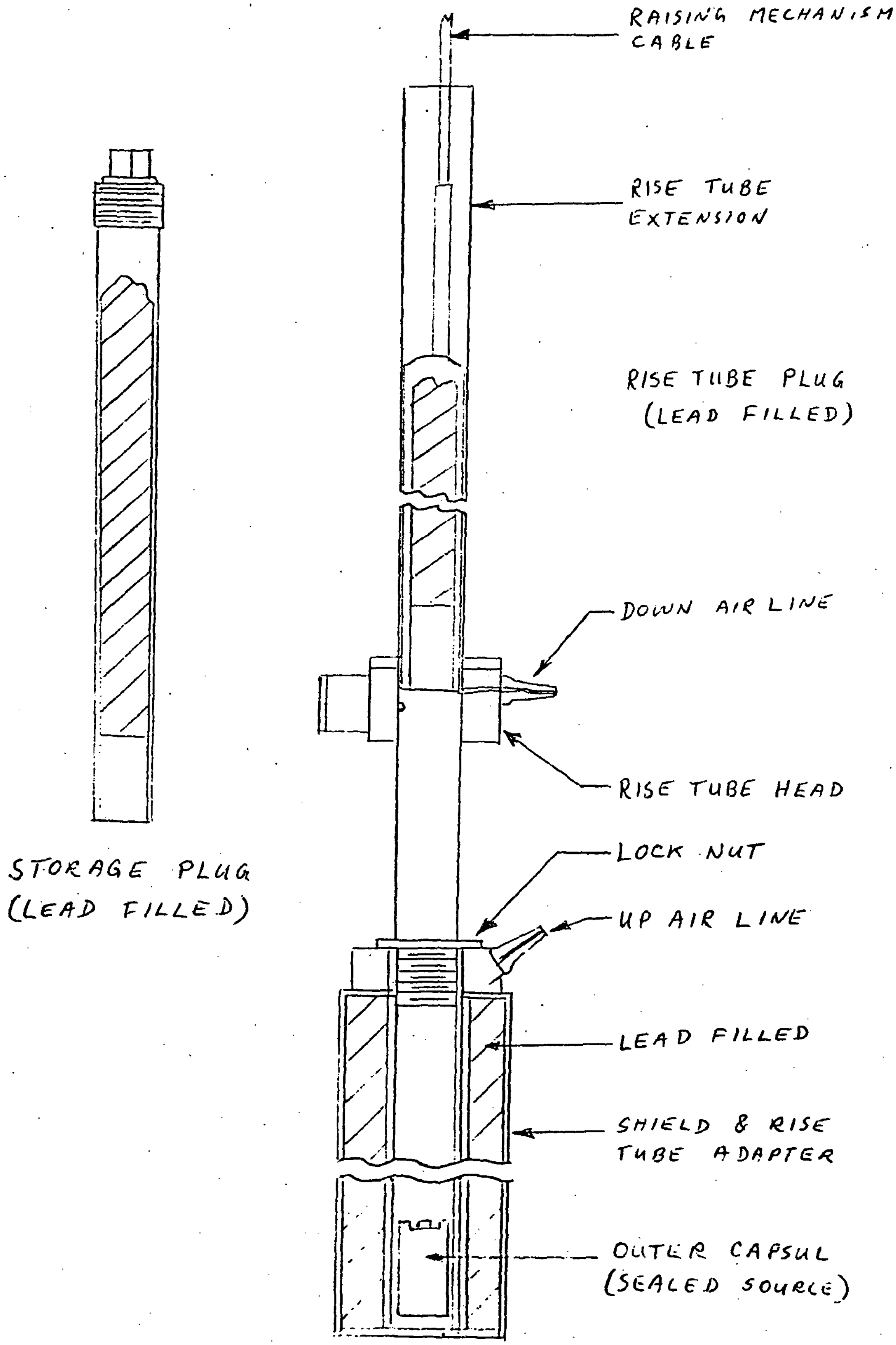


FIG. C-8a CAPSULE & RISE TUBE ASSEMBLY
SOURCE 1

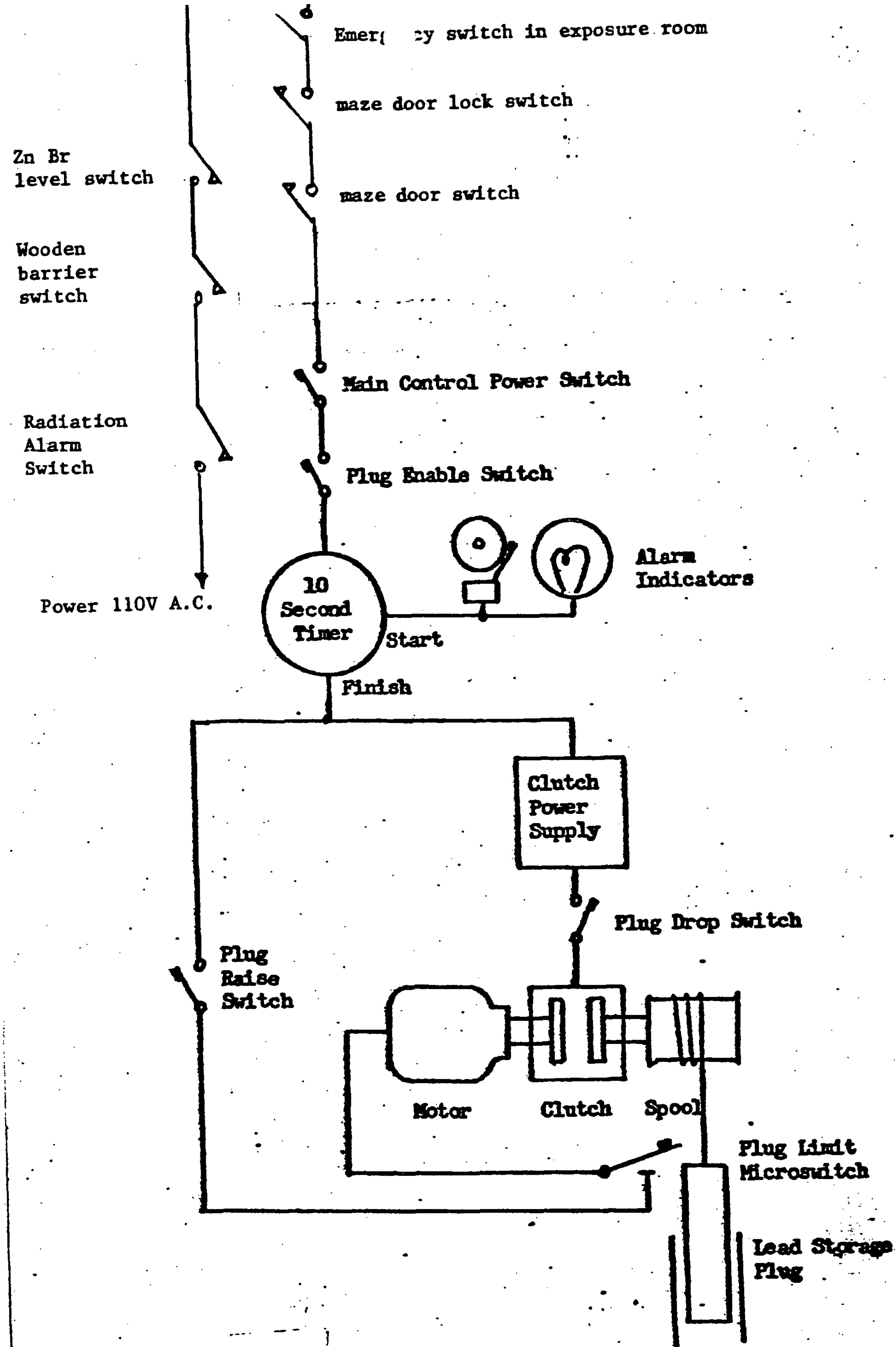


Figure C-8b SCHEMATIC OF STORAGE PLUG CONTROL MECHANISM (SOURCE 1)

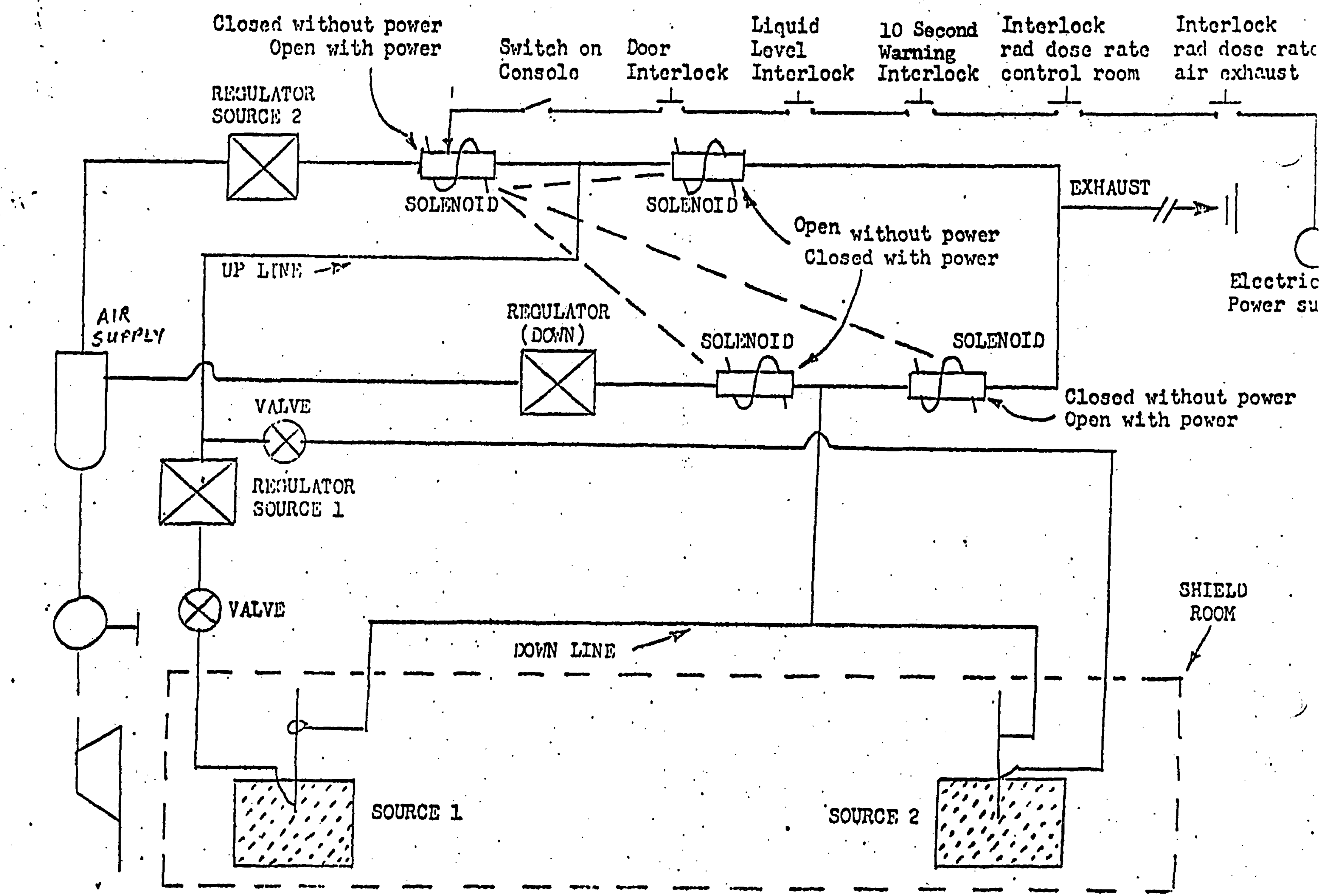
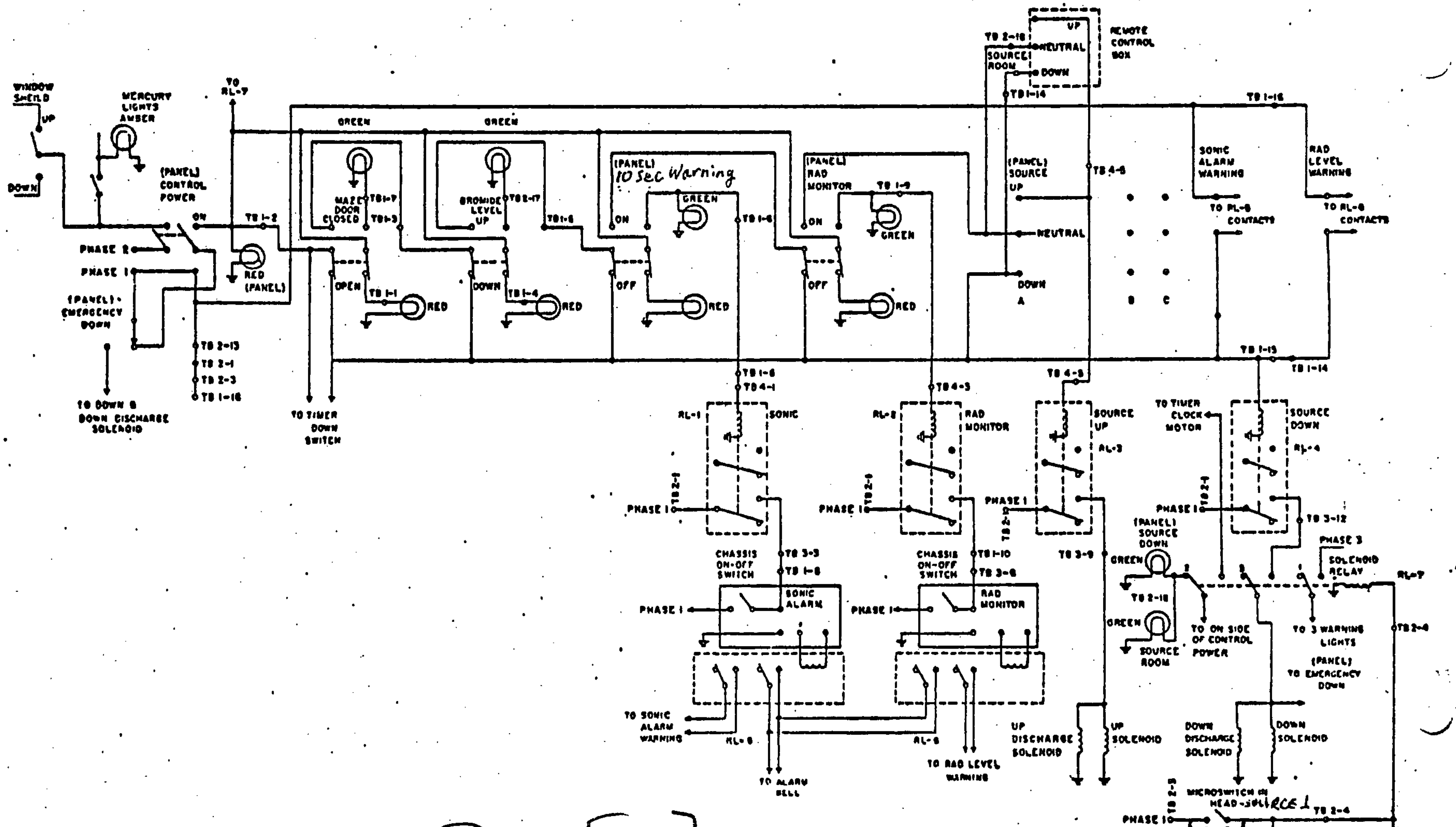


FIG. C8a PNEUMATIC CONTROL SYSTEM.

SOURCE 1 [redacted] SOURCE

ℰ2



X2 [ ] UNDERGROUND VAULT
SCHEMATIC DIAGRAM
FIG. C-10

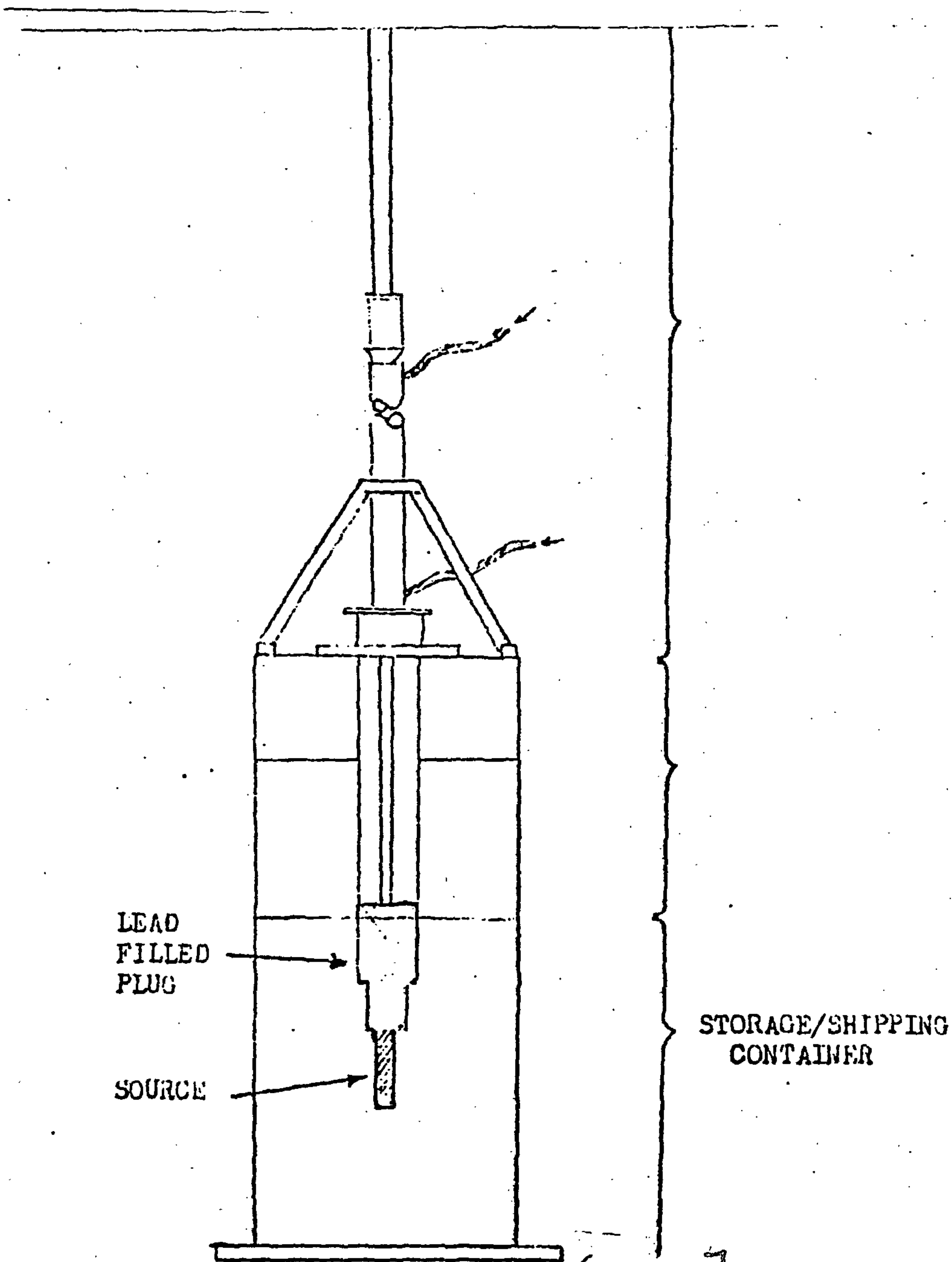


Figure C-11 source. Ex 2

Source in down (storage) position.

(This source is disconnected and cannot be operated)

SUPPLEMENT D

RADIATION DETECTION INSTRUMENTS

SUPPLEMENT D

SUBJECT: RADIATION DETECTION INSTRUMENTS
Reference NRC FORM 313 (I), Item 10

TYPE	NUMBER AVAILABLE	RADIATION DETECTOR	SENSITIVITY	WINDOW THICKNESS mg/cm^2)	USE
Victoreen 440	2	B,G	0-300 mR/hr	0.0005" mylar	Survey Measurement
Ludlum Model 28	1	B,G	500K CPM	NA	Survey
Eberline RD-15, MS-3 & HP 190	1	A,B,G	six digits CPM	1.4-2.0mg/cm^2	Measurement
Beckman LS-1000	1	B	10^6CPM	NA	Measurement
Victoreen R-Meter	1	Gamma	NA	NA	Calibration
Nucleus	1	A,B,G	10^5CPM	2.3mg/cm^2	Measurement
Tracor Northern 1705 1024-channel multi-channel analyzer	1	NA	NA	NA	Calibration Identification
Direct Reading Victoreen Pocket Dosimeters Model 541R	2	Gamma	0-200mR	NA	Monitoring
Direct Reading Pocket Victoreen Dosimeters Model 656-R	2	Gamma	0-500mR	NA	Measurement
Victoreen 440RF	2	Gamma	0-300mR/hr.	1mg/cm^2 mylar & 0.005" magnesium	Survey Measurement

RADIATION DETECTION INSTRUMENTS

TYPE	NUMBER AVAILABLE	RADIATION DETECTOR	SENSITIVITY	WINDOW THICKNESS (mg/cm^2)	USE
Victoreen 740-Cutie Pie	2	Alpha, Beta, Gamma	0-2500mR/hr	0.005"mylar	Measurement
Nuclear Chicago 2671	2	Neutron	0-25,000 CPM 0-7.5K $n/cm^2/Sec$	BF_3	Survey Measurement
Radiac IM-141 PDR-27J	2	Beta, Gamma	0-500mR/hr	GM Tube	Survey
Eberline Corp. E-530	1	Beta, Gamma	0-200mR/hr	GM Tube	Survey
Ludlum 5	4	Beta, Gamma	0-1000mR/hr	GM Tube	Survey
Baird-Atomic 420-E	2	Alpha, Beta, Gamma	0-125 mR/hr 0-50,000 CPM	GM Tube	Survey
Baird Atomic Chirpee-904517	3	Gamma	1 chirp/0.1mR	GM Tube	Warning
Atomic Accessories Chirpee-PRM-253	5	Gamma	1 chirp/0.1mR	GM Tube	Warning
Eberline PRS-1 "Rascal Kit"	1 Kit	Alpha, Beta, Gamma	10^6CPM	3 GM Tubes & 3 Scintillation Crystals	Survey Measurement
Harshaw TASC-12 Low Background Counter	1	Alpha, Beta, Gamma	10^6CPM	Phoswich(CaF^2 vs NaI detector	Measurement

SUPPLEMENT E

INSTRUMENT CALIBRATION

SUPPLEMENT E

SUBJECT: Instrument Calibration
Reference: NRC FORM 313 (I), Item 11

1. Survey instruments that respond to Gamma radiation are calibrated for gamma response in a standard gamma flux, obtained from an AN/UDM-1 (Co-60) or an AN/UDM 1A (Cs-137) calibrator. The calibrators are calibrated annually with Victoreen-R meters. The R-meters are calibrated by NBS and certified to 3%. The source intensities are corrected every two months for decay.

2. Two Army Radiac Calibrators, AN/UDM-6, containing four standard Plutonium sources, are available for calibrating alpha instruments.

3. Counting systems for determining the amount of radioactive material present in samples, are calibrated with commercially available reference sources, accurate to $\pm$7% or less. The commercial firms warranty traceability of calibration of the sources to the NBS. The quality control consists of:

a. chi-square tests to determine system reliability.

b. known sample counts plotted on each instrument.

c. efficiency determinations on each system utilized.

4. An NBS calibrated Ra-226-Be, neutron source of 2.92 mCi ($\pm$3%) is available to calibrate neutron instruments.

5. Calibrations are performed after instrument maintenance procedures have been completed which may result in an improper radiation field indication and at three month intervals.

6. Instruments may also be sent to Federal and commercial facilities for NBS traceable calibrations.

7. Pocket Dosimeters are calibrated semi-annually with either source referenced in 1, above. Indications are made for percent deviation and electrical leakage.

SUPPLEMENT F

PERSONNEL MONITORING DEVICES

SUPPLEMENT F

SUBJECT: Film Badges, Dosimeters, and Bio-Assay Procedures Used
REFERENCE: NRC FORM 313 (I), Item 12

1. US Army, Lexington-Bluegrass Depot Activity, Film Badge Service is used for personnel monitoring on a monthly basis and on an as-needed-basis, for visitors.

2. Film badges and/or quartz-fiber dosimeters and survey instruments are utilized as needed for visitors and RD&E radiation workers in high radiation areas.

3. Individuals working in high radiation areas may also wear audible personnel monitors, known as "chirpees", or other similar type devices.

4. Bio-assay services are available from the Army Surgeon General, as required.

SUPPLEMENT G

RADIATION PROTECTION PROGRAM

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGO

REFERENCE OR OFFICE SYMBOL	SUBJECT
DRDEL-SS-H	Radiation Protection, Combined Directive

TO All Elements of
TSA
CSTAL
ETDL
EWL

FROM Cdr TSA
Cdr CSTAL
Dir ETDL
Dir EWL

DATE 15 Dec 1983 **CMT 1**
Renne/mnp/65292

1. POLICY

a. It is the policy of the Commander/Directors that radiation sources be used in a fashion which protect personnel from unwarranted radiation exposure and will maintain radiation exposures at a level as low as reasonably achievable.

b. Radiation sources will be used with the understanding that their procurement and utilization shall be in accordance with Radiation Safety Procedures (copy attached). Any questions concerning the interpretation of procedures will be brought to the attention of the Radiological Protection Officer (RPO) for assistance and guidance.

2. DISCUSSION

a. These procedures apply to all addressee organizational units and individuals who procure, possess, use, store, transfer, or dispose of radiation sources, i.e., radioactive material with an activity of one microcurie or greater, and ionizing radiation protection devices.

b. Responsibilities and procedures governing the radiation protection program are described in the enclosure.

3. REFERENCES

a. Code of Federal Regulations, Title 10 and 49.

b. US Nuclear Regulatory Commission Guide 8.10 September 1975 (A.L.A.R.A.)

c. AR 40-14

d. AR 385-11

e. DARCOM-R 385-25

f. DARCOM-R 385-29

g. ERADCOM-R 385-25

LEE S. REED COL, SC Deputy Commander for Administration	THOMAS E. DANIELS Acting Dir CSTAL	MAX ADLER Acting Dir EWL	CLARE THORNTON Dir ETDL

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ENCLOSURE 1

CHAPTER 1

Responsibilities

1. The Chief, ERADCOM Safety Office, has the responsibility for establishing an effective Radiation Protection Program in coordination with laboratory directors. For this purpose, he will appoint a Radiation Protection Officer to develop and coordinate safety policies and procedures among various users of radiation sources, in accordance with ERADCOM 385-1.

2. The Radiation Protection Officer is responsible for:

a. Staff supervision of the Radiation Protection Program, including authority to order temporary suspension of hazardous operations.

b. Advising the Commander TSA and Laboratory Directors on the degree of hazards associated with ionizing radiation and the effectiveness of measures to control these hazards.

c. Performing inspections to insure compliance with provisions of NRC licenses and applicable Army regulations.

d. Maintaining the inventory of radiation sources and radioactive materials, including both materials licensed by NRC and those requiring DA authority.

e. Coordinating purchases of radioactive material to assure compliance with NRC licenses or DA authorizations.

f. Serving as Chairman for the ERADCOM, Fort Monmouth Radiation Control Committee.

g. Coordinating submittal of applications for renewal or amendment of NRC licenses and DA authorizations and for issuing permits to use radiation sources.

h. Maintaining a library of current regulations pertinent to the Radiation Protection Program, which will be furnished on request to persons covered by this regulation.

3. The Industrial Safety Officer is responsible for providing assistance and advice on general safety matters in relation to the radiological safety programs.

4. The Chief, Logistics Management Division, TSA, is responsible for assuring that all purchases for items containing radioactive material, X-rays, lasers, or other radiation sources have been cleared through the Radiation Protection Officer

5. The Chief, Logistics Management Division, TSA, is also responsible for prompt notification of the Radiation Protection Officer when radiation sources are received. Items will be picked up by the user after check by the Radiation Protection Officer.

6. Supervisors in areas where radiation sources are used are responsible for:

a. Insuring that permits are obtained before any work with radiation sources begins.

b. Insuring that the purchase or use of radiation sources are coordinated with the Radiation Protection Officer.

c. Insuring that all requisitions or contracts requiring radioactive material or other sources of radiaiton are clearly marked as "documents for procurement of radiation sources" and that these requisitions are coordinated with the Radiation Protection Officer.

d. Providing training of new employees in the safe handling of radiation sources.

7. Workers in areas where radiation sources are used are responsible for strict compliance with procedures approved for the specific application. These procedures and limitations will be contained in the application for a local permit.

8. Even though current occupational exposure limits provide a very low risk of injury, it is prudent to avoid unnecessary exposure to radiation. ERADCOM's objective is thus to reduce occupational exposures as far below the specified limits as is reasonably achievable by means of good radiation protection planning and practice, as well as by management's committment to policies that foster vigilance against departures from good practices.

9. Any person who notices a situation where an ionizing radiation safety hazard might exist will report that situation to the Radiological Protection Officer, telephone X65292, or his alternate, at the same number. In the event that these persons cannot be contacted, the report will be made to Dr. Walter McAfee, telephone, X54131.

CHAPTER 2

Definitions

Accelerator	A device for imparting kinetic energy to chaiged particles, such as electrons, proton, deuterons and helium ions.
Airborne radioactive material	Any Radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors or gases.
Bioassay	The determination of kinds, amounts or concentrations, and locations of radioactive materials in the human body, whether by in vivo counting (whole body counting, selective organ counting, etc.) or by analysis and evaluation of materials excreted or removed from the human body.
Byproduct materials	Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material.
Contamination (Radioactive)	Deposition of radioactive material in any place where it is not desired, and particularly in any place where its presence can be harmful. The harm may be in invalidating an experiment or a procedure, or in actually being a source of danger to persons.
Controlled area	A defined area in which the exposure of personnel to ionizing radiation is under the supervision of an individual in charge of radiation protection.
Decay, Radioactive	The disintegration of the nucleus of an unstable nuclide by the spontaneous emission of charged particles and/or photons.

Decontamination Factor	The ratio of the amount of undesired radioactive material initially present to the amount remaining after a suitable processing step has been completed. A factor referring to the reduction of the gross measurable radioactivity.
Dose (Dosage)	The radiation delivered to a specified area or volume or to the whole body. The dose may be specified in air, or the skin, or at some depth below the surface, but no statement of dose is complete without specification of location.
Dose Equivalent (DE)	This is the product of absorbed dose (D), quality factor (QF), and other factors needed to achieve the common exposure scale referred to under the definition of Quality Factor. It is commonly expressed in rems.
Dose Rate	Radiation dose delivered per unit time.
Dosimeter	An instrument used to detect and measure an accumulated dose of radiation.
Dpm	Disintegrations per minute.
Gamma Ray	Electromagnetic radiation emitted by a nucleus as a result of a transition between two nuclear energy levels. Gamma rays have high energies with correspondingly short wavelengths and their ability to penetrate matter is high.
Health Physics	A term in common use for that branch of radiological science dealing with the protection of personnel from harmful effects of ionizing radiation.
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 equivalent in excess of 100 millirem.

Ionizing Radiation	Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter.
Ionizing Radiation Producing Devices	Electronic devices which are capable of generating ionizing radiation such as x-ray machines, linear accelerators, cyclotrons, radio frequency generators which use klystrons, magnetrons, or other tubes which produce x-rays, and electron microscopes.
Isotope	One or more nuclides having the same atomic number but a different mass. Istopes of a substance have almost identical chemical properties.
Monitoring	Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in any occupied region or location.
MPC	Maximum permissible concentration(s).
mRad	Millirad
mRem	Millirem
Neutron	An elementary uncharged nuclear particle which has a mass equal to that of a hydrogen atom.
Photon	A quantity of electromagnetic energy whose value in ergs is the product of its frequency in hertz and Planck's constant.
Planck's Constant (h)	A natural constant of proportionality relating the frequency of a quantum of energy to the total energy of the quantum. $h=6.624 \times 10^{-34}$ joules-sec.
Positron	A particle equal in mass to the electron and having an equal but positive charge.

Quality Factor (QF)	This is the linear-energy-transfer-dependent factor by which absorbed doses are to be multiplied to obtain, for purposes of radiation protection, a quantity that expresses on a common scale for all ionizing radiations, the effectiveness of the absorbed dose.
Radiation	Energy propagated through space. As used in this regulation, the term refers to two kinds of ionizing radiation: 1. Electromagnetic waves (x-rays, gamma rays) and 2. Corpuscular emissions from radioactive substances or other sources (alpha and beta particles and neutrons). Ionizing radiation is any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter.
Radiation Absorbed Dose (Rad)	The amount of dose imparted to matter by ionizing radiation per unit mass of irradiated material. The unit of absorbed dose, the Rad, is equivalent to 10^{-5} Joules/gm.
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 equivalent in excess of 2 millirem or in any five consecutive days a dose equivalent in excess of 100 millirem.
Radiation Hazard	A condition under which persons might receive radiation in excess of the applicable maximum permissible dose, or where radiation damage might be caused to materials or personnel.
Radiation Sources	Materials or devices which generate or are capable of generating ionizing radiation, including naturally occurring radioactive material, by-product materials, source materials, special nuclear materials, fission products, materials containing induced or deposited radioactivity, radiographic and fluoroscopic equipment, particle generators and accelerators, and

	electronic equipment which utilizes kystrons, magnetrons, or other electron tubes which produce x-rays.
Radiation Work Permit	A locally developed form which is completed prior to the start of any work that is to be performed in a controlled area and describes the potential radiation hazards and a given job.
Radioactivity	Process whereby certain nuclides undergo spontaneous disintegration, liberating energy through the emission of alpha or beta particles or gamma photons or a combination of these.
Radiological Survey	Evaluation of the radiation hazard incident to the production, use, or existence of radioactive materials or other sources or radiation under a specific set of conditions.
Radiological Protection Officer (RPO)	An individual designated by the commander to provide consultation and advice on the degree of hazards associated with radiation and the effectiveness of measures to control these hazards. In addition, he is tasked with the supervision of the Radiation Protection Program. This individual will be technically qualified by virtue of education, training, and professional experience, to assure a capability commensurate with the assignment. (The term "Radiological Protection Officer" is not intended to denote a commissioned status.)
Restricted area	Any area to which access is controlled for purposes of protection of individuals from exposure to radiation and radioactive materials.

Roentgen	The quantity of X or gamma radiation such that the associated corpuscular emission per 0.001293 gram of air (1cc of dry air at standard conditions) produces, in air, ions carrying one electrostatic unit or quantity of electricity of either sign. This is the radiological unit of exposure.
Roentgen Equivalent Man (REM)	This is the unit of dose equivalent (DE) and is commonly referred to as the radiation equivalent man.
Special Work Permit	A permit to assure that no work will commence in areas where radiation is greater than 20 mrem/hr until each job has been properly evaluated from a radiological standpoint and has been approved by Health Physics personnel.
User	An individual assigned to an activity, section, division, or other organizational unit which has been delegated the responsibility for the use, operation, or storage of radiation sources,
X-ray	Penetrating electromagnetic radiation having wavelengths shorter than those of visible light. X-rays are similar to gamma rays, but originate in the extra-nuclear origin.

CHAPTER 3

EXPOSURE GUIDES

1. Regulations. Requirements as set forth in Title 10, Parts 19 and 20, Code of Federal Regulations, and AR 40-14, for the Control of Occupational Exposure to Ionizing Radiation, will be followed. Recommendations in the National Bureau of Standards Handbooks on Radiation will be used in addition.

2. Exposure of individuals in controlled areas. a. A controlled area is any area in which the exposure of personnel to radiation or radioactive materials is under the supervision of a radiation protection officer. Every effort will be made to maintain radiation doses as low as possible. Avoid all unnecessary exposure to ionizing radiation. Radiation protection standards for the control of occupational exposures to ionizing radiations include the following:

(1) The accumulated dose of radiation to the whole body, head and trunk, active blood-forming organs, gonads, or lens of the eye shall not exceed:

(a) 1.25 rem in any calendar quarter, nor

(b) 5 rem in any one calendar year, nor

(c) 5(N-18) rem total lifetime dose, where N equals the present age in years.

(2) The accumulated dose of radiation to the skin of the whole body, forearms, or the cornea of the eye shall not exceed:

(a) 7.5 rem in any calendar quarter, nor

(b) 30 rem in any calendar year.

(3) The accumulated dose of radiation to the hands and wrists or the feet and ankles shall not exceed:

(a) 18.75 rem in any calendar quarter, nor

(b) 75 rem in any calendar year.

(4) All radiation exposure will be maintained as low as reasonably achievable, in accordance with NRC Reg. Guide 8.13.

b. Personnel not occupationally exposed, and persons who are less than 19 years of age will not be exposed in any calendar quarter in excess of 0.125 rem or in excess of 0.50 rem in any calendar year. Pregnant women will not be exposed to occupational doses of ionizing radiation in excess of 0.5 rem for her nine month term. When a female employee becomes aware of her pregnancy, she has the option to request that her duties be changed to eliminate all occupational exposu to ionizing radiation, in accordance with NRC Reg. Guilde 8.10.

c. Occupational exposure to radioactive concentrations in air or water may not exceed the limits set forth in Title 10, Part 20 of the Code of Federal Regulations.

3. Exposure of individuals in uncontrolled areas. Radioactive materials and other sources of ionizing radiation will not be possessed, used, or transferred in such a manner as to create in any uncontrolled area radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of 0.5 rem in one calendar year.

4. Limits for contamination. When hands, body surfaces, clothing or shoes become unavoidably contaminated, steps will be taken as soon as possible to remove loose contamination. Decontaminate hands and body surfaces until no detectable activity above background is observed. Some degree of fixed contamination in certain cases cannot be avoided and the following maximum limits are recommended for personal clothing and shoes (see Chapter 6, Para 6n):

Alpha activity - 200 disintegrations per minute per 100 square centimeters of area.

Beta-gamma activity - 0.2 millirad per hour at one centimeter.

5. Concentrations of radioactive contamination surfaces. a. Loose contamination on exposed surfaces such as bench tops and floors will be removed as soon as possible. Small amounts of fixed contamination will be unavoidable at times, but the degree of such contamination should be kept as low as practicable. Maximum limits of fixed contamination of 1000 dpm per 100 cm^2 of alpha and 2 mrad/hr at 1 cm of beta-gamma are recommended for controlled areas. Amounts of contamination in excess of the above limits will not be permitted to remain on exposed surfaces without approval of the RPO. Higher levels of contamination may be permitted for restricted surfaces, that is in areas where entry or access is controlled by procedures or special work instructions. The same standards of contamination control shall apply to tools and equipment. In all cases, signs and controls for contaminated surfaces, areas, or euqipment will be instituted to the extend necessary to prevent the occurrence of a health hazard or the spread of contamination. In no case will the levels result in exposure to individuals in excess of the established limits. Any material or equipment so contaminated will be properly labeled with a contamination tag giving:

(1) Type and level of radiation (mrad/hr) at a specified distance.

(2) Extent of contamination on surfaces.

b. No contaminated equipment or material may be removed from any area without prior notification and approval of the RPO. Any equipment or material to be maintained or handled in a clear area must be decontaminated according to the requirements set forth in Chapter 6, paragraph 6, Table 1.

6. Radiation protection controls governing beta-gamma exposure. The following limits will be observed:

a. No individual without a special work permit will be permitted to work in a radiation controlled area where exposure levels are greater than 20 mrem/hr.

b. Any radiation area where exposure levels are greater than 100 mrem/hr shall be classified as a high-radiation area. An accurate exposure record will be maintained for each individual required to work in a high-radiation area. Based on pencil dosimeter reading, the record will contain the total cumulative exposure of the individual during the life of the special work permit.

c. The time during which any individual is exposed will be controlled so that exposure limits will not be exceeded. Exposure at all times will be kept as low as reasonably achievable.

7. Radiation protection controls governing alpha exposure. External exposure to alpha radiation is negligible, since the range of the alpha particles is less than the thickness of the layer of dead skin. Fume hoods will be used in conjunction with the long-lived alpha-emitting substances or other substances presenting a similar health hazard. In handling an unsealed alpha source, gloves or forceps afford adequate protection. Sealed alpha-neutron sources must be carefully handled to protect the integrity of the seal and prevent the spread of contamination. The prime hazard to consider is personnel contamination and the danger of ingestion or inhalation of airborne contamination. Fume hoods should have an absolute filter. The linear flow rate should be at least 150 ft/min. Airborne contamination levels will be determined as set forth in Chapter 6, paragraph 6.

8. Leak test procedures for detecting removable contamination. Nu-Con cloth smears are used to make leak tests. To leak test source No. 1, a wipe is taken inside the rise tube. To leak test source No. 2, a wipe is taken around the crack separating the source storage container and the window mounted on it.

The instrument used in the analysis of leak test samples is Harshaw Tasc 12 low Background, Phoswhich counter. The detector is in a shielded counting chamber in order to minimize background radiation.

The efficiency (E) of the detector is calculated by counting a calibrated check source and using the result in the following equation:

$$E = \frac{\text{CPM - BKG}}{\text{Activity in DPM}}$$

where CPM is counts per minute, BKG is background counts and DPM is disintegrations per minute (NDPM) on the leak test is determined using the equation:

$$\text{NDPM} = \frac{\text{CPM - EKG}}{\text{E}}$$

The activity (A) on the wipe in microcuries is determined by

$$A = \frac{NDPM}{2.22 \times 10^6}$$

CHAPTER 4

Radiological Permits

1. Local permits for the use of radiation sources are required. Applications for permission to use or store radioactive materials or sources of ionizing radiation will be submitted to the Radiation Protection Officer, DRDEL-SS-FM-H.

2. Radioactive sources. Local permits for the use or radioactive materials will be issued only when an approved NRC license or DA authorization is available. Contractors will be issued a local permit based on an approved DA permit.

3. Application for local permits. The local permit must be obtained before procurement of the particular item(s). Each organization desiring to use a radiation source will apply for a permit. Application will be on DF addressed to Radiation Protection Officer, DRDEL-SS-FM-H, and will include the following information:

a. Organization.

b. User personnel and qualifications (include training and experience).

c. Type or radiation source.

d. Physical form of the radioactive material.

e. Number of sources required.

f. Quantity of radioactive material or power of radiation source(s).

g. Planned use of radiation source.

h. Radiation protection equipment.

i. Facilities where radiation source will be used.

j. Radiation protection program (SOP).

Special Work Permit

An application for a special work permit must be submitted to the RPO before working in any area with radiation levels greater than 20 mrem/hr when authorization has not been otherwise obtained (included in local permit).

Radiation Work Permit (RWP)

Upon request from radiation area supervisors, a radiation work permit will be issued by health physics personnel for work when unusual working conditions are required as prescribed by the RPO.

CHAPTER 5

Procuring, Shipping, and Receiving of Radiation Sources

1. Procurement. All requisitions or contracts for items that contain radioactive materials will be coordinated with the Radiation Protection Officer. Each request for radiation sources will include a covering DF stating the need for the material and citing the local radiation permit and where the sources will be used. Procurement of radioactive materials will not be initiated until proper coverage under a NRC license or DA authorization is issued.

2. Shipping.

a. The user (person originating the shipment) is responsible for the proper packaging and labeling of radioactive materials for shipping. The user will initiate a request for Radiation Control Committee Action form (see Enclosure 3), which will then be completed by the Radiation Protection Officer, unless it would require committee approval.

b. The user will provide the Radiation Protection Officer with a copy of the NRC license or DA authorization of the person who will receive the radioactive material.

3. Receiving.

a. The Radiation Protection Officer or Alternate, will check all radioactive material when it arrives. He will complete all necessary shipping paperwork, then notify the user to pick up the radioactive material. Radioactive materials will only be transported in privately owned vehicles in emergency cases, and only with specific approval of the RPO.

b. Upon receipt of radioactive material, the Radiation Protection Officer will perform a leak test, when required, and notify the user of the results of the leak test.

CHAPTER 6

Prevention of Radiation Hazards

1. Method. a. This chapter contains information on the prevention of radiation hazards and special precautions necessary to safely work with radioactive materials. The three methods of radiation hazard prevention are: Mechanical and chemical, medical, and monitoring. All personnel required to work in radiation hazard areas will be informed as to the function and use of each method.

b. Some methods of radiation hazard prevention involve the proper use of fire extinguishers, roping off and posting of areas, permanent and portable shielding, and the use of area-monitoring instrumentation.

c. Another method of radiation hazard prevention includes the protection of personnel by wearing some or all of the following items, depending on the type of work: Disposable clothing, coveralls, plastic aprons, gloves, plastic shoe covers, and/or boots.

d. Decontamination materials include such things as; the chemicals used to decontaminate personnel and laboratory equipment, waste containers, swabs or Kemwipes, and paper - both absorptive and non-absorptive.

e. Prevention of radiation hazards is effected by the establishment of restricted areas, time limits for stay in danger zones, and the requirements to comply with exposure limits and other rules.

2. Procedures. a. Mechanical and chemical. (1) Film badge service will be initiated or discontinued by request to the RPO. An adequate supply of film badges will always be available for immediate use. Staff members who escort visitors to radiation areas are responsible for signing badges in and out for their visitors.

(2) Each person assigned a film badge will wear only the particular badge number assigned to him. Under no circumstances will badges be exchanged with another person. Film packs should never be removed from the badge or tampered with in any way.

(3) Personnel working in radiation areas must wear badges at all times while they are in such areas. These badges may be worn comfortably on the belt line or chest but they must never be covered by any other clothing or carried in pockets.

(4) All film badges will be kept in the assigned badge rack at the end of the work period. They will not be taken out of the building unless the outside specific duty or travel will be associated with an exposure to radiation.

(5) Film badges will be collected for exchange of film each month on the day specified on the assigned badge rack.

(6) Pocket dosimeters will be recharged as required. Additional pocket dosimeters will be maintained for visitors or persons whose routine does not require a permanently assigned film badge. These dosimeters will be signed for in a log, the dose will be recorded, and a notation will be made that the person wearing it was a visitor.

(7) All persons entering radiation areas will wear a dosimeter or a film badge. People who are unfamiliar with the facility will be accompanied by responsible personnel acquainted with the facility. All persons entering a high radiation area will wear a film badge and a dosimeter.

(8) Fire extinguishers will be placed in conspicuous places in radiation areas and clearly marked. They will be periodically checked and maintained by the Area Fire Captain. Any extinguisher that is used will not be returned to its rack but will be reported to the Fire Captain as soon as possible. All personnel will familiarize themselves with the location and use of these extinguishers throughout the building so that in the event of an emergency they will be brought into use as soon as possible.

(9) Radiation signs and tags are posted for the safety of every employee and must be respected. The Radiological Protection Officer will post and remove radiation warning signs. When radiation levels exceed permissible levels, the area will be posted with appropriate signs. These signs will indicate the nature of the radiation and/or contamination, the date of posting, the radiation level at a specified distance, and any other appropriate data.

b. Medical. (1) Each person working with radiation will be required to undergo a complete medical examination at the start of employment and at one-year intervals thereafter. This initial examination will include a complete medical history and physical examination. The history will include a notation of previous work with ionizing radiation. A copy of each medical record will be kept on file by the preventative-medicine facility. The entering examination will include a complete blood count, urinalysis, and a chest x-ray.

(2) Special checkups will be made at any time as determined necessary by the Radiation Protection Officer and/or Preventive Medicine Officer.

c. Monitoring. (1) Personnel monitoring will be accomplished by the use of film badges and dosimeters with resulting data recorded. Special monitoring due to exposure or contamination may be required. Cases of overexposure or contamination may require a special medical checkup.

(2) If an individual receives a dose of ionizing radiation in an amount exceeding 1.25 rem per calendar quarter, he will be removed from duties involving occupational exposure to ionizing radiation until subsequent exposure limitations are established in consultation with competent medical authority. Should an individual receive an accumulated dose of ionizing radiation in excess of 5(N-18) rem, he will be removed from duties involving occupational exposure to ionizing radiation until his exposure record has been evaluated by the Surgeon General of the Army and subsequent exposure limitations are established as necessary.

(3) The frequency of area monitoring will depend upon the radiation levels of the usual work in the area, the frequency of the use of the area and other conditions specific for each area. The radiation area supervisor will assure radiation levels are determined prior to working in a radiation control area, on a daily basis.

(4) The general radiation background in the area will be first recorded. Successive readings in representative work areas will be taken and noted. If any locations are noted where the dose rate is greater than the maximum permissible, the area will be posted immediately. Where additional sheilding will correct the situation, this will be done as soon as possible.

(5) The RPO will insure that each radiation facility is surveyed at least monthly. As each area is surveyed, a check will be made to detect any existing or potential hazard and to rectify it.

(6) Special surveys will be made by the RPO at any time upon specific request of an individual or before unrestricted entry is permitted to a previously contaminated area.

(7) Sufficient instrumentation is available to the RPO to properly support all special radiation surveys. All instrumentation used for radiation protection will be calibrated at least every three (3) months, and after each maintenance or battery change. Dosimeters will be calibrated at least every six (6) months, when utilized.

3. Periodic checkups.

a. From time to time, inspections will be made to insure that personnel are complying with procedures in radiation areas. Periodic checks will also insure that any modifications to the basic operating procedures are being followed correctly so as to minimize radiation hazards.

b. Constant inspections are necessary to avoid a dulled alertness on the part of personnel. It cannot be overemphasized that while working with radiation can be safe, mistakes may be very dangerous and possibly fatal. The checkups are for the safety of personnel.

c. The efficiency of all warning devices safeguarding unenergized high radiation source material, will be determined at intervals not greater than one month; this is in addition to the complete maintenance check which will be made at any time on all locks, etc. If at any time there is a failure in any remote monitors, work will be halted immediately and the approval of the Radiation Protection Officer will be required before normal operating procedure is resumed.

4. Access to radiation areas.

a. Access to areas where there is a potential radiation hazard will be limited to minimum personnel required to safely, efficiently, and most readily carry out the required procedures. All persons entering an area classified as a Radiation Control Area or a High Radiation Area must wear a film badge. A pocket dosimeter may also be required in certain areas. All visitors to radiation areas are required to be accompanied by personnel assigned to the area. A "visitor" is considered anyone directly related with the work being conducted but not a member of the immediate operational staff. All visitors must be advised of the potential hazards prior to being allowed into a radiation area.

b. Anyone discovering an area of hazardous radiation will evacuate the area and call the RPO, who will accurately survey the area and post it. Only the RPO has the authority to remove any signs once they are posted.

5. Radiation hazard signs. These signs are in the form of labels, tags, and signs for posting areas and equipment and identifying radiation areas and items which may be radioactive or contaminated. They incorporate the standard magenta and yellow color, the three bladed radiation symbol, and appropriate wording, such as "Caution", "Danger", "Contamination", "Radiation Area", and "High Radiation Area". Where such signs and tags are used, additional information may be added to them by the RPO to further identify the nature of the hazard. The information will contain the nature of the substance causing the hazard, its dose rate at a specified distance, the date, and other pertinent information.

6. Decontamination and waste disposal.

a. In order to prevent the possibility of contamination, the following regulations will be observed:

(1) There will be no smoking, drinking, or eating in radiation control areas.

(2) In cases of skin contamination, no eating, smoking or application of cosmetics will be permitted until all removable radioactivity has been taken from the skin and the person is released by the RPO.

(3) Organic solvents, highly alkaline soaps, or abrasives should not be used for decontamination at any time, since they increase the possibility of skin injury and serious contamination. Levels of radiation beyond which areas are considered to be contaminated radiation areas are outlined in Chapter 3. Any incident or accident which causes an area to be contaminated must be reported immediately to the RPO. The use of any decontaminates other than mild soap and water should only be done under the supervision of medical personnel.

b. The RPO will be responsible for establishing procedures controlling the spread of contamination. These procedures will include emergency ventilation control, controlled step-off areas, controlled passageways, personnel monitoring, decontamination procedures, etc.

c. All persons selected by the RPO to work on monitoring and decontamination will be equipped with protective clothing, suitable gloves and other equipment required by the level of work.

d. In the event of airborne contamination the RPO will determine through the use of fixed or portable air sampling monitors the extent of the contamination. The RPO will specify the maximum levels for personnel access to airborne contamination areas. These limits will not exceed:

For Personnel Wearing	Alpha Concentrations	Beta Concentrations
No respiratory protection	1 MPC*	1 MPC*
M-17 full face respirator	5 MPC*	10 MPC*
Supplied air or self-contained air supply with full face mask	50 MPC*	50 MPC*

*Maximum permissible concentration

e. When there is a possibility of contamination or radiation hazard, all ducts and vents leading from the building, whether they are for water, air, gas, or electrical conduit, will be marked so that maintenance or repairmen will be aware of the potential hazard. Where these tags exist, the RPO will be notified to survey the area before any work is started. If the need for shielding is indicated by monitoring procedures, the supervisor or the project leader will provide the shields before work in this area can resume.

f. Personnel decontamination methods depend upon the nature of the contaminating material and the size of contaminated skin area. No detectable contamination level above background is allowed to remain on hands or skin after decontamination. The following procedures will be used immediately:

(1) First notify the RPO. All materials needed for decontamination will be furnished by the RPO and will be located where they will be most convenient for use.

(2) Thorough washing with soap and water and rinsing with large quantities of water is the best general decontamination method for the hands and other parts of the body, regardless of the nature of the radioactive contaminant. If, however, the contamination is well localized,

it is recommended that the area be cleaned immediately with small swabs and later, if necessary, by a general washing. Spread of contamination to other skin areas is thus avoided.

g. If the contamination is widespread, a general washing or shower should be taken and other more specific measures outlined below should be followed under medical supervision and the RPO.

(1) For general washing: Wash the hands for two to three minutes in tepid water using a mild soap, with special attention to finger folds, outer edges of hands and fingernails. Rinse thoroughly and repeat a maximum of four times. If the required degree of decontamination is not reached, proceed with step (2).

(2) Using a soft brush, wash and rinse contaminated areas three times in eight minutes of which no less than six minutes are spent in scrubbing. Use pressure light enough not to abrade the skin. Rinse thoroughly and monitor. If the desired level is not reached after several trials, chemical decontaminaion may be attempted as outlined in step (3).

(3) Chemical decontamination should not be attempted without medical help.

h. Persons with cuts or wounds will not be permitted to work in a contaminated area or radioisotope laboratory unless specific approval is obtained from the RPO. Any wounds, cuts, or abrasions, received while working with, in, or near radioactive materials should be flushed with water immediately. Any such accidents should be referred to the RPO immediately so that specific measures can be taken.

i. The RPO will assist in and monitor the decontamination of materials and equipment. He will supervise the disposal of radioactive waste and other work connected with radiation hazards.

j. In the event of contaminated clothing, the contaminated articles will be removed immediately. Skin areas underneath the clothing will be cleaned as soon as possible and the contaminated clothing placed in plastic bag so that it may be properly laundered and recovered.

k. In order to prevent the gross contamination of laundered items, two separate laundry systems are employed. All contaminted laundry generated in radiation areas is laundred in a specially equipped laundry.

l. Contaminated materials will be disposed of in suitable dry radioactive waste or liquid radioactive waste containers. At no time should dry radioactive and liquid radioactive wastes be mixed. Containers for radioactive waste containers will be stored in the radioactive storage vault.

m. The RPO will aid in the problem of evaluating contaminated equipment. If it is not practical to decontaminate the equipment, it will be handled as dry radioactive waste. In some cases, it may be possible to store such equipment for future use when radiation levels have decayed to acceptable levels. Equipment properly marked and shielded will be stored in the radiation storage vault.

n. The following methods can be used to decontaminate equipment; the decision as to the actual and most practical method will be determined by the RPO.

(1) Equipment may be washed with a hot, strong detergent solution, rinsed, and procedure repeated until the desired decontamination is reached. Chemicals that may be used include chromic acid, nitric acid, ammonium citrate, trisodium phosphate, and ammonium bifluoride. In selecting decontamination materials, the nature of the surface and extent of contamination must be considered. For all practical purposes, decontamination effectiveness of a solution is considered complete at the end of the second repetition of any one process. If the desired level is not reached at this time, other methods should be considered.

(2) Before any decontaminated equipment or articles can be moved or transported to a "clear area" the RPO will determine the extent of contamination of the particular item. Limits of contamination for items to be admitted to a clear area on the basis of 100 cm^2 area, are as follows:

Loose contaminiation detectable by smear

Alpha (DPM)	50
Beta-Gamma (DPM)	100

Maximum fixed contamination

Alpha (DPM)	200
Beta-Gamma (m Rad/hr	0.25

In the case of area contamination, the method of decontamination will depend upon the nature of the surface. These methods are vacuuming, physical removal of surfaces, covering of short-lived materials with impervious materials, detergents, and chemicals. When practical, areas which are contaminated will be isolated until radioactive decay permits safe entry.

o. All areas which are contaminated by accidents or spills will be evacuated immediately. If certain safety precautions can be insituted (such as placing absorbent paper on a spill to prevent spread of the contaminant) without endangering one's safety before leaving, it should be done. The RPO will monitor the contaminated area and determine the most practical methods of decontamination.

REQUEST R RADIATION CONTROL COMMITTEE ACTION

1. ORIGINATOR

NAME ______ CODE ______

2. DATE

MONTH ______ DAY ______ YEAR ______

3. DOCKET NO (COMMITTEE USE)

4. REQUEST FOR APPROVAL OF

- ☐ DA Procurement (Radiation Source)
- ☐ Contractor Procurement (Radiation Source)
- ☐ Local Accelerator Produced Source
- ☐ Use on ______ Program
- Change of Custodian of Radiation Source (Previous Custodian ______)
- ☐ Offsite Shipment
- ☐ Transfer
- ☐ Modification
- ☐ Other (Loan etc.)

5. ALL IDENTIFICATION NUMBER(S) (If Applicable)

6. NUCLIDE(S)

Sealed

Unsealed

7. TOTAL ACTIVITY IN MILLICURIES

Activity Date ______

8. DA OR CONTRACTOR PR NUMBER (Specify Contractor)

9. COMPLETE DESCRIPTION OF SOURCE (Make & Model No.)

10. PROGRAM OF USE (OR REASON FOR REQUEST) Use additional sheets if necessary

a. Program Outline

b. Methods of Control and Procedures

c. Location of Use and/or Storage

d. Method of Disposal

11. INDIVIDUAL RESPONSIBLE FOR CONTROL & ACCOUNTABILITY (Attach resume of experience with Radioactive Mate if not previously submitted to Radiatior Committee)

______ ______ USERS

______ ______ CUSTODIAN

NAME CODE

12. REVIEWED & APPROVED (Branch Head or otherwise as appropriate)

NAME ______ DATE ______

13. RADIATION COMMITTEE

☐ Approved ☐ Disapproved

☐ Approved subject to attached requirements

CHAIRMAN ______ DAT ______

Encl 3

RADIOLOG L PERMIT APPLICATION

DATE ________ ____________________

CHECK ONE

☐ INITIAL PERMIT APPLICATION

☐ APPLICATION FOR AMENDMENT TO PERMIT NO. ________

Use supplemental sheets if necessary) ☐ APPLICATION FOR RENEWAL OF PERMIT NO. ________

1. TO:	2. ORGANIZATION APPLYING FOR PERMIT:

RADIOLOGICAL PERMIT SUPPLEMENT MUST BE FILED WITH THE HEALTH PHYSICS OFFICE FOR INDIVIDUALS NAMED IN 3 AND 4 BELOW.

3. RESPONSIBLE INVESTIGATOR	4. RADIATION AREA SUPERVISOR
NAME ____________________	NAME ____________________
SIGNATURE ____________________	SIGNATURE ____________________

5. RADIOISOTOPE(S) AND/OR OTHER SOURCES OF IONIZING RADIATION DESIRED

ELEMENT AND MASS NUMBER	CHEMICAL FORM	PHYSICAL FORM	POSSESSION LIMIT DESIRED (CURIES)

6. OPERATIONAL PERSONNEL

7. LOCATIONS WHERE SOURCE(S) OF IONIZING RADIATION WILL BE

	BLDG	ROOM OR AREA
A. USED		
B. STORED		

Encl 4

8. DESCRIBE PROCEDURE(S) IN WHICH RADIOISOTOPES . .
RADIATION WILL BE USED.
INCLUDE HEALTH PHYSICS PRECAUTIONS TO BE TAKEN.
ATTACH COPIES OF PERTINENT SOP AND EMERGENCY SOP TO BE POSTED.

9. RADIATION DETECTION INSTRUMENT AVAILABLE.

	TYPE OF INSTRUMENT	NUMBER ON HAND	RADIATION DETECTED	FULL RANGE	USE E.G., MONITORING SURVEYING	CALIBRATION	
						FREQUENCY	SOURCE

10. DESCRIBE LABORATORY FACILITIES AND EQUIPMENT, STORAGE CONTAINERS, SHIELDING, FUME HOODS, AND PROTECTIVE CLOTHING.

11. SIGNATURE OF DIRECTOR OR DIVISION CHIEF.

RADIOLOGICAL PERMIT APPLICATION SUPPLEMENT

NAME: ____
(Last) (First) (Middle)

Completed by HEALTH PHYSICS OFFICE	
RADIATION AREA SUPERVISOR	RESPONSIBLE INVESTIGATOR

LIST BELOW YOUR TRAINING AND EXPERIENCE WITH RADIOISOTOPES AND OTHER SOURCES OF IONIZING RADIATION (Use supplemental sheets if necessary)

1. TRAINING (To be completed by Radiation Worker, Responsible Investigator, Radiation Area Supervisor)

	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practice of radiation protection			Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes
d. Biological effects of radiation			Yes No	Yes

2. EXPERIENCE

ISOTOPE OR OTHER SOURCE	MAXIMUM AMOUNT OR DESCRIPTION OF SOURCE	LOCATION	DURATION	TYPE OF USE

Encl 5

SUPPLEMENT H

RESUMÉS OF INDIVIDUALS WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL

QUALIFICATIONS STATEMENT

ANTHONY S. KIRKWOOD

RADIATION PROTECTION OFFICER

EDUCATION AND TRAINING

AA (Radiologic Technology), Prince Georges Community College - [ ] Ex 6

BS Radiation Science and Administration, George Washington University - [ ]

Registered Radiographer, American Registry of Radiologic Technologist - 1974

Registered Radiation Protection Technologist, National Registry of Radiation Protection Technologists - 1983

COURSES INVOLVING RADIATION

*	1972 - 1978	51 semester hours in formal courses pertaining to radiation, including Technical Physics, Radiation Physics and Safety, Physics of Radiologic Imaging, Directed Studies in Radiation Physics, Radiographic Techs., Clinical Radiology, Radiologic Electronics and Engineering, and Radiobiology.
*	April 1979	Respiratory Protection Course, concerning use of respirators, Goddard Space Flight Center.
*	May 1980	Radiation Safety Course, concerning liquid radioisotopes, National Institutes of Health
*	Jan-May 1981	Health Physics Certification Prep Course, with topics such as: Interactions of Radiation With Matter; Shielding; Decay; Standards; Measurements; Air Sampling; Health Physics Aspects of Reactors, Uranium Fuel Cycle, Waste Management; and Environmental Health Physics, Baltimore-Washington Chapter, Health Physics Society.
*	Feb 1982	Accelerator Health Physics, National Health Physics Society Mid-Year Topical Symposium, Orlando, Florida.
*	June 1983	Internal Dosimetry, Health Physics Society Summer School, Baltimore, Maryland.
*	Sep 1983	Health Physics In Radiation Accidents, Oak Ridge Associated Universities, Oak Ridge, TN.

Anthony S. Kirkwood, Radiation Protection Officer

EXPERIENCE WITH RADIATION

* 1972-1974 Prince Georges General Hospital, Radiography Student - training leading to registration requiring thorough knowledge of diagnostic X-ray equipment, so that such usage is accomplished safely.

* 1974-1978 George Washington University Medical Center, Sr Staff Radiographer - requiring close work with medical students and staff personnel, assisting and instructing when necessary, in safe and optimum equipment use.

* 1978-1984 NASA/Goddard Space Flight Center, Greenbelt, Maryland, Senior Health Physics Technician - responsible for initiating and carrying out programs to assure management control of numerous radioactive sources, among which are:

Kilocurie amounts of Co^{60}

Curie amounts of H^{3} and Cs^{137}

Millicurie amounts of Fe^{55}, Kr^{85}, Sr^{90}, I^{125}, Po^{210}, Ra^{226}, Am^{241}, Cm^{244}, Cf^{252}

Microcurie amounts of a wide variety of other radionuclides; Accelerators; hotcells; rad waste disposal; Deuterium-Tritium neutron generators

Experience has also included:

Using sources for experimental and calibration purposes.
Leak testing and inventory of sources.
Providing surveys and monitoring for operations involving a wide variety of radiation sources.
Packaging and disposal of sources.
Evaluating radiation hazards and recommending procedures and actions to eliminate or significantly reduce unsatisfactory conditions.
Providing and evaluating personnel monitoring devices.
Setting health physics conditions for the use of radiation sources and facilities.
Evaluating health physics programs and recommending improvements.

RESUME

NAME: Scott Liggett Davis

BIRTHDATE:

BIRTHPLACE: Ex6

SOCIAL SECURITY NO.:

EDUCATION:

Marshall County Senior High School
Lewisburg, Tennessee
Ex4

Columbia State Community College
Columbia, Tennessee
Ex4
A.S., Radiologic Technology, with Honors

University of Tennessee Center for the Health Sciences
Memphis, Tennessee
Ex4
B.S., Radiologic Technology, with Honors

HONORS:

Graduated from Columbia State Community College - cum laude
Deans List at Columbia State Community College
Deans List at University of Tennessee Center for the Health Sciences
Professional Achievement Award - UTCHS

MILITARY SERVICE: None

BOARD CERTIFICATION:

Certified in Radiography by the American Registry, January 1979.

SOCIETY MEMBERSHIPS:

American Society of Radiologic Technologists, 1978-1981
Tennessee Society of Radiologic Technology, 1977 to present
Vice President, District 1, 1982-83

EMPLOYMENT:

1967-69 Worked for the City of Lewisburg, Tennessee. Did odd jobs around city garage, picked up paper at parks, and mowed grass with a variety of mowers, i.e., lawn mower, bush hog.

1969-71 Marshall County Recreational Center. Maintained public swimming pool and adjacent golf course. Mowed fareways and dressed greens. Also, responsible for night water detail on course and end of season, clean-up of pool.

1971-73 Marshall County Recreational Center. Promoted to maintenance and care of sports fields. This included both the baseball field and football field. Certain jobs consisted of grooming and raking both fields. Painting concession stands and bleachers.

1974-75 Kuhn's Department Store, Lewisburg, Tennessee. Worked as a stock person until graduation from high school.

1975-77 Hershel Davis Erecting and Service Maintenance Company, Lewisburg, Tennessee. My father's business allowed me to obtain experience in electrical wiring, welding of stainless and black pipe, and some experience in electronics.

1977-78 Anderson Brothers and Foster (Department Store), Columbia, Tennessee. Worked on a part time basis in the Men's Clothing Department. Also worked as a stock person on weekends and did furniture delivery when needed.

1977-78 Columbia State Community College, Columbia, Tennessee. Part-time Radiologic Technologist for nursing home portables. Under the supervision of Mr. Bill Buher, the Technical Director of the Radiologic Technologist Program at CSCC.

1978-79 Wayne County Hospital, Waynesboro, Tennessee. Part-time Radiologic Technologist on call for weekends, on a rotating basis with Giles County Hospital, responsible for department from 6:00 PM, Friday until 6:00 AM, Monday. Worked with doctors and residents in Emergency Room and Radiology, under the supervision of the Chief Technologist, Carole Becallo.

1978-79 Giles County Hospital, Pulaski, Tennessee. Part-time Radiologic Technologist, Responsible for week-end call under the supervision of the Chief Technologist, Joyce Yokley.

1979 LeBonheur Children's Medical Center, Memphis, Tennessee. Staff Radiologic Technologist on Evening shift while attending school at UTCHS. Responsible for all facets of department under the supervision of the Chief Technologist, Dowtin Martin.

EMPLOYMENT, continued:

1979-80 St. Joseph Hospital (Downtown), Memphis, Tennessee. Evening Supervisor. Worked full time and attended UTCHS to obtain a B.S. degree in Radiologic Technology. Responsible for 3 technologists and 1 ancillary personnel.

1980-81 Baptist Hospital, Nashville, Tennessee. After graduating from UTCHS, I took a special procedures job at Baptist. As a special procedures technician, I was responsible for all angio work as well as most subspecialty work, such as myelograms, arteriograms, and transhepatic choleangiograms. The special work was predominantly neuro work for Doctors Hays, Bond, and Ferguson. Studies such as carotids, aortas, femorals, and some heart caths, LV. After specials, I was promoted to CT to do head work for the above mentioned physicians. Heads and bodies were done on an EMI Scanner until the purchase of the GE 8800. I had some training on this machine.

1981- LeBonheur Children's Medical Center, Memphis, Tennessee. Assistant Chief Technologist. Responsible for all of radiology and its branches, i.e., radiology, nuclear medicine, special procedures, heart caths, ultrasound, echo's, and EKG's.

Responsible for in-services, departmental meetings, staffing, scheduling, consulting at doctors meeting, quality control, and quality assurance, some coverage for special procedures, but a supervisor has been named to this area to lighten the work load. Specials and heart cath's were installed, and some design consulting done upon arrival to this institution. Ultrasound and real-time experience in head work. Some work in Nuclear Medicine so that all technicians can rotate in the department. EKG's and echo's - all techs were in-serviced on EKG's, one ultrasound technician trained to do echos on Varian 2D. I did some consulting on the echo machine. All areas of radiology are my concern, i.e., front desk, filing system, and patient information are all parts of my responsibility.

Hospital responsibilities - clinical instructor to Shelby State Community College, also, clinical instructor to St. Joseph Hospital School of Radiologic Technology - scheduling, rotating, and counselling of the students ehile they did their clinical rotations at this hospital.

Board member for LeBonheur Hospital Federal Credit Union, Officer Treasurer; Chairman of Employees Advisory Committee.

1982-83 Dillards Department Store, Memphis, Tennessee. Part-time. Credit representative, customer service, job duties include contracts, credit cards, and accounts information and verified through computer from Memphis to Little Rock.

EMPLOYMENT, continued.

1983	LeBonheur Children's Medical Center, Memphis, Tennessee. Heart Cath. Lab Supervisor. Responsible for all aspects of heart catheterizations. Ordering of supplies, Quality Control & Assurance for both the Heart Cath Labs and Special Procedures Suite. Responsible for in-services on patient care and upgrades in technology, as well as liaison between technical staff and professional staff. Some work done in selecting and installing digital equipment.
Oct 1983 - Present	US Army Electronics Research & Development Command (ERADCOM) DRDEL-SS-H, Ft. Monmouth, New Jersey. Health Physicist - Secondary RPO for several NRC Licenses. Working in conjunction with Primary RPO on Research and Development Projects. For specific duties see enclosed copy of Amendant of Personal Qualification Statement.

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
ARRT American Registry of Radiological Technologist	Radiology	Oct 1978

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION	* CSCC * UTCHS	100 130	790 50
b. RADIATION PROTECTION	CSCC UTCHS	40 30	40 30
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY	CSCC UTCHS	50 60	50 60
d. RADIATION BIOLOGY	CSCC UTCHS	40 60	
e. RADIOPHARMACEUTICAL CHEMISTRY	CSCC UTCHS	20 60	20 60

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Tc 99m	25-30 mCi	CSCC/Maury Co. Hosp	1976-1978	Medical
I^{131}	50 mCi	" " "	" "	"
P^{32}	10 mCi	" " "	" "	"
Ga^{67}	10 mCi	" " "	" "	"
Cs^{137}	25 mCi	" " "	" "	"
Ra^{226} (implant)	10 mCi	" " "	" "	"
Co^{60}	100 mCi	" " "	" "	"

*CSCC (Columbia State Community College)
*UTCHS(University of Tennessee Center for the Health Services)

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE LABORATORY COURSES (Hours) C	SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION			
b. RADIATION PROTECTION			
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY			
d. RADIATION BIOLOGY			
e. RADIOPHARMACEUTICAL CHEMISTRY			

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Tc^{99m}	20 mCi	*UTCHS-LeBonheur Child Medical Ctr, Memphis, TN	1981- 1983	Medical
Ga^{67}	10 mCi	" " "	" "	Medical
In^{111}	10 mCi	" " "	" "	Medical
Co^{57}	10 mCi	" " "	" "	Medical
Co^{58}	10 mCi	" " "	" "	Medical

* UTCHS (University of Tennessee Center for the Health Sciences)

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICE

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE/LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION			
b. RADIATION PROTECTION			
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY			
d. RADIATION BIOLOGY			
e. RADIOPHARMACEUTICAL CHEMISTRY			

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Am 241	35 mCi	ERADCOM Signal Lab	1983-Present	Research & Development
Cs^{137}	400 mCi	" " "	" "	"
Co^{60}	100 mCi	" " "	" "	"
H^{3}	60 Ci	" " "	" "	"
Po 210	1 Ci	" " "	" "	"
Pm 147	1.2 Ci	" " "	" "	"
Sr 90	5 Ci	" " "	" "	"

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION			
b. RADIATION PROTECTION			
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY			
d. RADIATION BIOLOGY			
e. RADIOPHARMACEUTICAL CHEMISTRY			

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Co^{60}	660 Ci	ERADCOM Signal Lab	1983-Present	R & D
Co^{60}	2048 Ci	" " "	" "	"
Co^{60}	125000 Ci	" " "	" "	"
U-natural or depleted	16 lbs.	" " "	" "	"
Th 232	22 lbs.	" " "	" "	"
Pu 238	50 gms	" " "	" "	"
Ra-Be	1 @ 3 mCi	" " "	" "	"

FORM NRC-313M Supplement A
(8-78)

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE/LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION			
b. RADIATION PROTECTION			
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY			
d. RADIATION BIOLOGY			
e. RADIOPHARMACEUTICAL CHEMISTRY			

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Ra-Be	1 @ 20 mCi	ERADCOM Signal Lab	1983-Present	R & D
Ra-226	1 @ 1 mCi	" " "	" "	"
Ra-226	1 @ 1 mCi	" " "	" "	"
Ra-226	1 @ 10 mCi	" " "	" "	"
Ra-226 Chk Src	10 @ 7 mCi	" " "	" "	"
Co^{57}	3 @ 50 mCi	" " "	" "	"

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Scott L. Davis	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE/LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION			
b. RADIATION PROTECTION			
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY			
d. RADIATION BIOLOGY			
e. RADIOPHARMACEUTICAL CHEMISTRY			

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Po 210	10 @ 50 mCi	ERADCOM Signal Lab	1983-Present	R & D
Pu 239	2.0 uCi to 5 mCi	" " "	" "	"
Eu 149	1 @ 50 mCi	" " "	" "	"
Pm 147	30 uCi Total 7.5 mCi	" " "	" "	"
Cs 137	1.0 mCi	" " "	" "	"

THOMAS E. DANIELS
Deputy Director
ERADCOM Combat Surveillance and Target Acquisition
Laboratory (CSTAL)
Member - Senior Executive Service

CSTAL is responsible for applied research and development in physical sciences and engineering in such broad technological areas as radar electro-optics, special sensors, and nuclear radiation detection.

CSTAL employs 200 workers which includes 125 engineers and scientists. CSTAL annual budget is approximately $60 million.

EDUCATION:

Electronics Engineer - State University of Iowa
Master of Business Administration - Monmouth College
Graduate of Industrial College of the Armed Forces

EXPERIENCE:

30 years in design, development, production and fielding of Complex electronic equipments; Systems development, integration and Compatibility of Communications equipment, electronic digital computers, electronic warfare systems, navigation systems and satellite systems.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

Who's who in the East and Who's who in Technology
Institute of Navigation
The Army Aviation Association of America
Institute of Electronic and Electrical Engineers
American Institute of Aeronautics and Astronautics
The Amierican Degense Preparedness Association

AWARDS:

2nd and 3rd highest given by the Department of Army namely, the Meritorious Civilian Service Award and the Commander's Award.

Distinguished Service Award from the University of Iowa

BIOGRAPHICAL SKETCH

Thomas E. Daniels is currently the Acting Director of the ERADCOM Combat Surveillance and Target Acquisition Laboratory (CSTAL). He is also a member of the Senior Executive Service consisting of the highest level of civilian managers in federal government service.

The Combat Surveillance and Target Acquisition Laboratory is responsible for research and development and initial production of combat surveillance target acquisiition battlefield identification, radiological survey, battlefield intelligence, and meteorological systems. The laboratory is responsible for applied research and development in physical sciences and engineering in such broad technological areas as radar, electro-optics, photo optics, special sensors, and nuclear radiation detection.

He is responsible for 170 military and civilian engineers, scientists, and support personnel, and an annual budget of approximately $60 million.

He is an electronic engineering graduate of the State University of Iowa and holds a Masters Degree in Business Administration from Monmouth College. He is also a graduate of the Industrial College of the Armed Forces.

He has over thirty years of broad professional experience in design, development, production, and fielding of complex electronic equipments. He managed multi-million dollar level ($300-500 million) programs with personnel including engineers, scientists, and military specialists (up to 50 directly and over 100 indirectly). His experience has included systems development, integration, and compatibility of communications equipment, electronic digital computers, electronic warfare systems, navigation systems, and satellite systems. He has served on high level panels, source selection boards, and study groups.

He is listed in the Who's Who in the East and Who's Who in Technology. Mr. Daniels is a member of the Institute of Navigation, the Army Aviation Association of America, Institute of Electronic and Electrical Engineers, American Institute of Aeronautics and Astronautics, and the American Defense Preparedness Association. He has previously published a number of articles and papers on air traffic control, navigation, and electronic warfare systems. He has presented papers at national and international symposia including NATO.

Ex 6

Ex 6

TRAINING & EXPERIENCE WITH RADIATION & RADIOACTIVE MATERIAL
OF

Dr. Walter S. McAfee

POSITION: ECOM Commander's designated committee representative
and
Scientific Adviser to the Director of Research, Development & Engineering and of Laboratories
US Army Electronics Command, Ft Monmouth, NJ

EDUCATION:

Ex6

B.S.	Mathematics	Wiley College,
M.S.	Physics	The Ohio State Univ,
Ph.D.	Physics	Cornell Univ,

Radio Astronomy, Harvard Univ, 1957-58

RADIATION TRAINING AND EXPERIENCE:

a. Dosimetry in X-ray Lab, including measurement of the roentgen by use of a free-air chamber. Also Nuclear Physics Lab. Training in safe handling of radioactive materials, evaluation of dose and dose rate, etc.

b. Worked in the nucleonics program of this Command from August 1948 into October 1953. Also planned initial radiation and calibration facilities.

RESUME OF TRAINING AND EXPERIENCE
OF DR. WALTER S. McAFEE

1. Educational Background:

BS	Mathematics	Wiley College,
MS	Physics	Ohio State University
PhD	Physics	Cornell University,
Radio Astronomy		Harvard University,

2. Radiation Training and Experience:

a. Dosimetry in X-ray lab, including measurement of the roentgen by use of a free-air chamber. Also Nuclear Physics Lab. Training in safe handling of radioactive materieals, evaluation of dose and dose rate, etc.

b. Worked in the nucleonics program of the US Army Electronics Command from August 1948 into October 1953. Also planned initial radiation and calibration facilitites used at Fort Monmouth.

TRAINING & EXPERIENCE WITH RADIATION & RADIOACTIVE MATERIAL

OF

MR. RICHARD RAST

EDUCATION: BS Degree in Chemistry, Seton Hall University [ ] Ex6

EXPERIENCE: Biological and Clinical Chemistry, Serology and Hematology (2 yrs), Monmouth Medical Center and Patterson Army Hospital, Fort Monmouth, NJ, 1950-52.

Health Physics, Research & Development and Calibration of radiation sensitive systems; design, fabrication and encapsulation of isotopes for calibration systems up to 200 curies level, 1952-62.

During past 19 years in the Radiac R&D Group he has applied his knowledge of physics, health physics, mathematics, and electronics to the solution of engineering problems and equipment design relating to the radiac development program. Specifically, he has worked on field calibration devices, design of new portable radiac equipment, a Remote Large Area Radiac Training Set and a Recording Radiation Monitor and Automatic Radiation Alarm System, 1962-81.

Actively participated in Nuclear Weapons tests at Nevada Test Site (NTS); operations "Upshot Knothole," "Teapot," and "Small Boy." Also operations "Castle," "Redwing," and "Hardtack" at Pacific Proving Ground, Eniwetok, M.I.

ACTUAL USE OF RADIOISOTOPES:

Isotope	Quantity	Place	Duration	Type of Use
^{60}Co	200 curies	Nevada	6 mos total	Equipment Calibration-Hi-range
^{60}Co	200 curies	Eniwetok	8 mos total	Dosimetry
^{60}Co	UDM-1(1-9 curies)	Evans	18 yrs (on an as needed basis)	Calibration-Dosimetry R&D
^{137}Cs	UDM-1A(120 curies)	Evans	16 yrs (on an as needed basis)	Calibration-Dosimetry R&D
^{137}Cs	Mrc 794(220 curies)	Evans	3 yrs.	Calibration Development
$^{90}Sr^{90}y$	Up to 2 Curies	Evans	12 yrs.	Calibration Development
^{60}Co	3500 curies	Evans	5 yrs.	Equipment Calibration-Hi-range Dosimetry R&D

TRAINING & EXPERIENCE WITH RADIATION & RADIOACTIVE MATERIAL
OF

Mr. Richard Rast

EDUCATION: BS Degree in Chemistry, Seton Hall University,
[ ] Ex6

EXPERIENCE: Biological and Clinical Chemistry, Serology and Hematology (2 yrs), Monmouth Medical Center and Patterson Army Hospital, Ft Monmouth, NJ, 1950-52.

Health Physics, Research & Development and Calibration of radiation sensitive systems; design, fabrication and encapsulation of isotopes for calibration systems up to 200 curies level, 1952-62.

During past ten years in the Radiac R&D Group he has applied his knowledge of physics, health physics, mathematics, and electronics to the solution of engineering problems and equipment design relating to the radiac development program. Specifically, he has worked on field calibration devices, design of new portable radiac equipment, a Remote Large Area Radiac Training Set and a Recording Radiation Monitor and Automatic Radiation Alarm System, 1962-72.

Actively participated in Nuclear Weapons tests at Nevada Test Site (NTS); operations "Upshot Knothole," "Teapot," and "Small Boy." Also operations "Castle," "Redwing," and "Hardtack" at Pacific Proving Ground, Eniwetok, M.I.

73 RD&E 06

ACTUAL USE OF RADIOISOTOPES:

Isotope	Quantity	Place	Duration	Type of Use
Co^{60}	200 curies	Nevada	6 mos total	Equipment Calibration-Hi-range-
Co^{60}	200 curies	Eniwetok	8 mos total	-Dosimetry
Co^{60}	UDM-1(1-9 curies)	Evans	18 yrs(on an as needed basis	Calibration-Dosimetry R&D
Cs^{137}	UDM-1A(120 curies)	Evans	16 yrs(on an as needed basis	Calibration-Dosimetry R&D
Cs^{137}	Mrc 794(220 curies)	Evans	3 yrs	Calibratior Development
$Sr^{90}y^{90}$	Up to 2 curies	Evans	12 yrs	Calibratior Development
Co^{60}	3500 curies	Evans	5 yrs	Equipment Calibration-Hi-range Dosimetry R&D

RESUME

NAME: Frank John Elmer 21 December 1983

Ex6

EDUCATION:

Doctor of Engineering Science, 1982, New Jersey Institute of Technology
M.S.E.E Monmouth College, N.J.
B.S.E.E Monmouth College, N.J. (Magna Cum Laude)
A.A.E.E Monmouth College, N.J. (Cum Laude)
1968 Manasquan High School (First High Academic Honors)

HONORS: in addition to above

Lambda Sigma Tau Most Valuable Member 1972 (Monmouth College Honor Society)
Listed in Who's Who in American Colleges and Universities 1972
Monmouth Scholar 1970-1972
Dean's List 8 consecutive semesters 1968-1972
4 year Academic Trustee Schlorship 1968-1972
Listed in Who's Who in American High Schools 1968
Bausch & Lomb Science Award 1968
Eta Kappa Nu (Electronic Engineering Honor Society)
Sigma Pi Sigma (Physics Honor Society)
National Honor Society (Manasquan High School Chapter)
Student Government Association (Senator representing Electronic Engineering Department, Monmouth College) 1971-1972

AWARDS:

Ribbon copies of my three patents
Outstanding Rating July 1975, CSTA Lab, Fort Monmouth

MEMBERSHIPS:

I.E.E.E. (Institute of Electronic and Electrical Engineers)

Additional Specialized Training:

GI License (tactical vehicles) May 1978 to present (Fort Monmouth) (M-60, M-113, etc.)
Sponsored "Optical Hazards Seminar" 28 September 1983 at EWL
Shelter Management Course 23 Jan. 1975 (Fort Monmouth)
Indoctrination Course for Career Interns 16 March 1973

PATENTS:

"Method of Determining Relative Orientation of Physical Systems", #4, 134, 618; 16 Jan 1979
"Optical Alignment Sensor", #4,035,659;12 July 1977
"Transparent Optical Power Meter", #4,019,381; 26 April 1977

Pending Publications:

- (U) Elmer, F., "Measurement of the TOW Day Sight", Technical Report (S-NFD)
- (U) Elmer, F., "Target Directional Measurement Under Optical Countermeasures", 1984 Army Science Conference, West Point, June 84 (C)

Publications:

- (U) Elmer, F. "Remote Attitude Measurement Techniques", (U) DELEW-TR-82-5, Dec. 82, AD-123852 (U)
- (U) Elmer, F. "Communications Effectiveness Electronic Warfare Model (CEEW)", DELEW-TR-80-3, Nov. 80, AD-B52741L (U).
- (U) Elmer, F. "EW Vulnerability Issues of the Candidates for the NATO Identification System (NIS)/US Identification System (USIS)", Memorandum Report, DELEW-V, Nov. 80 (S-NFD)
- (U) Elmer, F., "EW Vulnerability of the Advanced Scout Helicopter (ASH)", DELEW-TR-81-6 Sept. 81, AD-C027945L (S-NFD)
- (U) D'Agostino, J., Dixon, R., Elmer, F., Rhode, R. "Gunflash Detection: Spectral/Temporal Data Base", Nov. 78, AD-C016626 (C)
- (U) D'Agostino, J., Dixon, R., Elmer, F., Rhode, R. "Fourier Spectroscopy of Artillery Gunflash", June 78, AD-C014727, (C)
- (U) D'Agostino, J., Dixon, R., Elmer, F., Rhode, R. "Time Resolved Gunflash Spectroscopy". 25th National IRIS, June 77, San Francisco, CA. (C)
- (U) Elmer, F., Dickey,V., Patterson, W., Gauch, H. "Infrared Fence Test, Fort Sill, Oklahoma, 16, 17 September 1976", ECOM 4463, Jan 77, AD-518006 (C)
- (U) Elmer, F., Hill, L., Buchmann, W., "Position and Attitude Monitor (PAM) with Application to an Airborne Flash Detection System", 7th Classified Conference on Laser Technology, West Point, N.Y. 10 June 76 (C)
- (U) Carillo, A., Dehne, J., Elmer, F., "Measurements of the Muzzle Flash Radiation from the Soviet 57 Millimeter Antiaircraft Gun, Model S-60", ECOM-4253, Sept. 74 AD-531895 (C)
- (U) Elmer, F. "Effects of Measurement Errors on the Accuracy of an Elevated Target Detection System", ARMCOM Meeting on Control System Design Problems, Rock Island Arsenal, Ill. 29 May 74 (U)
- (U) Dickey, V., Sheehan, T., Pardes, H., Bayha, W., Elmer, F., "Artillery Location Sensor Package for the Elevated Target Acquisition System (ELTAS)", May 74 (C)
- (U) Carillo, A., Dehne, J., Elmer, F., "Measurements of the Muzzle Flash Radiation from the Soviet 130 Millimeter, M-46 Field Gun" Volume 1., ECOM-4156, Sept. 73 AD-531485 (C)
- (U) Carillo, A., Dehne, J., Elmer, F., "Measurement of the Muzzle Flash of the Soviet 100 Millimeter, T-55 Tank Gun", Volume 1. ECOM-4156, Sept. 73 AD-527798 (C)
- (U) Carillo, A., Dehne,J., Elmer, F. "Radiometry of Soviet Artillery Muzzle Flashes" American Ordnance Association Meeting, Military Pyrotechnics Section Meeting, Picatinny Arsenal, 18-19 Oct. 72 (C)

EMPLOYMENT:

1978- Present - Electronic Warfare Laboratory, EWL, Fort Monmouth, N.J. Electronic Engineer, GS-0855-12
My present assignment is to conduct original research in areas of Electro-Optics, EO, which augment equipments currently under development and may potentially form the basis for future equipments to be fielded by EWL. While at EWL, I have been educated in the techniques of electronic warfare and applied those skills to vulnerability analyses of various US equipments, cost and operational effectiveness studies (e.g. ASH COEA), ECCM and ECM techniques (e.g. stearable null antenna processor, SNAP, and frequency hopping/spread spectrum, OCM and OCCM techniques, millimeter wave and artificial intelligence techniques and practices. I am responsible for the Wayside Laser Range in the sense that I am the primary user of that facility. Working routinely with class IV lasers, I have acquired some expertise in their use and an appreciation for their hazards.

1972-1978 - Laser Division, NVEOL and CSTA Labs, Fort Monmouth, (GS-0855-07 to 12). During this period, the Laser Division was transferred from the Combat Surveillance and Target Acquisition Laboratory, CSTA Lab, to the Night Vision and Electro-Optics Laboratory, NVEOL, (at Fort Belvoir, VA). My duties here were primarily directed at first to the measurement of gun flash for the purpose of developing a Flash Detection Sensor, FDS. This would allow hostile artillery to be located and destroyed, thus minimizing US casualties. I was heavily involved in FDS testing and development. As a result, I acquired a working knowledge of optics and radiometry. In order to increase the line of sight range of the FDS, it was proposed that it be flown on a remotely piloted vehicle RPV. (e.g. tethered helicopter). This led to my interest in remote attitude measurement which was to become the topic for my doctoral dissertation. The latest patent, #4,134,618 grew from that interest. The other two patents,#4,035,659 and 4,010,381 arose from my Masters Thesis, and are my own. While in the Laser Division, I acquired a working knowledge of various Lasers including solid state (e.g. GaAlAs), gas dynamic (e.g. CO_2), both gas discharge and RF lasers (e.g. CO_2) and flash lamp pumped lasers(e.g. NdYAG and Ruby). The transfer of the Laser Division to Fort Belvoir necessitated my reassignment to EWL.

1969-1972 Laser Division, CSTA Lab, Fort Monmouth (GS-0855-03-07)). As a student trainee, I was assigned first to work under a Mr. Sam Stein who trained me to work a 13U spectrometer which characterized the optical transmission of various samples (e.g. dyes) and detectors (e.g. HgCdTe). I then was reassigned to Mr. Carillo and Mr. Dehne who gave me a good background in not only infrared technology (ala the gunflash measurements), but also computer data reduction techniques (e.g. power spectra via fast fourier transform). Both here and while in the Laser Division, I acquired the basics of the technical engineering skills (e.g. designing an operational amplifier circuit to "correct" the response of a measurement circuit to 005 Hz) and appreciation for their practical implementation (via DP parts) in real applications.

Prior to 1969 - I worked approximately 1 month as a stock boy in an auto parts store (Garrison's, now in Sea Girt, N.J.) and helped my father as a free-lance carpenter. Here, I acquired a basic knowledge of carpentry and mechanics along with a good helping of common sense.

RESUME OF TRAINING AND EXPERIENCE
OF DR. STANLEY KRONENBERG (RCC ADVISOR-EXPERT)

1. Educational background:

PhD in Physics, University of Vienna, [ ] Ex6

2. Vocational experience with radiation:

1951-1952	With Institute for Radium Research, Vienna, Austria as Researcher.
1952-1953	At the General Hospital of Vienna, Austria, as Radioisotope and Nuclear Radiation researcher, medical applications.
1953-Present	With US Army Electronics Research and Development Command, Fort Monmouth, NJ, Supervisor Research Physicist

3. Formal Training in Radiation:

a. Principles and practices of radiation protection.

Where Trained	Duration of Training
University of Vienna	1948-1952

b. Radioactivity measuremer , standardization, and monitoring techniques and instruments.

Where Trained	Duration of Training
University of Vienna	1948-1952

c. Mathematics and calculations basic to the use and measurement of radioactivity.

Where Trained	Duration of Training
University of Vienna	1948-1952

4. On-the-job training in radiation.

a. Principles and practices of radiation protection.

Where Trained	Duration of Training
University of Vienna	1948-1952
Institute for Radium Research	1950-1952
Vienna General Hospital	1952-1953
Fort Monmouth, NJ	1953-Present

b. Radioactivity measurement, standardization and monitoring techniques and instruments.

Where Trained	Duration of Training
University of Vienna	1948-1952
Institute for Radium Research	1950-1952
Vienna General Hospital	1952-1953
Fort Monmouth, NJ	1953-Present

c. Mathematics and calculations basic to the use and measurement of radioactivity.

Where Trained	Duration of Training
University of Vienna	1948-1952
Institute for Radium Research	1950-1952
Vienna General Hospital	1952-1953
Fort Monmouth, NJ	1953-Present

5. Experience with radioisotopes.

Isotope	Maximum Activity	Place of Experience	Duration of Experience
Radium and Derivitives	2 Ci	Inst of Radium Res, Vienna	2 yrs
^{131}I	1 Ci	Inst of Radium Res, Vienna	2 yrs
^{90}Sr	3 Ci	Inst of Radium Res, Vienna	2 yrs
^{137}Cs	220 Ci	Fort Monmouth, NJ	25 yrs
^{60}Co	125 kCi	Fort Monmouth, NJ	25 yrs
^{90}Sr	5 Ci	Fort Monmouth, NJ	25 yrs
^{210}Po	10 Ci	Fort Monmouth, NJ	25 yrs
^{241}Am	100 uCi	Fort Monmouth, NJ	25 yrs
Ra & Be neutron source	20 mCi	Fort Monmouth, NJ	25 yrs
^{239}Pu	20 lbs (fast burst reactor)	Aberdeen Proving Ground, MD	5 yrs
^{235}U	20 lbs (fast burst reactor)	Aberdeen Proving Ground, MD	5 yrs
^{85}Kr	1 Ci	Fort Monmouth, NJ	25 yrs
^{27}Na	100 mCi	Fort Monmouth, NJ	25 yrs
^{3}H	90 Ci	Fort Monmouth, NJ	25 yrs

. ... with devices equivalent to that of actual · e of radioisotopes.

DEVICE	PLACE OF EXPERIENCE	DURATION
2 MeV Van de Graaff	Fort Monmouth, NJ	25 yrs
X-ray Machines	Fort Monmouth, NJ	25 yrs
Linear Accellerator	White Sands Missile Range	25 yrs (occassional
Cocroft Walton Accellerator	Edgewood Arsenal, MD	25 yrs (occassional
Flash X-rays (e.g. FX 100)	Fort Monmouth, NJ	25 yrs
Cyclotrons	Brookhaven National Labs	25 yrs (occassional
Nuclear Reactors	Oak Ridge, TN	25 yrs (occassional

Authored 45 scientific papers and reports in the areas of nuclear radiation, dosimetry, biology, radiation transport, tactical dosimetry, etc.

Member: American Nuclear Society

Holds 5 patents in the area of radiation dosimetry.

Served on 5 occasions as project officer at nuclear weapons tests.

TRAINING & EXPERIENCE WITH RADIATION & RADIOACTIVE MATERIAL
OF

Dr. Stanley Kronenberg

TITLE: Supv. Research Physicist

POSITION: Chief, Nuclear Hardening Technical Area
Electronics Technology & Devices Laboratory
USAECOM

EDUCATION: PhD in Physics, University of Vienna, [ ] Ex6
Dr. Kronenberg did his doctorate in theoretical nuclear physics but participated actively during his study in the experimental work performed at the Institute for Radium Research in Vienna. After graduation he was employed by the General Hospital in Vienna to study radioisotopes in connection with medicine, therapeutic and diagnostic applications of X-rays and corpuscular rays.

Since 1953 he has been employed by the US Army Electronics Command and worked since that time with the nuclear physics group in Fort Monmouth, NJ. Research has been mainly in radiation dosimetry, nuclear effects testing, and basic research in nuclear and radiation physics.

He has published numerous papers in the above fields and holds several US patents in his area of interest. He has also participated in numerous nuclear weapon tests as project officer.

EXPERIENCE - Dr. Stanley Kronenberg
Chief, Nuclear Hardening Technical Area, ET7D Lab, ECOM, Ft. Monmouth, NJ

Received his education at the University of Vienna and earned his PhD in Physics in [ ] Did his doctorate in theoretical nuclear physics but participated actively during his study in the experimental work performed at the Institute for Radium Research in Vienna. After graduation he was employed by the General Hospital in Vienna to study radioisotopes in connection with medicine, therapeutic and diagnostic applications of X-rays, and corpuscular rays. Ex 6

Since 1953 he has been employed by the U. S. Army Signal Corps and worked since that time with the nuclear physics group in Fort Monmouth, N. J. Did mainly research in radiation dosimetry, nuclear weapon effects testing, and basic research in nuclear and radiation physics.

Has published numerous papers in the above fields and holds several US patents in his area of interest.

Participated in numerous nuclear weapon tests as project officer.

ISOTOPE	MAX AMOUNT	PLACE	DURATION	TYPE OF USE
$^{3}_{1}H$	100 Ci	ECOM	1960	Sources assembly
^{22}Na	Several milicuries	ECOM	1962	Research
32 p	Tracer	ECOM	1953 - present	Dosimetry
^{60}Co	3500 Ci	" & Vienna	1951, 1960 -pres.	Research
^{85}Kr	1 Ci	ECOM	1963	Research
Ag	Tracer	ECOM	1955-present	Dosimetry
^{90}Sr	1 Ci	ECOM & Vienna	1950, 1958	Dosimetry
^{198}Au	Tracer	ECOM	1955-present	Dosimetry
^{137}Cs	150 Ci	ECOM	1958-present	Research
Th (Various Isotopes)	several kg	ECOM	1970-present	Research
^{235}U	several Kg	ECOM	1958-present	Use of Burnt rea in Research
Pu	several Kg	ECOM	1958-present	Use of Burnt rea and Atom bombs

RESUME

DAVID W. GRIFFIS

PERSONAL:

Born:
Martial Status:
Health:
Military Service: Captain, Medical Service Corps, Unites States Army, October 1978 - July 1982
Present Position: Radiation Protection Officer, Safety Office, HQ, US Army Electronics Research and Development Command

Ex6

EDUCATION:

Texas A&M University, College Station, Texas
Degree: MS, Nuclear Engineering -
Thesis: Computer Determination of Bacterial Volume

Degree: BS, Nuclear Engineering -

Ex6

Texas Tech University, Lubbock, Texas
Degree: BS, Chemistry -

San Antonio Junior College, San Antonio, Texas
Degree: AS -

WORK EXPERIENCE:

July 1983 to Present — Radiation Protection Officer, Safety Office, HQ, USA ERADCOM

This job includes on site visits to ERADCOM laboratories and activities to insure compliance with DOD and other Governmental agency directives concerning ionizing and nonionizing radiation safety. The job also includes the responsibility to review and comment on various documents including equipment and facility designs, proposed regulations, and environmental assessments. It is usually necessary to prepare oral and written reports of the findings of these visits and documentation reviews. Additionally, the job includes responsibilities to coordinate various inspections, audits, surveys, or studies performed by other DoD or non-military governmental agencies and prepare responses which may be generated by various recommendations prepared by these agencies. Other duties include preparing training requirements for the Health Physics staff of ERADCOM and keeping various safety statistics.

Work Experience Continued:

November 1981 to July 1982	Nuclear Medical Science Officer; Health Physics Division, US Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland This job included on-site visits to various Department of Defense (DoD) installations to insure compliance with DoD and other governmental agency directives concerning radiation safety. The job also included the requirement to review and comment on various documents including facility designs, proposed installation regulations and environmental assessments. It was usually necessary to prepare oral and written reports of the findings of the on-site visits and document reviews. There was also a requirement to prepare and present lectures during various short courses presented by the division as well as act as an assistant supply officer for the division (approximately 20 persons).
January 1979 to November 1981	Nuclear Medical Science Officer, Laser-Microwave Division, US Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland This job included on-site visits to various DoD and other governmental agencies' installations to insure compliance with DoD or other directives concerning the safe use of lasers or other high intensity optical sources. Often the job required the evaluation of newly developed systems which used laser devices to insure that the laser would be safe to use during training or repair of the laser device. It was usually necessary to prepare oral and written reports of the findings of the on-site visits and device evaluations. There was also a requirement to prepare and present lectures during various short courses presented by the division. Other duties included scheduling the quarterly and yearly on-site visits for a branch of approximately 10 persons, and preparing job description statements required for the hiring of technicians.

PART TIME EMPLOYMENT:

August 1977 to September 1968	Fort Sam Houston Independent School District, Fort Sam Houston, Texas
and	
August 1982 to June 1983	Substitute teacher for various science and mathematic courses. Class size varied - up to 25 persons.
August 1975 to May 1977	Department of Mathematics, Texas A&M U, College Sta, Texas. Instructor of entry level mathematics course. Number and size of classes varied from 40 to 150 persons.

Part Time Employment continued

August 1972 to May 1973 — Department of Chemistry, Texas Tech University, Lubbock, Texas

Responsible for preparing chemicals and replacing broken laboratory utensils for laboratory (10 labs/week). (One of approximately 20 individuals with this job).

August 1970 to May 1971 — Department of Chemistry, San Antonio Junior College, San Antonio, Texas

Responsible for preparing chemicals and replacing broken laboratory utensils for laboratories (5 labs/week). (One of three individuals with this job).

MISCELLANEOUS:

Member of:

DARCOM Radiation Advisory Group
DoD Laser Safety Working Group
Health Physics Society

Military Courses Completed:

Army Medical Department Radiation Protection Officer Workshop - 1982
Nuclear Hazards Training Course - 1980
Medical X-Ray Survey Techniques - 1979
Laser and Microwave Hazard Analysis - 1979
Lasers - 1979
Army Medical Department Officer Basic Course - 1978

Other Courses Completed:

Radiation Emergency Management - 1984
Health Physics Aspects of Depleted Uranium - 1984

RESUME

Dr. Ernest Potenziani, II

Office (201) 544-4630

Experience: 1982 To Present: US Army Electronics Technology and Devices Laboratory, Electronic Materials Research Division, Magnetic Materials Team. Responsible for installation and setup of superconducting vibrating sample magnetometer, Mössbauer Spectrometer and zero-field spin-echo NMR Spectrometer. Also responsible for interfacing the above analytical tools to this laboratory's PDP 11/34 MiniComputer.

1979-1982: Henry Krumb School of Mines, Columbia University. Responsible for installation and setup of Mössbauer Spectrometer. Also responsible for analysis, deconvolution, and interpretation of Mössbauer Spectra by computer analysis.

1976-1978: Physics Department, Rensselaer Polytechnic Institute, Troy, NY. Investigation of the isomeric states of 197 Hg as obtained from a $^{197}Au(\gamma, \pi^-)^{197}Hg$ reaction. This work involved the use of the 500 MeV Bates Linear Accelerator, Massachusetts, separation techniques, and the use of semiconductor radiation detectors.

Education: Columbia University, City of New York, NY. Master of Science, ; Doctor of Engineering Science, Major: Solid State Science and Technology.

Rensselaer Polytechnic Institute, Troy, NY. Bachelor of Science, Physics, ; Minor: Computer Science.

Professional Societies: IEEE, APS, AOPA.

Personal Interests: Student Pilot, member and head custodian of the Fort Monmouth Army Flying Club. Hobbies include electronics and automobiles.

SUPPLEMENT G

SUBJECT: Radiation Protection Program
REFERENCE: NRC FORM 313 (I), Item 15

RADIOLOGICAL SAFETY PROCEDURES

RESPONSIBILITIES AND PROCEDURES GOVERNING THE RADIATION PROGRAM ARE DESCRIBED HEREIN. ANY QUESTIONS CONCERNING THE INTERPRETATION OF PROCEDURES SHOULD BE BROUGHT TO THE ATTENTION OF THE RADIOLOGICAL PROTECTION OFFICER (RPO) TELEPHONE EXTENSION 65292

SUPPLEMENT I

VAULT SOP and GENERAL SAFETY

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
DRDEL-SS-H	Operating Procedures for the Underground Vault

TO	FROM	DATE	CMT 1
SEE DISTRIBUTION:	DELCS-D	14 May 1984 Kirkwood/mnp/65292	

1. POLICY

a. It is ERADCOM policy that radiation sources be used in a fashion which protects personnel from unwarranted radiation exposure and will maintain radiation exposures at a level as low as reasonably achievable.

b. The Underground Vault sources will be used with the understanding that their procurement and utilization shall be in accordance with Radiation Safety Procedures. (Standing Operating Procedures attached). Any questions concerning the interpretation of procedures will be brought to the attention of the Radiological Protection Officer (RPO) for assistance and guidance.

2. DISCUSSION

a. These procedures apply to all organizational units and individuals who procure, possess, use, store, transfer, or dispose of radiation sources, i.e. radioactive material with an activity of one microcurie or greater, and ionizing radiation devices.

b. Responsibilities and procedures governing the use of the sources are described in the enclosure.

3. REFERENCES

a. Code of Federal Regulations, Title 10 and 49.

b. US Nuclear Regulatory Commission Guide 8.10 September 1975 (A.L.A.R.A.).

c. AR 40-14

d. AR 385-11

e. DARCOM R 385-25

f. DARCOM R 385-29

g. ERADCOM R 385-1.

1 Encl
as

For Norman E. Daniels (signature)
JOHN F. MARKHAM
COL, SC
Commanding

CONCURRENCE: Anthony J. Kirkwood (signature)
ANTHONY S. KIRKWOOD
RPO, ERADCOM
Ft. Monmouth, NJ 07703

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OPERATING PROCEDURES FOR THE FACILITY

<u>LOCATION</u>: Evans Area of Fort Monmouth.

<u>ORGANIZATION</u>: Radiac Division, CSTAL, ERADCOM, Ft. Monmouth, NJ.

1. References:

a. NRC License No. 29-01022-07.

b. AR 40-14, 'Medical Services', 'Control and Recording Procedures For Exposure to Ionizing Radiation and Radioactive Materials', dated 15 March 1983.

c. ERADCOM-R 385-1, 'Safety, Radiological Protection Program', dated 1 September 1981.

d. DF, Subject: "Radiation Protection, Combined Directive", dated 15 December 1983, from; Commander TSA, Commander CSTAL, Director ETDL, and Director EWL.

NOTE: Copies of the above references are available in the Console Room in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X65443) and/or the Radiological Safety Office (Room 25, Bldg. 45, X65292).

2. <u>Description of Facility</u>: See Supplement C of Reference 1a.

3. <u>Purpose</u>: The purpose of these procedures is to:

a. Provide guidance to individuals who may have occasion to enter the area.

b. Serve as a check list or reminder to operator of approved operations.

c. Serve as a training aid for individuals studying to become approved operators of the facility.

d. Minimize the exposure of personnel to radiation and radioactive material.

e. Minimize the release of radioactive material if the sealed source should rupture.

4. <u>Applicability</u>: These procedures apply to:

a. Visitors

b. Custodial Personnel

c. Maintenance Personnel

d. Individuals who position material to be irradiated.

e. Facility Operators

f. Operator Trainees.

g. Emergency Personnel (Firemen, Guards, Rescue Squad, etc....)

h. Inspectors

i. Any other individuals who may have occasion to enter the areas involved.

5. Responsibility:

a. The Supervisor of the Radiation Facilities or his designated representative is responsible for enforcement of these procedures.

b. The Supervisor of Radiation Facilities or his designated representative have the responsibility of insuring that individuals do not enter the exposure room without an approved operator being present to directly supervise the entrance.

c. Approved operators and individuals authorized to directly supervise the work of individuals undergoing operator training shall insure that the items listed in these Operating Procedures are carried out and that every individual entering the area involved are apprised of the potential hazards.

d. Individuals entering the areas involved have the responsibility of following the instructions given by the approved operator in charge at the time they are in the areas.

6. Personnel Limits:

a. Control Room

(1) Up to 10 individuals may be in the Control Room when the sources are in their storage position.

(2) Up to 6 individuals may be in the Control Room when any of the sources are in the UP (expose) position. An approved operator must be present when anyone is in the Control Room and any source is in its UP (expose) position.

7. Radioactive Material Limits: The amount of COBALT-60 in the Exposure Room at any one time shall not exceed .

8. Radiation Limits:

a. Console Room. The shielding material between the Exposure Room and the Console Room shall be maintained in such a manner that the exposure rate in the Console Room does not exceed 1.0 mR/hour at locations near the Exposure Room door and the surfaces of other shielding between the two rooms. The average exposure rate in the room shall not exceed 2 mR/hour.

b. <u>Exposure Room</u>. (Sources and shield plug on 225 Ci source down).

(1) The exposure rate over either source, 30 inches above the platform, shall not exceed 250 mR/hour.

(2) The exposure rate 30 inches above the platform and 40 inches from a perpendicular line that passes through either source shall not exceed 1 mR/hr.

9. <u>Exposure Limits</u>: The exposure rates and the length of time spent in the Underground Vault Area shall be controlled so that the exposure limits given in AR 40-14, are not exceeded. NOTE: A copy of AR 40-14 is available for use in the Console Room and in the Office of the Supervisor of Radiation Facilities (Bldg. 401, X65443) and the Radiological Safety Office (Bldg. 45, Rm 25, X65292).

10. <u>Dosimetry Requirements</u>:

a. Radiation workers shall wear their film badges while in the Underground Vault area.

b. Each individual who performs work in the Exposure Room shall wear a film badge and a pocket dosimeter (0-200 mR) while in the room. At least one of each two individuals working in the room shall wear a "chirpee" type of dosimeter. The two individuals shall stay together if only one of them is wearing a "chirpee".

c. At least one out of each group of four or less of visitors in the Exposure Room at one time shall wear a personnel dosimeter. The members of such a group shall stay close to each other so that any exposure indicated by the dosimeter will be representative of each member of the group.

d. The Supervisor of Radiation Facilities, the Radiation Protection Officer, or one of their designated representatives, or the approved operator in charge of the facility at the time, may require the use of additional personnel dosimeters and/or radiation detectors.

11. General Safety Precautions:

a. Individuals wishing to visit the Underground Vault Area, to have material irradiated, or to enter the area for some other reason (other than for emergency reasons) should schedule the visit so that advance preparations can be made. Contact the Supervisor of Radiation Facilities, X65443 to make reservations.

b. Individuals shall sign in and be issued personnel dosimeters, radiation detection and measuring devices before entering the restricted portion of Bldg. 401. These steps are carried out in the [ ] office, nearest the entrance to the building.

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c. All individuals going to the Console Room shall be accompanied by an approved operator or his designated representative.

d. Only approved operators or their designated representatives will use the key to the Underground Area.

e. Only an approved operator may obtain the two keys for the switch locks that operate the Plug control device and the solenoid air valves that control the positioning of the sources by air flow.

f. An approved operator and at least one other individual shall be in the Underground Vault Area while the door to the Exposure Room is open.

12. Source Storage:

a. The [ ] source will be kept in its storage container with the lead plug over the source if:

(1) The source is not in use.

(2) Individuals are in the Exposure Room.

(3) A leak test of the source indicates the source is leaking.

(4) Radioactive contamination is found in the Exposure Room.

b. The steps to follow in order to put the sources in their storage positions are listed in Item 14e below.

13. Emergencies:

a. No air pressure.

(1) If source capsules are in their lead storage containers they cannot be raised to exposure position until air pressure is supplied.

(2) [ ] source capsule in exposure position. The source can be returned to the lead storage container by opening the switch to the magnetic clutch, which lowers the lead storage plug and pushes the source capsule into the lead storage container.

b. Electrical Power Failure

The source capsule automatically returns to the lead storage container by being pushed down by the lead plug, with any interruption of the electrical circuit.

c. If the meter that indicates exposure rate at the source exhaust air vent reads above 3 mR/hour or if there are other indications of the sources leaking:

(1) Cut off the air supply valve to the source controls. This hand valve is located on the wall beside the electrical panel.

(2) Shut off the Console Room exhaust fan. The switch for this fan is located on the wall beside the electrical panel.

(3) Leave the Underground Vault Area. Close the door at the top of the stairs as you leave. Remove your shoes as you leave the area (they may be contaminated).

(4) Proceed to the Large Work Area of the building. If anyone is in the work area ask them to contact the Supervisor of Radiation Facilities or the Radiological Safety Office (X65292) and ask for assistance. If no one is in the area try to contact the Radiological Safety Office yourself. Two phones are in the large Work Area.

(5) Proceed to the nearest restroom, wash exposed portions of the body and remove outer garments. Remain in or near the restroom until you have checked for contamination.

14. Sequence of Operations.

a. Pre-Entry Requirements.

(1) Obtain advanced approval of the Supervisor of Radiation Facilities or his designated representative.

(2) Register in office for film badge (if not permanently assigned) and personnel monitoring equipment (dosimeter, chirpee).

(3) Accompany approved operator to locked entrance of Vault Console Room.

b. Entry into Console Room. Upon entering the Console Room, operator will:

(1) Activate equipment by turning on main electrical switch on wall panel.

(2) Open valve supplying air pressure to source controls.

(3) Open valve at bottom of filter to remove water from air lines.

(4) Check readings of monitors for the console room and the one for the source exhaust air.

(a) If the Console Room Area monitor indicates that the exposure rate is over 1 mR/hour, notify the Supervisor of Radiation Facilities or the Radiation Safety Office (X65292).

(b) If the exhaust air monitor reads over 3 mR/hour follow the instructions in Item 13c, "ERMERGENCIES", above.

c. Entry into the Exposure Room.

(1) Make sure all entrants have required dosimeters and radiation instruments in addition to their film badges.

(2) Check and make sure the source and its lead plug are down.

(3) The operator will place source control switch keys in his pocket and keep then there.

(4) The first individual to enter the Exposure Room must take survey meter readings before and during entrance. (Check meter response, before entry, with source in lead pig, at maze door entrance - expect a reading of $\approx$1 mR/hr.)

(5) Check survey meter at end of maze to insure that the source is in its safe position.

(6) When setting up equipment for exposures, do not lean over source rise tubes.

d. Raising the Source.

(1) Make sure all equipment in exposure room is secure and in correct position.

(2) Remove all excess cables and wires from exposure room.

(3) Leave Exposure Room, making sure to bring survey meter out.

(4) The operator in charge will check the Exposure Room to insure that everyone is out of the room before proceeding to (5) below.

(5) Close interlock barrier and close lead clad maze door to maze, making sure interlocks close.

(6) Check the level of solution in the zinc bromide window. Green light console should be ON.

(7) To use the 225 Ci source:

(a) Open air valve for Source 1.

(b) Check air pressure gauges. The pressure for the Source UP gauge should be between 8 and 18 psi, while the pressure on the DOWN guauge should be between 18 and 25 psi.

(c) Actuate the plug enable switch. This locks the lead lined door and initiates a 10-second warning period, all during which an alarm bell sounds and a red warning light is on in the exposure room.

(d) After the warning period is ended, actuate the plug raise switch. This initiates a 15-second period during which the lead storage plug is being raised. A green light on the console indicates the end of this period.

(e) After the plug raising period has ended, insert the key in the source control switch and turn it clockwise. This will activate the air control, raising source 1 to the exposure position. The red lights on the console, the upper hallway, the outside of the building, and the earth mound will remain lit as long as the source is up. After the red lights go out (indicating that the source is up) return the console key to its "off" position.

(8) If overnight or weekend exposures are required, notify the Fire Department on X65432, also the security guards, X65670.

e. Lowering the Sources.

(1) Depress the "down" switch on the (lead plug) console. This lowers the plug and the source capsule into the storage container. All remote monitors should return to background readings, red lights will go out and green light will appear on console.

(2) Close the air valve for the source.

(3) Open lead shield door leading to exposure room.

(4) Turn on exhaust fan to remove ozone air due to exposure.

(5) Take survey meter and enter exposure room to remove equipment or make changes for further exposures.

f. Leaving Underground Vault.

(1) Make sure all excess equipment, cables, etc., are removed from exposure room.

(2) Make sure you have the keys to both the source switch and the door of the vault before leaving.

(3) Turn off air pressure valve to source controls.

(4) Turn off air vent blower.

(5) Turn off main electrical switch.

(6) Note the exposure just performed, in the log book.

(7) Make sure door to entrance of Underground Vault is locked.

(8) Turn in all personnel monitors,

15. Periodic Inspection and Maintenance Procedures.

a. The lead door to the exposure room has an interlock. If the door light on the control panel is red, this indicates the door is not closed far enough to close the interlock. If the source is up and the door is opened, the action of the interlock will cause the source to be lowered into the storage container.

b. Zinc bromide level. There is a micro-switch on a float to check the level of the zinc bromide filled window. If the indication light is red, the source will not go up. If the window liquid should leak out into the exposure room and not be apparent in the control room, a drop in the level of the zinc bromide liquid will cause the float to activate the micro-switch. If the source was in the exposure position, it would lower the source back into the storage container, making it safe to enter the control room.

c. Radiation monitors. The control room monitor is set at just above background, and the exhaust air monitor is set at likewise.

d. The plug enable switch must be in the "on" position or the plug and the source will not raise. When this switch is turned "on", a warning bell will ring for 10 seconds in the exposure room to give warning that the source will be raised.

e. When the source is not in use, the air shut off valve is turned clockwise to the closed position. The air shut off valve must be turned counter-clockwise to the open position before the source can be raised. The source cannot be raised to exposure position if there is no air pressure.

f. The following checks will be made every six months.

(1) Turn on main power to control panel and console containing monitoring system by closing knife switch located on electrical panel at the foot of the stairs.

(2) Check all lights on console and control panel. The following lights should be on.

(a) Control panel

Source switch (key) green
Plug enable - green
Door to exposure room - red (open) green (closed)
Window - green
Monitors - green

(b) Console

Alarm: Red light will show and alarm will ring until system equalizes. Green light will show, alarm will shut off.

Remote monitors: All meters should be lighted. All monitors should be to background with red lights out. If red light shows on monitor, reset button must be pushed and held until light stays out. It takes time for monitors to reach equilibrium if the system has been off.

(3) Check interlock on lead door leading to exposure room. When door is closed, red light on control panel should go out and green light should show.

(4) Check float level of zinc bromide window, green light sould go out and red light activate when float is pushed lower in the solution.

(5) Check remote monitoring meters on console. If power transit has produced high reading(s), push reset button(s).

(6) Check plug enable light. Green light should go on after plug enable switch has been on for 10 seconds and alarm bell has rung.

(7) Turn on air valve, located on rear wall. This supplies air to the source operating system. Observe air gauges for up and down pressures. UP pressure for Source 1 should be between 12-14 lbs., and DOWN pressure approsimately 18 lbs. Adjust if necessary.

(8) Check source operation as follows:

(a) Close lead door leading into source room, green light should show.

(b) Check window float level, green light should show.

(c) Check source key switch, green light should show.

(d) Raise lead safety plug for checking Source 1.

(e) Using source control key, turn switch clockwise, this activates air control valves and raises source to exposure position. Red light on source control switch should activiate, green light should go out. Remote area monitor in source room should show indications of radiation. Red lights in upper-hallway, outside wall of vault and on mound, should light.

(f) Source should remain in exposure position when key is returned to center position.

(9) Check source safety operation as follows:

Source in exposure position

(a) Open lead door leading to exposure room, source should immediately lower into storage container, red door light on control panel should show.

(b) Push up on back of float level for zinc bromide window, forcing float lower in solution, source should automatically lower to storage container, float level red light should come on.

(c) Check loss of power by opening knife switch on electrical panel controlling console power. With power off or interrupted, source should automatically return to its lead storage container.

(10) Check of Remote Monitoring System

(a) This system provides separate readout, in the control room, of the dose rate at each of the three remote sensing units. The units have logarithmic meter readout covering four decades. Two of the units have 0.01 to 100 mR/hr range. The third unit covers 0.1-1000 R/hr. Radiation levels in excess of pre-set alarm conditions are indicated by a red alarm light and bell. The system operates on 115V, 60 hertz supply.

(b) Remote units are checked for accurate response using a calibrated survey meter and a test source during the routine monthly health physics surveys.

The monitor in the Exposure Room indicates if the source is up or down. Its operation can be checked by raising the source.

g. In addition to the checks described in "f", the following are performed at the interval indicated.

(1) Sources are leak tested every six months. (See Supplement G for method).

(2) Source 1 head holding mechanism, is checked for wear and adjustment every 3 months.

(3) Micro-switch on holding heads are inspected and tested for radiation damage every 3 months.

(4) Wooden platform in source room is checked yearly and replacement made if any radiation damage is present.

(5) Mercury vapor lamps in exposure room are checked ever 3 months, and replaced or repaired, if necessary.

(6) Air system is inspected for leaks every 3 months.

(7) Filter in air line is drained and purged every month to remove water collected from the air.

(8) Remote monitoring systems are checked every month.

(9) Air compressor is oiled and checked every month.

(10) Air vent blower is checked and oiled every 3 months.

(11) Dehumidifiers are checked and oiled every 6 months.

SUPPLEMENT J

VAULT EMERGENCY PROCEDURES

EMERGENCY PROCEDURES

1. Attached as Attachment 1, is the text of a sign which is conspicuously posted in the Control Room of the irradiation facility.

2. Attached as Attachment 2, is a copy of emergency procedures for the First Aid Team.

3. Attached as Attachment 3, pages J-5 and J-6, are copies of emergency procedures of Patterson Army Hospital, which is the primary medical facility which will be used in the event of an emergency at the irradiator facility. Attached as Attachment 4, pages J-6, 7, and 8, is Chapter 7 of TM 8-215, which is a reference of Attachment 3.

In the event of suspected or known Radiation overexposure or personnel, the following procedures are to be carried out:

1. The vault will be evacuated immediately.

2. The First Aid Team will be called. (X65680 and/or 65244)

3. The Radiological Protection Officer will be notified. (X65292)

FIRST AID TEAM

EMERGENCY PROCEDURES

In responding to suspected or known radiation overexposre of personnel, the following procedures are to be carried out:

1. Until there is a positive assurance to the contrary, it will be assumed that the patient is radiologically contaminated and appropriate procedures will be implemented to keep the contamination from being spread.

2. The patient will be taken to Patterson Army Hospital by ambulance and will be checked in for treatment and/or observation.

ANNEX L (HANDLING OF RADIOACTIVE CONTAMINATED PATIENTS)
EMERGENCY PREPAREDNESS PLAN

1. PURPOSE. The purpose of the plan is to set forth the procedures to be followed in case of radiation accidents.

2. SCOPE. This plan is applicable to the Emergency Room personnel, the Administrative Officer of the Day, the Adjutant and Radiation Protection Officer.

3. RESPONSIBILITIES:

a. Persons receiving call.

(1) In addition to the routine information sought the person receiving the call should inquire about the typ of the radioactive contaminant and level of contamination remaining after initial contamination at the scene of the accident.

b. Emergency Room Personnel should notify:

(1) Adjutant (21043) during duty hours
AOD after duty hours

(2) MOD

(3) Radiation Protection Officer (Environment Sci Officer).

c. Emergency Room Personnel:

(1) The guidelines set forth in TM 8-215, Chapter in particular, should be followed as appropriate.

(2) Contaminated patients will be brought in the entrance to the immediate left of the emergency entrance ar placed in the holding area at the rear of the emergency roc area.

(3) All patients, personnel and material leaving this area must be checked for contamination by the Radiatio Protection Officer or his assistant.

(4) Access to the patient treatment area will be limited to the personnel necessary to provide treatment.

(5) All waste and contaminated material will be held for disposal by Medical Supply.

(6) Lifesaving measures will take precedence over patient decontamination.

(7) Pregnant personnel will not be assigned to radiation injury patients.

d. It will be the responsibility of the Radiation Protecti Officer to perform the necessary monitoring of radiation.

e. Ambulance and Emergency Room personnel sent to the scen of a nuclear accident will:

(1) Report to the Nuclear Accident/Incident Control Officer (NAICO) or on-scene commander to receive the situation briefing as to the presence of casualties, the type of accident and whether the accident has a potential for creating a radioactive contamination hazard.

(2) Ascertain from the NAICO or on-scene commander the requirements for individual protective measures to be taken by rescue and medical personnel against potential hazards from high explosives and radioactive or other hazardous materials.

(3) Prepare casualties for early evacuation. Take simple and feasible but not unreasonable time-consuming decontamination measures (e.g., removal of shoes, external clothing, etc., weather permitting) to minimize the spread of contamination to transport vehicles or treatment facilities.

f. Mass Casualty Recall should be initiated by the AOD if the number of casualties is too great for the staff on hand to manage.

4. <u>REFERENCE</u>:

a. TM 8-215

CHAPTER 7

MEDICAL MANAGEMENT OF PATIENTS IN NUCLEAR WARFARE

32. General

The successful early management of patients depends upon the exercise of sound judgment in the following basic areas:

a. Medical sorting of patients (Triage).

b. Treatment. This should be directed toward providing maximum benefit to the greatest number under the circumstances while avoiding any procedure which would unwarrantably reduce the patient's ability to care for himself.

c. Utilization of medical service personnel. Medically trained individuals must be used efficiently and should not be diverted to first aid, rescue, transportation, or nonmedical labor functions.

d. Flexibility of the supporting medical facility to respond and adapt to rapidly changing circumstances.

e. Rigorous supply conservation.

f. Evacuation of casualties.

g. Planning and training. Preparation for the management of patients in nuclear warfare must be based on a knowledge of nuclear weapons effects and sound medical practices. Training must be practical rather than theoretical.

33. Medical Sorting

a. Medical sorting or triage is the key to the effective management of large numbers of sick and wounded. It includes the immediate classification of patients according to type and seriousness of injury and likelihood of survival, and the establishment of priorities for treatment and evacuation to assure medical care of the greatest benefit to the largest number. Sorting permits the orderly, timely, and efficient utilization of available medical means. It is a continuous process, carried out at each echelon of medical care as patients are evacuated rearward. The critical importance of sorting demands that medical officers assigned this responsibility be selected on the basis of mature professional judgment.

b. Criteria for the classification of patients will vary with the military situation, the patient load, and the capability of the medical unit involved. The following is a classification of patients according to their need for medical care and chance for survival:

(1) *Patients requiring Minimal treatment:* Those who may be returned to duty include those who have: 1) small lacerations or contusions, 2) simple fractures of small bones, 3) second-degree burns of less than 10 percent extent but not involving face or hands, or who have received, 4) short term body ionizing radiation doses of 100 to 150 rads. The second group includes noneffective persons who need minimal nursing care for: 1) disabling minor fractures; 2) burns of the face or hands which interfere with the person's ability to care for himself; 3) moderate neuropsychiatric disorders, or, 4) early symptoms of nausea and vomiting due to short term whole-body ionizing radiation doses of 150 rads or less. These patients truly have no priority for treatment but in practice would receive some treatment when first seen. Ordinarily, their wounds and diseases would be such that the treatment they receive while being sorted is all the treatment they would require, and they could then be returned to duty or sent to a facility for minimal nursing care. This group could constitute up to 40 percent of the total injured.

(2) *Patients requiring Immediate Care.* Included as patients requiring immediate care are those with: 1) hemorrhage from an easily accessible site, 2) rapidly correctible mechanical respiratory defects, 3) severe crushing wounds of the extremities, 4) incomplete amputations, 5) severe lacerations with open fractures of major bones, and 6) severe burns of the face and upper respiratory tract necessitating tracheotomy. The patients in group 2 will be given the highest priority for surgical treatment because a relatively short procedure could save life or limb. More definitive surgery would be delayed to a later date. An increased rate of complications and permanent disability would have to be accepted. This group is expected to comprise about 20 percent of the total injured.

(3) *Patients whose surgical treatment ...*

be Delayed. Persons whose surgical treatment can be delayed without immediate jeopardy to life include those with: 1) simple closed fractures of major bones, 2) moderate lacerations without extensive bleeding, 3) second-degree burns of 10 percent to 25 percent and third-degree burns of 10 percent to 15 percent of the body surface (after body fluid levels have been stabilized), and 4) noncritical central-nervous-system injuries. This group is composed of patients for whom a delay in treatment might lead to complications but whose lives would not be unduly jeopardized by delay. The amount of delay between wounding and surgery for this group depends on the total number of patients with higher priorities who need treatment and the medical facilities available. This group may comprise about 20 percent of all injured.

(4) *Patients whose treatment would be on an extended delayed basis (Expectant).* These patients include those with: 1) critical injuries of the central nervous system or respiratory system, 2) penetrating abdominal wounds, 3) multiple severe injuries, 4) severe burns of large areas (30 percent or above), or 5) known lethal or supralethal doses of total body radiation. The treatment for group 4 patients would consist of that resuscitation and emergency medical treatment which the available facilities, total supplies, and number of professional personnel permit. They would have the lowest priority for surgery because the operative procedures required would be time consuming and technically complicated, so that an operation on one of these patients would theoretically jeopardize the lives of several in other higher priority groups. The more rapidly patients in other treatment categories are treated and moved, the sooner more definitive treatment could be started on the injured in category 4. It is anticipated that this group will comprise about 20 percent of all injured.

c. The percentages noted above for each classification may vary considerably in a specific instance during nuclear warfare, depending on a multitude of factors including the physical environment, orientation of the personnel, weapon employment, time of day, presence or absence of fallout, and many other variables.

34. Handling the Radioactively Contaminated Patient

a. Patients who have been in fallout areas may have varying amounts of radioactive contamination on their skin and clothing. The contamination will be in the form of fission products which have become absorbed on the surfaces of dirt or dust particles of varying sizes. The patient him will not be radioactive but he will suffer ra tion injury (beta burn , from the contamina unless it is removed early. In addition, as patient is handled, much of the contamina will be scattered about, contaminating o people and the surroundings. The objective proper decontamination is to control the rem of this hazardous material from patients, rest ing it to defined areas. This will allow pr handling of contaminated equipment and clot and will reduce the hazard to other personnel

b. It is important to bear in mind the dist tion between contaminated patients and radia injured patients. Patients who have received stantial doses of radiation and who subseque exhibit clinical manifestations of the acute ra tion syndrome are not necessarily contamina Likewise, patients who are contaminated h not necessarily received substantial doses of ra tion. Mere exposure to radiation does not re in a contaminated casualty. Only when substan emitting radiation are deposited upon, or beco attached to, the patient or his clothing is patient radiologically contaminated.

c. The presence of fallout contamination u a patient represents by far a greater hazard the patient himself than it does to the person caring for him. The duration of the exposure, quantity of contact contamination, the dista between the source and those exposed, and geometry of the radiation exposure all comb to maximize the danger to the patient wh minimizing that to those around. Further, if medical facility which receives the contaminat patients is itself in a fallout area, the high gam environment and its threat to all patients a medical personnel would far outweigh any h ards from handling contaminated patients.

d. Fear that the gathering of large numbers heavily contaminated patients in or around medical facility is hazardous is unfounded. T only hazard from radioactive contamination whi can cause injury at any distance in air is gam radiation. It would be very difficult to get enou patients crowded together to constitute a signi cant gamma hazard. If all the radioactive co tamination from many heavily contaminated p tients was collected in one small area of a fe square meters, a minor hazard could result, b the patients themselves will not present a gamm hazard.

e. The major hazard associated with handlin contaminated patients is the possibility of be burns caused by transfer of the radioactive m terial from the patients to the unprotected sk surfaces of other per...nel. Th...gh this hazard is not a lethal one, it could result in the incapacitation of medical personnel from the burns if the material is not removed from their skin.

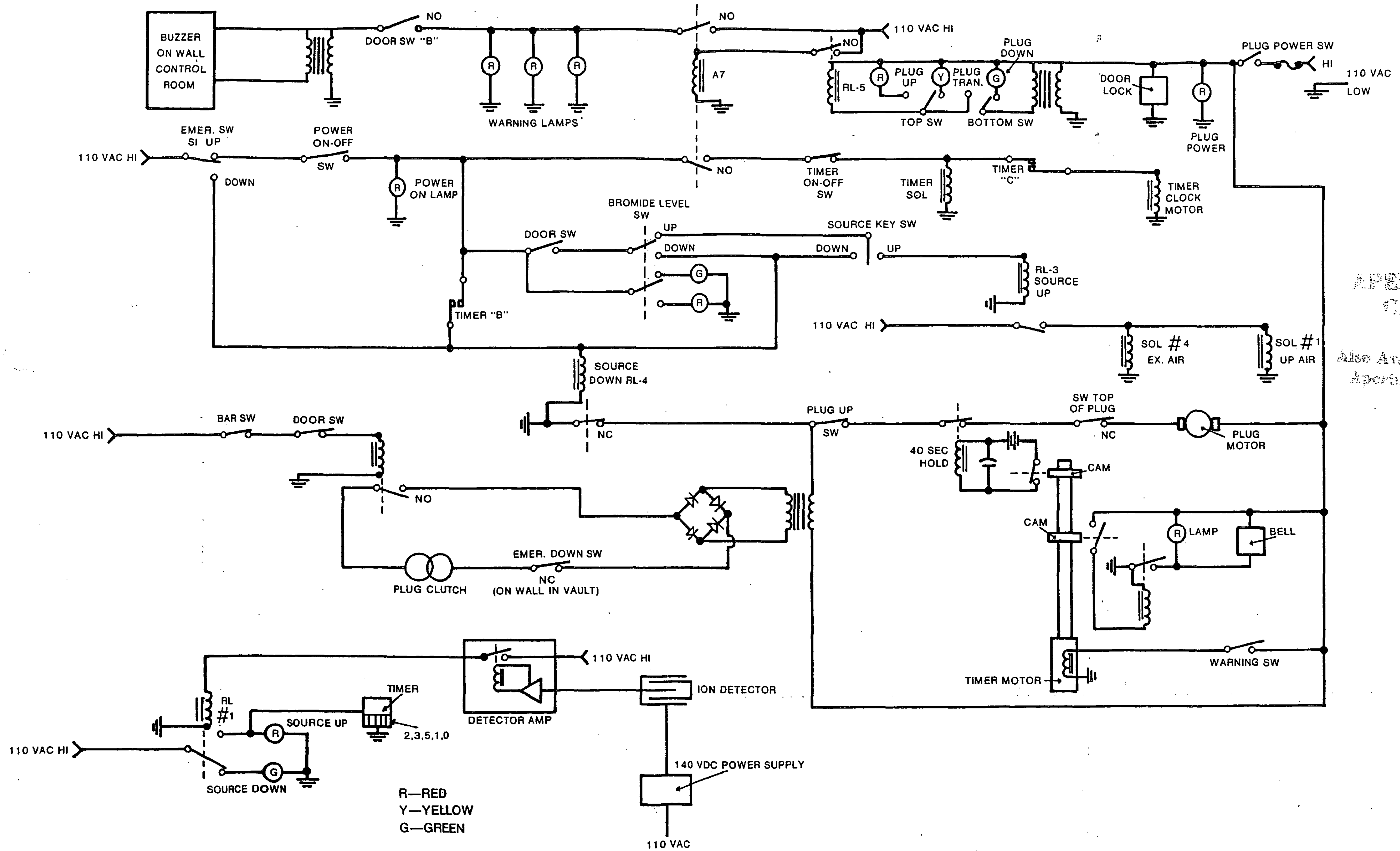
f. In order to handle the radiologically contaminated patients properly, it is first necessary to detect contaminated patients. The only way to detect radioactive contamination is by proper monitoring with radiac instruments. Since the levels of radiation to be dealt with are rather low and the governing hazard is beta radiation, a Geiger-Mueller counter such as the AN/PDR-27 should be used to monitor incoming patients for contamination. As a general rule, if the reading is twice current background radiation or higher, the patient should be considered contaminated.

g. Incoming patients should be monitored at any time there is any reason to believe that contaminated patients are arriving at the medical facility. (Possible indications: reports from ambulance drivers, messages from another hospital or a headquarters, sighting of a nuclear burst or cloud.) Otherwise, patients may be "spot checked" every 15 minutes or every five or six patients. This monitoring need not be carried out at a great distance from the medical facility. It can be accomplished within or just outside the admission area. The only requirement is that it be done if at all possible prior to admission of the patient to the facility. Once it has been confirmed that the patient is contaminated, decontamination is easily accomplished. The simple removal of all outer clothing and a brief washing or brushing of the exposed skin surfaces will achieve a high degree of decontamination without subjecting the patient to the trauma of vigorous bathing and showering. These simple tasks can be accomplished prior to admission or later on the ward or elsewhere in the medical facility depending upon the condition of the patient. *The radiological contamination of the patient should not be allowed to interfere with immediate life saving treatment or the best possible medical care.* However, whenever decontamination of a patient is done, the material removed results in contamination of another area. If a patient is brushed or washed off, all the material removed must be collected and removed from the medical facility. Even though the quantities of radioactive material on one patient may be small, the uncontrolled removal of contami...ion fr... large numbers of patients could result in hazardous accumulations of materials in hospital facilities. Problems can arise as a result of trying to decontaminate seriously injured patients who require extensive resuscitative and surgical treatment without delay. It may be necessary to accept a certain amount of contamination in the treatment facilities, during the care of such patients. At intervals when possible, thorough cleaning of the areas will have to be done.

h. It is desirable for those handling patients before or during their decontamination to wear gloves. Any gloves will help, but rubber gloves are preferable. Monitors should supervise disposition of contaminated clothing and equipment, and all staff personnel must emphasize normal hygiene, such as washing hands and face.

i. Whenever a contaminated patient is admitted to the facility prior to complete decontamination, his records should be clearly marked to indicate that he is contaminated. Any suitable code word may be used, such as "RADCON," so long as personnel who come in contact with the patient understand its meaning. After incompletely decontaminated patients have been admitted, monitors should make followup rounds of clinics and wards. When the decontamination of the patient has been completed within the facility, and the monitor verifies this, the monitor should line out the code word and enter the word "clear" along with the date and his initials on the medical record. The patient need receive no special treatment or handling thereafter for reasons of radiological contamination.

j. The receipt of contaminated patients by a medical facility need not require the declaration of any alert or special "condition" throughout the facility. Only the few people who come in direct contact with the patient prior to decontamination need be concerned. Monitors who detect the contamination should notify those in the admission area and those in the supply section who may handle contaminated clothing and equipment. Others in the facility who come in contact with the patient prior to completion of decontamination will be alerted to the extent necessary by the coded entry on the patient's attached record. These are the only members of the staff who need be concerned about the situation (app B).



X 2

UNDERGROUND VAULT SCHEMATIC DIAGRAM

FIG. C-9

8509180371-0

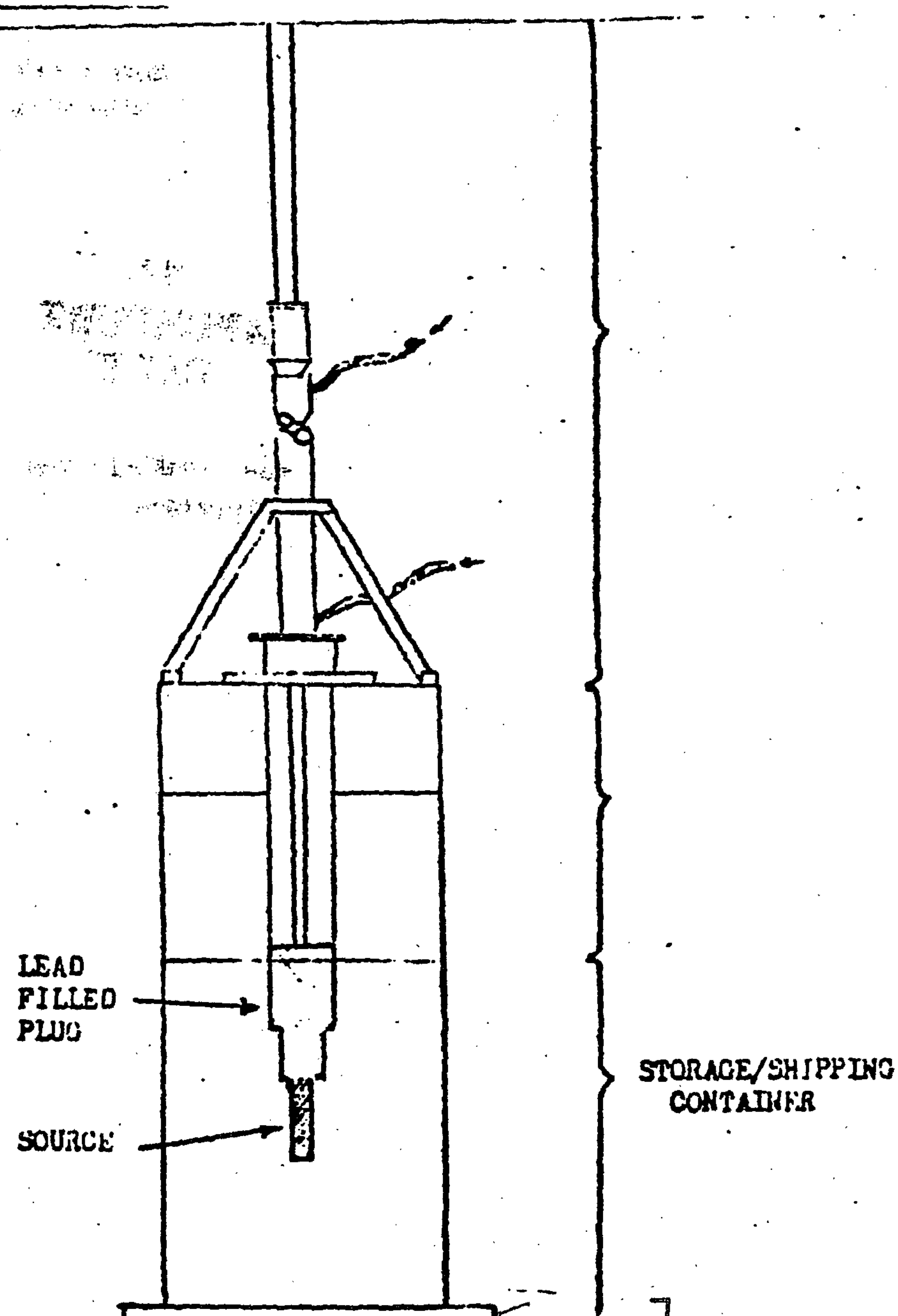


Figure C-10 source.
Source in down (storage) position.
(This source is disconnected and cannot be operated)

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
AMDEL-SS-FM	Operating Procedures for the Underground Vault

TO SEE DISTRIBUTION: FROM DELCS-D DATE 23 April 1985 CMT 1
Griffis/mnp/65292

1. POLICY

a. It is ERADCOM policy that radiation sources be used in a fashion which protects personnel from unwarranted radiation exposure and will maintain radiation exposures at a level as low as reasonably achievable.

b. The Underground Vault sources will be used with the understanding that their utilization shall be in accordance with Radiation Safety Procedures. (Standing Operating Procedures attached). Any questions concerning the interpretation of procedures will be brought to the attention of the Radiological Protection Officer (RPO) for assistance and guidance.

2. DISCUSSION

a. These procedures apply to all organizational units and individuals who possess, use, store, transfer, or dispose of the Vault sources.

b. Responsibilities and procedures governing the use of the sources are described in the enclosures.

3. REFERENCES

a. Code of Federal Regulations, Title 10 and 49.

b. US Nuclear Regulatory Commission Guide 8.10 September 1975 (A.L.A.R.A.).

c. AR 40-14

d. AR 385-11

e. DARCOM R 385-25

f. DARCOM R 385-29

g. ERADCOM R 385-1.

1 Encl
as

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STANDARD OPERATING PROCEDURES FOR THE [redacted] FACILITY

Ex 2

Ex 2 LOCATION: [redacted] Evans Area of Fort Monmouth, NJ.

ORGANIZATION: Radiac Division, CSTAL, ERADCOM, Ft. Monmouth, NJ.

1. Reference:

a. NRC License No. 29-01022-07

b. AR 40-14 "Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials", dated 15 Mar 81.

c. ERADCOM R-385-1 "Radiological Protection Program", dated 1 Sep 81.

d. DF, subject: "Radiation Protection, Combined Directive", dated 15 Dec 83, from: Commander, TSA, Commander, CSTAL, Director, ETDL, and Director, EWL.

NOTE: Copies of the above references are available in the Control Room, in the office of the Supervisor of Radiation Facilities [redacted], X65543) and/or the Radiological Safety Office (Room 25, Bldg. 45, X65292). Ex 2

2. Description of Facility: See Supplement C of Reference 1a.

3. Purpose: The purpose of these procedures is to:

a. Provide guidance to individuals who may have occasion to enter the area.

b. Serve as a check list or reminder to operator of approved operations.

c. Serve as a training aid for individuals studying to become approved operators of the facility.

d. Minimize the exposure of personnel to radiation and radioactive materials.

e. Minimize the release of radioactive material if the sealed source should rupture.

4. Applicability: These procedures apply to:

a. Visitors

b. Custodial Personnel

c. Maintenance Personnel

d. Individuals who position material to be irradiated.

e. Facility Operators

f. Operator Trainees

g. Emergency Personnel (Firemen, Guards, Rescue Squad, etc...)

h. Inspectors

i. Any other individual who may have occasion to enter the areas involved.

5. <u>Responsibility</u>:

a. The Supervisor of the Radiation Facilities or his designated representative is responsible for enforcement of these procedures.

b. The Supervisor of Radiation Facilities or his designated representative have the responsibility of ensuring that individuals do not enter the exposure room without an approved operator being present to directly supervise the entrance.

c. Approved operators and individuals authorized to directly supervise the work of individuals undergoing operator training, shall ensure that the items listed in these Operating Procedures are carried out and that every individual entering the area involved are apprised of the potential hazards.

d. Individuals entering the areas involved have the responsibility of following the instructions given by the approved operator in charge at the time they are in the areas.

6. <u>Personnel Limits</u>:

a. Control Room

(1) Up to ten (10) individuals may be in the Control Room when the sources are in their "storage" position.

(2) Up to six (6) individuals may be in the Control Room when any of the sources are in the "up" (exposure) position. An approved operator must be present when anyone is in the Control Room and any source is in its "up" (exposure) position.

7. <u>Radioactive Material Limits</u>: The amount of Cobalt-60 in the Exposure Room at any one time shall not exceed [ ]

8. <u>Radiation Limits</u>:

a. Control Room. The shielding material between the Exposure Room and the Control Room shall be maintained in such a manner that the exposure rate in the Control Room does not exceed 1.0 mR/hour at locations near the Exposure Room door and the surfaces of other shielding between the two rooms. The average exposure rate in the room shall not exceed 2 mR/hour.

b. Exposure Room.

(1) The exposure rate over either source, 30 inches above the platform, shall not exceed 250 mR/hour.

(2) The exposure rate, 30 inches above the platform and 40 inches from a perpendicular line that passes through either source, shall not exceed 1 mR/hr.

9. Exposure Limits: The exposure rates and the length of time spent in the Underground Vault Area shall be controlled so that the exposure limits given at paragraph 7, reference 1b, are not exceeded.

10. Dosimetry Requirements:

a. Radiation workers shall wear their film badges while in the Underground Vault area.

b. Each individual who performs work in the Exposure Room shall wear a film badge and a pocket dosimeter (0-200 mR) while in the room. At least one of each two individuals working in the room shall wear a "chirpee" type monitor or use a dose-rate meter which produces an audible signal for individual counts. The two individuals shall stay together if only one of them is wearing a "chirpee" or carrying the dose-rate meter.

c. At least one out of each group of four or less of visitors in the Exposure Room at one time shall wear a personnel dosimeter. The members of such a group shall stay close to each other so that any exposure indicated by the dosimeter will be representative to each member of the group.

d. The Supervisor of Radiation Facilities, the Radiation Protection Officer, or one of their designated representatives, or the approved operator in charge of the facility at the time, may require the use of additional personnel dosimeters and/or radiation detectors.

11. General Safety Precautions:

a. Individuals wishing to visit the Underground Vault Area, to have material irradiated, or to enter the area for some other reason (other than for emergency reasons) should schedule the visit so that advance preparation can be made. Contact the Supervisor of Radiation Facilities, X65443, to make reservations.

b. Individuals shall sign in and be issued personnel dosimeters, radiation detection and measuring devices before entering the restricted portion of [ ] These steps are carried out in the [ ] vestibule.

c. All individuals going to the Underground Vault shall be accompanied by an approved operator or his designated representative.

12. Source Storage:

a. The source will be kept in its storage container with the lead plug over the source if:

(1) The source is not in use.

(2) Individuals are in the Exposure Room.

(3) A leak test of the source indicates the source is leaking.

(4) Radioactive contamination is found in the Exposure Room.

b. The steps to follow in order to put the sources in their "storage" positions are listed in Item 14g, below.

13. Emergencies:

a. Source Leakage. If the meter that indicates exposure rate at the source exhaust air vent or the meter in the Control Room read above 3 mR/hour or if there are other indications of possible source leakage:

(1) Cut off the air supply valve to the source controls.

(2) Shut off the Control Room exhaust fan. The switch for this fan is located on the wall beside the electrical panel.

(3) Leave the Underground Vault Area. Close the door at the top of the stairs as you leave. Remove your shoes as you leave the area (they may be contaminated).

(4) Proceed to the large Work Area of the building. If anyone is in the Work Area, ask them to contact the Supervisor of Radiation Facilities or the Radiological Safety Office (X65292), and ask for assistance. If no one is in the area, try to contact the Radiological Safety Office yourself. Two phones are in the large Work Area.

(5) Proceed to the nearest restroom, wash exposed portions of the body and remove outer garments. Remain in or near the rest room until you have been checked for contamination.

b. Electrical Power Failure. In the event of any interruption of the electrical circuit, the source capsule automatically returns to the lead storage container by being pushed down by the lead plug. No further action by the operator is required.

c. Individuals inadvertently remaining in the Exposure Room. Upon hearing the warning alarm, any individual remaining in the Exposure Room will immediately:

(1) Set the emergency stop switch, located near the maze wall, to the "down" position.

(2) Proceed to the lead clad door and announce your presence.

(3) Exit when control room operator opens lead clad door.

NOTE: No further action is required since plug cannot be raised when emergency stop switch is in the "down" position.

14. Sequence of Operations.

a. Pre-Entry Requirements.

(1) Obtain advanced approval of the Supervisor of Radiation Facilities or his designated representative.

(2) Register in office for film badge (if not permanently assigned) and personnel monitoring equipment (e.g. dosimeter, meter, "chirpee").

(3) Proceed to locked entrance of Vault Control Room.

b. Entry into Control Room. Upon entering the Control Room, operator will:

(1) Check readings of monitors in the Control Room.

(a) If the Control Room Area monitor indicates that the exposure rate is over 1 mR/hour, notify the Supervisor of Radiation Facilities or the Radiation Safety Office (X65292).

(b) If the exhaust air monitor, the Control Room monitor, or both, read over 3 mR/hour, follow the instructions in paragraph 13a; Source Leakage, above.

(2) Activate equipment by turning on main electrical switch on wall panel.

(3) Open valve supplying air pressure to source controls.

(4) Open valve at bottom of filter to remove water from air line.

c. Interlock operability checks. Prior to placing any equipment in the Exposure Room:

(1) With the source plug in the "down" position, independently check the following interlock systems:

(a) Try to raise the plug, as described at paragraph 14, below, with the emergency switch in the Exposure Room "down". It should not work.

(b) Try to raise the plug with the barrier bar down. It should not work.

(c) Try to raise the plug with the lead clad door open. It should not work.

(d) Try to raise the plug with the emergency stop switch on control panel "down". It should not work.

(e) Try to raise the plug while depressing the float in the Zinc Bromide sindow. It should not work.

(2) Raise the plug and source, as described at paragraph 14e, and 14f, below.

(3) With the source in the "up" position, independently check the following interlock systems:

(a) Unlock lead clad door. Sources should return to storage container.

(b) Depress float for Zinc Bromide window level. Source should return to storage container.

(c) Place emergency stop switch on control panel in "down" position. Source should return to storage container.

(4) Annotate log to indicate interlock checks performed.

NOTE: If the facility is used two (2) or more times during the same day, only one interlock check is required. Further interlock checks may be performed at the discretion of the operator(s).

d. Entry into the Exposure Room.

(1) Make sure all entrants have required dosimeters and radiation instruments in addition to their film badges.

(2) Ensure that source and plug are "down" by observing lights on control panels. Turn plug control key switch counter-clockwise and remove key. Turn source control key switch (SW3) counter-clockwise, remove key and place control panel power switch (S2) in "off" (down) position.

(3) As a final check, observe the remote monitor marked "vault" and ensure that source is "down" (background readings only).

(4) The operator will place both control switch keys in his pocket and keep them there.

(5) The first individual to enter the Exposure Room must take survey meter readings before and during entrance. (Check meter response, before entry, with source in lead pig at maze door entrance.

(6) Check survey meter at end of maze to ensure that the source is in its safe position.

(7) When setting up equipment for exposure, do not lean over source rise tubes.

(8) Make sure all equipment in Exposure Room is secure and in correct position.

(9) Remove all excess cables and wires from Exposure Room.

(10) Exit Exposure Room, making sure to bring survey meter out.

(11) The operator in charge will check the Exposure Room to ensure that everyone is out of the room before proceeding.

(12) Raise barrier bar and close lead clad door to maze.

e. Raising the plug.

(1) Raise control power panel switch (S2) to "on" position. Red power on lamp is lit.

(2) Insert key into source key switch (SW3) and place in central position.

(3) Insert key into plug control panel key switch and turn clockwise. A red "pwr-on" lamp and green "plug down" lamp will be lit and the lead clad door to maze will lock.

(4) Raise and hold warning switch on plug control panel. A ten (10) second alarm will sound in the Exposure Room.

(5) Within 45 seconds after alarm stops, raise and hold plug raise switch. This initiates a two (2) minute period during which the lead storage plug is being raised. During this period the yellow "plug-tran" lamp is lit. The red lights near the maze door in the Control Room, in the upper hallway, outside of the building, and on top of the earth mound, will turn on. They will remain on until the plug returns to its "down" position. The plug is raised when the red "plug-up" lamp is lit on the plug control panel.

f. Raising the source:

(1) Turn key switch (SW3) on control panel clockwise to "up" position.

(2) When red source "up" lamp, above key switch, is lit, return key to center position. This light, as well as the timer and its red light, are activiated by an ion chamber detector located 75 cm from the source rise tube. A reading above the original background level on the 0.0-1000 R/hr remote monitor (labeled "Vault") on the console will also indicate that the source is in the "up" position.

g. Lowering the source:

(1) Turn the source key switch (SW3) counter-clockwise. Source "down" lamp and plug "down" lamps (green) will be lit. Return key switch to central position.

(2) Turn key switch on plug console "off" (counter-clockwise).

(3) Check "vault" remote monitor to ensure source down.

(4) Open lead clad door to Exposure Room.

(5) Follow procedures at paragraph 14d(1)-6, above, before entering Exposure Room to remove equipment or make changes for further exposure.

h. Leaving Underground Vault after completing exposure.

(1) Make sure all excess equipment, cables, etc., are removed from Exposure Room.

(2) Enter the exposure, just performed, in the log book.

(3) Turn off air pressure valve.

(4) Turn off main electrical switch.

(5) Make sure you have the keys to both the source and plug raise switches, and the door to the vault, before leaving.

(6) Make sure door to entrance of Underground Vault is locked.

(7) Turn in all personnel monitors, [redacted] Ex 2

15. <u>Periodic Inspection and Maintenance Procedures</u>.

a. Prior to the first use of the facility during a calendar day, the operators perform the interlock checks listed at paragraph 14c, above, and annotate the log book.

b. On a monthly basis: The operation of the remote monitor and alarms will be checked by using a test source during monthly routine health physics surveys.

c. Every six months:

(1) Sources will be leak tested. (See Supplement G of reference 1a, for method).

(2) The Vault Co-60 Irradiation Facility Maintenance Checklist (Attachment 1) will be completed and a copy placed on the log.

Underground Vault Co-60 Irradiation Facility
Maintenance Checklist

Date of Maintenance Check:______________

The following checks will be performed every six (6) months.

plus (+) items that pass.
zero (0) items that fail.

Check readings on remote monitors in Control Room.

1. All monitors read green. (If either "air vent" or "control room" monitor indicate source leakage, follow steps outlined at paragraph 13a; Source Leakage, of SOP. Do not continue.)

Activate equipment by turning on main electrical switch.

Open valve supplying air pressure to source controls.

2. Air pressure between 8-10 psi.

Purge any water remaining in line by opening valve at bottom of filter.

Raise control panel switch (S2) to "on" position.

3. "Power-on" lamp - red.
"Maze door" lamp - red
"Zinc Bromide Level" lamp - green

Ensure that no-one is in Exposure Room and close maze door.

4. "Maze door" lamp - green

Depress and hold Zinc Bromide float.

5. "Zinc Bromide Level" lamp - red

Insert key into source key switch (SW3) and place in central position.

Insert key into plug control panel key switch and turn clockwise.

6. "Pwr-on" lamp - red
"Plug-down" lamp - green
Maze door - locked.

Raise and hold warning switch

7. Alarm - audible

Raise and hold plug raise switch within 45 seconds after alarm

8. Verify Control room red light - "on".

9. As soon as possible, after raising plug raise switch, have other individual(s) verify condition of the following lights:

Hallway red light - "on"
Earth mound red light - "on"
Red light outside building - "on"

During plug raise period:

10. "Plug down" lamp - "off"
"Plug tran" lamp - yellow

At end of plug raise period (approximately two (2) minutes)

11. "Plug tran" lamp - "off"
"Plug up" lamp - red

Turn key switch (SW3) clockwise to "up" position

12. Source "up" lamp - red
Timer light - red
Timer - "on"
"Vault" remote monitor - indicating radiation field (yellow and red lamps lit)

Place key switch in center position.

Depress and hold float for Zinc bromide window. Source and plug should return to container.

13. Plug "down" - green
Source "down" - green
"Vault" remote monitor - background readings

Return source to "up" position. Place control panel emergency stop switch in "down" position. Source and plug should return to container.

14. Plug "down" - green
Source "down" - green
"Vault" remote monitor - background

Return source to "up" position. Turn plug control key switch counter-clockwise to unlock maze door. Source and plug should return to container.

15. Plug "down" - green
Source "down" - green
"Vault" remote monitor - background

Turn control panel key switch (SW2) "off", counter-clockwise. Remove both keys. Open lead clad door. Enter Exposure Room following procedures at paragraph 14d(1-6) of SOP. Place Exposure Room emergency stop switch in "down" position. Return to Control Room, raising barrier bar and closing maze door. Attempt to raise plug following procedure above. Plug should not raise.

16. Exposure Room interlock functional.

Return to Exposure Room following procedures at paragraph 14d(1-6) of SOP. Return Exposure Room emergency stop switch to "up" position. Return to Control Room, leaving barrier bar "down". Close maze door. Attempt to raise plug following procedure above. Plug should not raise.

17. Barrier bar interlock functional.

Open maze door. Raise barrier bar. Leave maze door open and attempt to raise plug following procedure above. Plug should not raise.

18. Maze door interlock functional.

Close maze door. Place control panel emergency stop swith in "down" position. Attempt to raise plug following procedure above. Plug should not raise.

19. Control panel emergency interlock functional.

Raise control panel emergency stop switch to "up" position. Depress and hold Zinc Bromide window float. Attempt to raise plug following procedure above. Plug should not raise.

20. Zinc Bromide level interlock functional.

Return source key switch to central position. Turn plug control key switch counter-clockwise. Check and calibrate, as necessary, the Remote Air Monitors, following the procedure outlined in the manufacturer's (Eberline) "Technical Manual for Radiation Monitoring System II Model RMS II". A copy is placed in the log.

21. Remote monitor's functional/calibrated

22. Source head holding mechanism functional.

23. Air vent blowers functional.

24. Dehumidifiers functional.

25. Wall outlet and control panel lamps functional.

26. Mercury lamps and control panel lamp functional.

Place control panel power switch in "down" position. Open maze door. Turn off equipment power. Place this checklist in log.