DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND
5001 EISENHOWER AVENUE, ALEXANDRIA, VA. 22333

DRCSF-P

7 July 1981

Director
Nuclear Material Safety and Safeguards
ATTN: Radioisotopes Licensing Branch
US Nuclear Regulatory Commission
Washington, DC 20555

Gentlemen:

Forwarded is US Army Electronics Research and Development Command's application for renewal of Byproduct Material License Number 29-01022-06. This request is for possession and use of any byproduct materials with atomic numbers 3 through 83 in sealed form, Americium-241 and Hydrogen-3 in sealed and unsealed form, and sealed forms of Cobalt-60, Polonium-210, Promethium-147, and Strontium-90, for research and development.

Please acknowledge receipt of correspondence on inclosed DA form 209 Mail Reply Card.

Sincerely,

DARWIN N. TARAS
Chief, Health Physics
Safety Office

2 Incl

CF:
HQDA (DASG-PSP-E) WASH DC 20310
Dir, DARCOM FSA, Charlestown, IN 47111
Cdr, US Army Electronics Research and Development Command, ATTN: DRDEL-SS, 2800 Powder Mill Road, Adelphi, MD 20783

TABLE OF CONTENTS

TABLE OF CONTENTS

C8476

FORM NRC-313 I (3-80) 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 BPL 29-01022-06

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

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION Stanley B. Potter
Radiological Protection Officer
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)*
See Supplement A

(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 individuals
b.	designated by the Radiation Control Committee,	Mr. Stanley B. Potter, Chairman.
c.	See Supplement C	

7. RADIATION PROTECTION OFFICER
Stanley B. Potter, RPO
Norman V. Pratt, 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 F for resumes

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)	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME (D)
(1)	Any byproduct material with atomic nos. 3-83	Sealed source	Any	1,000 ea radionuclide
(2)	Americium 241	Any	NA	35
(3)	Cesium 137	Sealed source	Any	[400,000] no single source over [120,000]
(4)	See Supplement D			

	DESCRIBE USE OF LICENSED MATERIAL (E)
(1)	See Supplement E
(2)	
(3)	
(4)	

08476

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.

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.

    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 Supplements C, F and J.

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)*	b. CERTIFYING OFFICIAL *(Signature)* Walter S. McAfee
	c. NAME *(Type or print)* Dr. Walter S. McAfee
(1) LICENSE FEE CATEGORY:	d. TITLE Scientific Advisor
(2) LICENSE FEE ENCLOSED: $	e. DATE 7 April 1981

SUPPLEMENT A

LOCATIONS WHERE BYPRODUCT MATERIAL WILL BE USED

SUPPLEMENT A

LOCATIONS WHERE BYPRODUCT MATERIAL WILL BE USED.

1. Fort Monmouth is made up of a number of sub-posts or areas located in Monmouth County, New Jersey. Byproduct material is primarily used in the Evans Area; however, occasionally it is used in other areas.

2. The following areas and locations combine to form Fort Monmouth.

   a. US Army Communications and Electronics Command Headquarters Bldg Tinton Avenue and Garden State Parkway, Tinton Falls, NJ.

   b. Charles Wood Area - Intersection of Tinton Avenue and Hope Road, Eatontown, NJ.

   c. Fort Monmouth (Main Post) - Entrance at intersection of Tinton Ave and NJ Hwy 35, Eatontown, NJ.

   d. Klystronics Bldg - Mid-Monmouth Industrial Park, intersection of Hope Road and NJ Hwy 36.

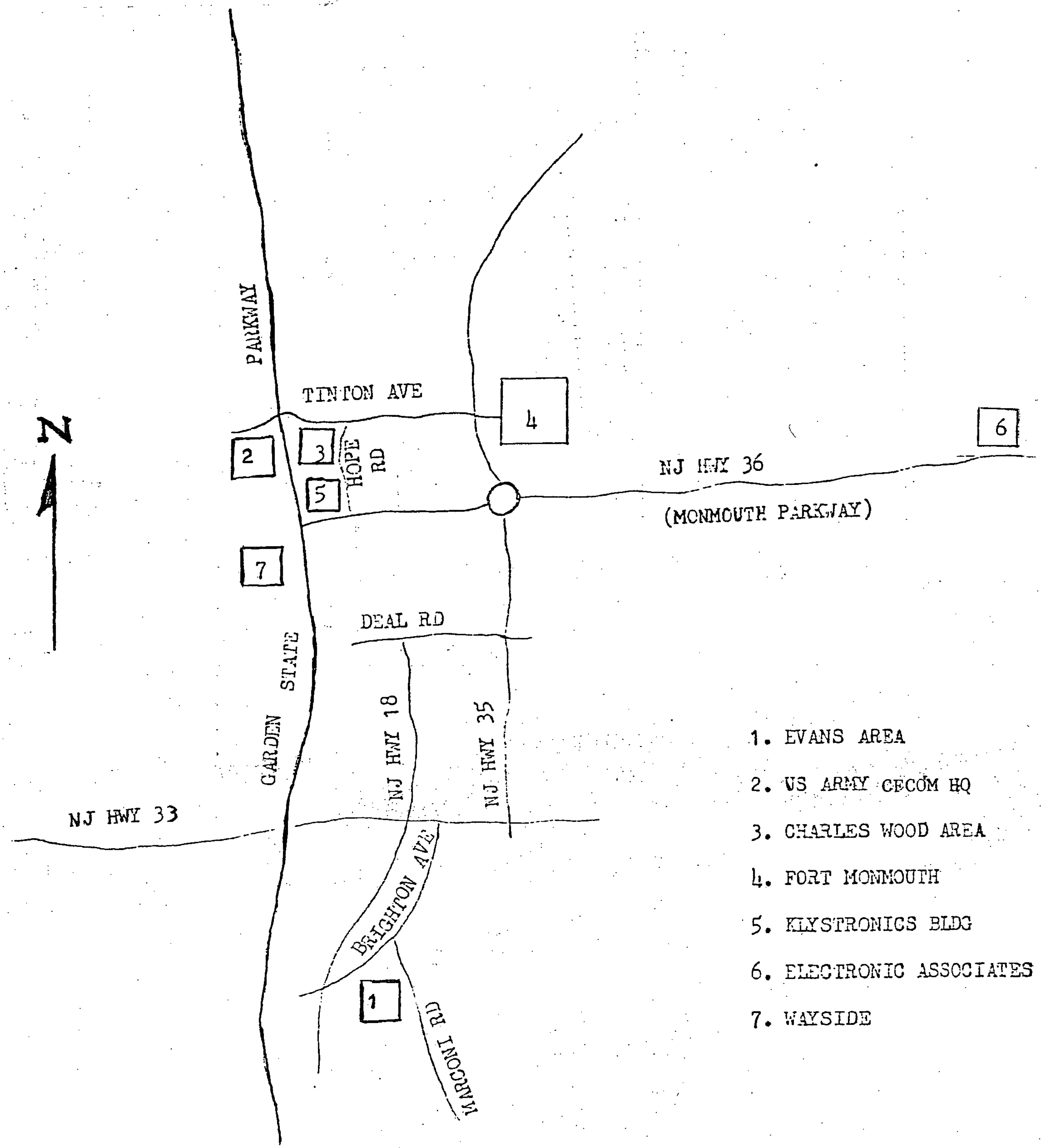
   e. A portion of Electronic Associates, Inc. - 185 Monmouth Parkway, Eatontown, NJ.

   f. Wayside Area Earle Ammunition Depot - Wayside Road and Wyckoff Road, Wayside, NJ.

   g. Evans Area - Intersection of Marconi Road and Brighton Avenue, Neptune, NJ.

3. Fig A-1 shows the relative locations of the above areas.

4. In addition to the above areas, sealed sources containing not more that 220 curies and two tritiated accelerator targets containing not more than 20 curies each may be used in the Kaman Nuclear Corp Model A-1001 Neutron Generator Facility at Gateway National Park, NJ.



1. EVANS AREA
2. US ARMY CECOM HQ
3. CHARLES WOOD AREA
4. FORT MONMOUTH
5. KLYSTRONICS BLDG
6. ELECTRONIC ASSOCIATES
7. WAYSIDE

FIG. A-1 FORT MONMOUTH AREA

SUPPLEMENT B

FILM BADGES, DOSIMETERS AND BIO-ASSAY PROCEDURES USED

SUPPLEMENT B

FILM BADGES, DOSIMETERS AND BIO-ASSAY PROCEDURES USED

1. US Army Inoizing Radiation Dosimetry Center service is used for personnel monitoring on a monthly basis for radiation workers and on an as needed basis for visitors.

2. Quartz fiber dosimeters are issued on an as needed basis to visitors of radiation areas. Dosimeters of this type are worn by both visitors and radiation workers in high radiation areas.

3. Individuals working in high radiation areas may also use Atomic Accessories Personal Radiation Monitors (chirpees) or other similar type devices.

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

5. ERADCOM, Fort Monmouth radiation workers take their film badges with them when they will be exposed to radiation at remote locations. If their stay extends beyond a film badge change date, fresh film is sent to them and they, in turn, mail the exposed film back to Fort Monmouth.

SUPPLEMENT C

RADIATION CONTROL COMMITTEE
MEMBERS

SUPPLEMENT C

MEMBERS OF RADIATION CONTROL COMMITTEE

Committee meets at least quarterly. Records of meetings are maintained in the files of the RPO.

* Mr. Stanley B. Potter (Chairman)
* Dr. Walter S. McAfee (Commanding General's Representative)
* Dr. Stanley Kronenberg
* Dr. Robert Pfeffer
* Mr. Richard Rast
* Dr. Johnson Cheppola
Mr. Benjamin Lane
Mr. George Mudd

* These members of the RCC are experienced in Radiation Protection. Their resumes are included in Supplement F.

SUPPLEMENT D

BYPRODUCT MATERIAL AND CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURES

SUPPLEMENT D

LICENSED MATERIAL

ELEMENT AND MASS NUMBER A	CHEMICAL AND/OR PHYSICAL FORM B	NAME OF MANUFACTURER AND MODEL NUMBER C	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D
Cobalt 60	Sealed Source	Any	[100,000]
Hydrogen 3	* accelerator targets Any H3 - Sealed light sources —	— NA 60 Ci	30 Ci / target 300,000 total
Polonium 210	Sealed Source	Any	1,000
Promethium 147	Sealed Source	Any	1,200
Strontium 90	Sealed Source	Any	5,000 80 mCi/source

* per phone call c̄ Norm Pratt Alt RPO 10/6/81 SKE

SUPPLEMENT E

PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED.

SUPPLEMENT E

PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED

1. The following are examples of the main portion of the ERADCOM research, development and testing programs that utilize radioisotopes.

   a. Radiation detection instrument research and development.

   b. Radiation affects on electronic parts and components.

   c. Radiation power sources.

   d. Self powered light sources.

   e. Basic research.

2. A large group is concerned with the design and development of radiation detection instruments, both rate meters and integrating dosimeters. These instruments range from the ones that measure background to those that measure intensities such as those found in the fireball of an atomic explosion. The instruments may be sensitive to gamma, beta, alpha, thermal or fast neutrons, or combinations of these. It is this program that requires most of the high intensity sealed sources and accelerators. New detectors are also frequently irradiated at reactor facilities. This results in radioactivity in the instruments. These instruments must be brought back to Fort Monmouth for evaluation and further testing, and since it would be impossible to predict the exact isotopes that result, a broad license is necessary.

3. The groups devoted to research and development of electronic parts and components devote considerable effort irradiating parts and components with various sources of nuclear radiation, both in the laboratory and at other installations. They determine the effects of nuclear radiation on new parts and develop radiation resistant parts. As mentioned above, the nature of induced activity is not known and time spent to determine it would make experiments useless. A broad license is therefore required.

4. The use of isotopes in basic research is two-fold. Small amounts of radioactive material are needed in experiments requiring high energy ions such as alpha particles and fission fragments while other isotopes are used in experiments involving nuclear decay schemes.

5. Some byproduct material may be used in training programs for radiation workers, and emergency and security personnel that may encounter radiological hazards in the performance of their duties.

SUPPLEMENT F

TRAINING AND EXPERIENCE

SUPPLEMENT F

TRAINING AND EXPERIENCE

1. ERADCOM, Fort Monmouth, RPO, Alternate RPO and Technical Staff of RPO:

   a. Mr. Stanley B. Potter, RPO

   b. Norman V. Pratt, Alternate RPO

2. Personnel to perform leak tests:

   a. Mr. Richard Rast

   b. Personnel listed in para 1 above.

3. Personnel on the Radiation Control Committee who have experience in Radiation Protection:

   a. Mr. Stanley B. Potter

   b. Dr. Walter S. McAfee

   c. Dr. Stanley Kronenberg

   d. Dr. Robert Pfeffer

   e. Mr. Richard Rast

   f. Dr. Johnson Chappola

Resume of Training and Experience
of Stanley B. Potter

1. Educational Background:

Ex6

Colorado State University	4 yrs [redacted]	BS, Physics
Chemical Corps School	2 wks 1964	Compl Radiation Safety Course
Naval Postgraduate School	2 yrs 1969	Compl Nuclear (Effects) Engineering Curriculum
Nuclear Weapons School	8 wks 1969	Compl SONAC, NET OPS, NHTC
Rockwell International	2 wks 1976	Compl Health Physics Course

2. Vocational Experience with Radiation:

1961-1964 At Nuclear Defense Laboratory, Edgewood Arsenal, Md, as Research Physicist.

1964-1967 With US Army in Germany, as Radiation Protection Officer for the 32nd Army Air Defense Command.

1969-1972 With Defense Nuclear Agency in Albuquerque, New Mexico, as Chief, Radiation Safety Support Division, Nuclear Weapons School.

1972 With Pan American Airways, Environmental Health Contractor for NASA and the Air Force at Cape Kennedy, Florida, as Chief, Health Physics Division.

1972-Pres With US Army at, Fort Monmouth, NJ, as Health Physicist.

3. Formal Training in Radiation:

a. Principles and practices of radiation protection.

Where Trained	Duration of Training
Colorado State University	24 weeks
Chemical Corps School	2 weeks
Naval Postgraduate School	2 years
Nuclear Weapons School	8 weeks
Rockwell International	2 weeks

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

Where Trained	Duration of Training
Colorado State University	12 weeks
Chemical Corps School	2 weeks
Naval Postgraduate School	36 weeks
Nuclear Weapons School	8 weeks
Rockwell International	2 weeks

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

Where Trained	Duration of Training
Colorado State University	24 weeks
Chemical Corps School	2 weeks
Naval Postgraduate School	2 years
Nuclear Weapons School	8 weeks
Rockwell International	2 weeks

d. Biological effects of radiation.

Where Trained	Duration of Training
Chemical Corps School	2 weeks
Naval Postgraduate School	36 weeks
Nuclear Weapons School	2 weeks
Rockwell International	2 weeks

4. On-the-job training in radiation.

a. Principles and practices of radiation protection.

Where Trained	Duration of Training
Nuclear Defense Laboratory	3 yrs - 1961-1964
Germany	3 yrs - 1964-1967
Albuquerque, New Mexico	3 yrs - 1969-1972
Cape Kennedy, Florida	1 mo - 1972
Fort Monmouth, New Jersey	- 1972-Present

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

Where Trained	Duration of Training
Nuclear Defense Laboratory	3 yrs - 1961-1964
Germany	3 yrs - 1964-1967
Albuquerque, New Mexico	3 yrs - 1969-1972
Cape Kennedy, Florida	1 mo - 1972
Fort Monmouth, New Jersey	- 1972-Present

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

Where Trained	Duration of Training
Nuclear Defense Laboratory	3 yrs - 1961-1964
Germany	3 yrs - 1964-1967
Albuquerque, New Mexico	3 yrs - 1969-1972
Cape Kennedy, Florida	1 mo - 1972
Fort Monmouth, New Jersey	- 1972-Present

5. Experience with radioisotopes.

Isotope	Maximum Activity	Place of Experience	Duration of Experience
^{226}RA	Less than 10 curies	Colorado State University	3 mo
		Naval Postgraduate School	3 mo
		Fort Monmouth, New Jersey	8 yrs
^{60}Co	Kilocuries	Colorado State University	3 mo
		Chemical Corp School	6 mo
		Naval Postgraduate School	3 mo
		Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	8 yrs
^{241}Am	Millicuries	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	8 yrs
^{147}Pm	Hundreds of curies	Cape Kennedy, Florida	1 mo
^{238}Pu	Kilocuries	Albuquerque, New Mexico	3 yrs
		Cape Kennedy, Florida	1 mo
		Fort Monmouth, New Jersey	8 yrs
^{239}Pu	Curies	Albuquerque, New Mexico	3 yrs
^{57}Co	Millicuries	Albuquerque, New Mexico	1 yr
		Fort Monmouth, New Jersey	8 yrs
^{232}Th	Kilocuries	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	8 yrs
^{229}Th	Curies	Edgewood, Maryland	3 yrs
Tritium	Hundreds of curies	Edgewood, Maryland	3 yrs
		Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	8 yrs
^{131}I	Millicuries	Edgewood, Maryland	1 yr
		Naval Postgraduate School	1 yr
^{210}Po Be	Curies	Edgewood, Maryland	3 yrs
^{238}Pu Be	Curies	Edgewood, Maryland	3 yrs
^{192}Ir	Hundreds of curies	Cape Kennedy, Florida	1 mo
^{85}Kr	Hundreds of curies	Cape Kennedy, Florida	1 mo
^{238}U	Millicuries	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	8 yrs
^{90}Sr	Millicuries	Germany	3 yrs
		Albuquerque, New Mexico	3 yrs
		Colorado State University	3 mo
^{90}Y	Millicuries	Germany	3 yrs
		Albuquerque, New Mexico	3 yrs
		Colorado State University	3 mo
		Fort Monmouth, New Jersey	8 yrs

6. Experience with devices equivalent to that of actual use of radioisotopes.

DEVICE	PLACE OF EXPERIENCE	DURATION
Cockroft Walton Accelerator	Edgewood, Maryland	2 years
Betatron	Edgewood, Maryland	1 year
Van de Graaff Accelerator	Naval Postgraduate School	1 year
	Fort Monmouth, New Jersey	8 years
X-Ray Machines	Fort Monmouth, New Jersey	8 years

RESUME OF TRAINING AND EXPERIENCE
OF NORMAN PRATT

1. Educational Background

US Army Facilities Engineering Support Agency School, Fort Belvoir, VA	52 Weeks	1978	Completed course with Health Physics-Process Control Specialty
Walter Reed Army Medical Center, Washington, DC	1 Week	1978	Radioisotope Users Cours
Oak Ridge Associated University Oak Ridge, TN	5 Weeks	1980	Applied Health Physics Course

2. Vocational Experience with Radiation

Aug-Sep 1978	Health Physics Technician, Walter Reed Army Medical Center
Nov 78-Mar 79	Health Physics Technician for US Army Communications and Electronics Material Readiness Command
Apr 79-Present	Health Physics Technician for US Army Electronics Research and Development Command

3. Formal training in radiation safety, to include principles and practices of radiation protection, radioactivity measurement, standardization, monitoring techniques and instruments, mathematics and calculations for use and measurement of radioactivity, and biological effects.

Where Trained	Duration of Training
US Army FESA, Ft Belvoir, VA	20 Weeks
Walter Reed Army Medical Center	1 Week
Oak Ridge Associated University	5 Weeks

4. On-the-job Training in Radiation Safety

Where Trained	Duration of Training
US Army FESA, Ft Belvoir, VA	2 Weeks
Walter Reed Army Medical Center	8 Weeks
Fort Monmouth, New Jersey	Nov 1978 to Present

5. Experience with radioisotopes

ISOTOPE	MAXIMUM ACTIVITY	PLACE OF EXPERIENCE	DURATION
^{241}Am	Millicuries	Fort Monmouth, New Jersey	Apr 79-Present
^{14}C	Millicuries	Walter Reed Army Medical Center, Fort Monmouth, New Jersey	Aug 78-Present
^{60}Co	Curies	Fort Monmouth, New Jersey Fort Belvoir, VA	Feb 78-Present

ISOTOPE	MAXIMUM ACTIVITY	PLACE OF EXPERIENCE	DURATION
^{137}Cs	Curies	Fort Monmouth, New Jersey	Apr 79-Present
^{125}I	Millicuries	Walter Reed Army Medical Center Fort Monmouth, New Jersey	Aug 78-Present
^{131}I	Millicuries	Walter Reed Army Medical Center Fort Monmouth, New Jersey	Aug 78-Sep 78
^{3}H	Curies	Fort Monmouth, New Jersey	Apr 79-Present
^{239}Pu	Millicuries	Fort Monmouth, New Jersey	Apr 79-Present
^{90}Sr	Curies	Fort Monmouth, New Jersey	Nov 78-Present
^{226}Ra	Millicuries	Fort Monmouth, New Jersey	Nov 78-Present

6. Experience with devices equivalent to that of actual use of radioisotopes.

DEVICE	PLACE OF EXPERIENCE	DURATION
Van de Graaff Accelorator	Fort Monmouth, New Jersey	Apr 79-Present
X-Ray Diffraction	Fort Monmouth, New Jersey	Apr 79-Present
Positive Ion Accelorator	Fort Monmouth, New Jersey	Apr 79-Present
Neutron Generator & Accelorator	Fort Monmouth, New Jersey	Apr 79-Present

RESUME OF TRAINING AND EXPERIENCE
OF DR. STANLEY KRONENBERG

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 measurement, 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

6. Experience with devices equivalent to that of actual use 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 use)
Cocroft Walton Accellerator	Edgewood Arsenal, MD	25 yrs (occassional use)
Flash X-rays (e.g. FX 100)	Fort Monmouth, NJ	25 yrs
Cyclotrons	Brookhaven National Labs	25 yrs (occassional use)
Nuclear Reactors	Oak Ridge, TN	25 yrs (occassional use)

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.

RESUME OF TRAINING AND EXPERIENCE
OF ROBERT L. PFEFFER

Ex 6

1. Educational Background:

City College of New York, New York, NY		BS, Physics
University of PA, Philadelphia, PA	1963-1964	Graduate courses in physics, astronomy, & electrical engineering
Stevens Institute of Technology, Hoboken, NJ		MS, Physics
Stevens Institute of Technology, Hoboken, NJ		PhD, Physics

2. Formal training and experience in radiation protection methods, measurement and effects.

a. Undergraduate Courses

Undergraduate Courses	Dates	Semester Hours
Atomic Physics	1962	3
Atomic Physics Laboratory	1962	1.5
Nuclear Physics	1963	3
General Physics	1960-61	10
Electricity and Magnetism	1962	4.5

b. Graduate Courses

Graduate Courses	Dates	Semester Hours
Advanced Physics Laboratory	1964	3
Modern Physics	1966-67	[illegible]
Nuclear Physics	1968	3
Electricity and Magnetism	1963-64,1966-67	11

c. On-the-job training, including radiation safety, detection instrumentation, radioisotope handling, high energy accelerators, nuclear weapons simulators, dosimetry, nuclear weapons effects.

1963 to Present

3. Experience with Radioisotopes including laboratory analysis, experiments and evaluations utilizing these sources. Duration of experience: 1963 to present. Place of experience: US Army ERADCOM, Fort Monmouth, NJ.

Isotope	Maximum Activity (Ci)
^{241}Am	1
^{252}Cf	1
^{60}Co	120,000
^{137}Cs	100
^{3}H	20
^{226}Ra	1

Isotope	Maximum Activity (Ci)
^{90}Sr	1
^{57}Co	1
^{22}Na	1
^{210}Po	1
^{239}Pu	1

4. Experience with other radiation producing machines.

Machine	Duration of Experience	Type of Experience
2 MeV Van de Graaff accelerator, US Army ERADCOM, Ft Monmouth, NJ	1963 to present	Operation involving diverse nuclear radiation physics experiments.
250 KV X-ray machine US Army ERADCOM, Ft Monmouth, NJ	1963 to present	"
14-MeV neutron generator (Cockcroft-Walton type) US Army ERADCOM, Ft Monmouth, NJ	1963 to present	"
Fast Burst Reactor Aberdeen Proving Ground, Aberdeen, MD	2 weeks	"
Fast Burst Reactor White Sands Missile Range, NM	1 month	"
Linear Accelerator Rennsaler Polytechnic Inst. Troy, NY	2 weeks	"
Linear Accelerator General Atomics Corp. San Diego, CA	2 weeks	"
FX-100 pulsed Van de Graaff Accelerators, Kirtland AFB, NM	2 weeks	"
PI Pulsed Gamma Ray Generators Kirtland AFB, NM	2 weeks	"
14-MeV neutron generators (Cockcroft-Walton type) Kaman Nuclear Co Colorado Springs, CO	2 weeks	"
PI Pulsed Gamma Ray Generators Physics International Corp. San Leadro, CA	2 weeks	"

TRAINING & EXPERIENCE WITH RADIATION & RADIOACTIVE MATERIAL

OF

MR. RICHARD RAST

Ex6

EDUCATION: BS Degree in Chemistry, Seton Hall University,

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 curie)	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

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,

Ex 6

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.

Resume of Training and Experience
of
Dr. Johnson D. Choppala

Ex 6

1. Educational Background:

University of Poona, India	- 4 years	B. Sc.,Physics, Biology, Chemist
Howard University USA	2 years	M.S. Genetics
Howard University USA	3 years	Ph.D. Radiation & Developmental Genetics

2. Radiation Safety Training — U.S. Army Chemical School, Ft. McLellan, Annistan, Ala.

3. Vocational Experience with Radiation

   1975-79 Chief, Division of Radiobiology, College of Medicine
   Howard University

   1980 Health Physicist — US Army DARCOM and ERADCOM

4. Formal Experience with Radiation

   Biological Effects of Radiation

   Where

   Division of Radiation Biology
   College of Medicine, Howard U. — Duration 5 years

5. Experience with devices equivalent to that of actual use of radioisotopes.

Device	Place	Duration
Janus Cobalt-60	Department of Radiotherapy Howard U.	5 years
4 MeV Linear Accelerator (Varian)	same	5 years
18 MeV Linear Accelerator	same	5 years

SUPPLEMENT G

RADIATION DETECTION INSTRUMENTS

SUPPLEMENT G

RADIATION DETECTION INSTRUMENTS

1. The radiation detecting and measuring instruments listed in this supplement are the instruments presently on hand. Instruments may be added or deleted from this inventory during the normal course of use and procurement, but the general overall capabilities of radiation detection and measurement will be maintained. Table G-1 lists the portable radiation detection instruments.

2. In addition to the instrumnets listed in the table, the following laboratory instruments are available.

a. Scalers for use with shielded GM tubes, gas flow and scintillating detectors.

b. Single channel pulse hwight analyzers.

c. Victoreen R meters with reader.

d. 1024 channel pulse height analyzers

e. "Long Counter" for neutrons.

f. Beckman LS-100C, Liquid Scintillation Counter.

TABLE G-1 RADIATION DETECTION INSTRUMENTS

Type of Instrument	Number Available	Radiation Detected	Sensitivity	Window Thickness (mg/cm^2)	Use
Bendix #862	2 ea	Gamma	200 mR	NA	Monitoring
Landsverk IM9EPD	5 ea	Gamma	200 mR	NA	Measuring
JAN IM147	5 ea	Gamma	0-50 R	NA	Measuring
Bendix #884 Tissure Equivalent	4 ea	Fast Neutron and Gamma	0-200 mrad	NA	Measuring
Bendix #609	4 ea	Thermal Neutron	120 mrem	NA	Measuring
Victoreen Model 440 RF/A	2 ea	Beta Gamma	0-300 mR/h	1 mg/cm^2 mylar & 0.005 magnesium	Measuring
Victoreen Model 740	2 ea	Beta Gamma	0-2500 mR/h	0.005 mylar	Measuring
Nuclear Chicago Neutron Survey Meter Model 2671	2 ea	Fast & Thermal Neutron	0-25000 mR/h n/cm^2/s	BF_3 Proportional counter/removable moderator	Surveying Measuring
Radiac Set IM-141/ PDR-27J	2 ea	Beta Gamma	0-500 mR/h	GM tubes JAN 5980 & JAN 5979 Mil-E-1	Surveying Measuring
Nuclear Chicago Model 2612	1 ea	Beta Gamma	0.2-20 mR/h	1.4 mg/cm^2	Surveying
Eberline Corp Model PAC-1SA	1 ea	Alpha	0-2000K CPM	UNK	Surveying
Eberline Corp Model PRM-5-3	2 ea	Beta Gamma	0-500K CPM	UNK	Surveying
Eberline Corp Model E-530	1 ea	Beta Gamma	0-200 mR/h	Beta Window GM Tube	Surveying
Ludlum Model 5	5 ea	Gamma	0-1000 mR/h	GM Tube	Surveying
Baird-Atomic 420E	2 ea	Beta Gamma	0-12.5 mR/h	End Window GM Tube	Surveying
Personal Radiation Monitor Baird Atomic Model 904517	3 ea	Gamma	1 chirp/ 0.1 mR	GM Tube	Warning
Personal Radiation Monitor Atomic Accessories Model PRM-253	5 ea	Gamma	1 chirp/ 0.1 mR	GM Tube	Warning

SUPPLEMENT H

INSTRUMENT CALIBRATION

SUPPLEMENT H

INSTRUMENT CALIBRATION

1. Instruments that respond to gamma radiation are calibrated 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 with Victoreen R-meters. The R-meters are in turn calibrated by the NBS and certified to 3%. The source intensities are corrected each month for decay.

2. An Army Radiac Calibrator, AN/UDM-6, containing four standard plutonium 239 sources is used for calibrating alpha instruments.

3. An Army Radiac Calibrator, AN/UDM-7B, containing two standard plutonium 239 sheet sources is used for calibrating alpha instruments that cannot be calibrated with the AN/UDM-6.

4. Counting systems for determining the amount of radioactive material in samples are calibrated with sources accurate to 7% or less. These are obtained from various commercial firms, such as US Nuclear Corp, Tracerlab Inc., Atomic Accessories, Baird Atomic, etc. These sources are certified by the supplier to be accurate to 7% or less.

5. Neutron instruments are sent to the US Army Calibration and Repair Facility at Lexington-Blue Grass Depot Activity for calibration.

6. Calibrations are made after maintenance procedures that may result in a calibration change and at at three month intervals.

7. When ERADCOM personnel take instruments to remote locations such as the Nevada Test Site or Fort Huachuca, Arizona, the instruments are calibrated prior to departure. If the instruments are to be gone for an extended period of time, arrangements are made to have them calibrated at the remote location, or the instruments are sent to a calibration facility, or appropriate sources or calibrators are taken to the remote location and the instruments calibrated on location.

8. The Atomic Accessories Model TSM-91-D Tritium Monitor is calibrated with a special source, Atomic Accessories Model TCS-179B, supplied with the monitor. The calibration procedure that came with the equipment is used.

SUPPLEMENT I

FACILITIES AND EQUIPMENT

SUPPLEMENT I

FACILITIES AND EQUIPMENT

1. The following facilities are described.

a. Evans area:

(1) Building 401

(a) Irradiation Room

(b) Van de Graaff

(c) X-Ray Room

(2) Building T-383 - Radioactive material storage vault.

(3) Building S-45 - Decontamination and Processing rooms.

b. Accelerator at Gateway National Park.

c. Other remote locations.

#2

2. Most of ERADCOM's work involving byproduct material is in the Evans Area. However, small quantities are routinely used in the Charles Wood Area. Work involving byproduct material occasionally takes place at other subposts of the Fort Monmouth complex. The main areas are described in this supplement. In addition, work involving tritium is routinely performed at Gateway National Park. A description of the Gateway National Park facility is included.

3. Evans Area. The Evans Area is the southern most subpost of the Fort Monmouth complex (See Fig A-1). The area covers approximately 230 acres. About half of the area is surrounded by a twelve foot high security fence. The unfenced area has a very low population density, even during working hours. Most of the work, involving byproduct material at the Evans Area takes place in Buildings 401, S-45 and T-383. These buildings are within the security area.

4. Evans Area - Building 401. With the exception of the heater room, vestibule and two offices, the inside of the building is a restricted area. The building has three levels (See Fig I-1).

a. Irradiation room. The irradiation room (See Fig I-2) has thick concrete walls. The wall between the irradiation room and the "Work areas" contains three multilayered, round, high density glass window. A 3 ft. wooden picket fence divides the room into areas referred to as the High Radiation Area and the Radiation Area. Near the fence on the High Radiation Area side are two Radiac Calibrator Sets, AN/UDM-1 and AN/UDM-1A. One is located on each side of the room. A large portion of the center part of the fence can be removed so that large equipment may be moved in or out. The gates and the calibrators are equipped with switches that are so arranged and wired that an audio alarm will automatically sound if a gate is opened when either of the calibrators are in use. In addition, a light near a calibrator and one at the door to the room goes on when a calibrator is put into operation.

The direction of the beams from the calibrators, when they are in use, is away from the fence. Normally only one calibrator is in use at a time; however, when both are on the highest setting, air dose rate on the Radiation Area side of the fence is only 30 mR/hr. The air dose rate at the open door is 2 mR/hr. With door (covered with 1/8 inch of lead) closed the air dose rate is 0.5 mR/hr outside the door.

b. X-Ray Room. This room (See Fig I-5) has thick concrete walls. The wall between this room and the "Work Area" has one multilayered, round, high density glass window. A three foot wooden picket fence divides the room into areas referred to as the "High Radiation Area" and the "Radiation Area". On the high radiation area side of the fence is a radiac calibrator set AN/UDM-1A. A gate in the fence allows access to the high radiation area and the gate is equipped with a switch that is so arranged and wired that an audio alarm will automatically sound if the gate is opened when the calibrator is in use. In addition, a red light above the calibrator and a red light above the entrance door to the room goes on whenever the calibrator is in use, open to its maximum, the air dose rate on the radiation area side of the fence is 40 mR/hr; the air dose rate at the open door is 7.5 mR/hr; and with the door (covered with 1/8 inch lead) closed, the air dose rate outside the door is 0.035 mR/hr. The use of this calibrator and the UDM-1A in the Irradiation Room are the same.

c. Van de Graaff Accelerator. A 2 MeV Van de Graaff accelerator, made by High Voltage Engineering, is located on the second floor (See Fig I-1). The accelerator target is located on the ground floor. Both areas have shielding walls. Entry into the target room is through a maze with a lead covered door at its entrance. Entrance to the second floor room where the accelerator is located and to the basement area below the target room is through the maze and target room. Two mirrors are located in the maze, such that a person standing just outside the open maze door has a fairly good view of the target room. The door to the maze is equipped with a safety interlock that normally makes it impossible to operate the accelerator with the door open. When it is necessary to make target room observations from just outside the entrance to the maze, the interlock may be bypassed when a individual, approved by the Committee for this operation, is at the maze door and the RPO has been informed in advance and has approved the operation. The control console is on the face of the maze.

The Van de Graaff may be used to accelerate either positive ions or electrons at energies up to two MeV. The electrons are used to produce X-rays. Accelerated protons or deuterons are used to produce neutrons, radioactive material or used to study nuclear reactions.

When all facilities are in use the radiation intensity in the work and office areas of the building is approximately 0.05 mR/hr from gamma and X-rays. Levels of other types of radiation is too low to detect with portable ratemeters.

5. Evans area - Building [T-383] - Radioactive Material Storage Vault. Fig I-3 shows the radioactive materials storage vault. One portion of the building is used to store radioactive waste for decay or until a waste disposal shipment is made. The remainder of the building is used to store radioactive material. The building is equipped with an exhaust fan that exhausts a volume of air approximately 2½ times the volume of the building every minute. The fan comes on whenever the door is opened. The building is locked when not in use and access to the key is controlled. The building is not used for any purpose other than the storage of radioactive material.

6. Evans area - Building [S-45] - Decontamination and radioisotope processing rooms. Fig I-4 shows the decontamination room and the processing room that are in bldg S-45. A Scott Air Pack, for emergency use, is located on the same floor of this building.

a. [Room 15B] - Decontamination room. This room is equipped with a shower, a hand sink and a floor drain. The three drains are connected to a 550 gallon "hot" waste storage tank that is buried NNE of the radioisotope processing room (See Fig I-4). The room is equipped with a toilet.

b. [Room 15C] - Radioisotope processing room. This room is equipped with remote handling tools, a ventilated hood and a glove box, and a stainless steel sink that drains into the "hot" waste storage tank. The hood and the glove box are both equipped with air filters. Air ducts from the filters lead to a tall stack. The drain from the hood cup sink is also connected to the "hot" waste storage tank. A second 550 gallon "hot" storage tank is also located NNE of the radioisotope processing room. Liquid in the first tank that the various drains are connected to can be pumped into the second tank. Tap water can be added to the second tank for dilution purposes. The tap water line is not directly connected to the tank so water from the tank cannot siphon into the tap water line. Liquid from this second "hot" storage tank can be pumped into the sanitary sewer. The two "hot" liquid waste pumps are located under a removable steel plate in the floor of the room. Lead brick are available for constructing temporary work and storage shields.

7. Accelerator at Gateway National Park.

a. An ERADCOM accelerator, manufactured by the Kaman Nuclear Corp. (Neutron Generator Model A1001) is located in building 539 at Gateway Park. Fig I-7 shows building 539 and its relation to the Atlantic Ocean and to other buildings. The insert map included in Fig I-7 shows the building location in relation to the ocean, bays, and the mainland. Gateway Park is located on Sandy Hook. Building 528 is the nearest building that is occupied. Facilities numbers 180, 530, and 541 are not occupied. The population density of the area near the facility is low.

b. There is a six foot fence around that portion of the building where a radiation area exists during operation, and caution signs have been posted on each side of the fence.

c. Fig I-8 shows the electrical circuits for heat, lights, safety interlock and warning lights. When the generator switch is first placed in the "on" position a warning bell rings for ten seconds before the accelerating voltage can be "run up". When the generator is "on" red warning lights are turned on in the locations indicated in Fig I-8. The gate to the maze is interlocked so that the generator is shut off if the gate is opened.

d. Fig I-9 shows the locations of the shielding walls. The shaded portion was added to the original building in order to increase the shielding. Between the control room and the generator room there is a total of 64 inches of concrete block and poured concrete.

e. Various instruments have been used to determine the dose rate an operator near the control console is exposed to. Examples of readings that have been obtained are:

Victoreen Model 440RF ratemeter - 1.3 mR/hr
Texas Nuclear Model 9140 NEMO
Special Neutron Dosimeter System - 1.4 mrem/hr
Eberline Model PNR-4 - 1.3 mrem/hr

f. Fig I-9 shows part of the ventilation system. Fig I-10 shows the overhead shielding and the ventilating duct elevation. Ventilating system measurements are as follows:

Location	Velocity	Volume per unit time
Inlet duct	1440 ft/min	576 CFM
Outlet duct	1950 ft/min	950 CFM

The volume of air being exhausted through the stack every two minutes is equivalent to the volume of the neutron generator room. The direction of air flow in the control room is toward the maze and generator room.

g. According to the Operation Manual for the Model A-1001 Neutron Generator the following total quantities of tritium are released under the circumstances indicated.

(1) Target changes (with isolation valve closed) - 1.8×10^{-3} mCi.

(2) Replenishing cartridge change (with isolation valve closed) - 1.8×10^{-3} mCi.

(3) Evacuation of entire accelerator (ion pump off) - 0.035 mCi.

(4) Breakage during replenishing - 0.207 mCi.

(5) Breakage at other time - no tritium released.

(6) Evacuation of entire accelerator (ion pump on using Kaman Sorption Pump) - no tritium released.

Condition (4) above would release the most tritium and it would take place in the shortest time. The tritium would be released into the neutron generator room. Assuming, to simplify the calculations, that all of the tritium released into the room would be removed in the length of time it would take the blower to exhaust a volume of air equal to the volume of the room (2 min or 120 sec), the average release rate would be

$$\frac{0.207 \text{ mCi}}{120 \text{ sec}} = 1.7 \times 10^{-3} \text{ mCi/sec}$$

Evaluation of the likelihood of someone outside the facility being exposed to excessive concentrations of tritium in air has been calculated using equations from Herman Cember's book "Introduction to Health Physics", published by Permagon Press. Using the above release rate and a wind velocity of 5 mph with all other values maximized for worst case resulted in a 96% assurance that the maximum concentration at ground level would be 1.2×10^{-9} microcuries per milliliter. This concentration is approximately 1/170 the MPC listed in 10 CFR 20.

h. A remote wind velocity and direction indicator is located in the control room. Target replenishing, target change or total system pump down is not performed unless the wind velocity is 5 mph or greater.

i. A tritium air monitor with an alarm is used during the target changes to insure that the air in the accelerator building, where operating and maintenance personnel are located, is below the MPC for air of 5×10^{-6} micorCi/ml for radiation workers.

8. Other remote locations. When sealed sources covered by an ERADCOM license are used at locations outside the Fort Monmouth complex by individuals approved by the Committee on a project approved by the Committee, the facilities of the remote location are used if they are adequate. The shipping container usually serves as both the storage and use container. If the shipping container is not suitable for use as both storage and use containers and suitable containers are not available at the remote location then suitable ones are supplied by the Radiological Safety Office. If they are needed and are not available at the remote location the Radiological Safety Office will supply radiation signs, fence posts, rope, survey instruments, etc.

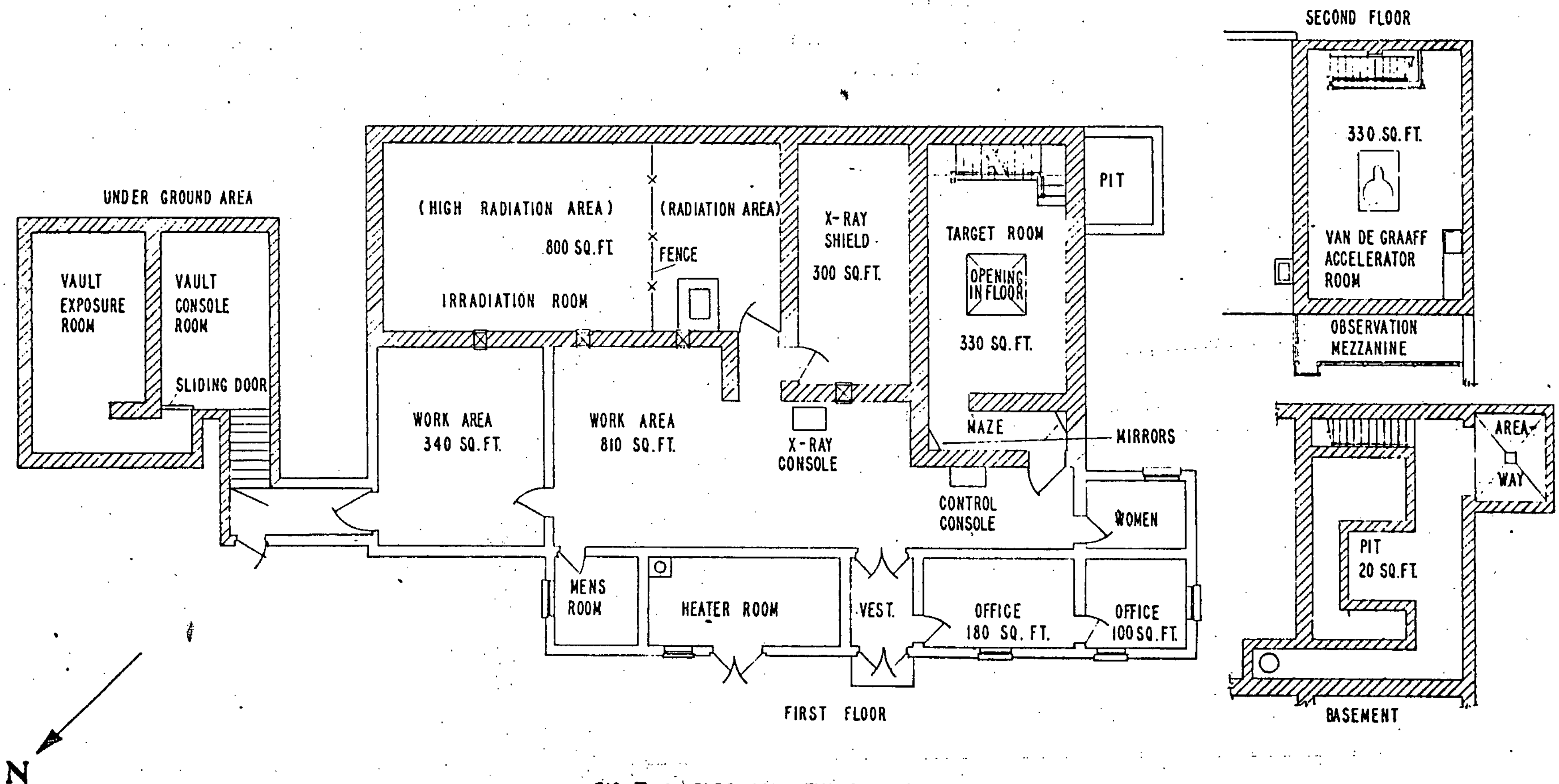


FIG. I-1 BLDG 401, EVANS AREA

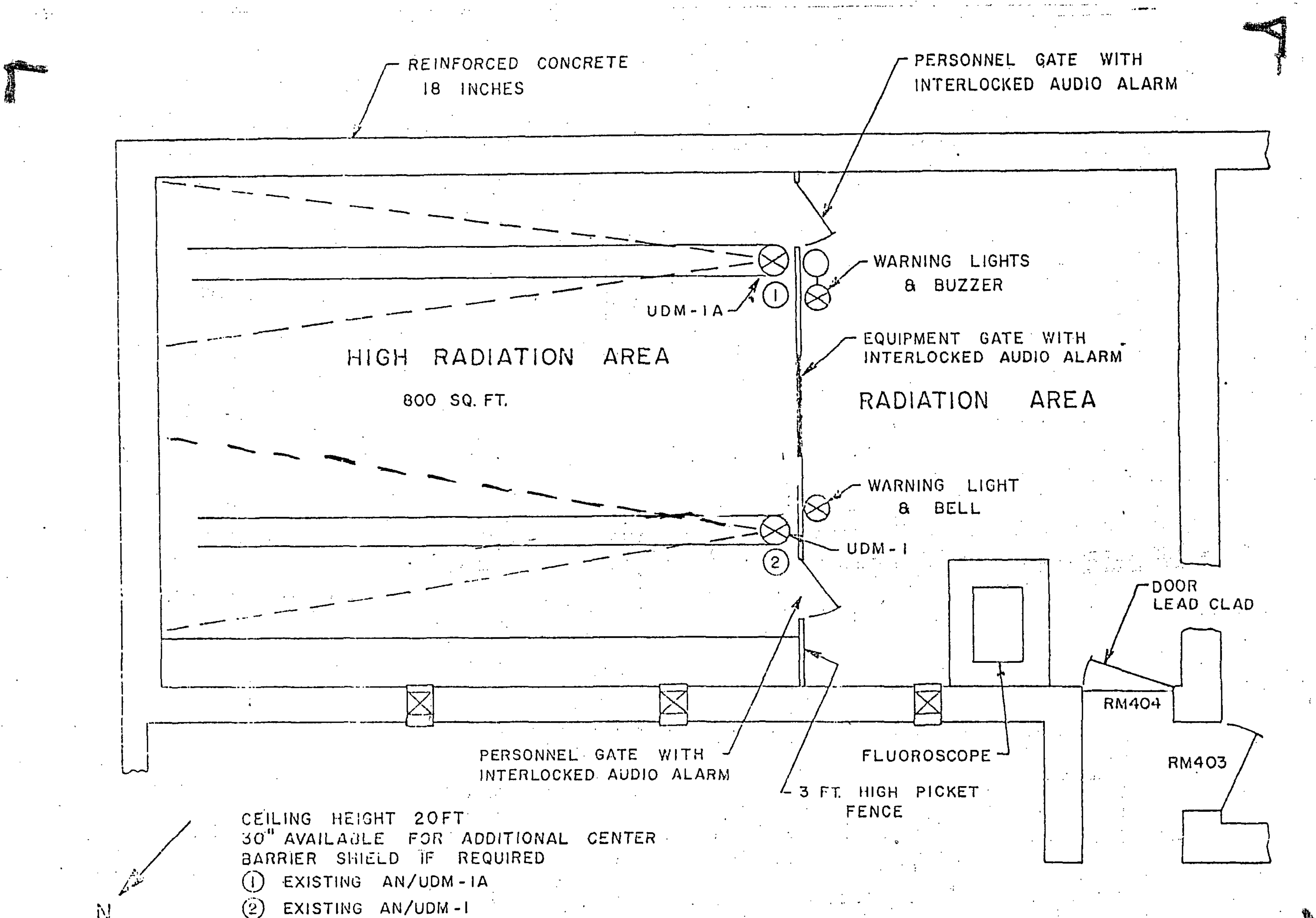


FIG. I-2 IRRADIATION ROOM, BLDG 401, EVANS AREA

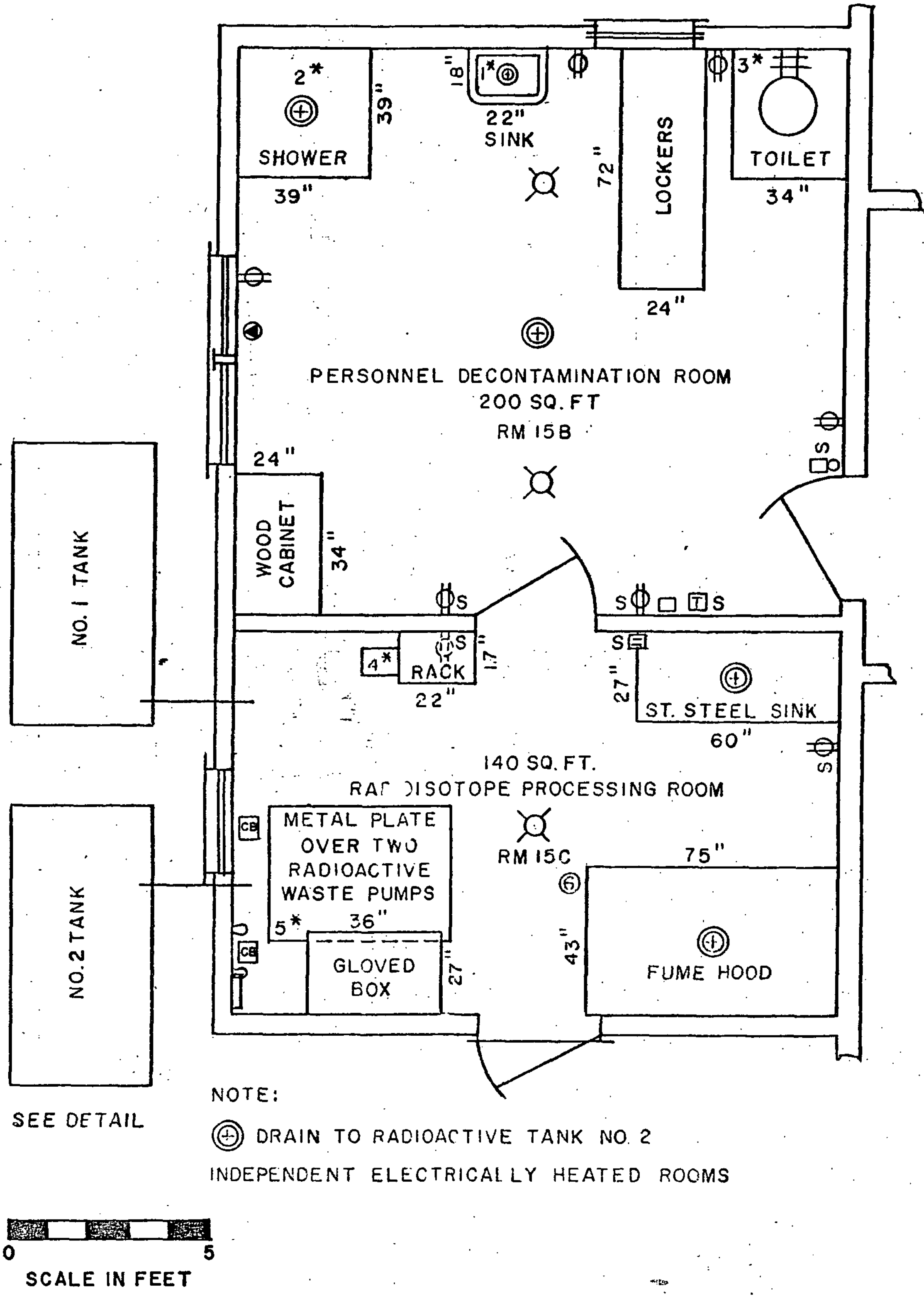


FIG. I-4 DECONTAMINATION AND PROCESSING ROOMS, BLDG S-45, EVANS AREA

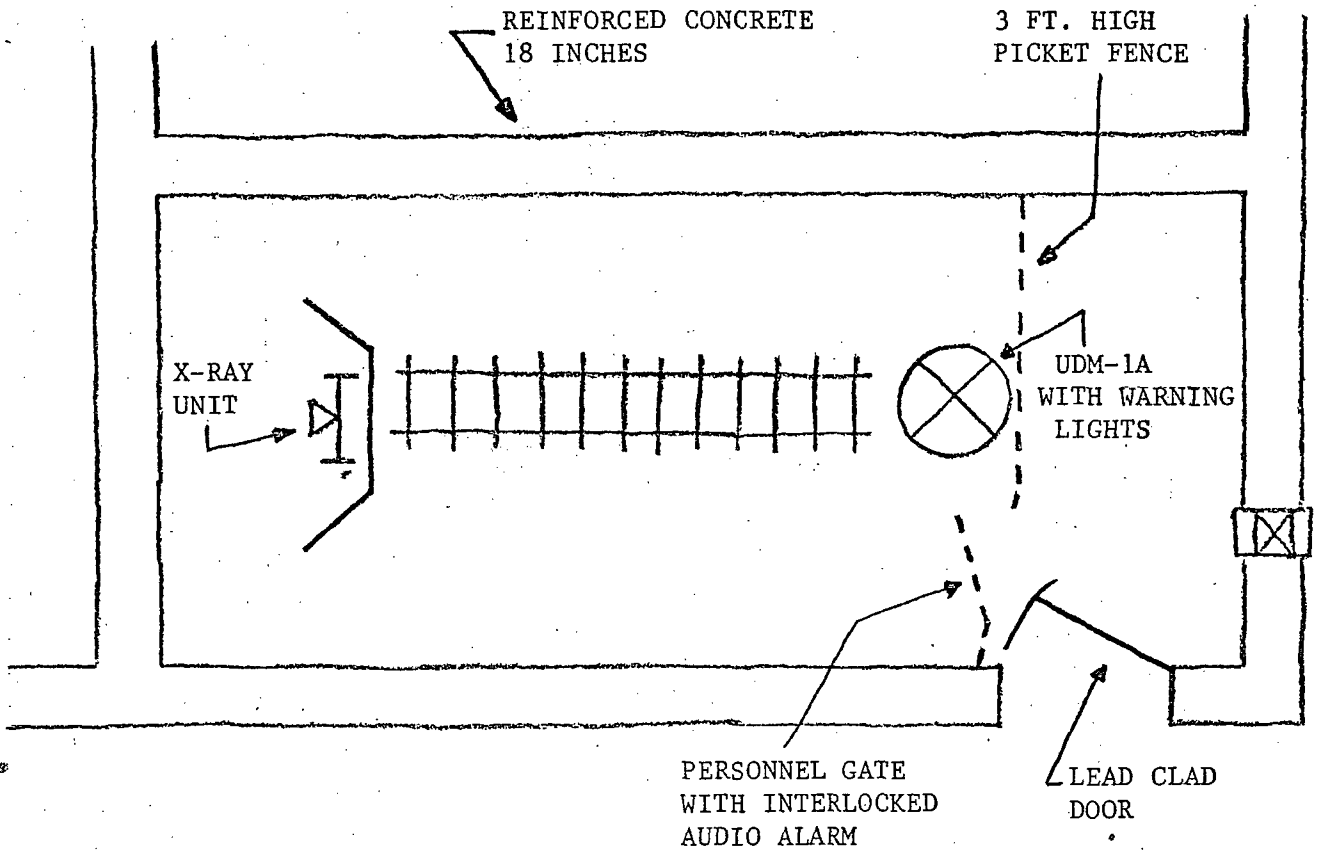


FIG. I-5 X-RAY ROOM, BLDG 401, EVANS AREA

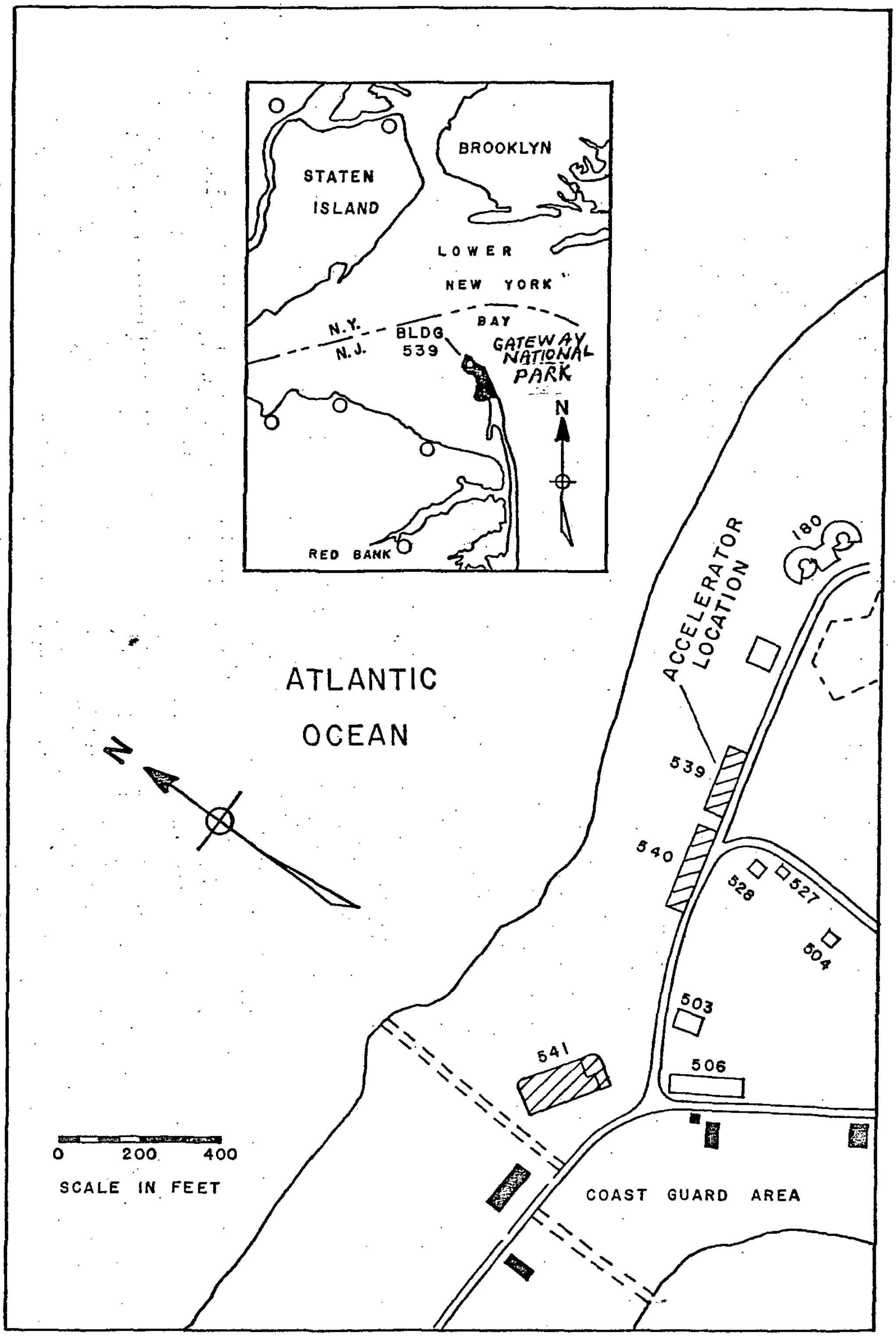
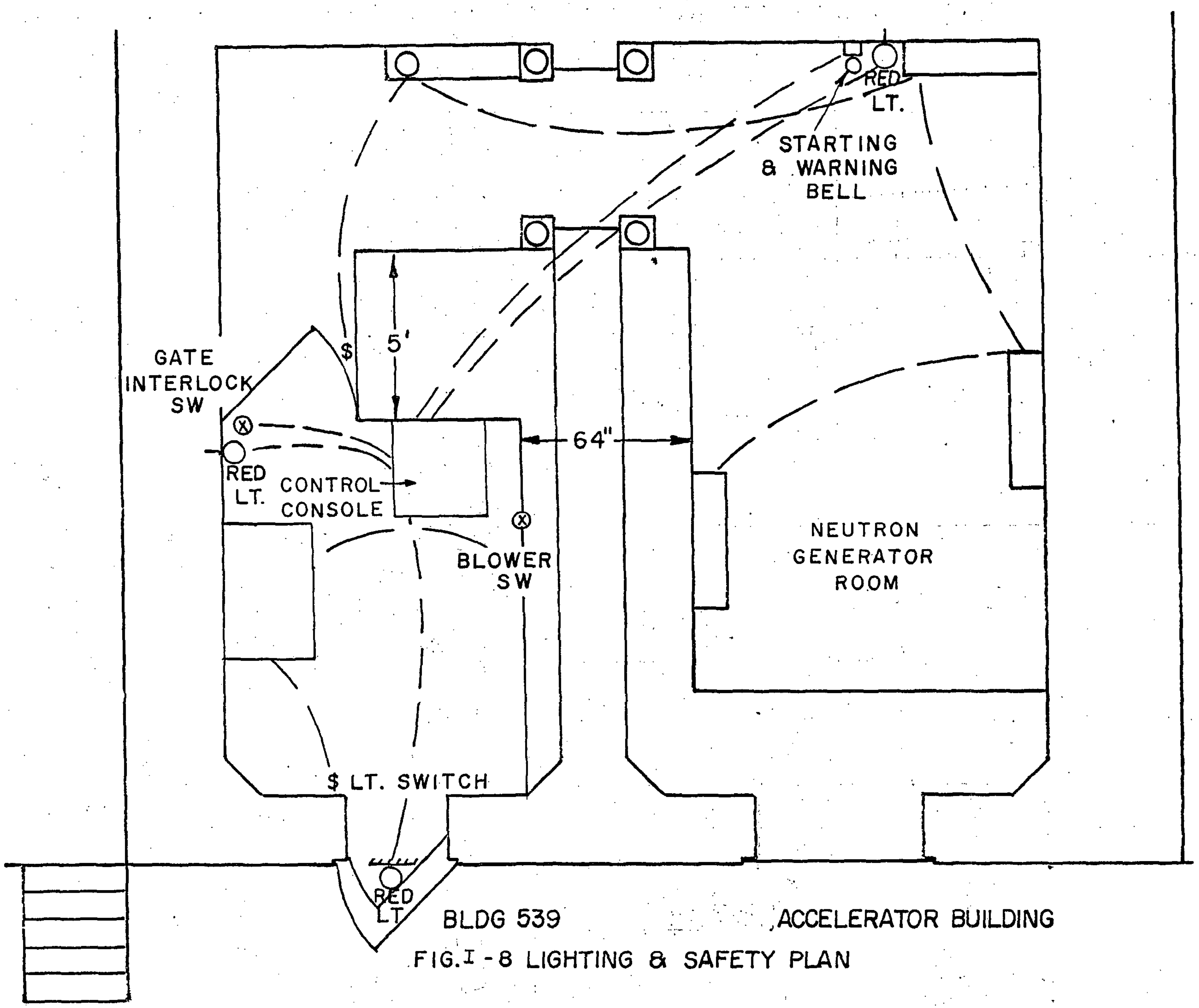
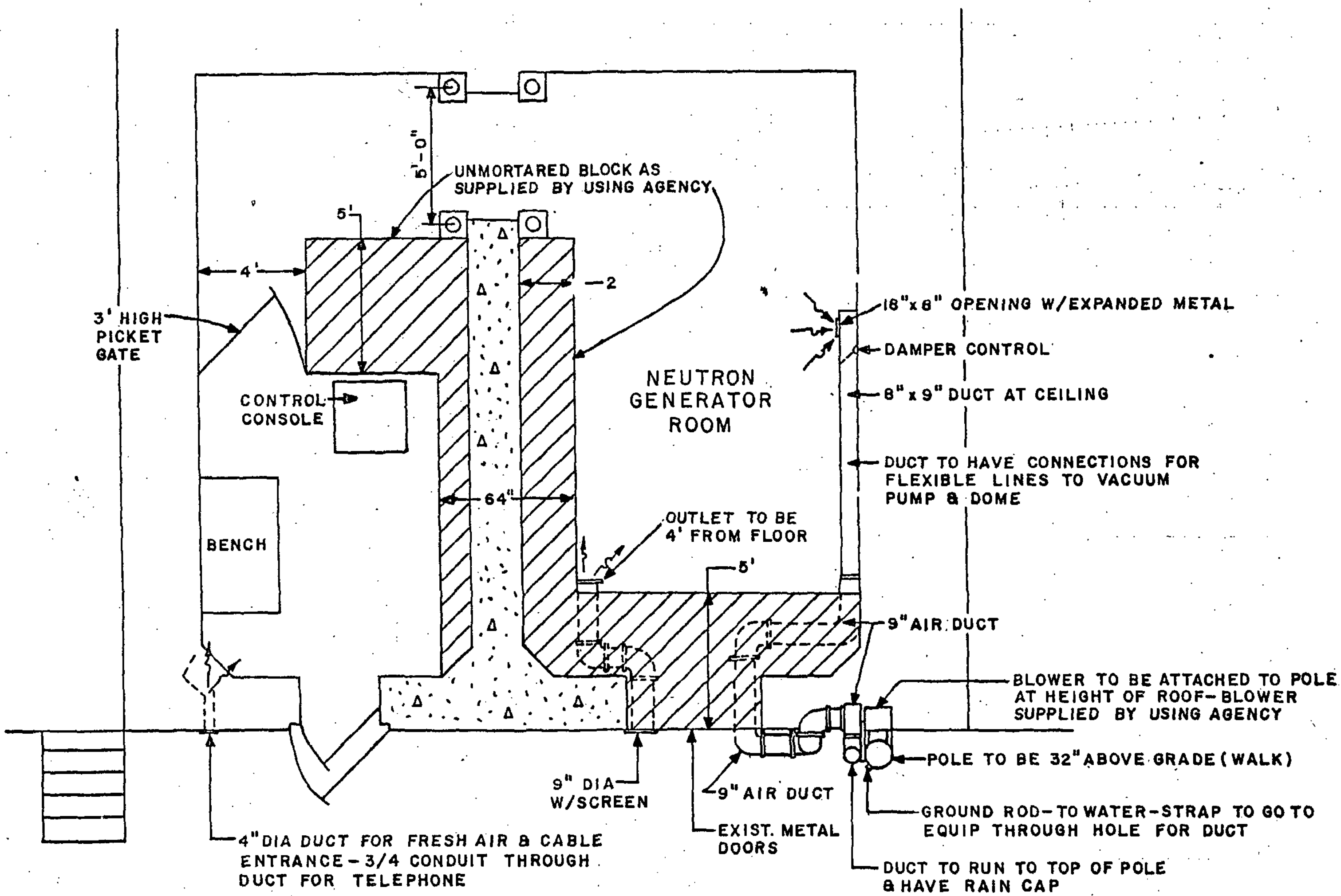


FIG. I -7 ACCELERATOR LOCATION AT
GATEWAY NATIONAL PARK



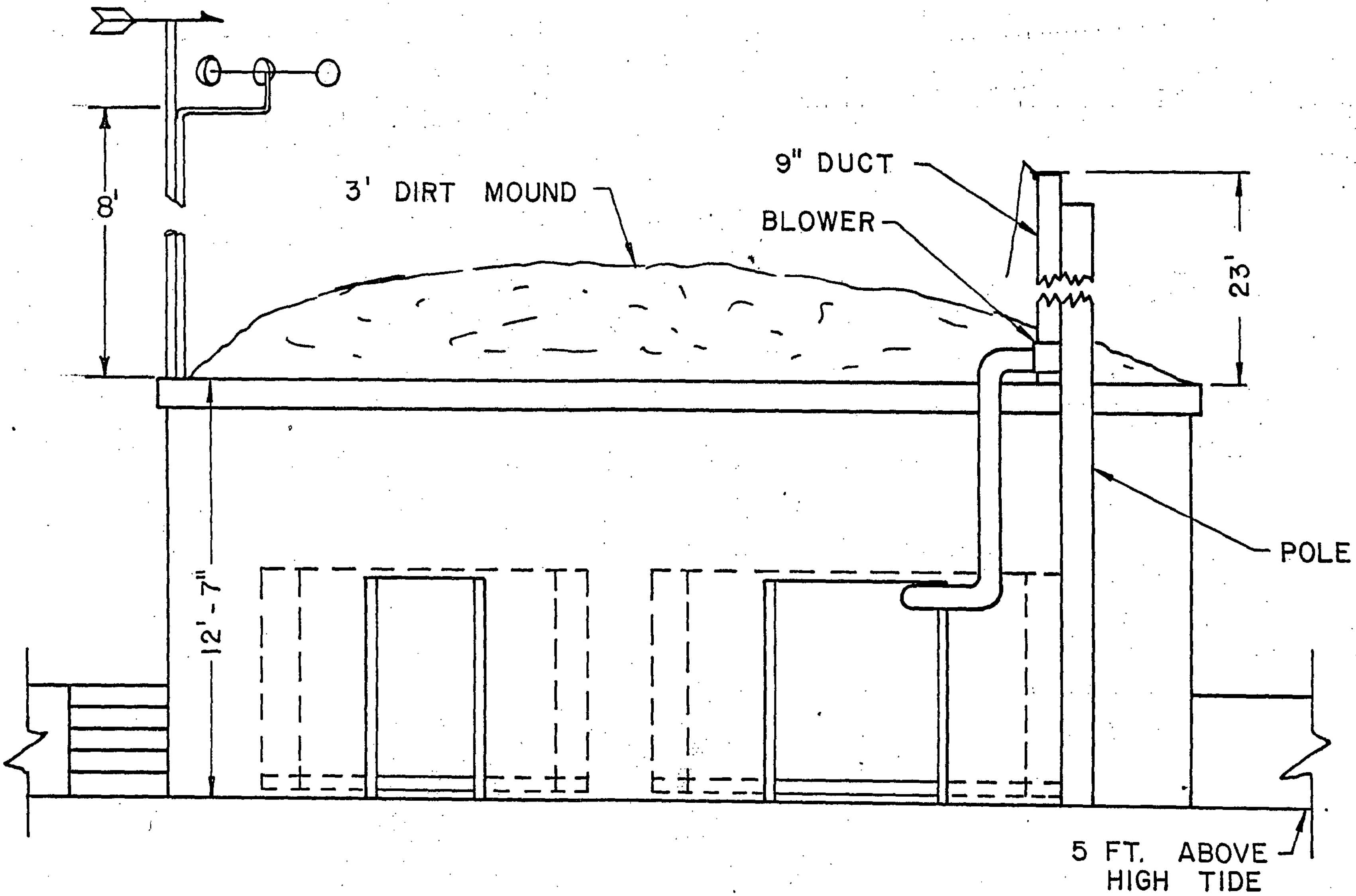
BLDG 539 ACCELERATOR BUILDING

FIG. I-8 LIGHTING & SAFETY PLAN



0 5
SCALE IN FEET

BLD. 539
ACCELERATOR BUILDING
FIG. I-9 BLOCK & VENTILATION PLAN



BLDG. 539
ACCELERATOR BUILDING
FIG. I-10 ELEVATION VIEW

SUPPLEMENT J

RADIATION PROTECTION PROGRAM

SUPPLEMENT J

RADIATION PROTECTION PROGRAM

1. The radiation protection program is described in ERADCOM Regulation 385-1 (See Incl 1) and Combined Directive (See Incl 2).

2. The primary sealed source leak test method will be smear tests, however, bubble leak tests, vacuum leach tests or other types of tests may be used occasionally on some sources. The amount of radioactive material removed by wipe or water used in the vacuum leach test will be determined by procedures and equipment capable of measuring 0.005 microcuries of the type of radioactive material in the sealed source being tested.

3. Sealed source leak tests will be performed by one or more of the individuals listed in para 2 of Supplement F. Resumes of their training and experience are also located in Supplement F.

4. Initial radiation surveys will be made by the RPO, a technical member of his staff, by individuals approved by the committee to make such surveys, or by the US Army Environmental Hygiene Agency.

5. Sealed sources that are found to be leaking will be sealed inside a storage container and placed in storage until arrangements can be made for their disposition. They will either be repaired by a "person" licensed to make such repairs or disposed of as radioactive waste.

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND
2800 Powder Mill Road, Adelphi, MD 20783

*ERADCOM REGULATION
NO. 385-1

2 June 1980

Safety
RADIOLOGICAL PROTECTION PROGRAM

Issuance of supplements to this regulation by ERADCOM elements is permitted. Two copies of each supplement will be furnished to Commander, ERADCOM, ATTN: DRDEL-SS.

1. PURPOSE. This regulation establishes the procedures to be followed in the ERADCOM Radiation Protection Program, outlines the duties of the Command Radiation Protection Officer (RPO), the RPO at ERADCOM, Ft. Monmouth, the ERADCOM Radiation Control Committee (RCC) at Fort Monmouth, the ERADCOM Laser Safety Officer (LSO), the installation RPO and LSO and prescribes the procedures and safe work practices which must be observed by personnel engaged in operations involving radiation sources.

2. SCOPE. This regulation applies to all ERADCOM organizational units and personnel who procure, possess, use, store, transfer or dispose of ionizing and nonionizing radiation sources.

3. POLICY. It is the ERADCOM policy to encourage the use of ionizing and nonionizing radiation sources when appropriate in the accomplishment of assigned research and development missions. It is also ERADCOM policy to utilize the least hazardous chemical and physical form consistent with mission accomplishment. Attendant with the above policy is the requirement that procurement and utilization of radiation sources shall be in accordance with written procedures and shall be conducted in a fashion which will protect personnel from unwarranted radiation exposure. Programs must insure that exposures are as low as reasonably achievable (ALARA). Trained personnel must be provided where radiation sources are used or operated. Failure to meet these requirements will result in cessation of operations. Compliance with Federal, State, Local and Army Regulations will be assured.

4. RESPONSIBILITIES:

a. The Commander ERADCOM will:

(1) Establish a formal written Radiation Protection Program.

(2) Appoint representatives to an ERADCOM RCC and to the CERCOM RCC on orders. Membership of the ERADCOM RCC is delineated in Appendix A.

(3) Appoint qualified individuals and alternates as Command RPO and ERADCOM, Ft Monmouth RPO.

(4) Appoint qualified individuals as Command LSO and ERADCOM, Ft. Monmouth LSO.

b. The Commander or Director of each ERADCOM element tenanted upon another Command's installation and utilizing or possessing radiation sources will:

(1) Appoint an individual as representative to the RCC of the host to represent the ERADCOM element.

(2) Assure that the laboratory abides by the Radiation Protection Program of the host.

(3) Appoint a RPO to obtain required Nuclear Regulatory Commission (NRC) Licenses or Department of Army (DA) Authorizations for radioactive materials unless such are provided by the host.

(4) Appoint a qualified individual as LSO if lasers are used.

(5) Assure implementation of a Title 10 Code of Federal Regulation (CFR) Part 21 program. (Appendix B).

c. The Commander of Harry Diamond Laboratories will:

(1) Establish a formal written Ionizing and Nonionizing Radiation Protection Program.

(2) Establish an installation RCC.

(3) Appoint a qualified individual as LSO, and a RPO and an alternate RPO.

*This regulation supercedes ERADCOM-R 385-1, 1 September 1978.

(4) Assure implementation of a 10 CFR Part 21 program. (Appendix B).

d. The ERADCOM Fort Monmouth RCC is responsible for:

(1) Advising the Commander, through the Command RPO, who is a member of that committee, concerning supervision and control of radiation sources and other radioactive materials.

(2) Reviewing applications for NRC Licenses and DA Authorizations.

(3) Reviewing and approving qualifications of users of radioactive sources.

(4) Reviewing reports of radiation accidents.

e. The ERADCOM Command RPO is responsible for:

(1) Staff supervision of the Radiation Protection Programs at all ERADCOM elements with authority to temporarily suspend hazardous operations.

(2) Advising the Commander on the degree of hazards associated with ionizing and nonionizing radiation, and the effectiveness of measures to control these hazards as well as periodically advising him of the general status of all ERADCOM programs.

(3) Performing evaluations of all elements to insure compliance with the provisions of NRC Licenses and applicable regulations.

(4) Maintaining the ERADCOM inventory of radiation sources and radioactive materials, including both materials licensed by NRC and those held under DA Authorizations.

(5) Coordinating the submittal of applications for renewal or amendment of NRC Licenses and DA Authorizations to higher headquarters.

(6) Coordinating requests for the incorporation of radioactive materials into ERADCOM items of equipment.

(7) Reviewing equipment test results to assure that ERADCOM equipment is safe and suitable for use.

(8) Reviewing plans for radiation facilities.

(9) Maintaining a library of current publications and regulations pertinent to the ERADCOM Radiation Protection Program.

(10) Participating as a member of the ERADCOM Fort Monmouth RCC.

f. The ERADCOM, Fort Monmouth RPO is responsible for:

(1) Supervising the Radiation Protection Program at all Fort Monmouth ERADCOM elements with authority to temporarily suspend hazardous operations.

(2) Advising the Commander through the Command RPO on the degree of hazards associated with radiation sources and the effectiveness of measures to control these hazards.

(3) Participating as the ERADCOM representative in the CERCOM RCC and chairing the ERADCOM, Fort Monmouth RCC.

(4) Maintaining a library of current regulations pertinent to the ERADCOM, Fort Monmouth Radiation Protection Program.

(5) Conducting, additionally, the tasks indicated for the Installation RPO in Paragraph 4g below.

g. The Installation RPO is responsible for:

(1) Providing the Commander or Director, local RCC and radiation workers with advice and assistance on all matters pertaining to radiation safety.

(2) Informing the ERADCOM Command RPO of all matters of significance which should be brought to the Command's attention. Such items would include, but are not limited to the following:

(a) Accidental overexposures or potentially serious incidents.

(b) Potentially serious or hazardous operations.

(c) Licensing violations, noncompliances or defects.

(d) Inspections by NRC representatives.

(3) Reviewing Standard Operating Procedures (SOP) and operations for the use of ionizing and non-ionizing sources.

(4) Maintaining an accurate inventory of all ionizing and nonionizing radiation sources.

(5) Performing radiation protection surveys of all radiation sources to determine compliance with provisions of NRC Licenses and applicable regulations.

(6) Maintaining radiation protection files.

(7) Calibrating or arranging to calibrate survey instruments.

(8) Supplying personnel monitoring devices, providing instructions in their use, and maintaining records of exposure.

(9) Monitoring shipments of radioactive materials.

(10) Supervising decontamination of materials or personnel.

(11) Monitoring storage and working areas as required.

(12) Supervising the disposal of radioactive wastes.

(13) Maintaining complete records of the receipt, transfer and disposal of radiation sources.

(14) Maintaining records of unusual incidents such as overexposures, radioactive spills, or the loss of radioactive materials.

(15) Arranging for radiation safety orientations and training of laboratory personnel on an annual basis to include requirements of 10 CFR Part 19 and DARCOM-R 385-25.

(16) Preparing and submitting application for NRC Licenses and DA Authorizations.

(17) Reviewing, updating, and amending licenses presently in effect.

(18) Taking the following action with regard to radiation sources prior to being relieved of duties:

(a) Securing all sources in such a manner as to preclude use or removal during the period for which there is no RPO appointed, or

(b) Turning over, to a properly qualified and authorized individual, all materials and records. Such an authorized individual will have the qualifications and training required of an RPO.

(19) Implementing a 10 CFR Part 21 Program (Appendix B).

(20) Coordinating purchases of radioactive material to assure compliance with NRC Licenses or DA Authorizations.

(21) Providing expertise in low level radiation waste packaging, transport, and disposal.

h. The ERADCOM Command LSO is responsible for:

(1) Staff supervision of laser radiation protection programs.

(2) Performing evaluations to insure compliance with applicable regulations.

(3) Maintaining records and descriptions of all lasers in the command.

(4) Maintaining inventories and data on confirmations of exemptions on all exempted lasers in the command.

i. The ERADCOM, Fort Monmouth and Installation LSO are responsible for:

C8476

(1) Reviewing proposals for laser operations.

(2) Insuring that protective devices used with laser operations are properly installed, tested, evaluated for functional performance, and used in accordance with approved operating procedures.

(3) Insuring that SOP for use and operation of lasers are current and adequate, and that safe procedures are complied with.

(4) Maintaining a record and description of all lasers in the installation or laboratory.

j. The ERADCOM Safety Office is responsible for providing assistance and advice on general safety matters in relation to radiation safety programs.

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

(1) Insuring that the RPO or LSO is consulted before any work with radiation sources begins.

(2) Insuring that all requisitions or contracts requiring radioactive material or other sources of radiation are clearly marked and that these requisitions are coordinated with the RPO or LSO as applicable.

(3) Insuring that new employees be trained in the safe handling of radiation sources to include the procedures to follow in an emergency.

(4) Preparing prior to the start of any operation involving radiation sources, a written SOP for review and approval by the RPO and RCC. The SOP will contain, as a minimum: responsibilities, maximum permissable levels of radiation in the areas concerned, storage of radioactive materials, procedures regarding dosimetry, interlocks, decontamination, and emergencies.

(5) Accounting for all radiation sources for which they are responsible.

(6) Posting appropriate warning signs and notices.

(7) Controlling contamination.

(8) Assuring radiation sources are secured against unauthorized use.

(9) Controlling personnel exposures.

(10) Enforcing SOP, rules, and special precautions.

(11) Reporting to the RPO any accident, unusual incident, personnel injury, or suspected overexposure immediately after occurrence.

(12) Taking the following actions with regard to all radiation sources prior to being relieved of duties:

(a) Securing all radiation sources in such a manner as to preclude use or removal while not under the immediate supervision of qualified and authorized individual; or

(b) Turning over to a properly qualified and authorized individual all radiation sources. Such an individual will have the qualification and training required for the safe handling of the materials involved.

l. Workers in areas where radiation sources are used are responsible for:

(1) Strict compliance with approved SOP for the specific application.

(2) Using personal protective equipment properly.

(3) Reporting to the supervisor any accident, unusual incident, personnel injury, or suspected overexposure immediately after its occurrence.

APPENDIX A

MEMBERSHIP, ERADCOM, FT. MONMOUTH, RADIATION CONTROL COMMITTEE

1. ERADCOM Radiation Protection Officer at Fort Monmouth, also serves as Chairman.

2. Commander's Representative, Fort Monmouth.

3. Commander's Representative, Headquarters ERADCOM.

4. One (1) Representative from CSTAL.

5. Two (2) Representatives from ETDL.

6. One (1) Representative from EWL.

7. One (1) Representative from TSA.

APPENDIX B

IMPLEMENTATION OF 10 CFR Part 21

1. ERADCOM organizations affected by 10 CFR Part 21 are as follows:

a. All those to which the NRC has issued the following:

(1) Byproduct Material Licenses (10 CFR Part 30 through 35).

(2) Source Material Licenses (10 CFR Part 40).

(3) Special Nuclear Material Licenses (10 CFR Part 70).

b. All ERADCOM elements packaging radioactive material for transport (10 CFR Part 71).

c. All ERADCOM elements which receive, store, use, distribute or dispose of radioactive commodities authorized by a specific NRC license.

d. All ERADCOM contracting activities involved in contracting for NRC Licensed radioactive commodities or supplies of safety-related parts, services, or consultation for NRC Licensed activities.

e. All ERADCOM organizations which evaluate radiation safety defects, hazards, or noncompliances.

2. Commanding Officers, Directors and Chiefs of all applicable ERADCOM elements shall:

a. Implement or assure coverage under a host installation Title 10 CFR Part 21 Program.

b. Establish written procedures for ensuring notification, investigations, and reporting of suspected safety defects and/or noncompliance.

c. Make a determination of whether or not a defect or noncompliance requires reporting. Sufficient information for this determination must be supplied by the servicing RPO and a memorandum concerning the basis for this decision should be maintained in the license file.

d. Report defects or noncompliance telephonically to the appli_ible NRC Regional Office of Inspection and Enforcement listed in Appendix D of 10 CFR Part 20, within 2 days after determining that a substantial safety hazard exists. A memorandum of the above report should be provided HQDA (DAPE-HRS), DARCOM (DRCSF-P), and this headquarters (DRDEL-SS). Following initial notification to the NRC, a follow-up written notification must be forwarded to the same NRC Regional Office within 5 days following the determination. Provide copies of all correspondence as indicated above.

e. Ensure through the servicing RPO or designated individual that the following items are posted in a conspicous position on the premises where NRC Licensed activities are conducted:

(1) A copy of 10 CFR Part 21.

(2) A copy of section 206 of the Energy Reorganization Act of 1974.

(3) Written procedures adopted for implementing the regulations in 10 CFR Part 21.

If posting of all three items above is not practicable, in addition to posting item (2), a notice may be posted describing the regulations/procedures including the name of the individual to whom reports may be made and stating where items (1) and (3) may be examined.

3. The Command Radiation Protection Officer (RPO) shall:

a. Provide guidance in evaluating the defect or noncompliance such that sufficient data is available for decision by responsible officers.

b. Keep the ERADCOM Commanding General informed concerning the posture of the Command Radiological Health Program to include reports of defects or noncompliance under Title 10 CFR Part 21.

4. The servicing RPO for activities utilizing licensed radioactive materials shall:

a. Implement the requirements of 10 CFR Part 21 in the form of a written document. This document should provide the RPO as the point of contact for reporting defects or items of noncompliance but should also indicate to the workers that they may report direct to NRC if they so desire.

b. Include "Responsibilities under Part 21" as a topic of discussion in annual retraining.

c. Assure posting of documents referenced in paragraph 2e.

d. Provide sufficient documentation to the responsible officer (Commanding General/Officer and those staff officers who are vested executive authority concerning NRC Licensed activities) to enable the responsible officer to make a determination regarding reporting. Notification under 10 CFR Part 21 requires first, a knowledge of a defect or a failure to comply and second, the defect or failure to comply must constitute a substantial safety hazard. If there is uncertainty as to whether the defect or failure to comply is significant, the ERADCOM Command RPO should be queried. The following constitute the criteria utilized in making a determination of the existence of a substantial safety hazard and should be addressed in this documentation.

(1) Moderate exposure to or release of licensed material.

(2) Major degradation of essential safety related equipment; or

(3) Major deficiencies involving design construction, inspection, test or use of licensed materials and facilities.

5. Supervisors are responsible for:

a. Assuring that any potential defects or items of noncompliance of which he is knowledgeable are brought to the attention of the servicing RPO, the Commander, Director, or Chief, or to the NRC.

b. Providing a climate suitable for worker reporting of potential defects or items of noncompliance without fear of reprisal.

c. Assuring posting of documents as indicated in paragraph 2e.

d. Assuring that workers are annually retrained and cognizant of the requirements of 10 CFR Part 21.

6. Workers are responsible for strict compliance with the regulations of 10 CFR Part 21 to insure notification of defects and items of noncompliance to the servicing RPO, Commanders, Directors, Chiefs, or to the NRC.

7. Contracting Officers who write contracts for purchasing radioactive commodities, supplies of safety related parts, services, or consultation for NRC Licensed facilities should insert in these contracts the following statement "Title 10 Code of Federal Regulations, Part 21 applies to this contract."

The proponent for this regulation is the Safety Office. Users are invited to send comments and suggested improvement on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, ERADCOM, ATTN: DRDEL-SS, 2800 Powder Mill Road, Adelphi, MD 20783.

FOR THE COMMANDER:

OFFICIAL:

ROBERT W. PATRICK
CPT, AG
Adjutant

EUGENE S. LYNCH
COL, GS
Chief of Staff

DISTRIBUTION:
P

DISPOSITION FORM

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

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

TO	FROM	DATE	CMT 1
All Elements of TSA CSTAL ETDL EWL	Cmdr TSA Cmdr CSTAL Dir ETDL Dir EWL	1 Jul 80 Mr. Potter/jlc/65292	

1. POLICY.

a. It is the policy of the Commander/Directors that radiation sources be used in a fashion which will 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 producing devices.

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

3. REFERENCES.

a. Code of Federal Regulations, Title 10.

b. AR 40-14.

c. AR 385-11.

d. DARCOM-R 385-25.

e. DARCOM-R 385-29.

J. G. MIKULA
COL, SC
Commander TSA

V. J. KUBLIN
Acting Dir
CSTAL

MAX ADLER
Acting Dir
EWL

CLARE THORNTON
Dir, ETDL

G. F. DANKO
Deputy Director, US Army Electronics
Technology and Devices Lab

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

RADIOLOGICAL SAFETY PROCEDURES

RESPONSIBILITIES AND PROCEDURES GOVERNING THE RADIATION PROTECTION 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.

CONTENTS

CHAPTER 1

Responsibilities

1. The Chief, ERADCOM Safety Office is responsible for establishing an effective Radiation Protection Program in coordination with laboratory directors. For this purpose he will appoint a Radiation Protection Officer to assist him and act in an advisory capacity and coordinate safety policies and procedures among various users of radiation sources.

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 authority.

f. Representing ERADCOM on the Ionizing Radiation Control Committee.

g. Coordinating submittal of applications for renewal or amendment of NRC licenses and DA authorization 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 radiation 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. Any person who notices a situation where an ionizing radiation safety hazard might exist will report that situation to the Radiological Protection Officer, Mr. Stanley Potter, telephone 65292, or his alternate, SP 5, Norman Pratt, at the same number. In the event that these persons cannot be contacted the report will be made to Dr Walter McAfee, telephone 54131.

CHAPTER 2

Definitions

Accelerator	A device for imparting kinetic energy to charged particles, such as electrons, protons, deterons and helium ions.
Airborne radioactive material	Any Radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors of 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, selection 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 or 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 or 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.
Istope	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. $h=6.624x10^{-34}$ 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 radiatio: 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 roentgen equivalent mammal.

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 deletated 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 or 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 or 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.

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. When a female employee becomes aware of her pregnancy, she will request that her duties be changed to eliminate all occupational exposure to ionizing radiation.

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 contaminatinn 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 or 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 reasonable 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.

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 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 DA Form 2791-R which will then be completed by the Radiation Protection Officer.

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 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 shielding will correct the situation, this will be done as soon as possible.

(5) The RPO will ensure 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.

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 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 to anyone not directly connected with the work being conducted. 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 working, 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 the 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 decontamination may be attempted as outlined in step (3).

(3) Apply a paste of titanium dioxide liberally and work it in over the contaminated areas for a minimum of two minutes. Use water sparingly, only enough to keep the paste moist. Rinse with warm water and follow with soap, brush and water, being extremely cautious to remove all paste about the nails. Monitor. Repeat process if necessary. If three successive trials fail to remove all contamination to the prescribed level, follow step (4). Note: Do not use near face or other body openings.

(4) Daub over the contaminated area a saturated solution of potassium permanganate for not more than two minutes. Wash with soap and water and rinse. Next, apply a solution of sodium bisulfite to remove the dark permanganate stain. The procedure may be repeated but since the permanganate is caustic to the skin, care should be taken to follow the prescribed times closely. Hand cream should be used as a final step to prevent chapping. Note: Do not use near face or other body openings.

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 or 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 cleansed 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 contaminated laundry generated in radiation areas is laundered 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 extend 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 contamination 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 instituted (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.