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

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16 November 1978

U.S. NUCLEAR REG. COMMISSION
NMSS MAIL SECTION

40-8194

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 Technical Support Activity application for renewal of Source Material License Number SMB-1183.

Please acknowledge receipt of correspondence on enclosed NRC-46 Reply Card.

Sincerely yours,

L. L. Mothersbaugh

L. L. MOTHERSBAUGH
Acting Chief
Safety Office

2 Incl
as

CF:
HQDA (DASG-PSP-E), WASH, DC 20310 (2 cys) w/incl
Dir, DARCOM FSA, Charlestown, IN 47111 w/incl

FEE EXEMPT

11247

CC/12

FORM AEC-2
(3-64)

FORM APPROVED
BUREAU OF BUDGET NO. 38-R0002.

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE 40-8194

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
- ☐ (a) New license
- ☐ (b) Amendment to License No. _____
- ☒ (c) Renewal of License No. SMB 1183
- ☐ (d) Previous License No. _____

2. NAME OF APPLICANT: Dept of Army, US Army Electronics Research and Development Command, Technical Support Activity

3. PRINCIPAL BUSINESS ADDRESS: ATTN: DELSD-SF-H
Fort Monmouth, New Jersey 07703

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
Will be processed and used within the US Army military reservation of Fort Monmouth, New Jersey.

5. BUSINESS OR OCCUPATION	6. (a) IF APPLICANT IS AN INDIVIDUAL, STATE CITIZENSHIP	(b) AGE
US Government	N/A	N/A

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED

See Inclosure 2

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (*Including % U or Th.*)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (*in pounds*)
NATURAL URANIUM	See Inclosure 1		
URANIUM DEPLETED IN THE U-235 ISOTOPE	See Inclosure 1		
THORIUM (ISOTOPE)	See Inclosure 1		

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (*in pounds*)
38 pounds

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES.

See Inclosure 2

10. DESCRIBE THE MINIMUM TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE THAT WILL BE REQUIRED OF APPLICANT'S SUPERVISORY PERSONNEL INCLUDING PERSON RESPONSIBLE FOR RADIATION SAFETY PROGRAM (OR OF APPLICANT IF APPLICANT IS AN INDIVIDUAL).

See Inclosure 3

FEE EXEMPT

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).

See Inclosure 4

11247

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).

See Inclosure 5

11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS, MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT.

See Inclosure 4

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9; INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS.

See Inclosure 6

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

See Inclosure 6

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

See Inclosure 6

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here* ☐ *and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated. None

(b) Detailed procedures for waste disposal.

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(*This item must be completed by applicant*)

15. ***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 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.***

Dept of Army, US Army ERADCOM TSA
(*Applicant named in Item 2*)

Dated 26 OCT 1978

BY: Walter S. McAfee
(*Print or type name under signature*)

WALTER S. MCAFEE
Commander's Representative
(*Title of certifying official authorized to act on behalf of the applicant*)

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.

GPO 881-771

INCLOSURES

INCLOSURE 1

Types, Chemical Forms and Quantities of Source Material

INCLOSURE 2

Purposes of Source Material and Processes Involved

INCLOSURE 3

Users of Source Material and Qualifications

INCLOSURE 4

Facilities and Equipment

INCLOSURE 5

Instrument Calibration

INCLOSURE 6

Radiation Protection Program

INCLOSURE ONE

TYPES, CHEMICAL FORMS AND QUANTITIES OF SOURCE MATERIAL

Inclosure 1 - Reference Item 8, Form AEC-2

The following types, chemical forms, and quantities of source material will be received, processed, used and transferred under the license:

Natural Uranium:

a.	Natural uranium	a. Metal	a. less than 1 lb.
b.	Any compound	b. any solid or liquid	b. less than 5 lbs.

Uranium depleted in the U-235 isotope:

c.	Uranium	c. metal (99% pure)	c. less than 10 lbs.

Thorium-232:

d.	Thorium	d. metal (99.9% pure)	d. less than 10 lbs.
e.	Thorium Oxide	e. Insulator beads	e. less than 5 lbs.
f.	Glass containing Thorium	f. Solid, 30% Th.	f. less than 2 lbs.
g.	Any compound	g. Any solid or liquid	g. less than 5 lbs.

INCLOSURE TWO

PURPOSES OF SOURCE MATERIAL AND PROCESSES INVOLVED

Inclosure 2 - Reference Item 9, Form AEC-2

1. Source material a, b, d, e, f and g is used for calibration of dosimeters and for obtaining standard alpha, beta and gamma spectra in spectral investigation.

2. Source material a is used in very thin layers in neutron sensitive semirad dosimeters that utilize the fission products triggered by the neutrons. Less than 22 g (0.01 lb) is used in these devices.

3. Source material c and d will be reacted with 3d transition metals to form magnetic intermetallic compounds (5-25 g). The reaction will consist of melting the compounds in a crucible inductively. This will be done in confinement under argon and vented through a hood. Samples employed for physical measurement will be sealed in epoxy, or other suitable plastic or sealable container.

4. Source material b and g will be used for various aspects of research and development by the laboratories..

INCLOSURE THREE

USERS OF SOURCE MATERIAL AND QUALIFICATIONS

Inclosure 3 - Reference Item 10, Form AEC-2

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

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

b. Individuals approved by the Ionizing Radiation Control Committee (IRCC).

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

a. Experience with radiation and radioactive material.

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

c. Familiarity with pertinent regulations and procedures.

3. The IRCC will consist of persons working in the positions indicated below. From time to time different individuals will work in these positions. The characteristic qualifications that are required of the individual in each position are indicated.

Chief Radiologist, Patterson Army Hospital

Physician with extensive experience in use of diagnostic radiation.

Safety Director, Communications and Electronics Materiel Readiness Command (CERCOM)

Extensive experience in industrial safety with administrative experience in radiological safety.

Chief of Environment and Health Activity, Patterson Army Hospital

Industrial Hygienest or Environmental Engineer with varying amount of training and experience in radiological safety (from very little to quite extensive).

Chief of Equipment Management Branch of ERADCOM TSA

Supply expert with little or no experience in radiological safety.

Health Physicist, CERCOM Safety Office

Extensive formal and practical training in radiological safety.

Health Physicist, ERADCOM TSA Safety Office

Extensive formal and practical training in radiological safety.

Safety Specialist, CERCOM Safety Office

Extensive experience in industrial safety and ordinarily 2 to 4 weeks formal training in radiological safety.

Chief, Radiation Research Branch, Electronic Technology and Devices Laboratory, ERADCOM

Extensive training and experience in use of radiation, radiation measurement and detection, and radiological safety.

Physicist, research, Radiation Research Branch, Electronics Technology and Devices Laboratory, ERADCOM

Extensive experience and training in use of radiation, radiation measurement and detection and radiological safety procedures.

Leader, Dosimetry and Calibration Team, Radiac Research and Development Group, Combat Surveillance and Target Acquisition Laboratory, ERADCOM

Minimum of a bachelors degree in a physical science or engineering with extensive experience in radiation detection, measurement and safety.

Scientific Advisor to Commander ERADCOM

Extensive education and experience in science and engineering. At least familiarization training and experience in radiological safety.

Maintenance Engineer, CERCOM Maintenance Engineering Directorate

An expert in Maintenance Engineering with little or no experience in radiological safety.

4. Attached are resumes of qualifications of the RPO and Alternate RPO.

Resume of Training and Experience
of Stanley B. Potter

1. Educational background:

Colorado State University	4 yrs	1961	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

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 32d 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

1972-1978 With US Army Electronics Command, Fort Monmouth, NJ as Health Physicist

1978-Pres Electronics Research & Development Command, 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

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

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

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

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	5 yrs - 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	5 yrs - 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	5 yrs - 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	5 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	5 yrs
^{241}Am	Millicuries	Albuquerque, New Mexico	3 yrs
^{147}Pm	Hundreds of curies	Cape Kennedy, Florida	1 mo
		Albuquerque, New Mexico	3 yrs
		Cape Kennedy, Florida	1 mo
		Fort Monmouth, New Jersey	5 yrs
^{239}Pu	Curies	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	5 yrs
^{57}Co	Millicuries	Albuquerque, New Mexico	1 yr
		Fort Monmouth, New Jersey	5 yrs
^{232}Th	Kilocuries	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	5 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	5 yrs
^{131}I	Millicuries	Edgewood, Maryland	1 yr
		Naval Postgraduate School	1 yr
^{210}Po Be	Curies	Edgewood, Maryland	3 yrs
^{239}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
		Fort Monmouth, New Jersey	5 yrs
^{238}U	Millicuries	Albuquerque, New Mexico	3 yrs
		Fort Monmouth, New Jersey	5 yrs

Isotope	Maximum Activity	Place of Experience	Duration of Experience
^{90}Sr	Millicuries	Germany	3 yrs
		Albuquerque, New Mexico	3 yrs
		Colorado State University	3 mo
		Fort Monmouth, New Jersey	5 yrs
^{90}Y	Millicuries	Germany	3 yrs
		Albuquerque, New Mexico	3 yrs
		Colorado State University	3 mo
		Fort Monmouth, New Jersey	5 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	5 years
Neutron Generator	Fort Monmouth, New Jersey	5 years
X-Ray Machines	Fort Monmouth, New Jersey	5 years

Resume of Training and Experience
of Michael J. Davison

1. Educational background

US Army Facilities Engineering Support Agency School	52 weeks	1977	Compl Nuclear Power Plant Operator (Health Physics - Process Control Specialty)

2. Vocational experience with radiation

1977 — 1 week OJT aboard MH-1A (Nuclear Power Barge STURGIS at Fort Belvoir, VA as Health Physics Technician.

1977-1978 — Facilities Engineering Support Agency, Fort Belvoir, VA as Instructor, Health Physics Training Division.

1978-Pres — Electronics Research & Development Command, Fort Monmouth, NJ, as Health Physics Technician.

3. Formal training in radiation

a. Principles and practices of radiation protection

Where Trained	Duration of Training
Nuclear Power Plant Operator School	52 weeks

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

Where Trained	Duration of Training
Nuclear Power Plant Operator School	36 weeks

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

Where Trained	Duration of Training
Nuclear Power Plant Operator School	52 weeks

d. Biological effects of radiation.

Where Trained	Duration of Training
Nuclear Power Plant Operator School	20 weeks

4. On-the-job training in radiation

a. Principles and practices of radiation protection.

Where Trained	Duration of Training
MH-1A (Nuclear Power Barge STURGIS)	1 wk 1977
Fort Monmouth, NJ	9 mo 1978

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

Where Trained	Duration of Training
MH-1A (Nuclear Power Barge STURGIS)	1 wk 1977
Fort Monmouth, NJ	9 mo 1978

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

Where Trained	Duration of Training
MH-1A (Nuclear Power Barge STURGIS)	1 wk 1977
Fort Belvoir, VA	4 mo 1977-1978
Fort Monmouth, NJ	9 mo 1978

5. Experience with radioisotopes

Isotope	Maximum Activity	Place of Experience	Duration of Experience
^{241}Am	Millicuries	Nuclear Reactor School	15 months
		Fort Monmouth, NJ	9 months
^{14}C	Millicuries	Nuclear Reactor School	15 months
		Fort Monmouth, NJ	9 months
^{36}Cl	Millicuries	Nuclear Reactor School	15 months
		Fort Monmouth, NJ	9 months
^{60}Co	Millicuries	Nuclear Reactor School	15 months
	125,000 Curies	Fort Monmouth, NJ	9 months
^{137}Cs	Millicuries	Nuclear Reactor School	15 months
	Hundreds of Curies	Fort Monmouth, NJ	9 months

Isotope	Maximum Activity	Place of Experience	Duration of Experience
^{3}H	Curies	Fort Monmouth, NJ	9 months
^{147}Pm	Millicuries	Nuclear Reactor School	15 months
^{239}Pu	Millicuries	Nuclear Reactor School Fort Monmouth, NJ	15 months 9 months
^{239}Pu-Be	Curies	Nuclear Reactor School	15 months
^{90}Sr, ^{90}Y	Millicuries Curies	Nuclear Reactor School Fort Monmouth, NJ	15 months 9 months

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

Device	Place of Experience	Duration
Van de Graaff Accelerator	Fort Monmouth, NJ	9 months
X-Ray Diffraction	Fort Monmouth, NJ	9 months
Positive Ion Accelerator	Fort Monmouth, NJ	9 months
Radiographic X-Ray System	Fort Monmouth, NJ	9 months
Medical X-Ray Unit	Fort Monmouth, NJ	9 months

INCLOSURE 4

FACILITIES AND EQUIPMENT

Inclosure 4 - Reference Item 11, Form AEC-2

1. Less than 2 g of natural uranium metal is stored and used in room 2D132 of Bldg 2700. This is a laboratory room in a large building which houses laboratories and office space as well as wood and metal working shops. This source material is used as a standard in conjunction with an electron microprobe.

2. Most of the work involving source material takes place at the Evans Area, the southern most sub post of Fort Monmouth. The area covers approximately 230 acres. About half of the area is surrounded by a twelve foot high security fence and traffic to and from this security area is controlled by guards. A brief description of the radiation facilities in the Evans Area follows, but more complete descriptions are included in applications for BML 29-01022-06, 07, and 10.

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

(1) Pool Room. The pool room contains a Co-60 125 kCi under water irradiator facility. This facility is authorized by BML 29-01022-10.

(2) Under ground vault. The under ground vault contains a Co-60 3.5 kCi in-air irradiator facility. This facility is authorized by BML 29-01022-07.

(3) Irradiation room. This room contains a 7 Ci Co-60 radiac calibrator and a 120 Ci Cs-137 radiac calibrator. These sources are used for calibration of radiation detecting and measuring instruments and are also used for irradiation of materials for research purposes.

(4) X-ray room. This room contains a 120 Ci Cs-137 radiac calibrator and a 250 kv 10 mA X-ray generator. These are used for irradiation of materials for research purposes.

(5) Van de Graaff accelerator room contains a 2 Mev Van de Graaff accelerator which may be used to accelerate electrons or positive ions. The target room is on the ground floor. The accelerator is used for research purposes only as authorized by the IRCC.

b. Evans Area - Building T-383 -- Radioactive Material Storage Vault. Fig. 4-2 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 that will be used at a later date. 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 normally locked and access to the key is controlled. The building is not used for any purpose other than the storage of radioactive material.

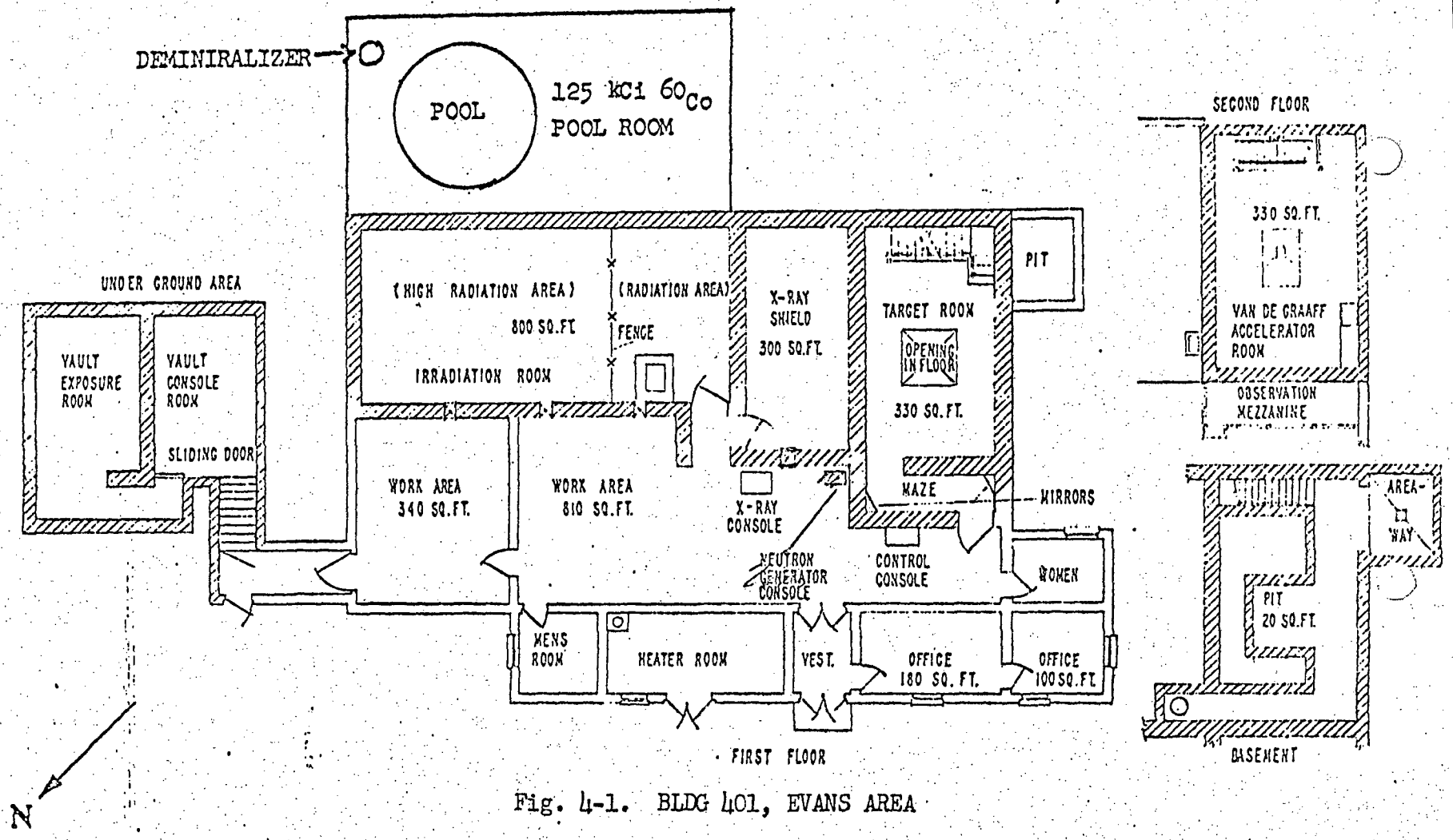
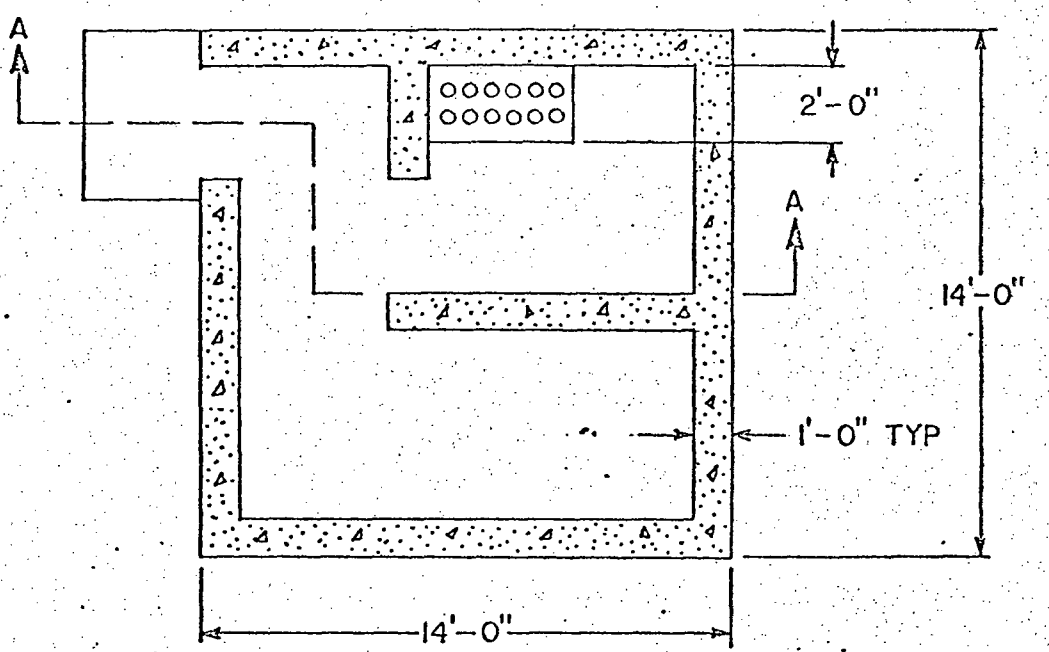
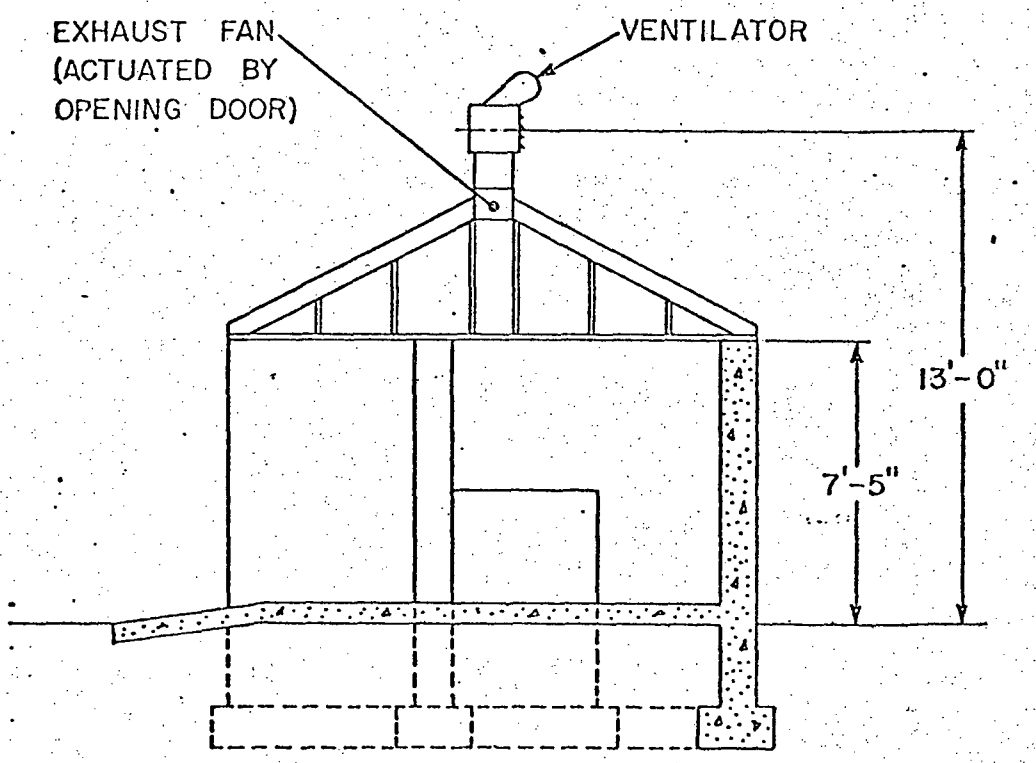


Fig. 4-1. BLDG 401, EVANS AREA



FLOOR PLAN



SECTION A-A

Fig. 4-2. BUILDING T-383 RADIOACTIVE STORAGE VAULT, EVANS AREA

c. Evans Area - Building S-45 -- Decontamination and Radioisotope Processing Rooms. Fig. 4-3 shows the Decontamination Room and the Processing Room that are in Building S-45. Sample counting equipment and a Scott Air Pack, for emergency use, are available as required.

(1) Room 15B -- Decontamination Room. The Decontamination Room, Rm. 15b, 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 North North East (NNE) of the Radioisotope Processing Room (See Fig. 4-3). The room is equipped with a toilet. In addition, coveralls, surgical caps, shoe covers, booties, gloves, etc., are available and lockers are provided for storage of an individual's personal clothing and belongings.

(2) Room 15 - C -- Radioisotope Processing Room. The Radioisotope Processing Room is equipped with remote handling tools, a ventilated hood (100 linear feet per minute across opening when half open) and a glove box, and a "hot" stainless steel sink. (1) The hood and the glove box are both equipped with air filters. Air ducts from the filters lead to a tall stack. (2) The drains from the hood cup sink and the "hot" sink are connected to the "hot" storage tank mentioned in Para 2c(1) above. In addition a second 550 gallon "hot" storage tank is also located NNE of the Radioisotope Processing Room. Liquid in the "hot" storage tank that the various "hot" drains are connected to can be pumped into the second "hot" storage tank. Tap water can be added to this second tank for dilution purposes. The tap water line is not directly connected to the tank -- 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. Gauges to measure the volume of liquid in the two tanks and switches for controlling the pumps are located on the NNE wall of the room. (3) Lead bricks are available for constructing temporary work and storage shields.

3a. Table 4-1 lists radiation detection instruments available.

b. In addition to the instruments listed in the table, the following laboratory instruments are available:

(1) Scalers with shielded GM tube, gas flow, and scintillating type detectors.

(2) Single channel pulse height analyzers.

(3) Victoreen R meters with reader.

(4) 1024 channel pulse height analyzer with 3" x 3" NaI(Tl) crystal.

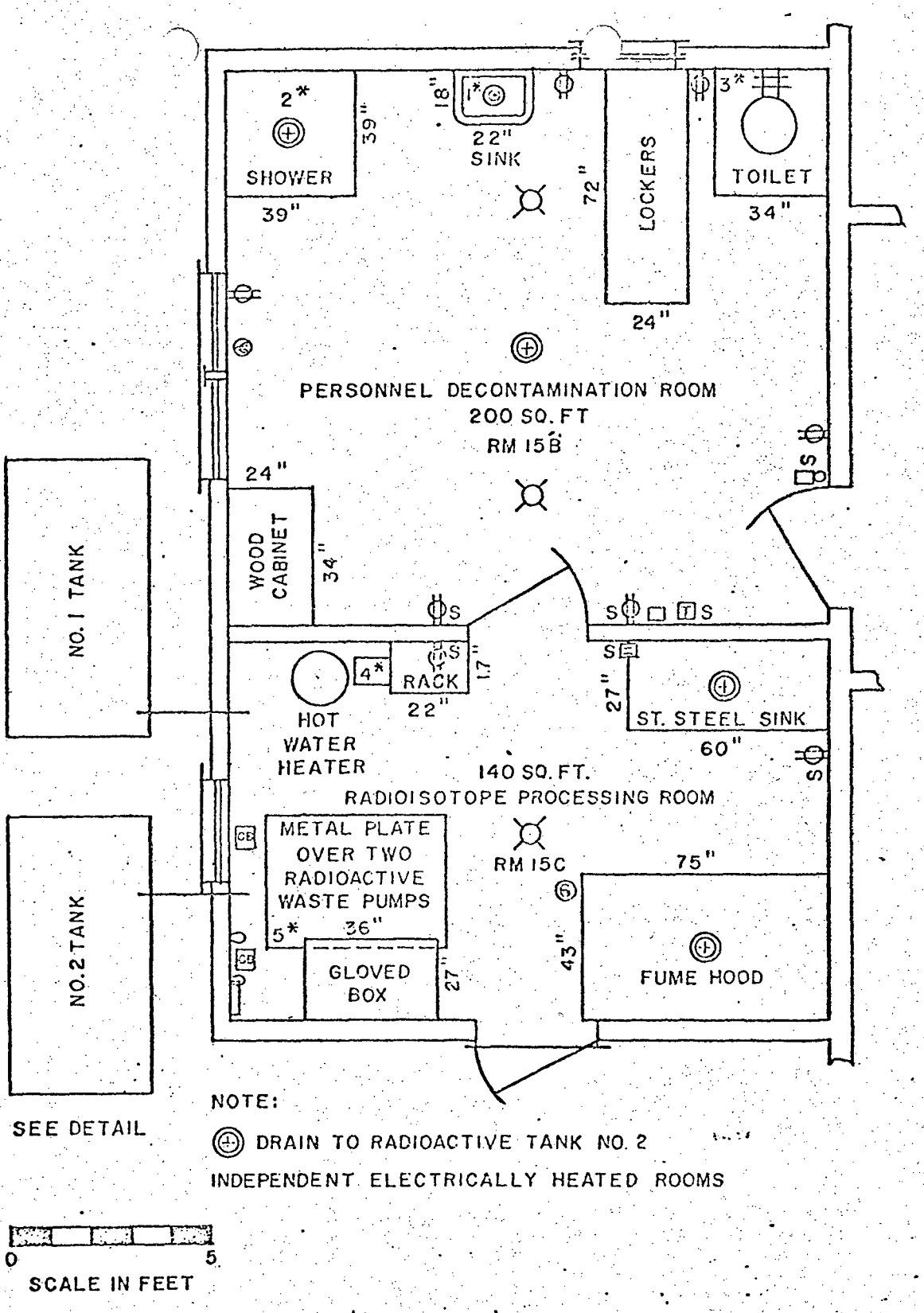


FIG. 4-3. DECONTAMINATION AND PROCESSING ROOMS, BLDG S-45, EVANS AREA

TABLE 4-1. PORTABLE RADIATION DETECTION INSTRUMENTS

TYPE INSTRUMENT	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE	WINDOW THICKNESS	USE
Bendix 611	3	Gamma	5,000 mR	NA	Dosimeter
Bendix 862	3	Gamma	200 mR		Dosimeter
Victoreen 541A	4	Gamma	200 mR		Dosimeter
Landsverk IM9EPD	3	Gamma	200 mR		Dosimeter
JAN IM147	5	Gamma	50,000 mR		Dosimeter
Bendix 884 Tissue equivalent	4	Gamma neutron(fast)	200 mR		Dosimeter
Bendix 609	4	neutron (thermal)	120 mrem		Dosimeter
Nucleus Tissue Equivalent	1	Gamma neutron(fast)	200 mR		Dosimeter
Victoreen 440RF	2	Gamma	300 mR/hr	1 mg/cm^2 mylar & 0.005 magnesium	Survey Measuring
Victoreen 440	2	Beta Gamma	300 mR/hr	1 mg/cm^2 mylar & 0.005 magnesium	Survey Measuring
Victoreen 740	2	Alpha Beta Gamma	2500 mR/hr	0.005 mylar	Survey Measuring
Radiac Set AN/PDR 27	3	Beta Gamma	500 mR/hr (4 scales)	GM Tubes JAN 5980 & JAN 5979 Mil-E-1	Survey Measuring
Radiac Set AN/PDR-39	2	Gamma	50,000 mR/hr	thick wall Ion ch	Survey Measuring

Nuclear-Chicago 2610-A-P.15	2	Beta Gamma	20 mR/hr	Thin wall GM tube D50	Survey Measuring
Nuclear-Chicago 2612-P.16	2	Beta Gamma Alpha	20 mR/hr	1.4 mg/cm^2	Survey Measuring
Baird-Atomic 420E	2	Beta Gamma Alpha	12½ mR/hr	End window GM tube	Survey Measuring
Nuclear-Chicago 2612	1	Beta Gamma	20 mR/hr	Thin wall GM tube	Survey Measuring
Eberline PIC-6	2	Gamma	1000 mR/hr		Survey Measuring
AN/PDR-52	1	Beta Gamma Alpha	1000 mR/hr	Thin mylar	Survey Measuring
Eberline PRM 5-3 w/HP 260 probe	2	Beta Gamma Alpha	500,000 CPM	2 mg/cm^2	Survey Measuring
Eberline E-500B	1	Beta Gamma	2000 mR/hr	Thin wall GM	Survey Measuring
Chirpee 904517	3	Gamma	1 chirp/.1 mR	GM tube	Warning Dosimeter
Chirpee PRM 253	5	Gamma	1 chirp/.1 mR	GM tube	Warning Dosimeter
Mighty Mite	2	air sampler			Air Sampling
Ludlum Model 28	2	Beta Gamma	To 500K CPM on 4 scales	Thin wall GM	Alarm Measuring
Staplex	1	air sampler			Air Sampling

INCLOSURE FIVE

INSTRUMENT CALIBRATION

Inclosure 5 - Reference Item 11, Form AEC-2

1. Gamma instruments are calibrated every 3 months using ^{60}Co or ^{137}Cs sources. The calibration of the sources is checked at least once a year using Victoreen R-meters or RADCON II. The R-meters or RADCON II are in turn calibrated by National Bureau of Standards (NBS) annually and certified to $\pm$ 3%. The source intensities are corrected each month for decay.

2. The Army Radiac Calibrators AN/UDM-6 and AN/UDM-7B are used to calibrate alpha instruments. These calibrators contain standard plutonium-239 sources and are certified by Lexington-Blue Grass Army Depot Activity annually by comparing with NBS standards. Alpha instruments are calibrated every 3 months.

INCLOSURE SIX

RADIATION PROTECTION PROGRAM

Inclosure 6 - Reference Item 12, Form AEC-2

1. The radiation protection program is described in the attached joint directive.

2. All uses of source material will be only under authority granted as specified in the attached directive.

DISPOSITION FORM

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

REFERENCE OR OFFICE SYMBOL	SUBJECT
DELSD-SF	Radiation Protection, Combined Directive

TO All Elements of
TSA
CSTAL
ETDL
EWL

FROM Cmdr TSA
Cmdr CSTAL
Dir ETDL
Dir EWL

DATE 29 Jun 78 CMT 1
Mr. Potter/rb/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.

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 700-52.

d. DARCOM-R 385-25.

e. DARCOM-R 385-29.

E. L. BOWMAN
Cdr, TSA

WINSTON EVANS
Cdr, CSTAL

CLYDE HARDIN
Dir, EWL
MAX ADLER

CLARE THORNTON
Dir, ETDL
S. F. DANKO
Deputy Director, US Army Electronic Technology and Devices Lab

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

☆ GPO—1975—665-422/1063

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

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

Ionizing Radiation	Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter.
Ionizing Radiation Producing Devices	Electronic devices which are capable of generating ionizing radiation such as x-ray machines, linear accelerators, cyclotrons, radio frequency generators which use klystrons, magnetrons, or other tubes which produce x-rays, and electron microscopes.
Isotope	One or more nuclides having the same atomic number but a different mass. Isotopes of a substance have almost identical chemical properties.
Monitoring	Periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in an occupied region. Also called surveying.
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	A natural constant of proportionality (h) relating the frequency of a quantum of energy to the total energy of the quantum. $h=6.624 \times 10^{-34}$ joules-sec.
Positron	A particle equal in mass to the electron and having an equal but positive charge.

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

	electronic equipment which utilizes klystrons, 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 protective equipment requirements for a given job. It should also provide a running record of radiation exposures received during 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 of 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 special 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 delegated the responsibility for the use, operation, or storage of radiation sources.
X-ray	Penetrating electromagnetic radiation having wavelengths shorter than those of visible light. X-rays are similar to gamma rays, but are originating in the extra-nuclear origin.

CHAPTER 3

EXPOSURE GUIDES

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

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

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

(a) 1.25 rem in any calendar quarter, nor

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

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

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

(a) 7.5 rem in any calendar quarter, nor

(b) 30 rem in any calendar year.

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

(a) 18.75 rem in any calendar quarter, nor

(b) 75 rem in any calendar year.

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 or 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 an 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, Table 1):

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

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

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

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

(2) Extent of contamination on surfaces.

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

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

a. No individual without a special work permit will be permitted to work in a radiation control 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.

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 100 ft/min. Airborne contamination levels will be determined as set forth in Chapter 6, paragraph 6.

CHAPTER 4

Local 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, DELSD-SF.

2. Radioactive sources. Local permits for the use of 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, DELSD-SF, and will include the following information:

a. Organization.

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

c. Type of radiation source.

d. Physical form of the radioactive material.

e. Number of sources required.

f. Quantity of radioactive material or power of radiation source.

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.

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. (See Incl 1 for sample RWP.)

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 an NRC license or DA authorization is issued.

2. Shipping.

a. The user 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 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 safety 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 extenguishers, 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 dosimeter 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. People who are unfamiliar with the facility will be accompanied by responsible personnel acquainted with the facility.

(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) When an individual has received 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. When an individual has received 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) 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 be anyone not directly connected with the work being conducted.

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

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

6. Decontamination and waste disposal. a. In order to prevent the possibility of contamination, the following regulations will be observed:

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

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

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

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

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

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

For Personnel Wearing	Alpha Concentrations	Beta Concentrations
No respiratory protection	< 1 MPC*	< 1 MPC*
M-17 Full face respirator	50 MPC*	50 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 of radioactive waste and other work connected with radiation hazards.

j. In the event of contaminated clothing, the contaminated articles will be removed immediately. Skin areas underneath the clothing will be 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 active waste or liquid active waste containers. At no time should dry active and liquid active wastes be mixed. When containers for radioactive wastes are full, the RPO will supervise the removal. All 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 active waste. In some cases, it may be possible to store such equipment for future use when radiation levels have decayed to acceptable levels. Equipment properly marked and shielded will be stored in the radiation storage vault.

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

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

(2) Before any decontaminated equipment or articles can be moved or transported to a "clean area" the RPO will determine the extent of contamination of the particular item. Limits of contamination for items to be admitted to a clean 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.

p. Maximum permissible contamination levels are listed in Table 1.