



DEPARTMENT OF THE ARMY
U.S. ARMY HEALTH PROFESSIONAL SUPPORT AGENCY
5109 LEESBURG PIKE
FALLS CHURCH, VA 22041-3258



REPLY TO
ATTENTION OF

June 5, 1989

Preventive and Military
Medicine Consultants Division

U.S. Nuclear Regulatory Commission
Region IV
Nuclear Materials Safety Section
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Dear Sir:

Enclosed are two copies of new information applicable to
Byproduct Material License Numbers 05-00046-13 and 05-00046-15
(Teletherapy), Fitzsimons Army Medical Center, Aurora, Colorado.

The information updates the applicable radiation protection
regulation and provides qualifications information for the
radiation protection officer, assistant radiation protection
officer and medical physicist.

Sincerely,

Charles E. Day, III
Lieutenant Colonel, U.S. Army
Radiological Hygiene Consultant

Enclosure

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DECOMMISSIONING RECORD
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DEPARTMENT OF THE ARMY

FITZSIMONS ARMY MEDICAL CENTER
AURORA, COLORADO 80045-5001

May 10, 1989

REPLY TO
ATTENTION OF

Radiation Protection Office

THRU: Commander *McBry*
U.S. Army Health Services Command *17 May 89*
ATTN: HSPA-P
Fort Sam Houston, Texas 78234-6000

Office of the Surgeon General
ATTN: DASG-PSP-E
5111 Leesburg Pike
Falls Church, VA 22041-3248

FOR: US Nuclear Regulatory Commission Region IV
Division of Radiation Safety and Safeguards
Nuclear Materials Licensing Section
511 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Gentlemen:

Reference NRC BML No: 05-00046-13
NRC BML No: 05-00046-15 (Teletherapy)

Attached (Encl 1a & 1b) are the NRC 313M, Supplement A for Eugene V. Potter and James A. Woods. Effective 1 June they will be the RPO and Assistant RPO for both NRC licenses. Dann Ward has been replaced as the medical therapy physicist by Harry N. Tyler (Encl 1c).

Enclosure 2 is a copy of the recently approved FAMC Reg 40-604, Radiation Protection, which governs the use of radiation sources at FAMC. This regulation supersedes the Radiation Protection regulation forwarded on 18 Aug 86.

Sincerely,

Ronald R. Bresell

Ronald R. Bresell
Captain, U.S. Army
Radiation Protection Officer

Enclosures

13/11/89
~~8908090030~~

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TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER Harry N. TYLER, Jr.	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
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3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
American Board of Radiology	Therapeutic & Diagnostic Radiology	Sept 88

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING	
		LECTURE/ LABORATORY COURSES (Hours) C	SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION	Univ Colorado, Health Sci. Ctr. Sept 81 - May 82	55	55
b. RADIATION PROTECTION	Univ Colorado Health Sci. Ctr. Jan - May 82	30	10
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY	Univ Colorado Health Sci Ctr. Sept 81 - May 82	5	5
d. RADIATION BIOLOGY	Univ Colorado Health Sci Ctr Jan - May 82	30	10
e. RADIOPHARMACEUTICAL CHEMISTRY	Univ Colorado Health Sci Ctr June - Aug 82	30	10

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

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs-137	60 mCi	Penrose Cancer Hospital Colorado Springs, Co	2½ Years	Clinical
Ir-192	200 mCi	St Anthony Hospital Denver, Co		
I-125	25 mCi	Memorial Hospital Cheyenne, Wyo		

DEPARTMENT OF THE ARMY
FITZSIMONS ARMY MEDICAL CENTER
AURORA, COLORADO 80045-5000

FAMC Regulation
No. 40-604

1 October 1988

Medical Services
Radiation Protection

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*This regulation supersedes FAMC Reg 40-604, 1 August 1986.

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CHAPTER 1

ADMINISTRATION

1-1. Purpose. a. Implement the applicable laws, regulations, conditions and restrictions under which radioactive materials and x-ray producing devices are used within Fitzsimons Army Medical Center (FAMC).

b. Promulgate the rules, direction and guidance of the Radiation Protection Committee (RPC) in the proper and safe handling of radioactive material and equipment which produce ionizing radiation.

c. Control the production, procurement, receipt, storage, use, repair, transfer, and disposal of radioactive material and equipment which produce ionizing radiation.

d. Prescribe the radiation protection program for FAMC.

1-2. Scope. These regulations apply to all activities and organizations using radioactive material and/or equipment which produce ionizing radiation at FAMC.

1-3. References. Required and related publications are listed at Appendix A.

1-4. Definitions. As used in this regulation, the following definitions apply. a. The word "shall" infers a standard, condition, or procedure which must be met if one is to be in compliance with punitive Federal regulations.

b. The words "should" and "may" infer a standard, condition, or procedure from which one may deviate for good and sufficient reason without violating a punitive regulation. Decisions to deviate from accepted procedures of this regulation warrant careful consideration by the principal user or other responsible individual in a supervisory capacity.

c. The word "he" when used in this publication represents both the masculine and feminine genders, unless otherwise specifically stated.

d. The terms "Radiation Protection" and "Health Physics" are synonymous and are used interchangeably throughout.

e. The term "dosimeter" means any personal device used to measure an individual's exposure to radiation. The following devices are all dosimeters: TLD badge, Film badge, TLD Ring, pocket dosimeter. See Chapter 6 for more information.

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1-5. Responsibilities. a. The Commander, FAMC, is responsible for the provisions of this regulation.

b. The Radiation Protection Officer (RPO), FAMC, is the principal staff officer responsible for the implementation of this regulation. Temporary minor exceptions to specific provisions of this regulation may be granted on an individual basis by the RPO providing such exceptions do not jeopardize individual safety, violate Federal law, the conditions of the US Nuclear Regulatory Commission (USNRC) license, or the provisions of the DA authorization to use radioactive materials.

CHAPTER 2

ROLE OF FAMC RADIATION PROTECTION

2-1. Purpose. To delineate the responsibilities of the RPO.

2-2. Responsibilities of the Radiation Protection Officer. The function and responsibilities of Radiation Protection may be found in FAMC Reg 10-1, Organization and Function Manual, and TB MKD 525. The RPO: a. Acts as radiation safety advisor to the Commander.

b. Directs all radiation safety activities at FAMC.

c. Serves as principal FAMC staff officer for control of radioactive material and machine sources of ionizing radiation.

d. Acts as executive agent for the USNRC licenses and the DA authorization for the possession, storage and use of radioactive material at FAMC.

e. Provides radiation safety advice and assistance to activities using radioactive material or machine produced ionizing radiation.

f. Conducts and administers radiation safety education and training programs.

g. Performs support services, including:

(1) Radiation protection surveys (Chapter 15).

(2) Administration of the personal dosimetry and bioassay programs (Chapters 6 and 7).

(3) Maintain inventories of radioactive material and machines which produce x-ray radiation.

(4) Ensure compliance with conditions specified in the USNRC licenses and the DA authorization.

(5) Render required administrative reports.

(6) Keep necessary and required records to ensure compliance with Federal law and DA regulations.

(7) Supervise incoming shipments of radioactive material to avoid contamination of the users' facilities and to ensure compliance with Federal packaging, labeling, and shipping requirements.

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(8) Insure radioactive material shipped from FAMC is in compliance with Federal regulations.

(9) Calibrate portable survey instruments used at FAMC and provide replacement instruments for all users.

h. Develops and tailors individual users' radiation protection programs to ensure that adequate radiation protection standards will be met.

i. Assists radiation workers in avoiding unwarranted exposure to radiation through close and continuous support.

CHAPTER 3

AUTHORIZATION TO USE RADIOACTIVE MATERIAL

3-1. Purpose. To describe the administrative policies and procedures relating to the use of radioactive material.

3-2. General. Fitzsimons Army Medical Center has been issued a BROADSCOPE USNRC license and DA authorization to permit the receipt, possession, storage, use, transfer, and disposal of radioactive material. The possession and use of radioactive materials by individuals within FAMC is permitted only when specifically authorized by the RPC.

3-3. Explanation of Terms. a. US NRC license. A license issued to FAMC which permits the receipt, possession, storage, utilization, transfer, and disposal of certain radioactive material subject to specific conditions.

b. DA authorization. An authorization issued to FAMC which permits the receipt, possession, storage, utilization, transfer, and disposal of naturally occurring and accelerator produced radioactive materials not controlled by the NRC.

c. Radioisotope authorization. An authorization issued by the RPC to an individual to receive, possess, store, use, and transfer radioactive material. FAMC radioisotope authorizations are subject to the conditions of the USNRC license, DA regulations, and this regulation.

d. Human use of radioactive materials refers to the internal or external administration of radioactive materials to human beings.

e. Nonhuman use of radioactive materials refers to those applications in which radioactive material is not applied to human beings. Invitro studies of human tissues are included in this category providing none of the product material is to be administered to humans.

f. A radioactive drug means any substance, defined as a drug in section 201(g)(1) of the Federal Food, Drug, and Cosmetic Act, which exhibits spontaneous disintegration of unstable nuclei with the emission of nuclear particles or photons and includes any nonradioactive reagent kit or nuclide generator which is intended to be used in the preparation of any such substance, but does not include drugs such as carbon-containing compounds or potassium-containing salts which contain trace quantities of naturally occurring radionuclides.

g. Principal user is an individual who, by virtue of his training and experience with radioactive material, has been authorized by the RPC to possess and use radioactive material for a given purpose. A Principal User bears the responsibility for the safe handling of the material and for proper precautionary measures to protect himself and others from unwarranted exposure to radiation. He may dictate such rules, procedures, or other restrictions as he deems necessary to effect the proper handling of the radioactive material and is responsible to the RPC.

h. Co-worker is an individual who possesses adequate training and experience with comparable radioactive material or equipment to qualify him as a Principal User; however, he is listed as a co-worker in support of Department/Service administrative policies. In the absence of the Principal User, a Co-Worker may assume the responsibilities of Principal User.

i. Trainee is an individual who does not possess adequate training and experience to be authorized as a Principal User. He is assigned to this category so that he may obtain the necessary experience under the direct supervision of the Principal User or Co-Workers. It is the aim of the Trainee to obtain suitable training and experience to become qualified as a Principal User or Co-Worker.

j. Technician is an individual who, under the supervision of the Principal User or Co-Worker, performs certain routine duties involving the use of radioactive material. He does not possess suitable training and experience to be classified as a Principal User or Co-Worker, and is not undergoing such training as would qualify him to attain that status. Technicians must be trained in the safe handling of radioactive materials, contamination control, and precautionary measures which may be taken to protect themselves and others from unwarranted exposure to radiation.

k. Health Physics is a profession devoted to the protection of man and his environment from unwarranted radiation exposure.

3-4. Procedures for initialling RPC authorization to use radioactive materials. a. The Principal User prepares one copy of the Request for Authorization to Use Radioactive Material (FAMC Form 4712). Instructions are included in the form, but assistance will be furnished by the RPO upon request.

b. If the contemplated use is a non-routine human use (Appendix B, TB MED 525) or the contemplated dosage range exceeds the recommended dosage range (Appendix C, TB MED 525), the Principal User must submit a protocol for nonroutine medical use of radioactive material (see para 3-7). Patient dose calculations and literature reprints should accompany such a protocol.

c. If the contemplated use involves the use of human volunteers, the provisions of AR 70-25 (Use of Volunteers as Subject of Research) and TB MED 525 (Licensing and Control of Radioactive Materials for Medical Purposes) apply. It is the responsibility of the Principal User to obtain the required approval, through Command channels, from the Office of The Surgeon General. A copy of this approval will be forwarded with the request. If the approval has not been obtained, a copy of the request for approval will be submitted.

d. Health Physics personnel will conduct an initial survey of the contemplated laboratory facility to evaluate potential occupational radiation hazards.

e. All documentation will be forwarded to the RPO who will verify the presence of all documents, attach additional documents as needed, and ensure that procedures, radioisotopes, and activities requested are allowed by the USNRC license or DA authorization issued to FAMC. If additional operating restraints are required to ensure personnel safety, they will be developed, discussed with the requester, and appropriate changes made to the request.

f. Copies of documentation will then be distributed to members of the RPC for review prior to the committee meeting. Questions or comments concerning the request may be resolved prior to the meeting by discussing them with the requester or the RPO, as appropriate. During the committee meeting the procedure requested and qualifications of the investigators will be evaluated to ensure adequate training and experience in the safe handling of radioisotopes. For human use involving nonroutine medical uses of radioisotopes, the protocol will be evaluated from a professional standpoint to determine the medical acceptability of the procedure.

g. Following approval, the authorization will be recorded, a number assigned, and distribution effected.

3-5. Amendment of authorizations. If at any time the principal user desires to deviate from his documented procedure, the radioisotope, or the specified investigation, he shall request an amendment to his authorization by submitting FAMC Form 4712, describing the proposed changes to his radioisotope authorization. Amendments will be formally reviewed by the RPC.

3-6. Review and renewal of authorizations. Current authorizations will be reviewed at least annually and at other times as deemed appropriate by the RPO. After review, authorizations are either renewed, discontinued, or revised in accordance with current requirements. Users will submit FAMC Form 4712 for annual review and list procedural or personnel changes.

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3-7. Nonroutine medical uses of radioactive material. Experimental and nonroutine medical uses of byproduct materials include all human uses not specified in Appendix B and C, TB MED 525. Principal Users, Co-Workers, and other, non-authorized personnel, desiring to obtain nonroutine medical use approval must coordinate the protocol with both the RPO and the Department of Clinical Investigations (DCI). The latter department has a detailed procedure which must be followed to obtain approval by FAMC and Health Services Command.

CHAPTER 4

RESPONSIBILITIES OF PERSONNEL WHO USE RADIOACTIVE MATERIALS

Section I. RESPONSIBILITIES OF PRINCIPAL USERS

- 4-1. Purpose. To delineate the responsibilities of Principal Users (and co-workers) of radioactive material.
- 4-2. Explanation of terms. a. Principal User. See definition, para 3f, chap 3.
- b. Co-Worker. See definition, para 3g, chap 3.
- c. Trainee. See definition, para 3h, chap 3.
- d. Technician. See definition, para 3i, chap 3.
- 4-3. Responsibilities. a. Become thoroughly familiar with the contents of this regulation prior to the use of radioactive materials.
- b. Obtain and use radioactive materials only as authorized by this regulation.
- c. Take adequate precautionary measures to protect himself and others from unwarranted exposure to radiation.
- d. Seek advice and assistance from the RPO when in doubt concerning the safety of an operation.
- e. Prescribe rules, procedures, or protocols for the use of radioactive materials under his control to insure proper and safe use. These will be made available to any radiation worker in that area and will be furnished for review and comment to the Health Physics Office.
- f. Insure that all personnel working under his authorization or in his area of responsibility are familiar with the specific practices to be followed in the interest of radiological safety. Health Physics will assist in providing instruction in radiation safety upon request.
- g. Preclude the misuse of radioisotopes and radiation producing devices by personnel who might endanger themselves or others by their conduct.
- h. Insure that all rules, procedures, and practices of radiological safety are rigorously followed in the work area.

i. Seek the assistance of the appropriate supervisors if assistance in obtaining cooperation and compliance is needed. Although Health Physics is available to provide necessary technical advice on matters of radiological safety, enforcement of regulations and rules is basically the responsibility of the immediate supervisor. All disputes should be resolved at the lowest possible level.

j. The Principal User will promptly report to the RPO all known or suspected overexposures to radiation. The overexposed individual will cooperate in any and all attempts to evaluate his radiation exposure.

k. Maintain a current inventory of the quantity of radioactive material on hand to be readily available to the RPO upon request. The inventory will include the radionuclide(s), activity, and the assay or "decayed to" date of that activity.

l. Provide information and assistance to Health Physics personnel as necessary for the completion of radiation protection surveys. Where recommended by NRC Reg Guide 8.23, the Principal User is responsible for insuring that daily radiation surveys of his activity are performed.

m. Remain directly responsible to the RPO for violations of this regulation by personnel working under his authorization. The RPO will report all cases of this nature to the RPO whenever appropriate corrective actions are not initiated by the Principal User or when violations are repeated or flagrant.

n. Additional specific responsibilities are described in:

- | | |
|-------------------------|-----------------------------|
| (1) Chapter 5, para 3 | (5) Chapter 13, para 2b, 2c |
| (2) Chapter 8, para 1 | (6) Chapter 15, para 2b |
| (3) Chapter 10, para 4b | (7) Chapter 19, para 2b |
| (4) Chapter 11, para 1c | (8) Chapter 21, para 3 |

Section II. MINIMUM RULES OF LABORATORY SAFETY FOR RADIATION WORKERS

4-4. Purpose. To delineate the responsibilities of all personnel who handle radioactive materials.

4-5. Responsibilities. a. No eating, drinking, smoking, or applying cosmetics in any area where radioisotopes are stored or used.

b. Do not bring food or drink into areas where radioisotopes are used or stored, even if it is to be eaten elsewhere.

c. Do not store food (lunch bags, soft drinks, etc.) in cabinets, refrigerators, etc., which are used or have been used to store radioactive material.

d. Do not use laboratory glassware or equipment for the preparation or consumption of food or drink.

e. Wear protective gloves, aprons, laboratory coats, etc., whenever there is a possibility of self contamination.

f. Protect all breaks in the skin with waterproof material (e.g., rubber gloves) when handling radioactive materials.

g. Wash hands thoroughly with mild soap and water after handling any radioisotope; monitor hands with a suitable detector before doing any other work and whenever leaving the laboratory for meals, coffee breaks, etc., and especially before eating, drinking, smoking or applying cosmetics.

h. Never wash hands with solvents; use mild soap and water.

i. Eliminate all sharp objects (e.g., broken glassware) from areas where radioactive materials are used.

j. Wear dosimeter (if issued) at all times when working with radiation. Do not wear dosimeter off duty.

k. When leaving the work area for the day, at lunch, for breaks, or for medical or dental appointments, leave the dosimeter in an approved storage area where it will not be exposed to radiation. Do not take your dosimeter home.

l. Do not tamper with the dosimeter.

m. Mark all radiologically contaminated or potentially contaminated containers and equipment clearly with radioactive marking tape.

n. At the conclusion of each run of an experiment using radioactive material: change absorbent paper, decontaminate areas, clean up equipment, etc., to avoid any build-up of contamination.

o. Lab coats which were worn during the use of radioactive material are not to be worn when doing other work or taken outside the lab. Contamination on the coat may be spread, absorbed, or ingested if care is not taken.

p. Never pipette by mouth, not even water. Bad habits, once formed, are not easily broken.

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q. Report all known or suspected exposures, contamination, spills, inhalations, ingestions, absorptions, or injections of radioactive materials IMMEDIATELY to Health Physics, and to your immediate supervisor. No punitive action will be taken against individuals who are accidentally exposed to radiation, for the accident, or for prompt reporting.

r. Dispose of radioactive waste only in the approved receptacles. Do not mix radioactive and nonradioactive waste.

s. If a radioactive waste sink is available, follow the posted instructions for use. Be sure to complete the logbook entry.

t. Keep radioactive material work areas free from unnecessary materials and equipment.

u. Where practical, use absorbent paper to limit the spread of contamination.

v. Do not handle telephone, reports, etc., with contaminated hands or while using protective gloves.

w. Keep fingernails short and clean.

x. Personnel working with radioactive materials will report IMMEDIATELY to the appropriate superior and to the RPO any cuts or skin abrasions occurring during radiation work.

y. The following procedures are to be followed in the event of a wound incurred while working with radioactive materials:

(1) Wash the injured area at once with running water. Time is important; even a few seconds could make a considerable difference.

(2) Notify your supervisor and the RPO.

(3) Self-treatment or antiseptics should not be employed until the wound has been checked by a medical officer.

CHAPTER 5

CONTROL MEASURES AND PROTECTION STANDARDS FOR RADIATION EXPOSURE

5-1. References. a. Title 10, Code of Federal Regulations, Part 20, U.S. Nuclear Regulatory Commission Rules and Regulations.

b. AR 40-14, Control and Recording Procedures for Occupational Exposure to Ionizing Radiation.

c. NUREG 0267, Principles and Practices for Keeping Occupational Radiation Exposures at Medical Institutions as Low as Reasonably Achievable.

5-2. Applicability. The definitions and limitations stated in this chapter are peacetime standards for occupational exposure of personnel to ionizing radiation. Occupational exposure to ionizing radiation is that exposure incurred as a result of an individual's employment or duty. No portion of this chapter shall be interpreted as limiting the intentional exposure of an individual to radiation for the purpose of medical diagnosis or medical therapy.

5-3. Definitions and requirements for controlled areas. a. A controlled area is a defined area in which the occupational exposure of personnel to radiation is under the supervision of the RPO or a Principal User/Co-Worker.

b. Restricted Area.

(1) Definition: Any area designated by the RPO to which access will be limited and in which precautionary measures are taken for the purpose of protecting individuals from exposure to ionizing radiation or radioactive materials.

(2) Requirement: A restricted area will be under the supervision of an individual authorized by the RPC to use sources of radiation in that area.

c. Radiation Area.

(1) Definition: 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.

(2) Requirement: Each radiation area shall be conspicuously posted with a sign bearing the radiation caution symbol and the words:

**CAUTION
RADIATION AREA**

d. High Radiation Area.

(1) Definition: 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 of dose equivalent in excess of 100 millirem.

(2) Requirements:

(a) A high radiation area shall not be established without the approval of the RPO except in an emergency.

(b) Each high radiation area established for more than 30 days shall be equipped with control devices in accordance with 10 CFR 20.203 or 29 CFR 1919.96

(c) Except in an emergency, no individual shall enter a high radiation area until the area has been monitored and approval for his entry has been given by the RPO.

(d) No individual shall enter or remain in a high radiation area unless personnel are immediately available in the vicinity to render assistance.

(e) Persons entering a high radiation area will carry a direct reading dosimeter.

(f) Each high radiation area shall be conspicuously posted with a sign bearing the radiation caution symbol and the words:

**CAUTION
HIGH RADIATION AREA**

e. Airborne Radioactivity Area.

(1) Definition: Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations exceeding the amounts specified in Appendix B, Table 1, Column 1, Title 10, Code of Federal Regulations, Part 20, or any room, enclosure, or operating area in which airborne radioactive material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceeds 25 percent of the amounts specified in the above referenced Code of Federal Regulations.

(2) Requirements:

(a) An airborne radioactivity area shall not be established without approval of the EPO except in an emergency.

(b) The EPO shall direct the use of respiratory protective devices, ventilation control measures, and other appropriate actions within airborne radioactivity areas.

(c) Each airborne radioactivity area shall be conspicuously posted with a sign bearing the radiation caution symbol and the words:

CAUTION
AIRBORNE RADIOACTIVITY AREA

f. Areas Where Radioactive Material is Present.

(1) Each area or room and principal container in which radioactive material is stored or used shall be conspicuously posted with a sign bearing the radiation caution symbol and the words:

CAUTION
RADIOACTIVE MATERIAL

(2) Samples, working solutions, laboratory standards, check sources, etc., must be labeled, segregated, or otherwise identified in such a manner that all personnel in the area recognize that radioactive material is present in the object. Radioactive marking tape may be used for this purpose. The label should include the specific nuclide, activity, and date (or time) of that activity. Beakers, flasks, test tubes, and other laboratory containers used transiently (within one working day) in laboratory procedures are exempt from labeling provided the area in which the material is used is adequately marked with signs.

g. Contaminated Areas.

(1) Definition: Any area, including work areas, which are contaminated with radioactive material to levels in excess of values published in Table 4, Chapter 18, Contamination Control and Decontamination Operations (Table 4-3, AR 385-11).

(2) All areas designated as "Contaminated Areas" will always be regarded as heavily contaminated and must be surveyed by Health Physics following use and decontamination in order to be considered free of contamination.

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h. Special Areas of Concern.

(1) At the discretion of the EPO, dose rates may be posted for information purposes at any point.

(2) Specially designated sinks, approved by the EPO, through which radioactive material may be discharged into the sanitary sewer system shall be conspicuously posted with the radiation caution symbol and the words:

**CAUTION
RADIOACTIVE MATERIAL DISPOSAL SINK**

A log will be maintained listing the date, isotope, and amount (in mCi) of liquid waste dumped.

(3) All laboratory receptacles for radioactive waste shall be conspicuously posted with the radiation caution symbol and the words:

**CAUTION
RADIOACTIVE WASTE**

5-4. Radiation protection standards. a. Every effort will be made to maintain radiation exposures as far below the radiation protection standards (See Table 1) as is practicable. Positive efforts will be carried out to fulfill this objective. In determining necessity of exposure, anticipated risks will be weighed against the benefits to be expected.

TABLE 1 - Occupational Exposure Limits

Effective Dose Equivalent of Radiation to:	Dose per Calendar Quarter	Dose per Calendar Year
WHOLE Body	1.25	5
Lens of the Eye, Thyroid	—	15
Skin or Extremity of the Whole Body	12.50	50
Organ Systems	—	15
Individuals Over 18 Years of Age, but Not Yet 19 Years - Whole Body	1.25	3
Unborn Children of Adult Workers	—	0.5

b. Basic radiation protection standards adopted for the control of occupational exposures to ionizing radiation include:

(1) The annual limit is the more limiting of--

(a) The sum of the (external) deep dose equivalent to the whole body and the (internal) committed effective dose equivalent being equal to 5 rems. Expressed mathematically:

$$H_d + \sum_T w_T H_{c,T} = 5 \text{ (rems)}$$

where:

H_d is the deep dose equivalent (rems) for the year (Dose equivalents to the extremities, the skin, and the lens of the eye are not considered in computing the whole body dose equivalent);

$w_T H_{c,T}$ is the committed effective dose equivalent for an organ or tissue, T, from radionuclides taken into the body during the year;

w_T is the weighting factor which is the proportion of the risk of stochastic effects resulting from irradiation of tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly;

$H_{c,T}$ is the committed dose equivalent for a tissue, T, over a specified time interval; and

\sum_T is the sum of the committed effective dose equivalent for all organs or tissues which receive a significant dose relative to the total dose to all organs or tissues; or

(b) The sum of the deep dose equivalent and the committed dose equivalent being equal to 50 rems to an organ or tissue other than the lens of the eye. Expressed mathematically:

$$H_d + H_{c,T} = 50 \text{ (rems)}$$

(c) If an individual is occupationally exposed at levels exceeding both 10% of the (external) deep dose equivalent and 30% of the (internal) annual limit of intake (ALI) of radioactive material, the licensee shall demonstrate compliance with the annual dose limit by summing the deep dose equivalent and the committed effective dose equivalent. If the deep dose equivalent is less than 10% of the annual limit, or if the committed effective dose equivalent is less than 30% of the

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annual limit, the doses need not be summed. (Note--The dose equivalents of the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to separate limits.)

(2) The dose equivalent of the lens of the eye, to the skin, and to the extremities are subject to the following limits.

(a) The annual dose equivalent limit to the lens of the eye is 15 rems (0.15 Sv).

(b) The annual dose equivalent limit to the skin and to each of the extremities is 50 rems (0.5 Sv). This limit applies to the dose equivalent average over 10 square centimeters in the region of highest exposure.

(3) Individuals under 18 years of age, declared pregnant women, and occasionally exposed individuals will not be exposed to a whole body dose equivalent of more than:

(a) 2 Millirem in any 1 hour, nor

(b) 100 millirem in any 7 consecutive days, nor

(c) 500 millirem in any 1 calendar year, nor

(d) more than 10 percent of the values in (1) and (2).

(4) Individuals over 18 years of age but who have not yet reached their 19th birthday may be occupationally exposed to ionizing radiation provided that they do not exceed 1.25 rem effective dose equivalent to the whole body in any calendar quarter, nor 3 rem in the 12 consecutive months prior to their 19th birthday.

(5) Women of reproductive capacity should be occupationally exposed only under conditions where the dose equivalent to the abdomen will not exceed:

(a) 170 millirem in any calendar quarter, nor

(b) 500 millirem in any 9 month period.

c. Radiation protection standards adopted for the control of planned occupational exposures to ionizing radiation under emergency situations include:

(1) Life Saving:

(a) The accumulated dose equivalent of radiation to the whole body should not exceed 100 rem.

(b) The accumulated total dose equivalent of radiation to the hands and forearms should not exceed 300 rem.

(2) Less Urgent:

(a) The accumulated dose equivalent of radiation to the whole body should not exceed 25 rem.

(b) The accumulated total dose equivalent of radiation to the hands and forearms should not exceed 100 rem.

d. Exposure of any individual member of the public shall be constrained so that the total dose from all known sources and operations, licensed and unlicensed, except for natural background, medical diagnosis and therapy, does not exceed 0.5 rem (5 mSv) per year. The total dose shall be the sum of the (external) deep dose equivalent to the whole body and the (internal) committed effective dose equivalent.

e. Alternate radiation protection standards, less restrictive than those prescribed in 4a above, may be used in special circumstances when approved by the Surgeon General of the military department concerned.

(1) Proposals for the use of alternate standards will contain complete justification and will describe the procedures by which the alternate standards will be implemented.

(2) Alternate radiation protection standards will not be considered for individuals under 19 years of age, females known to be pregnant, occasionally exposed individuals, women of reproductive capacity, or nonoccupational exposure to ionizing radiation.

f. When dosimetry indicates that an individual may have received greater than 125 millirem per calendar quarter whole body exposure; exposure to unusual concentrations of airborne radioactive material; or the individual believes he may have been exposed to excessive ionizing radiation, the RPO will direct an investigation of the circumstances of the exposure. A written report of the investigation will be prepared and maintained by the RPO.

g. When it is determined that an individual may have received a dose of ionizing radiation in excess of the limits stated in para 4 above, or has been exposed to airborne concentrations of radioactive material in excess of 25 percent of the amounts specified in Appendix B, 10 CFR 20, when averaged over the number of hours in any week, a report of the findings will be made to the RPO. A recommendation for corrective action will be prepared by the RPO and submitted through US Army Health Services Command, ATTN: HSPA-P, Fort Sam Houston, TX 78234, to the Surgeon General and the USNRC in compliance with pertinent directives.

h. The exemption of medical exposure from consideration relative to permissible exposure limits of this chapter apply only to the patient. All other personnel such as physicians and technicians administering exposures are subject to the permissible exposure limits listed above.

5-5. Accidental exposure to ionizing radiation. The specific procedures and responsibilities relating to the accidental exposure of personnel to known or suspected overexposures are delineated in Chapter 20. a. Internal Exposure. All persons who are known or suspected to have been internally exposed to quantities of radioactive material in excess of the amounts specified in Chapter 20 of this regulation shall be reported to the RPO.

b. External Exposure. All persons who are known or suspected to have been externally exposed to radiation levels in excess of those listed in para 4 above shall be reported IMMEDIATELY to the RPO.

5-6. Radiation units. Table 2 includes a list of the currently used radiation units.

TABLE 2 Currently Approved Radiation Units

Unit	Quantity Of Which It is a Measure	Definition	Major Use
CURIE (Ci)	Activity	Quantity of a radionuclide in which 3.7×10^{10} nuclear transformations occur per sec. Historically, the number of transformations per sec. of a 1 gm sample of Ra-226.	Describes rate at which a radionuclide decays. $1 \text{ Ci} = 3.7 \times 10^{10} \text{ DPS}$ $= 2.22 \times 10^{12} \text{ DPM}$
BECQUEREL (Bq)	Activity	A unit of radioactivity measurement equal to one transformation per second.	$1 \text{ Bq} = 1 \text{ DPS}$
ROENTGEN (R)	Exposure	Quantity of X or Y radiation that produces ionization in air equal to 2.08×10^6 ion pairs per cubic centimeter of air at STP. 2.58×10^4 Coulomb/kg 1 e.s.u. of charge /cc 1 e.s.u. of charge/0.001293 gm	Measure of intensity of radiation fields. Tells nothing about the amount of energy absorbed or the biological injury that might occur.

CHAPTER 7

MEDICAL SURVEILLANCE OF RADIATION WORKERS

7-1. Purpose. To establish medical evaluation procedures for radiation workers at FAMC.

7-2. General. The low exposures at FAMC and the limited potential for exposure of radiation workers obviated the need for extraordinary medical surveillance. At the exposure levels experienced at FAMC (usually be low then limits set for the general population), no clinical effects to radiation exposure can be expected. Under certain circumstances (e.g., an exposure investigation), the RPO may require medical evaluation specific to radiation exposure.

7-3. Responsibilities. a. The RPC is responsible for providing guidance regarding medical evaluation procedures for radiation workers at FAMC.

b. The RPO is responsible for monitoring working conditions which could results in accidental ingestion, inhalation, injection, or absorption of radioisotopes by workers and taking action to reduce such hazards.

c. The Preventive Medicine Officer is responsible for:

(1) Coordinating with each radiation worker's supervisor the medical examination requirements (pre-employment, medical surveillance, etc.). These requirements will be based on guidance from the RPC, the RPO, and the Office of the Surgeon General.

(2) Evaluating the results of examinations and recording these in the individual's medical record.

(3) Ordering appropriate examinations for possible overexposures to ionizing or nonionizing radiation based on recommendations from the RPC or other qualified specialists.

7-4. Medical evaluations. a.. Initial Examination. Pre-placement/pre-employment medical examinations are required. For workers to radiation hazards, this examination should consist of a review of prior occupational exposure and a description of any unusual exposure to radiation resulting from previous occupations, accidents, or diagnostic procedures. Any therapeutic exposure will be listed by the dosage and the areas treated. This information in diagnostic and therapeutic radiation will be recorded as a portion of the history, but will not be entered on DD Form 1141 (Record of Occupational Exposure to Ionizing Radiation). The family and personal medical history will note the presence or absence of cancer, blood dyscrasias,

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(7) The results of bioassay, whole body radioactivity measurements, or estimation of internal exposure to persons registered in the personnel monitoring program shall be sent to AIEDC quarterly.

f. Personnel monitoring will be discontinued when an individual departs or is assigned duties which, in the opinion of the RPO, do not warrant continuation.

6-8. Investigations. The RPO will investigate all excessive, unusual, or unanticipated exposure results (i.e. exposures in excess of ALARA standards) and prepare a written report to the RPC.

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6-4. General guidelines. a. Each person, except those being exposed to radiation for medical purposes, who occupies a controlled area for more than one day will wear a dosimeter badge unless specifically exempted by the RPO.

b. Dosimeters will not be used for any purpose other than personnel monitoring without approval of the RPO.

c. Only those dosimeters issued from the Health Physics Office shall be acceptable in meeting the requirements of this paragraph for persons coming under the scope of this regulation.

d. Dosimeters shall not be worn by personnel when occupationally exposed at other facilities. When military or civilian personnel are exposed to ionizing radiation at an installation outside the jurisdiction of FAMC, they shall insure that the required exposure information is furnished to the RPO at least quarterly.

e. Under certain circumstances other dosimeters or dosimetry methods may be employed to supplement the basic TLD dosimeter. The RPO will approve those individuals authorized to substitute another device or method for the whole body badge based upon the occupational hazards to which they are exposed.

f. Dosimeters should be stored in limited access, low dose rate areas when not being worn by the individual.

g. Dosimeters shall not be worn during medical and dental x-ray exposures or when the individual is to receive a radioisotope treatment. Clearance will be obtained from the RPO before wearing the dosimeter after completion of a radioisotope treatment procedure.

h. Dosimeters will not be worn off duty.

i. The dosimeter will not be intentionally exposed, tampered with, or damaged.

j. Whenever a dosimeter is thought to have been lost, damaged, accidentally exposed, etc., the RPO will be promptly notified. A replacement badge will be issued immediately.

k. The whole body badge should be worn on the torso between the neck and the waist.

l. The whole body badge will be worn under the lead apron and the wrist badge under the lead glove when these protective items are worn.

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m. The wrist badge/TLD ring will be worn oriented toward the radiation source on the wrist/finger closest to that source.

n. Dosimeters will be worn only by the individual to whom they are issued.

o. Collar badges will be worn on the outside of the lead apron.

6-5. Administration. a. An applicant for a whole body badge will appear in person at the Health Physics Office to complete the required forms and receive the initial safety briefing.

b. Personnel on permanent monitoring service will be subject to the medical surveillance program in accordance with Chapter 7 of this regulation.

c. Each section is responsible for exchanging their personnels' dosimeter monthly. Health Physics will notify each section when it is time for the exchange.

d. The RPO will send the dosimeters and the Photodosimetry Reports to the Army Ionizing Radiation Dosimetry Center (AIRDC) for monthly exposure evaluation.

e. Records of exposures will be maintained as follows:

(1) The AIRDC maintains permanent records of all exposure readings and returns the Photodosimetry Report to the RPO.

(2) The RPO maintains DD Form 1141 (Record of Occupational Exposure to Ionizing Radiation) for all military and civilian personnel assigned or attached to FAMC and participating in the FAMC personnel monitoring program.

(3) When an individual's DD Form 1141 is maintained by the RPO, a copy of FAMC Form 1519 (DD Form 1141 Locator) will be placed on the outside of the Health Record.

(4) When clearing Post, personnel who are occupationally exposed to ionizing radiation will clear through the Health Physics Office for proper posting of the DD 1141.

(5) Reports of zero exposure will not be furnished to monitored visitors, unless requested by the visitor or the custodian of his exposure record.

(6) The "Record of Occupational Exposure to Ionizing Radiation" and records of bioassay results shall be made available to the individual or supervisors upon request.

CHAPTER 6

PERSONNEL MONITORING

6-1. Purpose. To describe the policies and procedures for managing the personnel monitoring program. Personnel monitoring is used to: a. Quantitatively estimate the magnitude of individual exposures to sources of ionizing radiation.

b. Detect hazardous conditions relating to ionizing radiation exposure not found during radiation protection surveys.

6-2. Selection of participants. Personnel selected for personnel monitoring will include: a. Individuals who may be exposed to radiation at levels in excess of 10 percent of the quarterly basic occupational exposure standards (see Table 1, Chapter 5).

b. Other individuals selected by the RPO.

6-3. Devices and methods for personnel monitoring.

a. Currently, a TLD badge is the primary dosimeter for personnel monitoring in the Army. It consists of a packet of radiosensitive thermoluminescent material in a plastic holder.

b. The RPO will determine which person(s) will be issued which type(s) of dosimeter using the guidelines in AR 40-14. The following types of dosimeters are available.

(1) Whole body badge. Sensitive to beta, x-ray, and gamma radiation and worn to measure the exposure received by the whole body.

(2) Wrist badge. Same as the whole body badge except that it is provided with a wrist band so that it can be used to measure the dose to the wrist. Anyone who is issued an extremity personnel dosimeter will also be issued a whole body badge.

(3) Collar badge. Same as the whole body badge except that it is used to monitor exposure to the head and neck area.

(4) Ring badge. A single TLD chip in a ring used to measure exposure to the fingers of one hand.

c. Bioassay methods are employed in certain cases to assess the quantity of a radioisotope which may be present within the body. Available techniques include selective organ scanning and liquid scintillation or multi-channel analysis of body fluids.

TABLE 2 cont.

Unit	Quantity Of Which It is a Measure	Definition	Major Use
RAD (rad)	Absorbed Dose	Quantity of any type of ionizing radiation which deposits 100 ergs of energy per gram of absorber material.	Describes the energy that is imparted to the material being irradiated. Puts all types of radiations on an absorbed energy basis. Not fully descriptive of the biological injury that might be caused.
GRAY (Gy)	Absorbed Dose	Quantity of any type of ionizing radiation which deposits 1 Joule of energy per kg of absorber material.	1 Gy = 100 rad
REM (rem)	Dose Equivalent	Dose in rads x RBE or Dose in rads x QF The 2 expressions for determining dose equivalents in rem are used to distinguish radiobiology experiments and radiation protection. The use of RBE in calculating dose equivalence in rem is reserved for radiation biology experiments where the specific biological effect is stated. The use of QF is reserved for use in radiation protection.	A unit that establishes equivalence on a biological effect basis (RBE). Compares the biological effect to Co-60 gamma rays.
SIEVERT (Sv)	Dose Equivalent	A unit of dose equivalence which is equal to 1 Joule per kg	1 Sv = 100 rem

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thyroid disease, history of recurrent abortion, congenital malformation, or any other inheritable conditions which may be associated with exposure to radiation.

b. Periodic Examinations. Radiation workers should receive periodic medical examinations at intervals not to exceed three years.

c. Termination Examinations. Termination examinations will not ordinarily be conducted. The RPO may, after reviewing the individual's DD 1141 at the time of outprocessing, request a termination examination of the individual by the Preventive Medicine Officer.

d. Special Cases. If the RPO identifies areas of particular hazard from radioisotopes, especially areas of potential internal hazards, he will take appropriate action to minimize the hazard and he will direct that appropriate bioassays or selective organ scans be conducted to evaluate the suspected exposure. Reports of these investigations will be provided to AIRDC.

e. Consultation. Professional advice in the area of radiation exposure is available from Chief, Radiology; Chief, Nuclear Medicine; or Chief, Therapeutic Radiology Service. Any physician engaged in the evaluation of radiation workers may seek the advice of any these individuals to assist in such evaluations.

f. Reports. Abnormal medical findings discovered during medical examinations of radiation workers will be immediately reported to the RPO for appropriate action.

CHAPTER 8

PREGNANCY SURVEILLANCE PROGRAM

8-1. Purpose. To describe the policies and procedures to be followed in managing declared pregnant radiation workers.

8-2. Procedure. Female radiation workers are subject to the pregnancy surveillance program. It is the responsibility of both the individual and her supervisor to notify the RPO immediately upon learning of a confirmed pregnancy.

a. The RPO will review the worker's radiation exposure history and her working environment to determine the advisability of her continuing work in that area for the duration of her pregnancy.

b. The RPO will brief the pregnant employee concerning radiation risks to the embryo-fetus and insure that she reads NRC Reg Guide 8.13, Instruction Concerning Prenatal Radiation Exposure (see Sections I and II, this chapter). The RPO will consider the worker's past exposure history and her working environment during this briefing. The primary objective is to advise the worker on risks involved in working in a controlled area. A statement (Section III, this chapter) acknowledging this briefing will be completed by the worker.

(1) If the worker has a fear that the type of work she is doing will be hazardous to her fetus, she may resign (civilian employee), or request discharge (military) because of pregnancy (if applicable). If she would prefer to be retained in the service but not be a radiation worker, she should request reclassification through appropriate personnel channels.

(2) If the worker desires to continue working in a controlled area, the briefing will also cover precautions she can utilize to insure that her exposure is maintained as low as practical.

c. The RPO will make specific recommendations to the appropriate personnel branch for a change in working environment during pregnancy when it is considered desirable from the radiological health standpoint.

8-3. Reference. HSPA-P. 9 March 1982 Letter, Subject: Utilization of Pregnant Radiation Workers.

SECTION I. APPENDIX A TO REGULATORY GUIDE 8.13

INSTRUCTOR'S GUIDE

EFFECTS ON THE EMBRYO/FETUS OF EXPOSURE TO RADIATION
AND OTHER ENVIRONMENTAL HAZARDS

In order to decide whether to continue working while exposed to ionizing radiation during her pregnancy, a woman should understand the potential effects on an embryo/fetus, including those that may be produced by various environmental risks such as smoking and drinking. This will allow her to compare these risks with those produced by exposure to ionizing radiation.

Table 1 provides information on the potential effects resulting from exposures of an embryo/fetus to radiation and nonradiation risks. The second column gives the rate at which the effect is produced by natural causes in terms of the number per thousand cases. The fourth column gives the number of additional effects per thousand cases believed to be produced by exposure to the specified amount of the risk factor.

The following section discusses the studies from which the information in Table 1 was derived. The results of exposure of the embryo/fetus to the risk factors and the dependence on the amount of the exposure are explained.

1. RADIATION RISKS

1.1 Childhood Cancer

Numerous studies of radiation-induced childhood cancer have been performed, but a number of them are controversial. The National Academy of Science (NAS) BEIR report reevaluated the data from these studies and even reanalyzed the results. Some of the strongest support for a casual relationship is provided by twin data from the Oxford survey. For maternal radiation doses of 1,000 millirems, the excess number of deaths (above those occurring from natural causes) was found to be 0.6 death per thousand children.

1.2 Mental Retardation and Abnormal Smallness of the Head
(Microcephaly)

Studies of Japanese children who were exposed while in the womb to the atomic bomb radiation at Hiroshima and Nagasaki have shown evidence of both small head size and mental retardation. Most of the children were exposed to radiation doses in the range of 1 to 50 rads. The importance of the most recent study lies in the fact that investigators were able to show that the gestational age (age of the embryo/fetus after conception) at the time the children were exposed was a critical factor. The approximate risk of small head size as a function of gestational

age is shown in Table 1. For a radiation dose of 1,000 millirems at 4 to 7 weeks after conception, the excess cases of small head size was 5 per thousand; at 8 to 11 weeks, it was 9 per thousand.

In another study, the highest risk of mental retardation occurred during the 8 to 15 week period after conception. A recent EPA study has calculated that excess cases of mental retardation per live birth lie between 0.5 and 4 per thousand per rad.

1.3 Genetic Effects

Radiation-induced genetic effects have not been observed to date in humans. The largest source of material for genetic studies involves the survivors of Hiroshima and Nagasaki, but the 77,000 births that occurred among the survivors showed no evidence of genetic effects. For doses received by the pregnant worker in the course of employment considered in this guide, the dose received by the embryo/fetus apparently would have a negligible effect on descendants.

2. NONRADIATION RISKS

2.1 Occupation

A recent study involving the birth records of 130,000 children in the State of Washington indicates that the risk of death to the unborn child is related to the occupation of the mother. Workers in the metal industry, the chemical industry, the textile industry, and farms exhibited stillbirths or spontaneous abortions at a rate of 90 per thousand above that of workers in the control group, which consisted of workers in several other industries.

2.2 Alcohol

It has been recognized since ancient times that alcohol consumption had an effect on the unborn child. Carthaginian law forbade the consumption of wine on the wedding night so that a defective child might not be conceived. Recent studies have indicated that small amounts of alcohol consumption have only the minor effect of reducing the birth weight slightly, but when consumption increased to 2 to 4 drinks per day, a pattern of abnormalities called the fetal alcohol syndrome (FAS) begins to appear. This syndrome consists of reduced growth in the unborn child, faulty brain function, and abnormal facial features. There is a syndrome that has the same symptoms as full-blown FAS that occurs in children born to mothers who have not consumed alcohol. This naturally occurring syndrome occurs in about 1 to 2 cases per thousand.

SECTION II. APPENDIX B TO REGULATORY GUIDE 8.13

PREGNANT WORKER'S GUIDE

POSSIBLE HEALTH RISKS TO CHILDREN OF WOMEN WHO ARE
EXPOSED TO RADIATION DURING PREGNANCY

During pregnancy, you should be aware of things in your surroundings or in your style of life that could affect your unborn child. For those of you who work in or visit areas designated as Restricted Areas (where access is controlled to protect individuals from being exposed to radiation and radioactive materials), it is desirable that you understand the biological risks of radiation to your unborn child.

Everyone is exposed daily to various kinds of radiation: heat, light, ultraviolet, microwave, ionizing, and so on. For the purposes of this guide, only ionizing radiation (such as x-rays, gamma rays, neutrons, and other high-speed atomic particles) is considered. Actually, everything is radioactive and all human activities involve exposure to radiation. People are exposed to different amounts of natural "background" ionizing radiation depending on where they live. Radon gas in homes is a problem of growing concern. Background radiation comes from three sources:

	<u>Average Annual Dose</u>
Terrestrial-radiation from soil and rocks	50 millirem
Cosmic-radiation from outer space	50 millirem
Radioactivity normally found within the human body	25 millirem
	<hr/> 125 millirem*
Dosage range (geographic and other factors)	75 to 5,000 millirem

*Radiation doses in this document are described in two different units. The rad is a measure of the amount of energy absorbed in a certain amount of material (100 ergs per gram). Equal amounts of energy absorbed from different types of radiation may lead to different biological effects. The rem is a unit that reflects the biological damage dose to the body. The millirad and millirem refer to 1/1000 of a rad and a rem, respectively.

The first two of these sources expose the body from the outside, and the last one exposes it from the inside. The average person is thus exposed to a total dose of about 125 millirems per year from natural background radiation. In

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addition to exposure from normal background radiation, medical procedures may contribute to the dose people receive. The following table lists the average doses received by the bone marrow (the blood-forming cells) from different medical applications.

<u>X-Ray Procedure</u>	<u>Average Dose*</u>
Normal chest examination	10 millirem
Normal dental examination	10 millirem
Rib cage examination	140 millirem
Gall bladder examination	170 millirem
Barium enema examination	500 millirem
Pelvic examination	600 millirem

*Variations by a factor of 2 (above and below) are not unusual.

NRC POSITION

NRC regulations and guidance are based on the conservative assumption that any amount of radiation, no matter how small, can have a harmful effect on an adult, child, or unborn child. This assumption is said to be conservative because there are no data showing ill effects from small doses; the National Academy of Sciences, recently expressed "uncertainty as to whether a dose of, say, 1 rad would have any effect at all". Although it is known that the unborn child is more sensitive to radiation than adults, particularly during certain stages of development, the NRC has not established a special dose limit, for protection of the unborn child. Such a limit could result in job discrimination for women of child-bearing age and perhaps in the invasion of privacy (if pregnancy tests were required) if a separate regulatory dose limit were specified for the unborn child. Therefore, the NRC has taken the position that special protection of the unborn child should be voluntary and should be based on decisions made by workers and employers who are well informed about the risks involved.

For the NRC position to be effective, it is important that both the employee and the employer understand the risk to the unborn child from radiation received as a result of the occupational exposure of the mother. This document tries to explain the risk as clearly as possible and to compare it with other risks to the unborn child during pregnancy. It is hoped this will help pregnant employees balance the risks to the unborn child against the benefits of employment to decide if the risk is worth taking. This document also discusses methods of keeping the dose, and therefore the risk, to the unborn child as low as is reasonably achievable.

RADIATION DOSE LIMITS

The NRC's present limit on the radiation dose that can be received on the job is 1,250 millirems per quarter (3 months). * Working minors (those under 18) are limited to a dose equal to one-tenth that of adults, 125 millirems per quarter (See 20.101 of 10 CFR Part 20).

*The limit is 3,000 millirems per quarter if the worker's occupational dose history is known and the average dose does not exceed 5,000 millirems per year.

Because of the sensitivity of the unborn child, the National Council on Radiation Protection and Measurements (NCRP) has recommended that the dose equivalent to the unborn child from occupational exposure of the expectant mother be limited to 500 millirems for the entire pregnancy. The 1987 Presidential guidance specifies an effective dose equivalent limit of 500 millirems to the unborn child if the pregnancy has been declared by the mother; the guidance also recommends that substantial variations in the rate of exposure be avoided. The NRC (in 20.208 of its proposed revision of Part 20) has proposed adoption of the above limits on dose and rate of exposure.

ADVICE FOR EMPLOYEE AND EMPLOYER

Although the risks to the unborn child are small under normal working conditions, it is still advisable to limit the radiation dose from occupational exposure to no more than 500 millirems for the total pregnancy. Employee and employer should work together to decide the best method for accomplishing this goal. Some methods that might be used include reducing the time spent in radiation areas, wearing some shielding over the abdominal area, and keeping an extra distance from radiation sources when possible. The employer or health physicist will be able to estimate the probable dose to the unborn child during the normal nine-month pregnancy period and to inform the employee of the amount. If the predicted dose exceeds 500 millirems, the employee and employer should work out schedules or procedures to limit the dose to the 500-millirem recommended limit.

It is important that the employee inform the employer of her condition as soon as she realizes she is pregnant if the dose to the unborn child is to be minimized.

INTERNAL HAZARDS

This document has been directed primarily toward a discussion of radiation doses received from sources outside the body. Workers should also be aware that there is a risk of radioactive material entering the body in workplaces where

unsealed radioactive material is used. Nuclear medicine clinics, laboratories, and certain manufacturers use radioactive material in bulk form, often as a liquid or a gas. A list of the commonly used materials and safety precautions for each is beyond the scope of this document, but certain general precautions might include the following:

1. Do not smoke, eat, drink, or apply cosmetics around radioactive material.
2. Do not pipette solutions by mouth.
3. Use disposable gloves while handling radioactive material when feasible.
4. Wash hands after working around radioactive material.
5. Wear lab coats or other protective clothing whenever there is a possibility of spills.

Remember that the employer is required to have demonstrated that it will have safe procedures and practices before the NRC issues it a license to use radioactive material. Workers are urged to follow established procedures and consult the employer's radiation safety officer or health physicist whenever problems or questions arise.

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SECTION III

STATEMENT

I ACKNOWLEDGE HAVING READ U.S. NRC REGULATORY 8.13 CONCERNING
POSSIBLE PRENATAL RADIATION EXPOSURE AND HAVING BEEN COUNSELED
BY THE RADIATION PROTECTION OFFICER (RPO) CONCERNING MY PAST
EXPOSURE HISTORY AND POTENTIAL FOR EXPOSURE
DURING MY PREGNANCY.

After having considered all the information presented and
having had the opportunity to ask questions concerning possible
risks, I have decided to (initial appropriate section):

a. I will resign because of my pregnancy since I do
not want to be occupationally exposed to ionizing radiation
(Civilian) _____

b. I will request discharge from the Army because of
pregnancy under applicable regulations. _____

c. I would like to be re-classified into an MOS for
which I am qualified. _____

d. Remain in my present position. The RPO has pointed
out methods whereby I can reduce my exposure to even lower
levels. _____

PRINTED NAME: _____

SIGNATURE: _____ DATE _____

CHAPTER 9

TRAINING AND EXPERIENCE OF RADIOISOTOPE
USERS AND X-RAY WORKERS

9-1. Purpose. To establish the standards of training required for personnel who work with radioisotopes and x-rays at FAMC.

9-2. General. The training required for personnel working with radioisotopes have been established by the NRC. The training courses outlined below, or their equivalents, are considered prerequisite for individuals who work in the various user categories. Exception to these requirements may be granted on an individual basis by the RPC.

9-3. Definitions. a. Human Use- See Definition, para 3d, chap 3.

b. Nonhuman Use- See Definition, para 3e, chap 3.

c. Principal User- See Definition, para 3f, chap 3.

d. Co-Worker- See Definition, para 3g, chap 3.

e. Trainee- See Definition, para 3h, chap 3.

f. Technician- See Definition, para 3i, chap 3.

g. Health Physics- See Definition, para 3j, chap 3.

9-4. Course of instruction. a. Safe Use and Handling of Radioisotopes. Designed for Principal Users, Co-Workers and Trainees who have not received equivalent training. A working knowledge is provided of the principles and practices of radiation protection, the biological effects of radiation, basic terminology, mathematics and calculations used in measurement of radioactivity, nuclear instrumentation, personnel monitoring devices and techniques, NRC and DA regulations governing radiation protection, dose calculations, shielding determinations, and laboratory and experimental design.

b. Nuclear Pharmacy Orientation Course. Instruction designed primarily for pharmacists, pharmacy technicians, and pharmacy students. Experience is obtained with radioisotope uptake, dose calculations, laboratory and experimental design, formulation of laboratory rules and safe working practices, nuclear imaging techniques and instrument operation, radioimmunoassay principles and procedures.

c. ALARA Training. Specific training in radiation risks, and location and use of radioactive materials or radiation producing devices at FAMC. Classes will be presented to target groups on an annual basis by the EPO.

9-5. Training and experience required of individuals. a. All Principle Users, Co-Workers and Trainees working with radioisotopes must have received the Safe Use and Handling of Radioisotopes Course or its equivalent and specialized instruction or clinical experience (if applicable) in the specific human use studies desired.

b. All individuals operating x-ray machines will receive instruction as required by para 1-14, TB MED 521.

c. Technicians working with radioisotopes should receive the Safe Use and Handling of Radioisotopes Course or its equivalent, along with specialized instruction as required by their supervisors or the Principal Users under whose authorization they work.

d. Residents and interns receive only familiarization instruction in the use of radioisotopes. Although they are exempted from the provisions of this chapter, the training received does not qualify them for independent use of radioisotopes.

e. All workers frequenting radiation use areas will receive annual ALARA training.

9-6. Qualification and certification. a. Personnel may become qualified in the use of radioisotopes through training at FAMC or through previous training and experience which satisfies the FAMC requirements.

b. In the case of human use physicians, evidence of satisfactory completion of the clinical practical experience will be provided to the RPO by the Principal User under whom the experience is obtained (Preceptor Statement).

c. Records of training and experience of radioisotope workers will be maintained by the RPO.

d. Physicians certified by the American Board of Radiology or American Board of Nuclear Medicine need only present their board certification.

9-7. References. a. TB MED 521 - Management and Control of Diagnostic X-Ray, Therapeutic X-Ray, and Gamma-Beam Equipment having Energies up to 10 Million Electron Volts.

b. APPENDIX A, USNRC Regulatory Guide 10.8 - Guide for the Preparation of Applications for Medical Programs.

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c. 10 CFR 30 - Rules of General Applicability to Licensing of Byproduct Material, Rules and Regulations of the US Nuclear Regulatory Commission.

d. NUREG 0267 - Principles and Practices for Keeping Occupational Radiation Exposures at Medical Institutions As Low As Reasonably Achievable.

CHAPTER 10

RECEIPT, TRANSFER AND SHIPMENT OF RADIOACTIVE MATERIAL

10-1. Purpose. To familiarize Principal Users with the Health Physics aspects of radioactive material procurement, receipt, transfer, and shipment.

10-2. Definitions. a. Radioactive Material. Any material which undergoes spontaneous nuclear disintegration with emission of corpuscular or electromagnetic radiation. Radioactive material includes naturally occurring isotopes, special nuclear material, byproduct material, accelerator produced isotopes, source material, and items contaminated with radioactive material.

b. Radioactive Commodity. An item of US Government property to which a Federal Stock Number (FSN) has been assigned and is composed in whole, or in part, of radioactive material.

c. US Nuclear Regulatory Commission License. See definition, para 3a, chap 3.

d. Department of the Army Authorization. See definition, para 3b, chap 3.

e. FAMC Radioisotope Authorization. See definition, para 3c, chap 3.

10-3. General. a. The RPO has supervisory responsibility for all radioactive material at FAMC to include movement into, storage within, and movement out of the facility.

b. Questions concerning procurement, receipt, transfer, and shipment should be directed to the RPO.

10-4. Procurement of radioactive material. a. A Principal User may procure for use at FAMC only those radioisotopes currently authorized for his use by the RPO.

b. The maximum quantity which may be ordered at any one time is limited by the maximum activity of that radioisotope which the user is authorized to possess unless arrangements have been made with the RPO for any deviation.

c. Maximum isotope possession limits of each Principal User or using activity are assigned by the RPO when a Principal Users authorization is approved. It is the responsibility of each Principal User to maintain records indicating amounts of each authorized isotope in his possession. Under no circumstances will the maximum possession limits be exceeded for a specific isotope without approval from the RPO.

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package are in excess of 10 millirem per hour immediately notify the RPO. The final delivering carrier and the Nuclear Regulatory Commission Inspection and Enforcement Office for Region IV, will be notified by the RPO.

b. If shipments are found to be contaminated in excess of levels specified in 10 CFR 20.205, the RPO will be notified and he will perform appropriate notifications.

c. Under no circumstances will an incoming shipment of radioactive material be refused when delivered.

d. After duty hours, radioactive material will be received by the AOD and processed as outlined in the AOD instructions.

10-6. Transfer of radioactive material. a. Transfer of radioactive material within FAMC shall be accomplished only between persons authorized to use those radioisotopes.

b. Transfer of radioactive material between Principal Users at FAMC and other activities or agencies outside the jurisdiction of FAMC (VA Hospital, etc.) shall be coordinated with the RPO. Health Physics must have proof in writing that the recipient is licensed or authorized to possess the radioactive material before the transfer can be accomplished.

c. The RPO will be notified before transfer of all adapted or experimental items of equipment containing radioactive material that are to be returned to a vendor for repair, replacement, and/or disposal.

10-7. Shipment of radioactive material. a. The RPO will certify all outgoing shipments identified as containing radioactive material except for used Mo-99/Tc-99m generators which are being returned to the supplier by Nuclear Medicine.

b. The Principal User shall coordinate with Logistics, Transportation, and the Comptroller in the preparation of all appropriate shipping documents.

c. The RPO, or his representative, will insure that the container is properly identified, described, packaged, and labeled in accordance with existing regulations.

10-8. Quantities of radioactive material exempted from shipment monitoring. a. Certain shipments of radioactive materials are exempted from the monitoring procedures required by paragraph 20.205, Title 10, Code of Federal Regulations, Part 20.

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b. The following shipments are not required to be monitored for radioactive contamination and excessive radioactive exposure rates (Note: All radioactive packages must be logged in by the receiver).

(1) Packages containing no more than the exempt quantities shown in Table 3 below.

(2) Packages containing no more than 10 mCi of radioactive material consisting solely of H-3, C-14, S-35, or I-125.

(3) Packages containing only radioactive material as gases or in special form.

(4) Packages containing only radioactive material in other than liquid form (including Mo-99/Tc-99m generator) and not exceeding the Type A quantity limit specified in Table 3, below.

(5) Packages containing only radionuclides with half-lives of less than 30 days and a total quantity of no more than 100 millicuries.

TABLE 3. EXEMPT AND TYPE A QUANTITIES

Transport Group*	Exempt Quantity Limit (In Millicuries)	Type A Quantity Limit (In Curies)
I	0.01	0.001
II	0.1	0.050
III	1.0	3
IV	1.0	20
V	1.0	20
VI	1.0	1000
VII	25,000.0	1000

* A Table of Radioactive Material Transport Groups is set forth in Appendix C, 10 CFR 71.

CHAPTER 11

ACCOUNTABILITY AND INVENTORY OF RADIOACTIVE MATERIAL
AND MACHINES WHICH PRODUCE IONIZING RADIATION

11-1. Responsibilities. a. The RPO is responsible for maintaining an inventory of all radioactive sources and ionizing radiation producing devices in accordance with AR 40-5.

b. The RPO is responsible for insuring that the total inventory of any radioisotope on hand does not exceed the possession limitations imposed for that isotope by the USNRC license or DA authorization, as appropriate.

c. Each Principal User is responsible for the control, security, and inventory of all radioactive material in his possession. He will insure that the maximum quantity which he has on hand does not exceed the possession limit stated in his radioisotope authorization. Quantities in excess of his possession limits will be returned to the RPO for storage until needed.

11-2. Procedures. a. Inventory records will be updated on a quarterly basis at FAMC.

b. Maintaining an inventory of on-hand radioisotopes and radioactive waste is the responsibility of the Principal User. The Principal User will forward the inventory to the RPO on a quarterly basis for consolidation.

c. Machines and devices which produce ionizing radiation will be registered with the RPO who will maintain a registry in accordance with AR 40-5. This registry will be updated as needed and verified annually.

CHAPTER 12

TRANSPORTATION OF RADIOACTIVE MATERIALS

12-1. Purpose. To prescribe general guidelines for the transportation of radioactive material within and from FAMC and to implement the provisions of AR 385-11 and 49 CFR 170 - 189.

12-2. Responsibilities. a. The Directorate of Industrial Operations (DIO), FAMC, is responsible for providing the means by which radioactive materials are transported.

b. The RPO is responsible for:

(1) Controlling all radioactive material at FAMC to include location, transfer, and transportation.

(2) Insuring that packaging meets standards of 49 CFR 173.24 and other pertinent directives.

(3) Insuring that all packaging and accessories which have previously been used for shipments of radioactive materials and are being shipped empty conform to 49 CFR 173.29; 173.427; and other pertinent directives.

(4) Verifying that removable radioactive contamination does not exceed the limits specified in 49 CFR 173.427 and 173.443.

(5) Verifying labeling of packages of radioactive materials in the manner prescribed in 49 CFR 173.444; 172, Subpart E; and other pertinent directives.

(6) Advising on the preparation of shipping documents for shipment of radioactive material as required.

(7) Releasing shipments to carriers after verifying that the vehicle intended for transport is suitable, in a proper state of repair, placarded in accordance with 49 CFR 172.200 or 177.817, and free from any obvious condition which could reasonably impair the safe transport of the cargo. Vehicles not meeting these tests will be reported to the Transportation Officer.

(8) Surveying military vehicles which have been used to transport radioactive materials for dose rate at any accessible surface and removable radioactive surface contamination in accordance with 49 CFR 173.427, 173.441, 173.443, 177.843, and other pertinent directives.

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12-3. Policies. a. All shipments and transportation requirements for radioactive material will be coordinated with the RPO and the DIO.

b. Vehicles transporting radioactive materials will comply with 49 CFR.

c. Passenger-carrying vehicles, including POV and motor vehicles which carry passengers for hire, will NOT be used to transport radioactive materials unless there is no other practical means of transportation available and, then, only with the expressed consent of the RPO. When passenger-carrying vehicles are authorized for use in transporting radioactive materials, the requirements in para 3b above will be met (45 CFR 177.870).

d. The U.S. Mail and Parcel Post will not be used for shipment of radioactive material except in case of emergency, or for the movement of radioisotopes which meet the requirements specified in 39 CFR. All such shipments must be coordinated with the RPO (para 4-3b, AR 385-11).

CHAPTER 13

RADIOACTIVE WASTE

13-1. Purpose. To prescribe the policies and procedures to be followed in the management of radioactive waste at FAMC.

13-2. Responsibilities. a. The RPO is responsible for:

(1) Managing and controlling radioactive waste, including effluents, released to unrestricted environments.

(2) Designating and maintaining the radioactive waste storage areas.

(3) Maintaining an inventory of on-hand radioactive waste.

b. Principal Users are responsible for segregation, packaging, and delivery of radioactive wastes generated under their control to the storage area designated by the RPO.

c. Individual users are responsible for:

(1) Keeping the inventory of radioactive waste in their possession to a practical minimum.

(2) Providing containers for their radioactive waste.

(3) Properly identifying the contents of their waste to include radioisotope and approximate activity.

(4) Defacing radioactive material/transportation labels prior to discarding empty, shipping containers as routine waste.

13-3. Procedures. a. Radioactive waste is unwanted radioactive material or unwanted material contaminated with radioisotopes. Radioactive waste will be classified and segregated prior to disposal depending upon the types and quantities of radionuclides used.

b. Procedures to be followed by users of radioactive material include:

(1) Limit the mixing of nonradioactive with radioactive waste.

(2) Solid waste should be placed in plastic bags or a receptacle lined with a plastic bag. The bag when filled and ready for removal will be taped closed.

(3) Liquid waste that is retained for disposal should be collected in plastic bottles or sealed cans to diminish the breakage hazard. However, liquid waste that will chemically react with plastic and liquid waste containing tritium should be placed in glass bottles. All bottle caps should be taped when presented for disposal.

(4) All radioactive waste containers shall be properly marked with the radiation caution symbol and the words "Caution - Radioactive Waste" and/or "Caution - Radioactive Material".

(5) Radioactive waste will be controlled by the user to prevent unauthorized disposal.

(6) Animal carcasses will be double wrapped in plastic bags and kept frozen until properly disposed of.

c. Disposal of radioactive waste.

(1) Excreta from patients undergoing medical diagnosis or therapy is exempt from waste limits and may be disposed of in the sanitary sewer without regard to their activity.

(2) Individual users are permitted to dispose of radioactive waste via laboratory sinks into the sanitary sewage system after coordinating this procedure with the RPO.

(3) Ultimate disposal of radioactive waste will be accomplished by the RPO in accordance with AR 385-11 and other pertinent directives.

CHAPTER 14

LEAK TESTING SEALED SOURCES

14-1. Purpose. To delineate responsibilities for leak testing radioactive sealed sources at FAMC.

14-2. Definitions. a. Sealed sources are those which meet all of the following criteria:

- (1) Radioactive material other than tritium.
- (2) Half-life greater than 30 days.
- (3) In any physical form other than gas.
- (4) In a quantity which is greater than 100 microcuries of beta and/or gamma emitting radionuclide or greater than 10 microcuries of alpha emitting radionuclide.
- (5) Enclosed in, and is intended to be used in, a container of durable (not fragile) material in a manner intended to prevent contact with and leakage or escape of the radioactive material under conditions of use and wear for which it was designed.

b. Leak Test. A nondestructive test in which a wipe is taken from the surface of the sealed source or from the surfaces of the device in which the sealed source is mounted or stored on which one might expect contamination to accumulate. Leak tests may be taken by any of a variety of techniques depending on the source, the radioisotope, the method of analysis, the mounting, etc.

14-3. Responsibility. The RPO is responsible for the performance, analysis, and posting of records of all leak tests performed at FAMC in satisfying the requirements of AR 385-11, USNRC license conditions, and DA authorization.

14-4. Criteria for leak testing. a. Leak tests, when required, will be performed on beta-gamma emitting sources at intervals not to exceed 6 months, and on alpha emitting sources at intervals not to exceed 3 months.

b. If a source requiring leak testing is supplied with a certificate from the vendor indicating that a leak test has been performed within 6 months (3 months for alpha emitting sources), the source need not be re-tested until 6 months (3 months for alpha emitting sources) from the date of the last test and may be issued for immediate use.

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c. If no documentary evidence is available to substantiate that a given source has been leak tested within 6 months (3 months for alpha emitting sources), the source will not be issued until it has been leak tested and the results evaluated.

d. The leak test instruments shall be capable of detecting the presence of 0.005 microcuries (11,100 DPM) of radioactive material on the test sample.

e. Sealed sources will be considered contaminated if a leak test removed 0.005 microcuries (11,100 DPM) of radioactive material.

f. The RPO will immediately withdraw all sealed sources found to be contaminated. He will then determine if the source is leaking. If it is leaking, he shall direct that it be resealed or disposed of. He shall also render any required reports.

g. The RPO shall be notified prior to fabrication of a sealed source so that the required leak testing may be accomplished.

CHAPTER 15

SURVEY OF WORKING AREAS

15-1. Responsibilities. a. Health Physics personnel will perform a formal radiation protection survey in each area of FAMC where radioactive material is located IAW Table 1, NEC Reg Guide 8.23, Radiation Surveys at Medical Institutions, and will notify the Principal User when removable contamination levels exceeding the values specified on FAMC Form 4721 are detected.

b. Each Principal User is responsible for radiological safety within his work area. He will insure necessary monitoring, surveys, and evaluations are accomplished as routine procedures when necessary to insure that unwarranted radiological hazards are not present. The RPO will, upon request, advise on appropriate procedures, and provide necessary survey instrumentation. The Principal User is responsible for cleaning contaminated areas identified by the RPO.

15-2. Areas of interest. Radiation protection surveys will include evaluations of the following, as appropriate:

- a. Surface contamination (removable and fixed).
- b. Dose rate measurements.
- c. Airborne radiological hazard (particulate and gaseous).
- d. Ventilation, including fume hoods.
- e. Storage areas for radioactive materials.
- f. Radioactive waste management, including radioactive waste disposal sinks.
- g. Radiation safety and contamination control aspects of the working environment and experimental procedures.
- h. The familiarity of personnel with radiological safety and emergency procedures.

CHAPTER 16

HEALTH PHYSICS ASPECTS OF PATIENT CARE

16-1. Responsibilities. a. The Commander, FAMC, provides necessary guidelines to insure adequate protection of medical treatment personnel involved in caring for patients who receive radioisotopes for therapy.

b. The RPO, FAMC, is responsible for providing Health Physics support to wards caring for radiation patients.

16-2. Requirements. a. Individuals who are occupationally exposed to radiation will wear dosimeters unless specifically exempted therefrom by the RPO.

b. Personnel, equipment, linen, and facilities will be monitored for radioactive contamination following any procedure in which the possibility of contamination exists.

c. Dressings, etc., destined for disposal will be monitored and disposed of as radioactive waste when warranted.

d. Health Physics personnel will not impede patient care, but will make recommendations to minimize the accumulated dose to medical personnel and patients not being treated with radiation.

e. Patients will not be discharged from the hospital with more than 30 mCi of radioactive material remaining in the body. The specific requirements of the FAMC NRC license are given in para 7, section V to this chapter.

f. Guidance on specific areas of patient care are described below:

- (1) Section I. Nursing Instructions - Sealed Source
- (2) Section II. Nursing Instructions - Radiopharmaceuticals
- (3) Section III. Death - Health Physics Procedures
- (4) Section IV. Health Physics Aspects of Surgery and Autopsy
- (5) Section V. Health Physics Aspects in the Therapeutic Administration of Radioactive Material

SECTION I. NURSING INSTRUCTIONS - SEALED SOURCES

16-3. Purpose. To familiarize the nursing staff with their responsibilities to the patient and themselves in preventing unnecessary exposure to radiation.

16-4. General. a. This type of radioactive source (sealed) is encapsulated in a sealed metal tube. It is intended to be removed after a specified treatment period. Once this source has been removed from the patient, there is no longer a source of radiation in the patient. Normally, there is no contamination on the linen, utensils, etc. Examples of this type of sealed source include Cs-137 and Ir-192.

b. If any of the following should occur, immediately notify the RPO and the physician who administered the radioactive material:

- (1) Major surgery.
- (2) Transfer of the patient.
- (3) Death of the patient.

16-5. Specific guidance. a. Whenever possible, place the patient in a private room with the bed near the outside wall of the room. Two radiation therapy patients should not be placed in the same room. Nonradiation therapy patients shall not be in the same room with a radiation therapy patient. If private rooms are not available, the RPO must be contacted to assist in establishing bed location.

b. Special restrictions may be noted on the precaution sheet in the patient's chart. Nurses should read these instructions before administering to the patient. Call the Therapeutic Radiology Service if you have any questions about the care of these patients.

c. Nurses should be in the room only for the time needed for nursing care and must obtain and wear a dosimeter.

d. Consistent with adequate patient care, perform only minimal nursing procedures close to the patient. If the patient's clinical status requires constant observation, rotate personnel required to perform adequate care and remain behind the lead shield in order to minimize radiation exposure. The patient's bed should be approached only when required for nursing duties.

e. When a nurse receives an assignment to a therapy patient, a dosimeter must be obtained from Radiation Protection prior to that nurse caring for a patient. The dosimeter shall be worn only by the nurse to whom it is issued and shall not be exchanged between nurses.

f. Pregnant nurses should not be assigned to the care of these patients.

g. Routine bed baths should be omitted while the sources are in place.

h. A television set, telephone, books, or other items should be provided for the patient's entertainment.

i. Perennial care is not given during gynecologic treatment; the perennial pad may be changed when necessary, unless order to the contrary have been written.

j. Special handling of the food tray is not required.

k. Surgical dressings and bandages used to cover an area of radioactive needle insertion may be changed only by the attending physician and may not be discarded until directed by the RPO. Dressings should be kept in a basin until checked by the RPO. Special orders will be written for oral hygiene for patients with oral implants.

l. No special precautions are needed for sputum, urine, vomits, stools, dishes, instruments, or utensils unless specifically ordered.

m. These patients must stay in bed unless orders to the contrary are written.

n. Visitors will be limited to those 18 years of age or over, unless otherwise noted on the precaution sheet in the patient's chart.

o. Visitors shall sit behind the lead shield. Visitors desiring to remain longer than two hours per visit should coordinate with the RPO.

p. No nurse, visitor, or attendant who is pregnant should be permitted in the room of a patient while brachytherapy sources are implanted in the patient. Female visitors should be asked whether or not they are pregnant.

q. Emergency procedures.

(1) If an implanted source becomes loose or separated from patient, or

(2) If the patient dies, or

(3) If the patient requires emergency surgery, immediately call the Therapeutic Radiology Service, or the RPO. After duty hours call the AOD.

r. The RPO will:

(1) See that the bed is placed to minimize exposure to adjacent areas.

(2) Determine the exposure rate at the bedside and at 1 meter from the sealed source, as necessary.

(3) Advise the patient of potential hazards to visitors.

s. At the conclusion of treatment call the RPO and request that the patient and room be surveyed to be sure all radioactive sources have been removed. Do not release linen until after the RPO surveys it.

t. Never touch needles, capsules or containers holding brachytherapy sources. If a source becomes dislodged, use long forceps and put it in the corner of the room or in the shielded container provided; contact the Therapeutic Radiology Service or the RPO at once. After normal duty hours ask the AOD to obtain RPO assistance.

SECTION II - NURSING INSTRUCTIONS - RADIOPHARMACEUTICALS

16-6. Purpose. To familiarize the nursing staff with their responsibility to the patient and themselves in the prevention of unnecessary exposure to radiation.

16-7. General. a. This type of radioactive source (non-sealed) is usually administered in liquid form and is thus classified as a non-sealed source. Though some low energy sealed sources may be used, the source material will remain in the patient until it decays and/or is excreted. Therefore, contamination of linen, bandages, etc., is possible. Examples of these types of sources include: Liquid - I-131, P-32; Sealed - I-125.

b. Immediately notify the RPO and the physician who administered the radioactive material if any of the following occur:

- (1) Major surgery.
- (2) Transfer of the patient.
- (3) Death of the patient.

16-8. Specific guidance. a. Nurses should spend only the amount of time required for ordinary nursing care near the patient. Special restrictions may be noted on the precaution sheet in the patient's chart. Nurses should read these instructions before caring for the patient. Call the Nuclear Medicine Service if you have any questions about their care.

b. Whenever possible, place the patient in a private room with the bed near the outside wall of the room. Two radiation therapy patients should not be placed in the same room. A nonradiation therapy patient shall not be in the same room with a radiation therapy patient.

c. Consistent with adequate care for the patient, carry out only minimal nursing procedures close to the patient. If the patient's clinical status requires constant observation, rotate personnel required to perform adequate nursing care in order to minimize exposure to personnel. The patient's bed should be approached only when required by nursing duties, otherwise remain at least 6 feet from the patient.

d. Wear your dosimeter when entering the area. Do not use another nurse's dosimeter. Dosimeters may be obtained by calling the PPO.

e. Nurses are not to remain in the room unless engaged in a specific nursing activity. Custodial, utility, maintenance, and food service personnel should not enter the room unless they receive permission and instructions from the ward nurse.

f. A television set and books may be provided the patient, however, due to potential contamination, some of those items may have to be held by the RPO for decay.

g. The food tray will be prepared entirely with disposable components. The tray will be disposed of as waste within the patient's room. Uneaten food will not be given to other patients or staff members.

h. Visitors will be limited to those 18 years of age or over, unless other instructions are noted on the precaution sheet in the patient's chart. Visits should be limited to one hour per day. Visitors desiring to remain longer should first coordinate with the RPO.

i. Patients must remain in bed while visitors are in the room and visitors will remain at least 6 feet from the patient.

j. Radioactive patients are to be confined to their rooms unless otherwise authorized by the RPO.

k. No nurse, visitor, or attendant who is pregnant should be permitted in the room of a patient who has received a therapeutic amount of radioactivity until the patient no longer presents a radiation hazard. Female visitors should be asked whether or not they are pregnant.

l. Attending personnel should wear rubber or disposable plastic gloves when handling urinals, bedpans, or other containers having any body material obtained from the patient. Wash gloves before removing and then wash hands. The gloves must be left in the patient's room in the designated waste container.

m. Disposable items will be used in the care of these patients whenever possible. These items should be placed in the designated waste container. Contact the RPO to arrange for disposal of the patient's waste container.

n. All clothes and bed linens used by the patient should be placed in the laundry bag provided and left in the patient's room to be checked the RPO.

o. All nondisposable items should be placed in a plastic bag and left in the patient's room to be checked by the RPO.

p. Surgical dressings should be changed only as directed by the physician. Gold-198 leaking from a puncture wound will stain dressings dark red or purple. Such dressings should not be discarded but should be collected in plastic bags and turned over to the RPO. Handle these dressings only with tongs or tweezers. Wear disposable gloves.

q. For Iodine-131 Patients:

(1) Disposable plates, cups, and eating utensils will be used by patients who are treated with Iodine-131.

(2) Vomiting within 24 hours after oral administration, urinary incontinence, or excessive sweating within the first 48 hours may result in contamination of linen and/or floor. In any such situations or if radioactive urine and/or feces is spilled during collection, call the RPO. Handle all contaminated material with disposable gloves to avoid spreading contamination.

(3) Feces and urine need not be routinely saved unless ordered on the chart. The toilet used by the patient should be well flushed (2-3 times) after each use.

r. Precautions must be taken to see that no urine or vomitus is spilled on the floor or the bed. If any part of the patient's room is suspected to be contaminated, notify the RPO.

s. If a nurse, attendant, or anyone else suspects that his skin, clothing, or shoes is contaminated, notify the RPO immediately. This person should remain outside the patient's room and not walk about the hospital. If the hands become contaminated, wash immediately with soap and water.

t. When the patient is discharged, the RPO will survey the room. The room will not be used for a nontherapy patient until it has been cleared by the RPO.

SECTION III. DEATH - HEALTH PHYSICS PROCEDURES

16-9. Applicability. Special precautions must be taken in the management of remains of patients who have undergone radiation therapy with radioactive implants or unsealed radioisotopes. If the residual quantity within the body is less than 5 mCi (check with the RPO), the body will be handled without regard for the presence of the radioactive material.

16-10. Radioactive implants. When the patient has been treated with a radioactive implant, the procedure outlined below will be followed: a. Notify the physician who administered the implant. The implant will be removed before the remains are taken to the morgue.

b. After the radioactive implant has been removed from the body, the remains may be handled in the routine manner.

c. If the radioactive implant cannot be removed from the body (e.g., radon seeds, gold seeds, etc.), process the remains as outlined in para 16-15, below.

16-11. Unsealed radioisotopes. When the patient has received radiation therapy using unsealed radioactive material, the procedure outlined below will be followed: a. Notify the physician who administered the radioactive material.

b. Notify the RPO. Health Physics will assist the ward in:

(1) Managing the remains and transporting the remains to the morgue.

(2) Surveying the room, personal effects, linen, etc.

(3) Removing any radioactive waste or items for disposal or decontamination, as appropriate.

(4) Removing protective markings and signs from the patient's room.

16-12. Administrative requirements. To insure the prompt identification of radioactive remains and to facilitate the minimizing of radiation exposure of the staff, the following administrative procedures will be followed: a. The "CAUTION - RADIOACTIVE MATERIALS" label affixed to the outside of the chart will remain in place until all radioactive material is removed from the body.

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b. A tag bearing the radioactive warning symbol and the words: "CAUTION - RADIOACTIVE MATERIAL. This patient's body contains a significant quantity of radioactive material as specified in Chapter 3, NCRP Report No. 37" will be attached to the body in the same manner as the tag contained in the mortuary pack.

c. Attach another tag or label to the outside of the shroud.

d. If the body contains residual quantities of radioactive material, the RPO or his representative will complete and sign one of the following statements in accordance with APPENDIX V, NCRP Report No. 37. This statement will be attached to the death certificate for transmittal to the funeral director by the Registrar, FAMC.

(1) REPORT ON RADIOACTIVITY.

TO: Funeral Director

FROM: Radiation Protection Officer
Fitzsimons Army Medical Center
Aurora, Colorado 80045-5001

This body contains no significant amount of radioactive material. No special precautions are required if only standard embalming procedures are employed.

Radiation Protection Officer
Fitzsimons Army Medical Center
Date: _____

(2) REPORT ON RADIOACTIVITY.

TO: Funeral Director

FROM: Radiation Protection Officer
Fitzsimons Army Medical Center
Aurora, Colorado 80045-5001

This body contains a significant amount of radioactive material. The following special precautions are recommended:

Radiation Protection Officer
Fitzsimons Army Medical Center
Date: _____

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16-13. Reference. NCRP Report No. 37, Precautions in the Management of Patients Who Have Received Therapeutic Amounts of Radionuclide.

SECTION IV. HEALTH PHYSICS ASPECTS OF SURGERY AND AUTOPSY

16-14. General. a. The RPO will provide guidance to surgery and autopsy personnel for patients whose bodies contain radioisotopes.

b. The principal guidance for surgeons, pathologists, and funeral directors on this subject is contained in NCRP Report No. 37, a copy of which will be provided by the RPO upon request.

c. Health Physics support and/or advice on radiation protection during surgery or autopsy may be obtained by calling:

Duty Hours: Radiation Protection Office
After duty hours: Call the Administrative Officer of
the Day (AOD) for telephone numbers
of the RPO.

16-15. Special requirements. a. Prior to the surgery (autopsy) the physician who administered the radioactive material should meet with the assigned surgeon (Pathologist) and the RPO. The residual quantity of radioactive material within the body will be estimated and the health physics aspects of the surgery (autopsy) procedure will be provided.

b. If the anticipated exposure to the surgeon (prosector) and his assistants is considered to be prohibitive, it may be necessary to delay the procedure to allow for decay of the radioactive material in the body or to rotate the personnel performing the procedure to preclude overexposure.

c. Personnel engaged in and supporting surgery (autopsy) will wear dosimeters if the patient contains radioisotopes, unless exempted by the RPO.

d. When the possibility of contamination exists, personnel, equipment, linen, and facilities will be monitored for radioactive contamination following the procedure.

e. Tissue, dressings, etc., destined for disposal will be monitored and disposed of as radioactive waste when warranted.

f. Health Physics personnel will not impede procedures, but are expected to make recommendations to minimize the accumulated dose to the surgeon (pathologist) and other members of the team.

g. Autopsy.

(1) At the completion of the autopsy, the physician who administered the radioactive material will inform the RPO of the probable residual quantity of radioactive material within the body based on the body fluids, tissues, and organs which were removed.

(2) The RPO will execute the statement on the radiation hazard for delivery to the funeral director based on information gained during autopsy.

SECTION V. HEALTH PHYSICS ASPECTS IN THE THERAPEUTIC
ADMINISTRATION OF RADIOACTIVE MATERIAL

16-16. Purpose. To specify the duties of Health Physics in the prevention of unwarranted exposure to nursing personnel, visitors, and those who occupy areas adjacent to the patient being treated with radioactive material.

16-17. Notification of therapeutic administration. a. Sealed Sources. Therapeutic Radiology will notify the RPO when they schedule a patient for a sealed source implant. The type and quantity of sealed sources, the patient's name, date of use, and ward number will be recorded.

b. Non-sealed sources. Nuclear Medicine will notify the RPO of the schedule for the administration of the radioactive I-131 or of other therapeutic isotopes.

c. Notification of ward nurse.

(1) The physician scheduling a patient for radiation therapy will notify the appropriate ward of the proposed administration of radioactive material.

(2) Health Physics personnel will obtain from the nurse the names and social security numbers of those persons who will be caring for the therapy patient and will issue dosimeters to any personnel not assigned one. A copy of Section I or II, Chapter 16, will be furnished to the ward as appropriate.

16-18. Preparation of the radioactive material. a. Sealed sources. Therapeutic Radiology will select the sources and is responsible for the safe handling of the radioactive material from the time it leaves Therapeutic Radiology until it is returned to the safe.

b. Non-sealed source. Insure that the therapeutic dose vial is initially opened in a fume hood to enable the volatile component to be safely vented. Nuclear Medicine is responsible for insuring safe delivery of the radioactive material to the ward.

- c. The RPO will provide assistance as required.

16-19. Therapeutic source administration. a. Health Physics personnel will be in attendance during therapeutic administration of sealed and unsealed radioactive material.

- b. Health Physics personnel will:

- (1) Ascertain that the protective materials are used in a manner that provides maximum protection of medical personnel.

- (2) Be available during administration for monitoring assistance.

- c. After the administration Health Physics personnel will:

- (1) Insure that any needed radioactive laundry and waste containers are in the patient's room and properly labeled.

- (2) Instruct the patient in ways to prevent the spread of contamination.

16-20. Patient care on the ward. a. When the therapy is performed at a location other than the patient's room, Health Physics personnel will monitor the therapy and then go to the ward as soon as the patient arrives.

- b. The Health Physics personnel will:

- (1) Ascertain that the patient's bed is placed in a position that will reduce any unnecessary exposure of adjacent areas.

- (2) Advise the patient of the potential hazard to visitors who spend too much time in the room and measures visitors can employ to reduce their exposure.

- (3) Prepare information to be posted on/near the patient's door. This will consist of:

- (a) A visitor's sign-in sheet.

- (b) A copy of "Nursing Instruction - Sealed Sources" or "Nursing Instructions - Radiopharmaceuticals" (section I or II, Chapter 16, respectively).

- (c) A "CAUTION - RADIOACTIVE MATERIALS" sign.

- (4) Execute a radiation survey record.

- (5) Monitor the patient at least twice a day.

c. Removal of protective markings.

(1) If the patient was treated with a sealed source, the Health Physics restrictions (signs, etc.) will be removed after the sources have been removed.

(2) If the patient was treated with a non-sealed source of radioactive material, Health Physics restrictions will remain in effect until the exposure at 1 meter indicates a "no restriction" level of activity as defined by Table 4, NCRP Report No. 37.

(3) The administering physician and the ward nurse will be notified when Health Physics restrictions are removed.

(4) Radioactively contaminated laundry and waste will be removed from the patient's room and the room will be surveyed before it is released for normal occupancy.

16-21. Discharge of therapy patients. a. Patients receiving radiotherapy with non-sealed Iodine-131 shall remain hospitalized until the residual activity in the body is 30 millicuries or less. Release of patients with activity between 8-30 mCi of Iodine-131 should consider the following:

(1) Age of persons in household.

(2) Probability of and length of contact with children and adults of childbearing age.

b. Patients containing radioactive implants, except Iodine-125 and Gold-198 seeds, shall remain hospitalized until the implant is removed.

c. Therapy patients will remain hospitalized until the residual activity in the body is 30 millicuries or less, regardless of isotope.

d. After radiation restrictions are removed, patient discharge clearance is obtained from the patient's physician.

e. If the patient is returning to a home where there are young children, an evaluation of the dose to them may be appropriate in determining discharge (see NCRP Report No. 37).

f. In no event will a patient be discharged if there is sufficient radioactive material remaining in the body to warrant posting of the patient's room with the radiation warning symbol.

g. In an endeavor to keep population and genetic dose "as low as reasonably achievable" (ALARA), the material in Tables 4 and 5 and para 4.1.2(d) of NCRP Report No. 37 will be reviewed prior to release of any therapy patient.

CHAPTER 17

CONTAMINATION CONTROL AND DECONTAMINATION PROCEDURES

17-1. Purpose. To delineate responsibilities relating to contamination control and decontamination procedures at FAMC.

17-2. Responsibilities. a. The EPO is responsible for control of radioactive contamination and supervision of decontamination procedures.

b. Each Principal User is responsible for assisting the EPO in decontamination by:

(1) Controlling contamination within his work area.

(2) Reporting all spill, releases, accidents, incidents, or unusual occurrences involving radioactive material promptly, so that contamination control may be initiated.

(3) Providing the resources for decontamination.

c. The individual who causes the contamination performs the decontamination. The EPO will provide advice and guidance relative to decontamination.

17-3. Contamination limits. The contamination limits prescribed by the Department of the Army are shown in Table 4, Permissible Levels of Radioactive Contamination.

17-4. General. Air and water that contains radioactive material in excess of concentrations specified in 10 CFR 20 shall be considered to be contaminated and shall be controlled and disposed of in accordance with the instructions of the EPO.

17-5. Contamination Control. Methods of controlling contamination which may be employed to minimize the spread of radioactive contamination include: a. Use of personal protective clothing and devices such as rubber or plastic gloves, laboratory coats, shoe covers, head covers, face masks, respirators, etc.

b. Providing and using radiation meters capable of detecting and monitoring contamination from the radioisotope(s) in use.

c. Using separate, specially marked radioactive waste containers.

d. Limiting traffic and occupancy of work areas where radioactive materials are in use.

e. Designing and enforcing work flow and procedures to minimize transfers and manipulations of radioactive material.

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f. Conducting procedures which generate radioactive aerosols, dusts, or gaseous products in fume hoods, gloves boxes, or other suitable closed systems.

g. Designating and posting of contaminated and potentially contaminated areas during procedures which are likely to produce contamination. Anyone can post radiation contaminated areas; however, only the RPO can remove contamination area signs.

h. Covering working surfaces with polyethylene and absorbent disposable material.

i. Using trays capable of containing a total spill of the liquid radioactive material being used.

j. Using double containers for vessels of radioactive materials which are easily upset (e.g. volumetric flasks).

k. Using polyethylene bags to contain waste and lining waste containers.

l. Avoiding the use of house vacuum lines with radioactive materials.

m. Posting cabinets, refrigerators, ovens, etc. where radioactive material are used so that all personnel will be advised of their presence. When the item is not used exclusively for radioactive material, the radioactive material should be separated from the other contents and conspicuously posted.

n. Establishing control points outside contaminated areas where personnel will monitor themselves for contamination with a suitable instrument before leaving the area.

o. Promptly cleaning up and monitoring all spills of radioactive material.

17-6. Decontamination. Decontamination methods are many and varied. The RPO will supervise and advise on decontamination procedures. a. Personnel Decontamination.

(1) Individuals with contaminated clothing should remove their clothing at the earliest opportunity.

(2) Decontamination of the skin should be attempted promptly after discovery of contamination. The skin should be washed thoroughly and repeatedly with a mild soap worked into a good lather. Care should be taken not to abrade the skin.

(3) Special decontamination of individuals beyond that described above will be under the supervision of the RPO.

b. Surface decontamination will be undertaken only by personnel who are wearing protective gloves and/or protective clothing. Material used in decontamination will be disposed of as radioactive waste in accordance with instructions received from the RPO.

17-7. Contaminated laundry. Contaminated clothing and bedding will be collected by RPO at the contamination site and taken for decontamination or disposal.

TABLE 4. RADIOACTIVE CONTAMINATION GUIDES

Contaminated Items and Indications for Actions	Contamination Level				Method of Measurement
	Fixed or Removable	Alpha DPM	Beta-Gamma rad/hr	DPM	
1. Clothing, including shoes:					
a. Personal—Should be replaced, decontaminated, or stored for decay if above.	F	200	0.05		Probe
	R	None		None	Scaler
b. Anticontamination—					
(1) General. Should be replaced and/or decontaminated if above.	F	1000	0.2		Probe
	R	200		1000	Scaler
(2) Respirators. Should be decontaminated or replaced after use, if above.	F	200	1.0		Probe
	R	None		None	Scaler
2. Containers. Before nonradioactive use, should be decontaminated if above.	F	200	0.2		Probe
	R	None		100	Scaler
3. Work Areas and Equipment.					
a. Uncontrolled. Requires decontamination if above.	F	1000	0.05		Probe
	R	100		100	Scaler
b. Controlled:					
(1) Areas	F	1000	0.02		Probe
	R	200		400	Scaler
(2) Hoods	F	1000	2.0		Probe
	R	200		2000	Scaler
(3) Workbench Surfaces	F	1000	2.0		Probe
	R	2000		400	Scaler
(4) Other Equipment Items	F	1000	2.0		Probe
	R	200		2000	Scaler
4. Skin:					
a. Body. Continue decontamination if above.	F	200	0.06		Probe
	R	None		None	Scaler
b. Hands. Continue decontamination if above.	F	400	0.06		Probe
	R	None		None	Scaler

CHAPTER 18

HEALTH PHYSICS ASPECTS OF FIRE FIGHTING

18-1. Purpose. To prescribe general measures to minimize radiological hazards associated with fire protection.

18-2. Fire prevention. a. Whenever possible, flammable materials will not be stored with radioactive materials. When flammable materials must be stored with radioactive materials, the manner of storage will be coordinated with the Fire Inspectors Office to minimize the fire hazard.

b. Every effort will be made by the user to eliminate fire hazards within his area of responsibility.

c. During routine inspections by fire inspectors, the location of radioactive material will be made known to the inspector. The "CAUTION - RADIOACTIVE MATERIALS" warning which must be posted on containers and rooms in accordance with Chapter 5 will assist in meeting this requirement.

18-3. Fire fighting. Whenever firemen respond to a call in an area posted "CAUTION - RADIOACTIVE MATERIALS", the following protective measures will be employed to minimize radiological hazard: a. The RPO will be notified of a fire in a posted area.

b. The RPO will make dose rate measurements, if necessary, prior to the arrival of fire department personnel and provide radiation hazard guidance.

c. Personnel assigned to the area in which the fire occurred should remain in a nearby area to provide current information concerning the location and activity of radiation sources.

d. Firemen should wear self-contained breathing apparatus and protective coat and boots if it does not unduly interfere with their mission.

e. Firemen should stay in a radiation area the shortest possible time necessary to fight the fire and they should avoid unnecessary contact with equipment, opening of containers, or handling of debris.

f. Personnel who have entered the area will remain in the vicinity until surveyed and released by the RPO. This measure is prescribed to avoid unnecessary spread of radioactive contamination. In the event of personal injury, the provisions of Chapters 19 and 20 will be followed.

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18-4 Special considerations. During fire fighting in areas where large radioactive sources are located, every effort should be made to cool the source with a stream of water if the heat of the fire might cause the shielding to melt. If the shielding melts, it may escape or change shape in such a way that a serious radiation hazard could result.

b. Health Physics personnel will conduct classes for the fire department regarding the radiological hazards associated with fire protection, and current locations of radioactive materials.

CHAPTER 19

RADIOLOGICAL EMERGENCIES

19-1. Purpose. a. To insure that an individual who is known or suspected to have been involved in a radiation accident and/or incident that could have resulted in an internal and/or external exposure to ionizing radiation receives proper medical care, and that the possible radiation exposure is evaluated.

b. To insure that the accidental radiation exposure source is contained so further exposure of personnel will be controlled.

19-2. General guidance. a. Radioactive material will be handled by qualified persons in accordance with existing regulations and policies. This chapter will be interpreted by those persons in the light of their knowledge of the relative radiotoxicity of the various radioactive materials (radionuclides) in their possession.

b. A radiation accident may be defined as an unforeseen occurrence, either actual or suspected, involving exposure or contamination of man and environment by ionizing radiation. An accident is considered to occur over a short period of time, from seconds up to several days. Chronic occupational or other long-term exposure is not considered accidental.

c. There are two ways in which humans can be exposed to ionizing radiation:

(1) External. The source of ionizing radiation may be outside of the body so that the radiation strikes the individual and is absorbed. Radiation from x-rays generators, particle accelerators, sealed sources of radionuclides and reactors are examples of this type. The radiation may be beta, gamma, or neutrons. Alpha emitters present no significant external hazard. Particle accelerators may produce other particles such as deuterons, mesons, etc. All persons who are known or suspected to have been externally exposed to an acute dose (within twenty four hour period) in excess of (a) - (c) shall be reported immediately to the RPO:

(a) Whole body --- 1.25 rem.

(b) Skin of the whole body, extremities --- 12 rem.

(c) Lens of the eye, thyroid --- 40 rem.

(2) Internal. The source of ionizing radiation may gain entrance into the human body by inhalation, ingestion, injection or absorption through the intact or abraded skin. Radionuclides may also be formed within the body following exposure to an

external source of neutrons. All persons who are known or suspected to have been internally exposed to activities of radioactive material in excess of 1/10 of the amounts specified in Appendix C, 10 CFR 20 shall be reported to the RPO.

d. There should be no undue delay in the evacuation of the victim to the treatment facility, but there is seldom a need for unusual haste.

19-3. In the event of an emergency the most senior individual present will assume control of the situation and direct activities until relieved by proper authority. The exact actions and sequence of actions to be taken will be determined by the nature of the emergency. The following actions are typical responses to emergency situations. The sequence of these actions is highly variable.

- a. Dismiss nonessential personnel.

- b. Limit or eliminate the radiation source if undue hazard to personnel does not result. For example:

- (1) Return sources to shielded containers.
- (2) Place absorbent material on spills
- (3) Turn off ventilation and equipment
- (4) Extinguish flames, heaters, etc.

- c. Evacuate ALL personnel from the area.

- d. Restrict access to the area.

19-4. The RPO will respond to all radiological emergencies and will:

- a. Provide technical advice as necessary.

- b. Arrange for additional resources (personnel, supplies, and equipment).

- c. Supervise the reduction of radiological hazards.

- d. Monitor the persons who were in the vicinity of the accident if there is a reasonable probability that they may have been exposed and/or contaminated.

- e. Take action to prevent further contamination of personnel and equipment.

- f. Make and/or coordinate all appropriate follow-up measures, reports, investigations, etc.

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19-5. The Commander, FAMC, will develop procedures to:

a. Insure the proper evaluation and treatment of patients who may have been accidentally exposed to ionizing radiation.

b. Assure effective control of radiation contamination and radiation exposure to personnel.

c. The RPO will provide direct support of patient care activities involving contaminated and/or radioactive patients to minimize occupational radiation exposure to medical personnel.

CHAPTER 20

MANAGEMENT OF RADIATION CASUALTIES

20-1. Purpose. a. To provide guidance in the management of radioactive or radioactively contaminated casualties.

b. To prescribe control measures to limit the staff's radiation exposure when treating radioactive or radioactively contaminated casualty.

c. To prescribe control measure to limit the spread of radioactive contamination through FAMC resulting from handling a radioactive or radioactively contaminated casualty.

20-2. Applicability. This chapter is applicable to all individuals and activities at FAMC in the handling of radioactive or radioactively contaminate casualties.

20-3. Definitions. a. A radioactive patient is a patient who is radioactive because of internal deposition of radioactive material or neutron activation of body tissues. If improperly managed, such a casualty could unnecessarily irradiate medical personnel or contaminate personnel, equipment, and facilities.

b. A radioactively contaminated patient is an individual who has external contamination on his clothing or body. After removal of radioactive contamination, the individual presents no radiation hazard.

20-4. General guidance. a. Radioactive and/or contaminated patients will receive all necessary medical care and treatment at the earliest practicable time.

b. Radiation fields and radioactive contamination will not deter medical personnel in efforts to save life or limb, although slightly different techniques may be employed (e.g. rotating medical personnel to minimize exposure to one individual) to keep individual exposures ALARA.

c. Radioactively contaminated patients will be decontaminated at the earliest opportunity consistent with their medical needs.

d. Every effort will be made to minimize radiation exposure and the spread of contamination during medical treatment.

e. The EPO will provide a representative to advise on exposure and contamination control at the site of patient treatment. This representative will not impede patient care, but is expected to make recommendations to minimize personnel exposure and avoid the loss of resources due to radioactive contamination.

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f. At the earliest possible time consistent with the patient's medical needs, the attending physician will allow decontamination to begin. Decontamination will be undertaken by paramedical personnel under the RPO's direction and guidance.

g. All contaminated clothing, equipment, and waste material will be retained by the RPO.

h. Contaminated valuables will be accounted for by using the DA Form 3696 (Patient's Deposit Record) in the conventional manner. These valuables will be retained by the RPO who will account for them, and will undertake to decontaminate them as soon as the situation permits so that they may be returned to the hospital treasurer or the patient. Valuables and personal property of the patient will not be disposed of as contaminated waste without written consent of the patient.

20-5. Responsibilities. a. The senior medical officer (or senior nursing individual, in the absence of a medical officer) present at the scene of an accident is responsible to:

- (1) Apply first aid to the radiation casualty patient.
- (2) Evaluate the injury of the patient and determine if immediate evacuation is required.
- (3) Evaluate the contamination of the patient, if practicable.
- (4) Decontaminate the patient before evacuation if the condition of the patient permits, and if such decontamination can be performed without aggravating the injuries
- (5) Employ contamination control measures.
- (6) Arrange, undertake, or direct evacuation of the casualty to the Emergency Room, FAMC, by the most practical means.
- (7) Notify the Emergency Room and the RPO that a radiation casualty is being evacuated to the Emergency Room.

b. The attending surgeon shall:

- (1) Notify the RPO that a potentially radioactive or radioactively contaminated casualty is enroute and request support.
- (2) Undertake treatment of the casualty emphasizing life saving measures until the RPO arrives.

(3) Contamination control measures which are appropriate for an emergency room are quite similar to isolation techniques employed with a highly contagious patient. The movement of the patient throughout the hospital should be minimized until decontamination procedures can be undertaken or contamination control measures implemented (e.g., have x-rays taken in the Emergency Room, etc.).

(4) Exposure control measures under emergency room conditions are as follows:

(a) Employ the minimum number of medical personnel necessary to evaluate and treat the patient.

(b) Limit the time individuals spend in the proximity of the casualty to the minimum consistent with his needs.

(c) Keep all nonessential personnel as far away from the patient as practicable.

(d) If the patient is highly radioactive or contaminated, rotate or replace staff personnel frequently to limit individual exposure. Keep a record of all personnel who attended the patient including the length of time they were near the patient.

c. The RPO is responsible to:

(1) Provide advice and radiation monitoring equipment to support the care of radiation casualties.

(2) Provide exposure control and monitoring of staff personnel attending the casualty.

(3) Direct decontamination of the casualty at the earliest time consistent with medical needs of the patient.

(4) Direct contamination control measures to limit the spread of contamination throughout the hospital.

(5) Survey hospital areas for contamination.

(6) Advise on decontamination of hospital areas following treatment of the casualty.

(7) Notify the Chairman of the RPC of the radiation casualty and, if necessary assemble members of the Committee for appropriate recommendations regarding the medical management of the casualty and parameters to be examined on a suspected or actual overexposure.

(8) Notify the Public Affairs Officer of the incident and periodically provide updated information.

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(9) Make appropriate reports to the Surgeon General, the NRC, and other agencies in accordance with pertinent directives.

(10) Make a prompt investigation of the incident.

(11) Prepare and submit necessary reports of the incident.

(12) Issue specific guidance for the management of the radiation casualty to minimize exposure of the staff or the spread of contamination depending on the situation. Such guidance will be developed on the scene by the RPO. His recommendations should be heeded whenever possible, since radioactive contamination can necessitate very costly decontamination operations and result in the loss of facilities for many days.

20-6. Reference. NCRP Report No. 65, Management of Persons Accidentally Contaminated with Radionuclides.

APPENDIX A

SECTION I. Required References

AR 40-5	Health and Environment
AR 40-7	Use of Investigative Drugs in Humans and the Use of Schedule 1 Controlled Drug Substances
AR 40-14	Control and Recording Procedures for Occupational Exposure to Ionizing Radiation
AR 40-38	Clinical Investigation Program
AR 70-25	Use of Volunteers as Subjects of Research
AR 385-11	Ionizing Radiation Protection
AR 700-64	Radioactive Commodities in the DOD Supply Systems
SB 11-206	Personnel Dosimetry Supply and Services for Technical Radiation Exposure Control
TB MED 521	Management and Control of Diagnostic X-Ray, Therapeutic X-Ray, and Gamma-Beam Equipment Having Energies up to 10 Million Electron Volts
TB MED 525	Control of Hazards to Health from Ionizing Radiation Used by the Army Medical Department
TM 3-261	Handling and Disposal of Unwanted Radioactive Material
TM 43-180	Calibration Requirements for the Maintenance of Army Material
TM 55-315	Transportability Guidance for Safe Transport of Radioactive Materials
Title 10	Code of Federal Regulations - Rules and Regulations of the Nuclear Regulatory Commission
Title 21	Code of Federal Regulations, Subchapter J - Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968
Title 49	Code of Federal Regulations - Rules and Regulations of the Department of Transportation

SECTION II. Related References

Nuclear Regulatory Commission Regulatory Guides

- 7.3 Procedures for Picking Up and Receiving Packages of Radioactive Material
- 8.13 Instruction Concerning Prenatal Radiation Exposure
- 8.18 Information Relevant to Insuring that Occupational Radiation Exposures at Medical Institutions Will Be As Low as Reasonably Achievable
- 8.20 Applications of Bioassay for I-125 and I-131
- 8.23 Radiation Safety Surveys at Medical Institutions
- 10.5 Applications for Type A Licenses of Broad Scope
- 10.8 Guide for the Preparation of Application for Medical Programs
- NUREG-1134 Radiation Protection Training for Personnel Employed in Medical Facilities

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The proponent activity of this regulation is Radiation Protection Office. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to the Commander, FAMC, ATTN: HSHG-RP, Aurora, CO 80045-5001.

FOR THE COMMANDER:



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TABLE 1
EFFECTS OF RISK FACTORS ON PREGNANCY OUTCOME

Effect	Number Occurring from Natural Causes	Risk Factor	Excess Occurrences from Risk Factor
<u>RADIATION RISKS</u>			
<u>Childhood Cancer</u>			
Cancer death in children	1.4 per thousand	Radiation dose of 1000 millirems received before birth	0.6 per thousand
<u>Abnormalities</u>			
		Radiation dose of 1000 millirads received during specific periods after conception:	
Small head size	40 per thousand	4-7 weeks after conception	5 per thousand
Small head size	40 per thousand	8-11 weeks after conception	9 per thousand
Mental retardation	4 per thousand	Radiation dose of 1000 millirads received 8 to 15 weeks after conception	4 per thousand
<u>NONRADIATION RISKS</u>			
<u>Occupation</u>			
Stillbirth or spontaneous abortion	200 per thousand	Work in high-risk occupations (see text)	90 per thousand
<u>Alcohol Consumption (see text)</u>			
Fetal alcohol syndrome	1 to 2 per thousand	2-4 drinks per day	100 per thousand
Fetal alcohol syndrome	1 to 2 per thousand	More than 4 drinks per day	200 per thousand
Fetal alcohol syndrome	1 to 2 per thousand	Chronic alcoholic (more than 10 drinks per day)	350 per thousand
Perinatal infant death (around the time of birth)	23 per thousand	Chronic alcoholic (more than 10 drinks per day)	170 per thousand
<u>Smoking</u>			
Perinatal infant death	23 per thousand	Less than 1 pack per day	5 per thousand
Perinatal infant death	23 per thousand	One pack or more per day	10 per thousand

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For mothers who consume 2 to 4 drinks per day, the excess occurrences number about 100 per thousand; and for those who consume more than 4 drinks per day, excess occurrences number 200 per thousand. The most sensitive period for this effect of alcohol appears to be the first few weeks after conception, before the mother-to-be realizes she is pregnant. Also, 17% or 170 per thousand of the embryo/fetuses of chronic alcoholics develop FAS and die before birth. FAS was first identified in 1973 in the United States where less than full-blown effects of the syndrome are now referred to as fetal alcohol effects (FAE).

2.3 Smoking

Smoking during pregnancy causes reduced birth weights in babies amounting to 5 to 9 ounces on the average. In addition, there is an increased risk of 5 infant deaths per thousand for mothers who smoke less than one pack per day and 10 infant deaths per thousand for mothers who smoke one or more packs per day.

2.4 Miscellaneous

Numerous other risks affect the embryo/fetus, only a few of which are touched upon here. Most people are familiar with the drug thalidomide (a sedative given to some pregnant women), which causes children to be born with missing limbs, and the more recent use of the drug diethylstilbestrol (DES), a synthetic estrogen given to some women to treat menstrual disorders, which produced vaginal cancers in the daughters born to women who took the drug. Living at high altitudes also gives rise to an increase in the number of low-birth-weight children born, while an increase in Down's Syndrome (mongolism) occurs in children born to mothers who are over 35 years of age. The rapid growth in the use of ultrasound in recent years has sparked on ongoing investigation into the risks of using ultrasound for diagnostic procedures.

CHAPTER 2

ROLE OF FAMC RADIATION PROTECTION

2-1. Purpose. To delineate the responsibilities of the RPO.

2-2. Responsibilities of the Radiation Protection Officer. The function and responsibilities of Radiation Protection may be found in FAMC Reg 10-1, Organization and Function Manual, and TE MWD 525. The RPO:

- a. Acts as radiation safety advisor to the Commander.

- b. Directs all radiation safety activities at FAMC.

- c. Serves as principal FAMC staff officer for control of radioactive material and machine sources of ionizing radiation.

- d. Acts as executive agent for the USNRC licenses and the DA authorization for the possession, storage and use of radioactive material at FAMC.

- e. Provides radiation safety advice and assistance to activities using radioactive material or machine produced ionizing radiation.

- f. Conducts and administers radiation safety education and training programs.

- g. Performs support services, including:

- (1) Radiation protection surveys (Chapter 15).

- (2) Administration of the personal dosimetry and bioassay programs (Chapters 6 and 7).

- (3) Maintain inventories of radioactive material and machines which produce x-ray radiation.

- (4) Ensure compliance with conditions specified in the USNRC licenses and the DA authorization.

- (5) Render required administrative reports.

- (6) Keep necessary and required records to ensure compliance with Federal law and DA regulations.

- (7) Supervise incoming shipments of radioactive material to avoid contamination of the users' facilities and to ensure compliance with Federal packaging, labeling, and shipping requirements.

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(8) Insure radioactive material shipped from FAMC is in compliance with Federal regulations.

(9) Calibrate portable survey instruments used at FAMC and provide replacement instruments for all users.

h. Develops and tailors individual users' radiation protection programs to ensure that adequate radiation protection standards will be met.

i. Assists radiation workers in avoiding unwarranted exposure to radiation through close and continuous support.