Joint Army Pamphlet 40–18
DLAI 1000.30

Medical Services

Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation

Headquarters
Departments of the Army
Washington, DC
30 June 1995

Unclassified

SUMMARY of CHANGE

DA PAM 40–18/DLAI 1000.30
Personnel Dosimetry Guidance and Dose Recording Procedures for Personnel Occupationally Exposed to Ionizing Radiation

This new pamphlet--

- Establishes as low as reasonably achievable investigational program levels (para 2-1 and table 2-1).
- Establishes the annual occupational dose limits and control measures necessary to meet the requirements of AR 40-14/DLAR 1000.28(para 2-2 and fig 2-1).
- Establishes emergency exposure limits (para 2-5).
- Establishes dose limits for the public and occasionally exposed individuals (para 2-6).
- Provides personnel dosimetry, bioassay, and medical surveillance guidance and procedures to meet the requirements of AR 40-14/DLAR 1000.28(chap 3).
- Outlines the requirements for reporting exposure from off-duty employment (moonlighting) (para 3-3g).
- Provides decision trees for the radiation protection officer to use to determine which individuals will be provided dosimetry(figs 3-1 through 3-4).
- Provides dose reporting and recording procedures necessary to meet the requirements of AR 40-14/DLAR 1000.28 (chap 4).
- Establishes dosimeter results that require notification of the Office of the Surgeon General (para 4-10 and table 4-1).
- Outlines the procedures for reporting overexposures(paras 4-10, 4-11, and 4-12).

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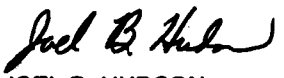
By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:



JOEL B. HUDSON
Acting Administrative Assistant to the Secretary of the Army

By Order of the Director, Defense Logistics Agency:

RAUL A. MARTINEZ
DASC Administrator

History. This printing publishes a new Department of the Army pamphlet.

Summary. This pamphlet provides personnel dosimetry guidance and dose recording procedures for personnel occupationally exposed to ionizing radiation. The medical policies and procedures regarding occupational ionizing radiation personnel dosimetry are prescribed in AR 40–14/DLAR 1000.28.

Applicability. This pamphlet applies to Department of the Army(DA) and Defense Logistics Agency (DLA) installations and activities. This includes the U.S. Army Reserve (USAR) and Army National Guard of the United States (ARNGUS), and civilians under contract to DA or DLA who perform tasks involving occupational exposure to DA and DLA controlled radioactive material or radiation-producing devices. This publication is not applicable during mobilization or anytime the U.S. Army adopts a state of readiness directly preparatory to actual or imminent armed conflict in a geographical zone where peacetime occupational radiation exposure conditions cannot reasonably be construed to prevail.

a. In particular, this pamphlet remains applicable to DA and DLA personnel deployed on either humanitarian or peacekeeping missions where the degree of readiness to respond to hostile fire requires the availability of radioactive commodities, such as depleted uranium ammunition, as a contingency.

b. This pamphlet does NOT apply to the following:

(1) Personnel exposed to ionizing radiation and radioactive materials resulting from the use of ionizing radiation sources and devices in geographical areas or zones where—

(a) Hostile fire or combat already exists or is strongly anticipated to occur, or

(b) Department of Defense personnel expect to conduct a combat mission.

(2) Patients exposed to ionizing radiation in the course of medical and dental examination, diagnosis, or treatment. This exception does not apply to health care providers.

(3) Human research subjects exposed to ionizing radiation in the course of voluntary participation in medical research programs.

(4) Doses received from natural background radiation.

Proponent and exception authority. The proponent of this DA Pamphlet is the Surgeon General. The Surgeon General has the authority to approve exceptions to this pamphlet that are consistent with controlling law and regulation. Proponents may delegate this approval authority, in writing, to a division chief under their supervision within the proponent agency who holds the grade of colonel or the civilian equivalent.

Interim changes. Interim changes to this pamphlet are not official unless they are authenticated by the Administrative Assistant to the Secretary of the Army. Users will destroy interim changes on their expiration dates unless sooner superseded or rescinded.

Suggested Improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Headquarters, Department of the Army (HQDA) (SGPS–PSP), 5109 Leesburg Pike, Falls Church, VA 22041–3258.

Distribution. Army:

Distribution of this publication is made in accordance with DA Form 12–09–E, block 5428, intended for command level B for Active Army, Army National Guard, and U.S. Army Reserve.

DLA:

Code 2.

Unclassified

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Chapter 1
Introduction

1–1. Purpose

This pamphlet provides specific guidance on—

a. Implementing the personnel dosimetry element of the occupational radiation protection program according to Department of Defense Instruction (DODI) 6055.8; Parts 19, 20, 34, 35, 39, and 40, Title 10, Code of Federal Regulations (10 CFR 19, 10 CFR 20, 10 CFR 34, 10 CFR 35, 10 CFR 39, and 10 CFR 40); 29 CFR 570; 29 CFR 1910; and volume 52, Federal Register, page 2822 (52 FR 2822).

b. Prescribing the ionizing radiation occupational dose limits (internal and external), personnel dosimetry, and bioassay requirements of AR 40–14/DLAR 1000.28.

1–2. References

Required and related publications and referenced forms are listed in appendix A.

1–3. Explanation of abbreviations and terms

Abbreviations and terms used in this pamphlet are explained in the glossary.

1–4. Waivers and exceptions

a. As a minimum, submit the following information to request a waiver or exception:

(1) Reference to the specific standard and to the specific paragraph under which the waiver or exception is being requested.

(2) Reasons why the standard cannot be met.

(3) Interim measure used that compensates for the inability to comply with the standard.

(4) Action being taken to meet the standard and the estimated date the action can be completed.

(5) Statement of the impact if the waiver or exception is not approved.

b. Forward the request for waiver, extension of waiver, or exception through command channels to Headquarters, Department of the Army (HQDA) (SGPS–PSP), 5109 Leesburg Pike, Falls Church, VA 22041–3258.

1–5. Procurement

The dosimetry requirements of this pamphlet must be incorporated into the procurement of contractor services initiated after the date of this publication. Preexisting contracts do not require modification.

Chapter 2
As Low As Reasonably Achievable Investigational Levels, Dose Limits, Emergency Exposure, and Control Measures

2–1. As low as reasonably achievable program investigational levels and actions

a. Investigational levels. For DA and DLA installations and activities, the investigational levels specified under any required as low as reasonably achievable (ALARA) program should be as shown in table 2–1. DA and DLA activities with a Nuclear Regulatory Commission (NRC) license may set their own investigational levels and these levels must be approved by the radiation protection officer (RPO) and the Radiation Control Committee (RCC).

Table 2–1
Investigational levels (mrem)(1,2)

Whole body[3]	125	375
Lens of the eye	375	1125
Other[4]	1250	3750

Notes:

[1] 1.All values rounded to nearest 5 mrem.

2. Action levels for some forms of uranium may be based upon their chemical toxicity rather than radiological properties(NRC Regulatory Guide 8.31). Facilities which produce radioactive effluents should also consider NRC Regulatory Guide 8.37.

3. TEDE.

4. Other includes: Shallow-dose equivalent(H(S)) to the skin or to any extremity, or the sum of the deep-dose equivalent (H(d)) and the committed dose equivalent (H(T)) to any individual organ or tissue other than the lens of the eyes.

b. Total effective dose equivalent (TEDE). When an installation or activity has individuals who are occupationally exposed to both external *and* internal radiation sources, the investigational levels specified under any required ALARA program will be specified in terms of the TEDE by taking into account the sum of the—

(1) Deep-dose equivalent (H(d))from external sources, and

(2) Committed effective dose equivalent (CEDE)from internal radiation sources.

c. Actions. Local installations and activities may specify what actions are required of the RPO when an individual's quarterly dose exceeds either of the above investigational levels. At a minimum, such actions shall follow the guidance of NRC Regulatory Guide 10.8 and this pamphlet.

2–2. Occupational dose limits

a. Dose limits for adults.

(1) The *annual*, peacetime ionizing radiation dose received by adult occupationally exposed individuals, except for planned special exposure (PSE), must not exceed the following dose limits:

(a) The more limiting of—

1. The stochastic limit of a TEDE of 5 rems/year (yr)(50 millisieverts (mSv)/yr). The TEDE is the sum of the H(d) from external exposure and the CEDE(H(E,50)) from internal exposures.

2. The nonstochastic limit of the sum of the H(d) and the CEDE (H(E,50))to any individual organ or tissue, other than the lens of the eye, for an adult occupationally exposed individual must not exceed 50 rems/yr (500 mSv/yr);

(b) An eye-lens dose equivalent of 15 rems (150 mSv); and

(c) An H(S) of 50 rems (500 mSv)to the skin or to any extremity.

(2) Figure 2–1 provides a bar chart depicting the annual dose limits specified above.

(3) The H(d) from external radiation exposure and the CEDE from internal radiation exposure must be added together only if both the external and internal dose are*each* likely to exceed 10 percent of the applicable dose limits specified in this paragraph. In most situations, occupationally exposed individuals sustain doses due almost exclusively to external exposure OR internal exposure, but not both. Thus, in most situations, only the H(d)or the CEDE must be measured; summation of external and internal doses will not normally be necessary.

(4) In cases of uniform whole-body irradiation, where the dose equivalent may be assumed to be the same for each organ, the TEDE is equal to the H(d) in the absence of any occupational internal exposure.

(5) DA and DLA installation and activity commanders must use the annual limits on intake (ALI) and derived air concentrations (DAC) published in 10 CFR 20 to limit radiation exposure from radionuclide intake or immersion. Alternative ALIs and DACs may be derived for different chemical or physical forms of radioactive material when such chemical or physical forms are known.

(6) To calculate the CEDE, the licensee may assume that the inhalation of one ALI or an exposure of 2000 DAC–hours results in a CEDE of 5 rems (50 mSv) for radionuclides that have their ALIs and DACs based on CEDE.

b. Dose limits for minors. The annual occupational dose limits for minors (less than 18 years of age) are 10 percent of the annual dose limits specified above for occupationally exposed adults.

c. Embryo or fetus dose limits.

(1) Commanders of installations and activities possessing ionizing radiation sources and devices must ensure that the dose to an embryo or fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). In complying with this occupational dose limit for declared pregnant females, the commander should make efforts to maintain the monthly occupational radiation exposure rate ALARA and relatively uniform, that is, free of any substantial dose rate variation above the uniform monthly exposure rate.

(2) The dose to the embryo or fetus must be taken as the sum of the H(d) to the declared pregnant woman(external radiation sources) and the dose to the embryo or fetus from radionuclides in the embryo or fetus as well as radionuclides in the declared pregnant woman (internal radiation sources).

(3) Because they have a right to know, the RPO must inform females occupationally exposed to ionizing radiation of the different, lower permissible dose limits applicable to the embryo or fetus during pregnancy. A formal declaration of pregnancy, however, is the prerogative of each pregnant female. The RPO must not in any way intimidate or coerce a pregnant woman occupationally exposed to ionizing radiation to declare her pregnancy.

(4) A female occupationally exposed to ionizing radiation does NOT fall under the lower annual permissible dose equivalent for pregnant women until she formally declares her pregnancy, in writing, to the RPO. The RPO will then notify the applicable licensee.

(a) Such a written declaration shall be made on an SF 600 (Health Record—Chronological Record of Medical Care) and placed in the woman's health record.

(b) The woman shall complete, date, and sign the following SF 600 entry and provide a copy to the RPO.

> I hereby make notification that I am occupationally exposed to radiation in the course of my normal job duties, and that I am now pregnant. My estimated date of conception is (date). I understand that by declaring my pregnancy, my occupational exposure to ionizing radiation will be controlled as prescribed in DA PAM 40–18/DLAI 1000.30.

(5) The RPO must provide instructions (and a copy of NRC Regulatory Guide 8.13) regarding the prenatal exposure risks and concerns to the developing embryo or fetus to females occupationally exposed to ionizing radiation (NRC Regulatory Guide 8.13 and National Council on Radiation Protection and Measures(NCRP) Report No. 53).

(6) If the dose to the embryo or fetus exceeds 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose by the time the woman declares the pregnancy to the RPO, the installation or activity must be deemed to be in compliance with (1) above, if the additional dose to the embryo or fetus does not exceed 0.05 rem(0.5 mSv) during the remainder of the pregnancy.

(7) Nursing mothers who are potentially exposed to intake of radionuclides require special consideration to limit the dose to their child. The child is considered a member of the general public.

d. Dose limit reduction. The installation or activity must reduce the dose that an occupationally exposed individual may be allowed to receive at the facility under the above dose limits during the remainder of any current year by the amount of any other occupational radiation dose known to have already been sustained elsewhere during the same current year.

e. Overseas standards. Whenever the occupational exposure dose limits specified in this pamphlet or the ALI and DAC values specified in 10 CFR 20 differ from those of the host country, the more restrictive of such limits or values must be used when required under the prevailing Status of Forces Agreement with the host country.

f. Less restrictive occupational dose limits. Occupational dose limits less restrictive than those specified above cannot be applied to minors (under 18 years of age).

2–3. Determination of internal dose

a. When an occupationally exposed individual meets the criteria specified in paragraph 3–3*b*, the RPO must use the following suitable and timely measurements to assess the individual's internal radiation exposure:

(1) Concentrations of radioactive materials in air in work areas;

(2) Quantities of radionuclides in the body;

(3) Quantities of radionuclides excreted from the body;or

(4) Combinations of these measurements.

b. The RPO must determine the type and frequency of internal exposure assessments.

c. Bioassay assistance is available, upon request, from the U.S. Army Center for Health Promotion and Preventive Medicine (Provisional) (USACHPPM (Prov)) on a cost reimbursable basis.

2–4. Planned special exposures

Although defined in 10 CFR 20 and permitted under NRC licenses under very limited, highly controlled circumstances, DA or DLA NRC license holders will NOT perform PSEs without a waiver. (See chap 1, para 1–4.)

2–5. Emergency exposure dose limits

a. In an emergency, it may be necessary for individuals such as fire fighters or occupationally exposed individuals to exceed the limits stated in paragraph 2–2. In such a situation, the probable risk of high radiation exposure to the rescuer must be weighed against the expected benefits. Nothing in this chapter will be construed as limiting any immediate actions necessary to protect health and safety. When potentially high radiation exposure appears to be necessary to save a life, to the extent that the circumstances surrounding the emergency situation permit, installation and activity commanders will attempt to accomplish the following:

(1) Ensure the rescuer's dose equivalent does not exceed 100 rems (1000 mSv).

(2) Brief the rescuer on the potential acute and on the statistically inferred increased risk of cancer from doses that may be incurred during the rescue operation.

(3) Ensure that the rescuer is a volunteer and is fully informed of the risk if the expected rescue exposure is above 25 rem. See U.S. Environmental Protection Agency (EPA) Guide 400–R–92–001.

b. When required emergency actions do not involve lifesaving rescue, but may include protection of valuable equipment or property, ensure the individual's dose equivalent does not exceed 10 rems (100 mSv).

2–6. Dose limits for individual members of the public and occasionally exposed individuals

a. Members of the public.

(1) Commanders of installations or activities will conduct radioactive material and ionizing radiation-producing device use operations so that both—

(a) The TEDE to individual members of the public from radiation source operation under their control does not exceed 100 mrem/yr (1.0 mSv/yr) exclusive of—

1. The dose contribution from any authorized disposal of licensed radioactive material into the sanitary sewerage system.

2. Any dose received as a patient from medical or dental procedures.

(b) The dose in any unrestricted area from external ionizing radiation sources does not exceed 0.002 rem (0.02 mSv) in any 1 hour per 10 CFR 20.

(2) Authorization to exceed 100 mrem/yr (1.0 mSv/yr) (but not to exceed 500 mrem/yr) must be requested, through command channels, from OTSG and must be approved by OTSG prior to exceeding the 100 mrem limit. NRC licensees must request authorization from NRC per 10 CFR 20.

(3) Facilities or installations regulated by EPA's National Emissions Standards for Hazardous Air Pollutants will limit public exposure per 40 CFR 61.102.

(4) If members of the public are permitted to have access to radiation source use areas controlled by the commander of the installation or activity, the applicable dose limits which such members of the public can sustain must remain those specified in(1) above; the occupational dose limits of paragraph 2–2 will NOT apply.

b. Occasionally exposed individuals. Individuals who occasionally enter restricted areas must NOT receive a radiation exposure in excess of that permitted for any member of the public specified in *a* above. These individuals can include such people as messengers, delivery persons, scientists, engineers or managers who witness tests, inspectors visiting facilities, etc. These individuals *normally*—

(1) Do not work in a restricted area.

(2) Are not exposed to ionizing radiation as part of their duties.

c. Transient operations. Transient operations or practices may exist which require exposure of individuals, who are not normally occupationally exposed individuals, to levels in excess of the 0.1 rem (1.0 mSv) annual public limit. Submit a request for approval of these practices, in advance, to OTSG, HQDA(SGPS–PSP–E), 5109 Leesburg Pike, Falls Church, VA 22041–3258. In any case, the exposure of these individuals will not exceed 0.5 rem/yr (5.0 mSv/yr). The request shall include the following information:

(1) Demonstration of the need for and the expected duration of operations in excess of the limit in *a* above;

(2) Documentation of a program to assess and control dose within the 0.5 rem annual limit; and

(3) Procedures to be followed to maintain the dose ALARA.

2–7. Control measures

a. The installation or activity commander must design, select, use, and maintain radiation exposure control measures to ensure that anticipated and actual occupational doses are maintained ALARA and do not exceed the limits specified above. The following guidance may be helpful in achieving this objective and may be developed for specific categories of workers or work situations:

(1) Development of a formal ALARA program with occupational personnel dose equivalent investigational levels as specified in table 2–1.

(2) Specification of radiation exposure rate or radioactive contamination trigger levels within ionizing radiation source use areas that signal the need for further investigation, recording, intervention, mitigation, and other measures.

b. Commanders of activities using ionizing radiation sources or devices shall ensure that occupationally exposed individuals who work in or frequent a restricted area will receive initial documented training on, but not limited to—

(1) Basic health risks due to radiation exposure at levels approximating those specified in paragraph 2–2.

(2) Somatic, in-utero, and genetic effects of exposure at levels approximating present occupational radiation dose levels.

(3) Basic radiation protection principles, including those specifically applicable to the workplace as discussed in pertinent NRC regulatory guides.

(4) Current Federal occupational dose limits (10 CFR 20).

c. Refresher training will be provided in each calendar year and documented. It must include reviews of pertinent items presented in initial training and updates on such things as—

(1) Changes in procedures and regulations.

(2) Review of accidents, spills, unintentional releases, misadministrations, unusual events, etc.

(3) Review of dosimetry results with emphasis on dose reduction and ALARA.

d. The extent of training must be commensurate with potential radiological health hazards created by the sources or devices in use.

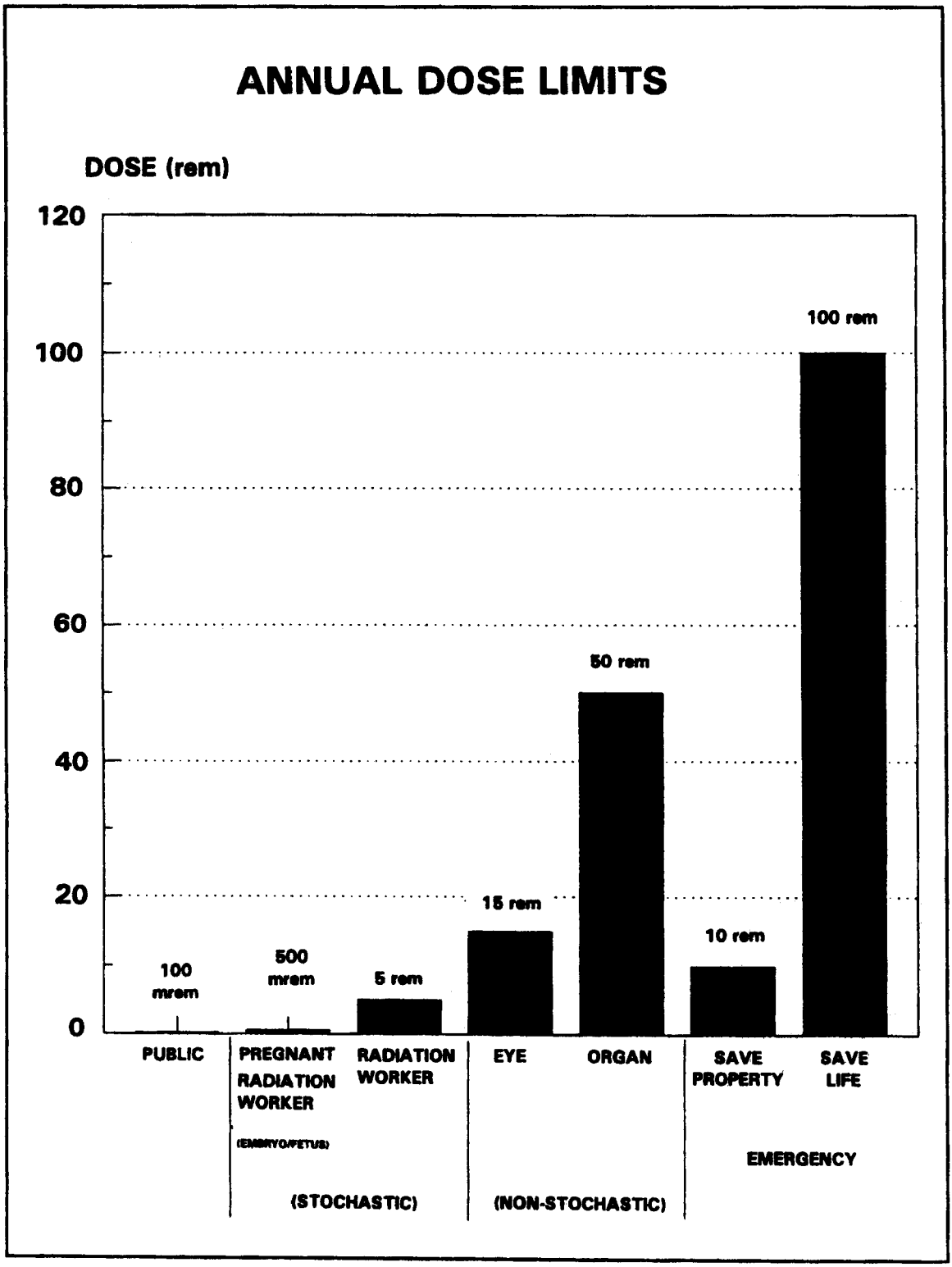

Figure 2-1. Annual Dose Limits

Chapter 3
Personnel Dosimetry Criteria, Guidance, Procedures, and Medical Surveillance

3–1. Conditions requiring individual dosimeters

a. Installations and activities possessing radioactive material and ionizing radiation-producing devices must monitor exposures to radiation and radioactive materials at levels sufficient to demonstrate compliance with the occupational dose limits in paragraph 2–2 and to effectively manage the ALARA program. As a minimum, the RPO will normally issue dosimeters to assess dose from ionizing radiation sources or devices *external to the body* to those individuals who meet the following criteria:

(1) Occupationally exposed to ionizing radiation in the course of normal job duties; and

(2) In the judgment of the RPO, have a reasonable probability of receiving the following doses in any 1 year:

(a) Adult occupationally exposed individuals. A dose in excess of 10 percent of the limits specified in paragraph 2–2*a*.

(b) Adult occupationally exposed individuals. Any dose associated with entering high or very high radiation areas.

(c) All radiographers and radiographers' assistants, as defined in 10 CFR 34. Any dose associated with the use of NRC- and nonNRC-licensed radioactive sources for radiographic purposes. Both a thermoluminescent dosimeter(TLD)-type dosimeter and a self-reading and alarming dosimeter will be issued and worn. The self-reading dosimeter must comply with 10 CFR 34.

(d) Individuals who operate or use NRC-licensed well logging sources. Any dose associated with the use of these devices. These individuals must be provided personnel dosimetry per 10 CFR 39. A TLD-type dosimeter must be issued and worn by all individuals working with such sources.

(e) Minors and declared pregnant women. A dose in excess of 10 percent of the limit specified in paragraphs 2–2*b* and 2–2*c*, respectively.

b. The RPO will institute monitoring of the occupational intake of radioactive material and assessment of the CEDE from radiation sources internal to the body only to those individuals who meet the following criteria:

(1) Occupationally exposed to ionizing radiation in the course of normal job duties.

(2) In the judgment of the RPO, have a reasonable probability of receiving the following dose in any 1 year:

(a) Adult occupationally exposed individuals. An intake of radioactive material in excess of 10 percent of the applicable ALIs specified in table 1, columns 1 and 2 of appendix B, 10 CFR 20.

(b) Minors and declared pregnant women. A CEDE in excess of 10 percent of the limit specified in paragraphs 2–2*b* and 2–2*c*, respectively, from radioactive sources internal to the body.

c. The RPO may institute monitoring on other individuals as required to provide dosimetry data needed for management of the ALARA program.

3–2. Guidance for issuing external radiation source dosimeters

a. For each type of external radiation source dosimeter under consideration (whole-body, collar, wrist, ring, etc.), the occupationally exposed individual should have a reasonable probability of exceeding 10 percent of the applicable occupational dose limits specified in paragraph 2–2 in order to be issued that particular type of dosimeter.

b. Some occupationally exposed individuals, such as fluoroscopic and cardiac catheterization personnel, are exposed to X rays scattered from the patient.

(1) Personnel, such as those working with medical fluoroscopic or cardiac catheterization X-ray equipment, exposed to X rays scattered from the patient, will wear both a collar dosimeter and a waist dosimeter. (The waist dosimeter is worn under the lead apron, between the waist and the shoulders;for pregnant personnel, over the developing fetus.) Calculate the TEDE by multiplying the recorded collar dosimeter exposure (C) by 0.04, multiplying the recorded waist dosimeter exposure (W) by 1.5 and summing the two(TEDE &equals. (0.04C) &plus. (1.5W)).

(2) In the practice of radiology involving fluoroscopy and cardiac catheterization, where the occupationally exposed individual is NOT behind any protective leaded control booth walls, lead aprons do indeed provide significant protection to the majority of the occupationally exposed individual's trunk(whole-body). Leaded aprons will, therefore, be worn and both a collar and a whole-body dosimeter will be issued to such individuals. The dose limit applicable to the collar badge which will trigger appropriate overexposure investigations will be based on the eye dose limit as specified in table 2–1. The dose limit applicable to the whole-body dosimeter that will trigger appropriate overexposure investigations will be based on the whole-body dose limit specified in table 2–1.

c. To determine if an occupationally exposed individual is likely to exceed 10 percent of occupational limits in paragraph 2–2, decision trees are provided in figures 3–1 through 3–4. All RPOs must follow these decision trees to determine which individuals will be provided dosimetry.

(1) Individuals excluded through the use of these decision trees will not be enrolled or be needlessly continued in the dosimetry program except on a case-by-case basis.

(2) For such case-by-case exceptions, the local RPO must compile a written justification that clearly sets forth the rationale for providing dosimetry to occupationally exposed personnel otherwise excluded by the decision trees. This documentation must be—

(a) Compiled for each case-by-case exception.

(b) Reviewed as an agenda item at the next RCC meeting.

(c) Included as an enclosure to the written RCC meeting minutes.

(d) Maintained with the individual's local dosimetry record file.

d. In research facilities a variety of isotopes may be used and the potential for exposure to over 10 percent of the allowable dose limits specified in paragraph 2–2 must be evaluated on a case-by-case basis. The RPO must determine the requirement for providing any dosimeters to exposed individuals working only with soft beta emitters, such as tritium, carbon-14, calcium-45, sulfur-35, and nickel-63, as well as alpha emitters.

(1) In general, working with such emitters does not require external dosimetry. If these isotopes are used in an unsealed fashion, bioassays to estimate internal dose may be necessary.

(2) The RPO must determine on a case-by-case basis the requirement for providing dosimetry to occupationally exposed individuals who work in a research environment using analytical chemistry laboratory equipment, such as X-ray diffraction, X-ray fluorescence, alloy analyzers, gas chromatographs, X-ray particle size analyzers, electron microscopes, and static eliminators.

e. Installation or activity commanders should not normally have to provide personnel dosimetry to the following individuals due to the very low probability of such individuals exceeding 10 percent of the occupational dose limits specified in paragraph 2–2. This includes individuals who—

(1) Operate, store, or handle explosive ordnance disposal X-ray systems.

(2) Work in the Directorate of Logistics'shipping, receiving, packaging, turn-in, and disposal operations.

(3) Use smoke detectors, chemical detectors, night vision devices, and flash X-ray systems.

(4) Work with or near depleted uranium munitions.

f. As soon as an occupationally exposed female declares her pregnancy in writing to the RPO, the installation or activity command, through the RPO, must provide *monthly* dosimetry throughout the duration of the pregnancy, to determine the extent of compliance with paragraph 2–2*c*. At the end of the pregnancy, the RPO will determine whether or not to continue dosimetry per this paragraph and paragraph 2–2.

3–3. Monitor dosimeters

a. In some areas where radioactive material or radiation-producing sources or devices are used, individuals may be occupationally exposed to ionizing radiation, but not meet the criteria of paragraph 3–1 and, consequently, not provided individual dosimetry. In such areas, the RPO may provide, for a limited period of time, temporary monitor dosimeters to a representative sample of such individuals in order to obtain confirmation that occupational doses of such individuals are less than 10 percent of the applicable limits.

b. The RPO must ensure that occupationally exposed individuals, who do not meet the criteria of paragraph 3-1, and who are provided *temporary* monitor dosimeters for dose confirmation purposes, will NOT—

(1) Be issued such dosimeters for more than one quarter in any calendar year;

(2) Wear such dosimeters for longer than one calendar quarter; or

(3) Be issued and wear such dosimeters over two consecutive calendar quarters in two different calendar years.

3–4. Dosimeter wearing requirements and procedures

a. Conditions.

(1) To quantify an occupationally exposed individual's dose, the dosimeters issued must be worn during any such occupational radiation exposure. All occupationally exposed individuals who are provided dosimetry under this pamphlet must wear any and all dosimeters provided during their individual conditions of occupational exposure incident to employment with DA or DLA.

(2) All occupationally exposed individuals issued a dosimeter must ensure correct use and handling. Misleading dose reports and unnecessary investigations may result from improper use. Malicious exposure of a dosimeter is forbidden. Dosimeter abuse is a misuse of Government property. These acts may result in disciplinary action.

b. Proper dosimeter wearing procedure.

(1) Occupationally exposed individuals provided dosimetry service will wear the whole-body dosimeter—

(a) Below the shoulders.

(b) Above the hips.

(c) Outside the clothing.

(d) On the portion or area of the body nearest the radiation source.

(e) With the dosimeter window facing out from the body.

(2) Individuals who wear lead aprons while working with materials specifically licensed by the NRC will wear their whole body dosimeter outside of any shielding.

(3) For individuals wearing lead aprons or similar protective garments while practicing medical radiology, the whole-body dosimeter will be worn outside the lead apron or on protective garment on the collar near the thyroid.

(4) Do NOT use an individual's whole-body dosimeter to measure localized exposures.

(5) Do NOT attach tape or other substances to the front of the dosimeter.

(6) Do NOT exceed the normal dosimeter wearing period established by the U.S. Army Ionizing Radiation Dosimetry Center(AIRDC).

(7) Store dosimeters only in the RPO approved storage location at the end of an activity or work day.

c. Wearing additional dosimeters.

(1) The RPO may provide an occupationally exposed individual additional dosimeters (collar, wrist, ring, etc.) to assess localized occupational dose per paragraphs 2–1 and 3–2. The AIRDC will provide these dosimeters. NonAIRDC provided dosimeters may be additionally used, but will not be considered substitutes for official AIRDC dosimeters. Supplemental dosimeters may include—

(a) Pocket ionization chambers.

(b) Self-reading pocket dosimeters with or without alarms.

(c) Other devices which provide localized exposure or exposure rate information.

(2) When an occupationally exposed individual wears—

(a) Eye protection, if the eye protection provides at least 700 milligram (mg)/square centimeter(cm^2) thickness, the RPO will annotate on the dosimetry issue listing beside the individual's name "eye protection provided" so that the 1000 mg/cm^2 depth dose will be computed by the AIRDC rather than the eye-lens dose at the standard depth of 300 mg/cm^2.

(b) A wrist or ring dosimeter, wear the dosimeter on the wrist or finger closest to the radiation source, oriented towards the radiation source, and under any protective gloves.

d. Identification.

(1) Dosimeters must display some readily identifiable, *temporary* individual identification (for example, an individual's name) to ensure that occupationally exposed individuals wear their own dosimeters.

(2) Individuals issued dosimetry will not permanently inscribe the dosimeter with a name, number, or other identifying symbol, and will not cover the dosimeter window.

(3) Immediate supervisors and the RPO must ensure that the dosimeter issued to one occupationally exposed individual is not issued to, or used by, another individual during the same wearing period.

(4) Government-owned, contractor-operated (GOCO)contractor personnel, other contract personnel working for the DA or DLA, as well as DA or DLA personnel who are occupationally exposed to ionizing radiation will not wear away from the Government job site or use Government issued dosimeters for nonDA or DLA work or other "moonlighting."

e. Storage. The RPO must approve all dosimeter storage locations. Each storage location must—

(1) Be close to the area in which the occupationally exposed individual works, yet outside of the areas where the radiation sources or devices are actually used or located.

(2) Be adequately shielded from ionizing radiation.

(3) Contain a control dosimeter.

f. Dosimetry service.

(1) DA and DLA installations or activities will use the Army dosimetry service provided by the AIRDC.

(2) GOCO facilities (long-term contractors) will use the Army dosimetry service unless specifically exempted by contract.

(3) While the above DA and DLA requirements do not preclude the use of supplemental dosimeters, as discussed in*c* above, use of supplemental dosimeters does not obviate the need to use official AIRDC provided dosimeters.Contractors may provide their own dosimeters to their workers, however, AIRDC dosimeters will also be worn.

g. Personnel exposure from off-duty employment (moonlighting).

(1) Any military occupationally exposed individual who is performing off-duty employment that involves additional occupational exposure to ionizing radiation will provide copies of his or her occupational dose records to the RPO as a condition of his or her authorization to moonlight.

(2) Any civilian or nonmilitary individual, whose primary job duty involves occupational exposure to ionizing radiation, who also sustains additional occupational exposure while moonlighting must provide copies of his or her off-duty (moonlighting) dose records to the RPO.

(3) Individuals will provide these off-duty(moonlighting) dose records to the RPO—

(a) No later than 2 months after such records are received by the moonlighting individual; or

(b) Within 4 months following the termination of such moonlight employment, whichever is earlier.

(4) The RPO must forward the records of these doses to AIRDC for inclusion into the individual's lifetime dosimetry records.

h. Armed conflicts. Any time the U.S. Army adopts a state of readiness directly preparatory to actual or imminent armed conflict in a geographical zone where peacetime occupational radiation exposure conditions cannot reasonably be construed to prevail, the dosimetry requirements outlined within this pamphlet will NOT

apply. Use tactical dosimeters (that is, IM-9, IM-93, or DT-236) during these periods.

3–5. Processing dosimeters

Commanders will ensure that batches of dosimeters are returned to AIRDC in a timely fashion at the conclusion of the established wearing period.

a. Normally, timely means within 14 days after the end of the wearing period.

b. Batches of dosimeters not received by AIRDC within 30 days of the end of a wearing period will be considered delinquent.

c. AIRDC will notify commanders in writing when their dosimeter accounts become delinquent. AIRDC will furnish a copy of these notifications to the U.S. Army Materiel Command (AMC) Safety Office (AMCSG–R).

d. AMC Safety will notify appropriate licensees of delinquent dosimeter accounts that involve their NRC regulated commodities or materials.

e. AIRDC may require reimbursement for the cost of dosimeters delinquent by more than 60 days.

3–6. Bioassay requirements and procedures

a. Bioassay measurements are made when—

(1) Required by 10 CFR 20.1502, or

(2) Needed to confirm the adequacy of radiological controls (that is, engineering principles and calculations, respiratory protection, etc.), or

(3) Needed to determine compliance with occupational dose limits, or

(4) Useful for management of the ALARA program.

b. Bioassay services will be made available if the types and quantities of radioactive material licensed for use at the facility could, under normal operational occurrences, result in airborne levels in normally occupied areas exceeding DACs. Provisions must be made for collection of appropriate samples, analysis of bioassay samples, and evaluation of the results of these analyses to determine intakes (10 CFR 20; 10 CFR 35; and NRC Regulatory Guides 8.9, 8.11, 8.15, 8.20, 8.22, and 8.32).

c. Frequency of bioassay measurements is based upon the exposure potential and the physical and chemical characteristics of the radioactive material and the route of entry into the body.

d. Elements that will be considered in establishing a bioassay program include—

(1) Potential exposure of the individual,

(2) Retention and excretion characteristics of the radionuclide,

(3) Sensitivity of the measurement technique, and

(4) Acceptable uncertainty in the estimate of intake and H(T).

e. Bioassay measurements used for demonstrating compliance with occupational dose limits will be conducted often enough to identify and quantify potential exposures and resultant intakes, during any year, that are likely to collectively exceed 10 percent ALI.

f. Conversions between bioassay values and CEDE will be done with a dose analysis methodology approved by DA (OTSG).

g. The bioassay laboratory will forward bioassay reports to the RPO.

h. The RPO will ensure an individual qualified to use DA approved analysis methods will convert raw bioassay counting data generated locally over to a CEDE. A person who is qualified to use DA approved analysis methods is—

(1) A health physicist with specific training in the DA approved analysis methods program.

(2) One who has formal training and experience in internal dosimetry.

i. The RPO will review the results and ensure the results are converted to dose when necessary. The RPO will then—

(1) Forward these results quarterly to the dose record custodian for inclusion in the occupationally exposed individual's dosimetry record.

(2) Send a copy of the results for inclusion in the individual's lifetime dose history maintained by the AIRDC.

j. The bioassay results forwarded to the AIRDC will include the following information:

(1) CEDE as determined by DA approved dose analysis methods.

(2) Lower limit of detection for the counting system.

(3) Isotope detected.

(4) Individual's name.

(5) Social security number of exposed individual.

(6) Occupational specialty code of exposed individual.

(7) Assigned work location of exposed individual.

(8) Dates or duration of the suspected or possible internal exposure.

(9) Whether the exposure was chronic or acute.

k. USACHPPM (Prov) will provide bioassay counting service to DA and DLA installations and activities on a reimbursable cost basis.Whenever a DA or DLA installation or activity elects to contract for bioassay service from a non DA or DLA activity, the contract will stipulate that the entity providing such service must meet the radiobioassay criteria established by the American National Standard Institute (ANSI) Guide N13.30. Contact Commander, USACHPPM (Prov), ATTN: MCHB–DL–LOQ/Laboratory Samples, Aberdeen Proving Ground, MD 21010–5422; DSN 584–3983 or Commercial (410)671–3983 for information regarding bioassay sampling materials, collection procedures, and sample shipping requirements.

3–7. Medical surveillance

Refer to AR 40–14/DLAR 1000.28, paragraph 4–4, for medical surveillance requirements.

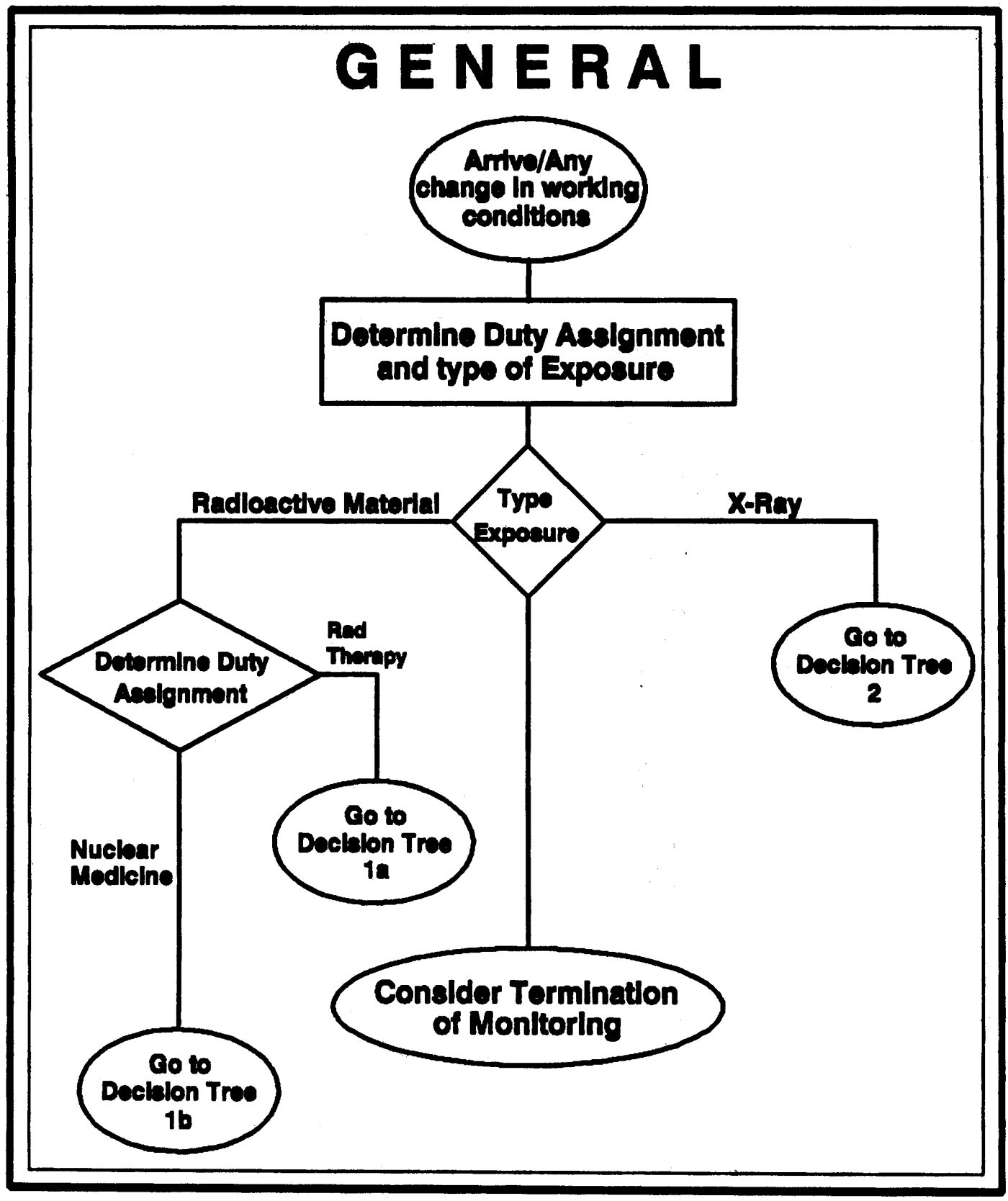

Figure 3-1. Decision Tree—General

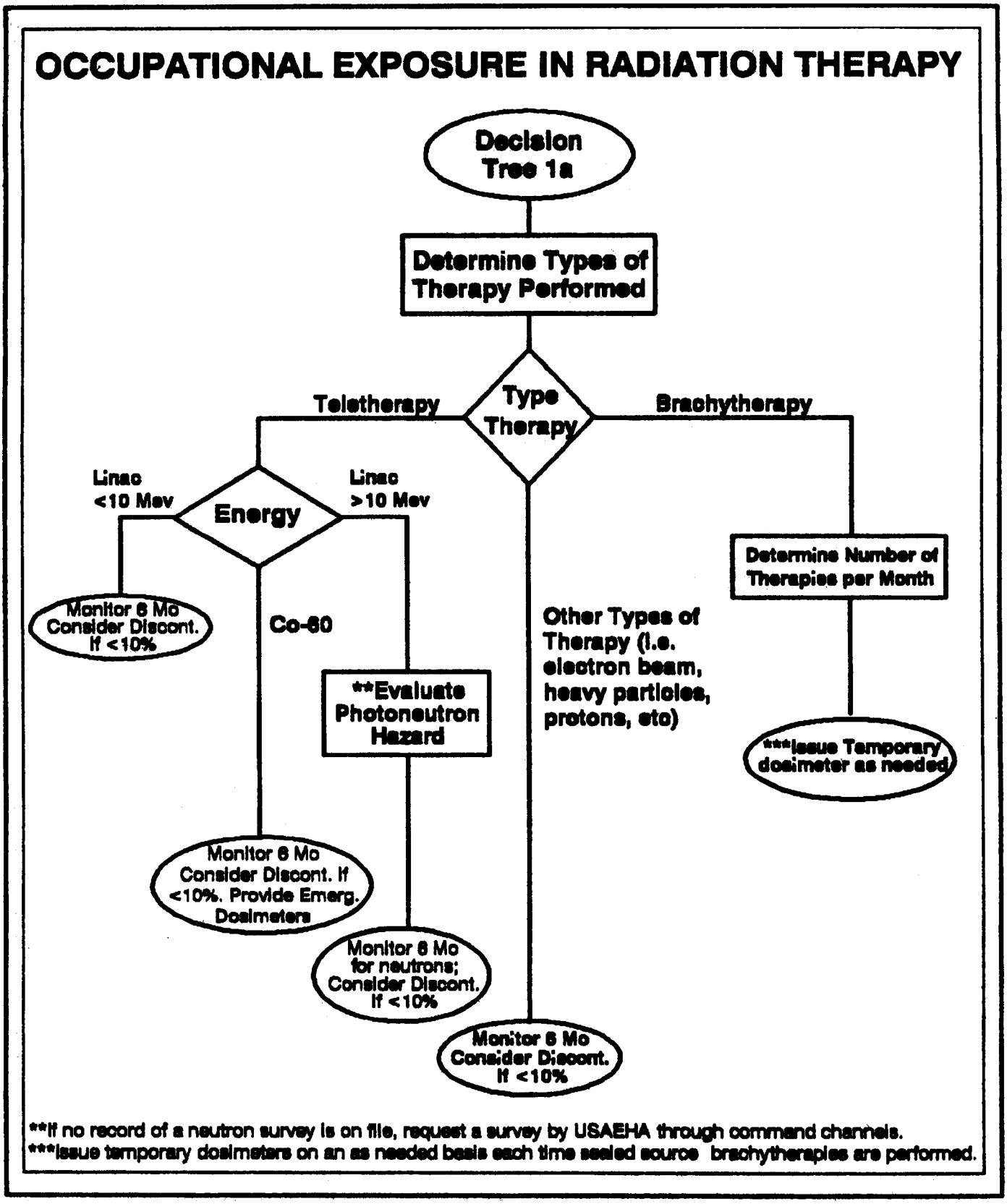

Figure 3-2. Decision Tree—Radiation Therapy

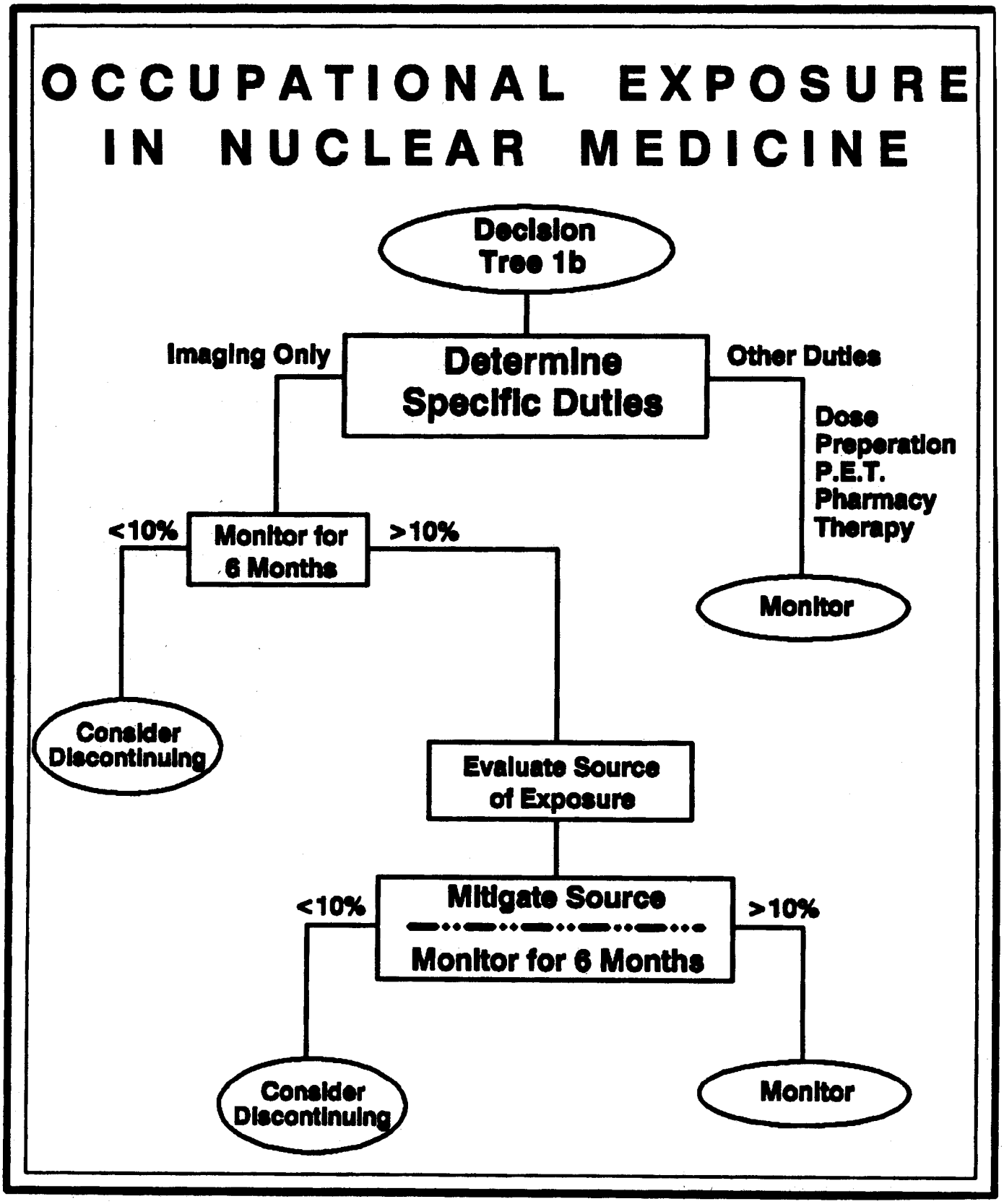

Figure 3-3. Decision Tree—Nuclear Medicine

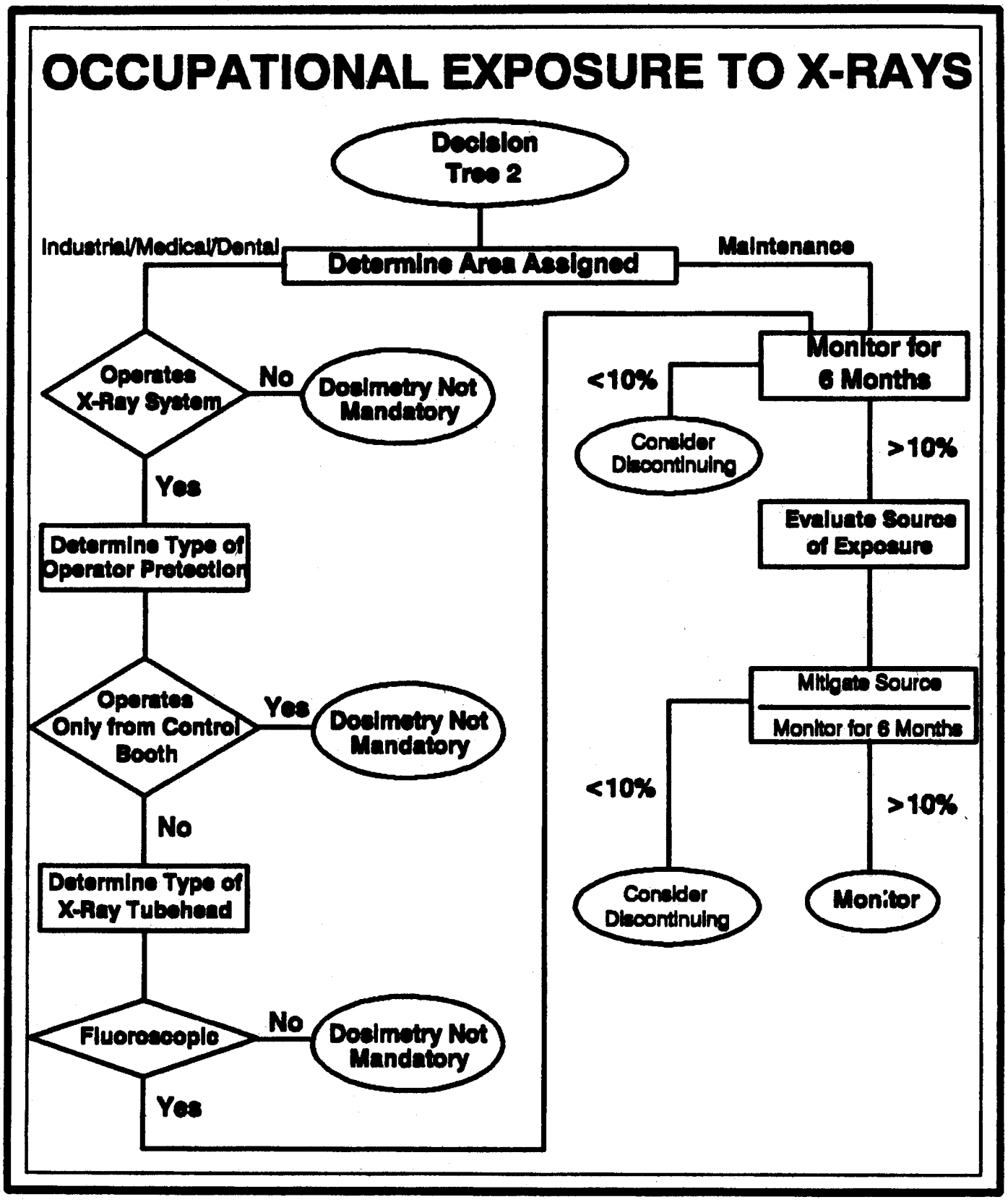

Figure 3-4. Decision Tree—X-ray Exposure

Chapter 4
Dose Reporting and Recording Procedures

4–1. Dose record custodian

The installation or activity commander may designate in writing one of the following individuals to serve as a dose record custodian responsible for preparing and maintaining the records of occupational exposure to ionizing radiation (dose records):

a. Custodian of health records.

b. Custodian of the civilian worker medical files.

c. The individual who prepares the dosimetry report and controls dosimeter issuance and recovery.

d. The RPO. Records of exposure are normally prepared by the AIRDC and maintained by the installation or activity.

4–2. DD Form 1952

a. Purpose. The DD Form 1952 (Dosimeter Application and Record of Occupational Radiation Exposure)documents—

(1) Previous occupational ionizing radiation history, analogous to NRC Form 4 (Cumulative Occupational Exposure History).

(2) Required training or instruction provided to all personnel in restricted areas.

(3) The type of dosimetry provided to the occupationally exposed individual.

b. Completion procedures. See AR 40–14/DLAR 1000.28, appendix B, for completion instructions and an example of a filled-in DD Form 1952.

4–3. Automated dosimetry record

a. The AIRDC—

(1) Provides a complete occupational dose history as reflected by current repository file information for each occupationally exposed individual upon written request from the RPO.

(2) Provides calendar-year-to-date updates on a quarterly basis.

(3) Maintains dose records of—

(a) Whole-body and skin of the whole-body.

(b) Head and neck.

(c) Hands and forearms.

(d) Feet and ankles.

(e) Lens of the eye.

b. The RPO—

(1) Verifies that all automated dosimetry record(ADR)related information is contained in the ADR. The RPO and AIRDC must correct any errors by written correspondence.

(2) Signs and dates the ADR to certify the information as the occupationally exposed individual's official dose record.

(3) Reviews and certifies each of the AIRDC updates and adds them to each occupationally exposed individuals' record. The RPO need not retain the previous updates for calendar quarters 1,2, and 3 once replaced by the succeeding update. The 4th quarter report includes all dose data for the entire year and should be retained permanently by the RPO.

4–4. Record retention

Refer to AR 40–14/DLAR 1000.28, paragraph 6–4, for record retention requirements.

4–5. Record disposition

Refer to AR 40–14/DLAR 1000.28, paragraph 6–5, for record disposition requirements.

4–6. Employment termination dose reports

a. For NRC regulated occupationally exposed individuals terminating employment, the RPO must—

(1) Provide a written dose report when requested to such individuals within 30 days after the request or within 30 days of when the dose for the final dosimeter wearing period is determined(whichever is later). Provide this report to either the previously occupationally exposed individual or to the individual's designee.

(2) Ensure that the occupationally exposed individual's request includes appropriate identifying data, such as a social security number and dates and location of employment.

(3) Ensure that the report contains—

(a) Results of any calculations and analyses of any radioactive material deposited in the body.

(b) The name of the installation or activity at which the individual was provided personnel dosimetry.

(c) The individual's name and social security number.

(d) The individual's exposure information.

(e) The following statement:

> This report is furnished to you under the provisions of the Nuclear Regulatory Commission regulation (10 CFR 19) or Department of Labor regulation (29 CFR 1910). You should preserve this report for further reference.

b. In addition to providing the dose report to the occupationally exposed individual terminating employment, installations or activities that possess NRC licenses must submit copies of this report, for occupationally exposed individuals whose dose was regulated under the licenses, through major Army command channels to the Director of Management and Program Analysis, Nuclear Regulatory Commission, Washington, DC 20555 per 10 CFR 20.2206.

c. When an occupationally exposed individual, who is not under NRC control, terminates employment and requests it, the RPO should give the individual a copy of the final dosimeter results in a timely fashion. Normally this will occur within 30 days after receipt of dosimetry results from routine processing of the terminating employee's dosimeter.

4–7. Disclosing information on records

Refer to AR 40–14/DLAR 1000.28, paragraph 6–6, for requirements on disclosing record information.

4–8. Record transfer

Refer to AR 40–14/DLAR 1000.28, paragraph 6–7, for record transfer requirements.

4–9. Record inspection

Refer to AR 40–14/DLAR 1000.28, paragraph 6–8, for record inspection requirements.

4–10. External potential overexposure criteria and investigations

a. The RPO must return dosimeters to AIRDC for processing—

(1) At the end of the established wearing period, or

(2) When a potential overexposure is suspected per SB 11–206.

b. The AIRDC must report to the RPO a personnel dosimeter result that exceeds the applicable ALARA Investigational Level II found in table 2–1. These dosimeters will be declared to be potentially overexposed.

c. The RPO must identify, in writing, dosimeters known to have been used under nonoccupational, emergency conditions or those suspected of having sustained a potential overexposure, when sending such dosimeters to the AIRDC for processing.

d. The AIRDC must report to the OTSG any personnel dosimeter result that exceeds the applicable dose levels found in table 4–1. These dosimeters may indicate exposure conditions that could result in annual doses that exceed NRC limits. The AIRDC must also report such potential overexposures directly to the RPO of the exposed individual's unit or activity and provide a copy to the AMC Safety Office.

Table 4–1
Dosimeter results that require notification of OTSG (mrem)(1)

Body parts	Quarterly monitoring	Monthly monitoring
Whole body[2]	1250	400
Lens of the eye	3750	1250

Table 4–1
Dosimeter results that require notification of OTSG (mrem)(1)—Continued

Body parts	Quarterly monitoring	Monthly monitoring
Other[3]	12500	4150

Notes:
[1] 1. All values rounded to nearest 50 mrem.
2. TEDE.
3. Other includes:The H(S) to the skin or to any extremity, or the sum of the H(d) and the H(T) to any individual organ or tissue other than the lens of the eyes.

e. The OTSG must in turn forward the results through command channels to the potentially overexposed individual's location per SB 11–206.

f. For dosimeters potentially overexposed at a rate in excess of the quarterly or monthly values specified in table 4–1, the RPO must—

(1) Recommend immediate removal from duties involving further exposure to ionizing radiation, pending the results of a full investigation, if the reported dose added to the individual's accumulated dose for the year exceeds the annual dose limit.

(2) Conduct an investigation.

(3) Determine the cause, timeframe, and circumstances surrounding the apparent potential overexposure.

(4) Correct or recommend to the commander corrective actions to prevent recurrence of the situation.

(5) Determine whether or not the dosimeter was actually worn by the occupationally exposed individual during the dosimeter wear period.

(6) Immediately notify the licensee if NRC licensed materials were involved in the overexposure and it was determined the badge was actually worn.

(7) Fully document the investigation. The written investigation report shall contain—

(a) A copy of the affected occupationally exposed individual's ADR covering the previous 12 months of exposure, if available.

(b) Results of any bioassays and medical examinations.

(c) Statements from supervisors or other knowledgeable personnel.

(d) A statement from the affected occupationally exposed individual stating:

> To the best of my knowledge and belief I(did) (did not) receive this dose because (state reason).

(e) Procedures describing corrective actions.

(8) Review the ALARA program to reduce the likelihood of recurrence and minimize future doses from the wearer's duties, if the indicated overexposure was actually received by the wearer of the dosimeter.

g. When the result of an investigation conclusively reveals an exposure in excess of those in table 4–1, the RPO must—

(1) Notify the immediate supervisor if the exposure exceeds the monthly limit but the total calendar quarter and calendar year limits are not exceeded.

(2) Notify the immediate supervisor if the total calendar quarter limit is exceeded but the total calendar year limit is not exceeded. Recommend that the person be allowed to return to duty involving potential exposure to ionizing radiation only under conditions which preclude exceeding the calendar year limit.

(3) Notify the immediate supervisor if the exposure exceeds the annual limit, and

(a) Recommend prompt removal of the individual from duties involving potential exposure to ionizing radiation.

(b) Recommend the individual return to duty involving potential exposure to ionizing radiation only upon consultation with the U.S. Army Medical Command (MCHO–CL–W) and no sooner than the end of the calendar year.

(c) Follow 10 CFR Parts 20, 34, 35, 39, and 40 as applicable, appropriate NRC regulatory guides, and this pamphlet as applicable regarding reporting of any overdoses for occupationally exposed individuals regulated under an NRC license to the NRC.

h. Upon investigation, the RPO will refer any occupationally-exposed individual who sustains an actual overexposure to the supporting occupational health physician. The occupational health physician in consultation with the RPO or designated representative will evaluate the worker's dose background and take into appropriate consideration the—

(1) Total reported dose and effective dose equivalent(H(E)).

(2) Type and energy of the ionizing radiation.

(3) Exposed body part or organ that sustained the reported overdose.

(4) Dosimeter wearing period.

(5) Time elapsed between overdose and notification.

(6) Other factors including previous occupational dose history.

i. The supporting occupational health physician and local RPO will—

(1) Determine the appropriate (if any) medical examination and medical or laboratory tests, including any bioassay procedures, necessary to document any potential short- or long-term health hazard or injury.

(2) Plan appropriate medical care (AR 40–501 or DLA Manual (DLAM) 6055.1).

j. The RPO will—

(1) Forward the investigation report as follows:

(a) Where an NRC license *is not involved*, forward through command channels to OTSG, HQDA(SGPS–PSP–E), 5109 Leesburg Pike, Falls Church, VA 22041–3258 or Director DLA (CAAE), Alexandria, VA 22304-6100, as applicable.

(b) Where an NRC license *is involved*, forward through command channels to the license manager for concurrence and transmittal to OTSG or DLA, as applicable.

(2) Maintain the investigation records as a permanent file per AR 25–400–2, and

(3) Provide to the individual concerned, and the individual's medical record custodian, a copy of the final investigation report including any revisions made to the individual's reported dose.

k. The OTSG or DLA director will provide AIRDC and NRC license managers (if applicable) the approved dose to be officially posted to the affected occupationally exposed individual's dosimetry record.

l. The medical records custodian will include a copy of the final investigation report, including any revised dose, in the individual's health or medical records.

4–11. Internal potential overexposure criteria and investigations

a. When internal exposure indicators(for example, bioassays, air samples, and similar tests) suggest an individual has been exposed in excess of investigational level II (see table 2–1), the event must be declared a potential overexposure.

b. When soluble uranium intake exceeds 10 mg per 50-hour work week, the event will be declared a potential overexposure.

c. Potential overexposures to internal radionuclides will be handled per applicable procedures in paragraph 4–10 above.

d. The RPO will ensure that appropriate bioassay samples are collected and analyzed as needed to establish retention and excretion curves for the individual.

4–12. Combined external and internal potential overexposure criteria and investigations

a. The AIRDC dosimetry service gives local RPOs a means of assessing the *external* doses sustained by occupationally-exposed individuals. Most occupationally-exposed individuals are exposed to either external or internal radiation, but generally not both at the same time. For those few individuals occupationally exposed to *both* external and internal radiation, the local RPO—

(1) Must ensure that appropriate bioassays are provided to such individuals. The local RPO or another individual qualified to use DA approved analysis methods can then determine the individual's CEDEs.

(2) Will investigate TEDEs and CEDEs that—

(a) Exceed an investigational level II found in table 2–1, or

(b) Exceed a notification level found in table 4–1.

b. When investigating TEDEs and CEDEs in the dose ranges specified in table 4–1, remove the occupationally exposed individual from duties which could lead to reportable overexposures until the overdose investigation is completed.

c. The investigation report must address the appropriate items specified in paragraphs 4–10*f*through *j*, above.

d. The RPO will—

(1) Conduct an investigation.

(2) Determine whether or not any external radiation dosimeters were actually worn by the occupationally exposed individual during the apparent excessive exposure.

(3) Correct the circumstances that caused the excess dose.

(4) Document the investigation.

(5) Review the effectiveness of the ALARA program.

e. NRC licensees will follow 10 CFR Parts 20,34, 35, 39, and 40, as applicable, and appropriate NRC regulatory guides.

4–13. Administrative dose assessment

a. If a dosimeter is lost or damaged or the occupationally exposed individual's TEDE or CEDE cannot otherwise be determined, the RPO must use one or any combination of the following methods to estimate a realistic administrative dose:

(1) Calculate the affected occupationally exposed individual's dose based on occupancy or workload information and radiation exposure levels at the radiation source operator location.

(2) Estimate the dose measured by a supplemental dosimeter if a primary dosimeter or official AIRDC provided dosimeter is unavailable.

(3) Average the affected occupationally exposed individual's previous occupational dose for the preceding 6 to 12 months.

Note. Use this method only if the exposure conditions for the period for which the dose is being estimated do not differ significantly from the conditions under which the previous, known doses were sustained.

(4) Estimate doses accrued by coworkers performing similar duties and having similar exposure opportunities.

b. If an administrative dose is assigned, the RPO will—

(1) Annotate on the local ADR that an administrative dose has been assigned.

(2) Indicate the administrative dose determination method(s) used on the ADR from *a* above.

(3) Forward a report to the Chief, USAIRDC, ATTN:AMXTM–SR–D, Lexington, KY 40511–5102, which contains the—

(a) Occupationally exposed individual's full name and social security number.

(b) Occupational specialty code (that is, military occupational specialty, specialty skill identifier, or DA civilian specialty code).

(c) Location where the individual is presently working to include AIRDC dosimetry account code.

(d) Administrative dose assessed.

(e) The type of administrative dose assessed(that is, H(d), H(S), eye-dose equivalent), as applicable.

(f) Method of determining the administrative dose to include type of dosimetric dose (that is, whole-body, collar, wrist, ring TLD, etc>).

(g) Period of time covered by the administrative dose>

(h) Authenticating signature of the RPO.

(4) Maintain a copy of this administrative dose correspondence sent to the AIRDC in each occupationally exposed individual's local dosimetry record file until this administrative dose appears on the individual's lifetime dose history.

Appendix A
References

Section I
Required Publications

AR 25–400–2
The Modern Army Recordkeeping System (MARKS). (Cited in para 4–10*j*(2).)

AR 40–14/DLAR 1000.28
Occupational Ionizing Radiation Personnel Dosimetry. (Cited in paras 1–1*b*, 3–7, 4–4, 4–5,4–7, 4–8, and 4–9.)

EPA 400–R–92–001
Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, Revised 1991. (Cited in para 2–5*a*(3).)(This publication may be obtained from the National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.)

NRC Regulatory Guide 10.8
Guide for the Preparation of Applications for Medical Use Programs. (Cited in para 2–1c.) (This publication may be obtained from the National Technical Information Service, 5258 Port Royal Rd., Springfield, VA 22161.)

Supply Bulletin (SB) 11–206
Personnel Dosimetry Supply and Service for Technical Radiation Exposure Control. (Cited in paras 4–10*a*(2)and *e*.)

Section II
Related Publications

A related publication is merely a source of additional information. The user does not have to read it to understand this publication.

ANSI N13.30
Performance Criteria for Radiobioassay

AR 25–1
The Army Information Resources Management Program

AR 40–3
Medical, Dental, and Veterinary Care

AR 40–5
Preventive Medicine

AR 40–66
Medical Record Administration

AR 40–501
Standards of Medical Fitness

AR 310–25
Dictionary of U.S. Army Terms

AR 385–11
Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety)

AR 385–40
Accident Reporting and Records

AR 385–80
Nuclear Reactor Health and Safety Programs

DLAM 6055.1
DLA Safety and Health Manual

DODI 6055.8
Occupational Radiation Protection Program. (This publication may be obtained from the Commanding Officer, ATTN: Code 301, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120–5099.)

ICRP Publication 12
General Principles of Monitoring for Radiation Protection of Workers

ICRP Publication 23
Report of the Task Group on Reference Man

ICRP Publication 26
Recommendations of the International Commission on Radiological Protection

ICRP Publication 30
Limits for Intakes of Radionuclides by Workers

ICRP Publication 48
The Metabolism of Plutonium and Related Elements

ICRP Publication 51
Data for Use in Protection Against External Radiation

ICRP Publication 60
1990 Recommendations of the International Commission on Radiation Protection

National Bureau of Standards Handbook 114
General Safety Standards for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV

NCRP Report No. 38
Protection Against Neutron Radiation

NCRP Report No. 39
Basic Radiation Protection Criteria

NCRP Report No. 53
Review of NCRP Radiation Dose Limits for Embryo and Fetus in Occupationally Exposed Women

NCRP Report No. 57
Instrumentation and Monitoring Methods for Radiation Protection

NCRP Report No. 58
A Handbook of Radioactivity Measurements Procedures

NCRP Report No. 96
Comparative Carcinogenicity of Ionizing Radiation and Chemicals

NCRP Report No. 106
Limit for Exposure to

NCRP Report No. 114
Maintaining Radiation Protection Records

NCRP Report No. 116
Limitation of Exposure to Ionizing Radiation

NRC Regulatory Guide 8.7, Revision 1
Instructions for Recording and Reporting Occupational Radiation Exposure Data

NRC Regulatory Guide 8.9, Revision 1
Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program

NRC Regulatory Guide 8.10, Revision 1–R
Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable

NRC Regulatory Guide 8.11
Applications of Bioassay for Uranium

NRC Regulatory Guide 8.13, Revision 2
Instruction Concerning Prenatal Radiation Exposure

NRC Regulatory Guide 8.15
Acceptable Programs for Respiratory Protection

NRC Regulatory Guide 8.18, Revision 1
Information Relevant to Ensuring that Occupational Radiation Exposures at Medical Institutions Will Be As Low As Reasonably Achievable.

NRC Regulatory Guide 8.20, Revision 1
Applications of Bioassay for I-125 and I-131

NRC Regulatory Guide 8.22, Revision 1
Bioassay at Uranium Mills

NRC Regulatory Guide 8.25, Revision 1
Air Sampling in the Workplace

NRC Regulatory Guide 8.31
Information Relevant to Ensuring that Occupation Radiation Exposures at Uranium Mills Will Be As Low As Is Reasonably Achievable

NRC Regulatory Guide 8.32
Criteria for Establishing a Tritium Bioassay Program

NRC Regulatory Guide 8.34
Monitoring Criteria and Methods to Calculate Occupational Radiation Doses

NRC Regulatory Guide 8.35
Planned Special Exposures

NRC Regulatory Guide 8.36
Radiation Dose to the Embryo/Fetus

NRC Regulatory Guide 8.37
ALARA Levels for Effluents from Materials Facilities

TB MED 525
Control of Hazards to Health from Ionizing Radiation Used by the Army Medical Department

10 CFR 19
Notices, Instructions, and Reports to Workers; Inspections

10 CFR 20
Standards of Protection Against Radiation

10 CFR 30
Rules of General Applicability to Domestic Licensing of Byproduct Material

10 CFR 31
General Domestic Licenses for Byproduct Material

10 CFR 32
Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material

10 CFR 33
Specific Domestic Licenses of Broad Scope for Byproduct Material

10 CFR 34
Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations

10 CFR 35
Medical Use of Byproduct Material

10 CFR 39
Licenses and Radiation Safety Requirements for Well Logging

10 CFR 40
Domestic Licensing of Source Material

29 CFR 570
Child Labor Regulations, Orders, and Statements of Interpretation

29 CFR 1910
Occupational Safety and Health Standards

40 CFR 61
National Emission Standards for Hazardous Air Pollutants

52 FR 2822
Radiation Protection Guidance to Federal Agency for Occupational Exposure

Unnumbered publication
A Primer on Low-level Ionizing Radiation and its Biological Effects, American Association of Physicists in Medicine Report No. 18

Unnumbered publication
Effects and Risks of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation(UNSCEAR) Sources, 1988

Unnumbered publication
Health Effects of Exposure to Low Levels of Ionizing Radiation: 1990, Committee on the Biological Effects of Ionizing Radiations (BEIR V), Washington, D.C.: National Academy Press

Unnumbered publication
Health Risks of Radon and Other Internally Deposited Alpha-Emitters, Committee on the Biological Effects of Ionizing Radiations (BEIR IV), Washington, D.C.: National Academy Press

Unnumbered publication
Radiation Protection Guidance for Federal Agencies, Federal Radiation Council

Unnumbered publication
Review of U.S. Army Ionizing Radiation Dosimetry System, National Research Council

Unnumbered publication
The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980, Committee on the Biological Effects of Ionizing Radiations (BEIR III), Washington, D.C.:National Academy Press

Section III
Prescribed Forms

There are no entries in this section.

Section IV
Referenced Forms

DD Form 1952
Dosimeter Application and Record of Occupational Radiation Exposure

NRC Form 4
Cumulative Occupational Exposure History

SF 600
Health Record—Chronological Record of Medical Care

Glossary

Section I
Abbreviations

ADR
Automated Dosimetry Record

AIRDC
U.S. Army Ionizing Radiation Dosimetry Center

ALARA
as low as reasonably achievable

ALI
annual limits on intake

AMC
U.S. Army Materiel Command

ANSI
American National Standards Institute

AR
Army Regulation

ARNGUS
Army National Guard of the United States

Bq
becquerel

CEDE
committed effective dose equivalent

CFR
Code of Federal Regulations

Ci
curie

cm
centimeter (length)

cm(2)
square centimeter (area)

DA
Department of the Army

DAC
derived air concentration

DA Pam
Department of the Army Pamphlet

DLA
Defense Logistics Agency

DLAM
Defense Logistics Agency Manual

DODI
Department of Defense Instruction

EPA
U.S. Environmental Protection Agency

FR
Federal Register

G(y)
gray

GOCO
Government owned, contractor operated

H(d)
deep-dose equivalent

H(E)
effective dose equivalent

H(S)
shallow-dose equivalent

H(T)
committed dose equivalent

HQDA
Headquarters, Department of the Army

ICRP
International Commission of Radiological Protection

MeV
million electron volts

mg
milligram

mrem
one thousandth of one rem

mSv
millisievert

NCRP
National Council on Radiation Protection and Measurements

NRC
Nuclear Regulatory Commission

OTSG
Office of the Surgeon General

PSE
planned special exposure

Q
quality factor

rad
radiation absorbed dose

RCC
Radiation Control Committee

rem
unit of dose equivalent

RPO
radiation protection officer

SB
Supply Bulletin

SF
Standard Form

Sv
sievert

TEDE
total effective dose equivalent

TLD
thermoluminescent dosimeter

USACHPPM (Prov)
U.S. Army Center for Health Promotion and Preventive Medicine(Provisional)

USAR
U.S. Army Reserve

W(T)
Tissue Weighting Factor

yr
year

Section II
Terms

Absorbed dose (D)
The mean energy imparted by ionizing radiation per unit mass of a specified irradiated material at the place of interest in the material. The units of absorbed dose are the rad and the gray(Gy). One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram. One Gy is equal to an absorbed dose of 1 joule/kilogram which is also equivalent to 100 rads. For purposes of radiation protection, 1 rad is considered to be the dose delivered by one roentgen of X-ray or gamma radiation.

Activity
The rate of disintegration (transformation) or decay of radioactive material. The units of activity are curie (Ci) and the becquerel(Bq). 1 Ci = 3.7 X 10^{10}disintegrations/second; Bq = 1 disintegration/second, 1 Ci = 3.7 X 10^{10} Bq. One microcurie = 2.22 X 10^{6} disintegrations/minute.

Adult
An individual 18 years of age or older.

Airborne radioactive material
Radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Airborne radioactivity area
A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of NRC regulated radioactive material, exist in concentrations either:

a. In excess of the DAC specified in appendix B, 10 CFR 20 or,

b. To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the ALI or 12 DAC-hours.

Annual limit on intake (ALI)
The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year(40 hours per week for 50 weeks). ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a CEDE of 5 rems (0.05 Sv) or an H(T) of 50 rems (0.5 Sv) to any individual organ or tissue. The ALI values are based on the intake rate and standards for "reference man" as defined in ICRP Publication 23.

As low as reasonably achievable (ALARA)

a. The taking of every reasonable effort to maintain exposures to radiation as far below prevailing dose limits as is practicable. These efforts must take into account—

(1) State of technology.

(2) Economics of improvements in relation to the state of technology.

(3) Economics of improvements in relation to benefits to the public health and safety.

(4) Other societal and socioeconomic considerations in relation to utilization of nuclear energy and radioactive materials in the public interest.

b. Samples of good ALARA practices may be found in NRC Regulatory Guides 8.10, 8. 31, and 10.8.

Background radiation
The radiation from cosmic (extraterrestrial) sources; radioactive materials naturally occurring on earth including radon (except as a decay product of source or special nuclear material), and global fallout in the environment incident to the past testing of nuclear explosive devices in the open atmosphere. "Background radiation" does NOT include radiation from source, byproduct, or special nuclear materials regulated by the NRC; or accelerator produced radioactive materials, radium, or machine produced ionizing radiation regulated by the DA.

Bioassay
The determination of kinds, quantities or concentrations, and in some cases, the locations or retention of radionuclides in the human body, whether by direct measurement (*in vivo*counting) or by indirect (*in vitro*)analysis of materials excreted or removed from the human body.

Byproduct material
Such material includes the following:

a. Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material. Generally, byproduct material is any radioactive material inevitably produced as a byproduct from the neutron-induced fission process within nuclear reactors.

b. The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "by-product material" regulated by the NRC under 10 CFR.

Calendar quarter
A period of time of not less than 12 consecutive weeks nor more than 14 consecutive weeks. The first calendar quarter will begin in January or begin with the dosimetry issue cycle closest to January. Subsequent calendar quarters will begin within 12 or 14 weeks of that date so that no day is included in both quarters or omitted from both quarters.

Class
A classification scheme for inhaled radioactive material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y which indicate a range of clearance half-times: Class D (Days)—clearance half-times of less than 10 days; Class W (Weeks)—clearance half-times of 10 to 100 days; Class Y (Years)—clearance half-times of greater than 100 days.

Collective dose
The sum of the individual whole-body doses received in a given period of time by a specified population from exposure to a specified source of radiation.

Committed dose equivalent (H(T,50))
The dose equivalent that will be received from an intake of radioactive material to organs or tissues of reference (T) by an individual during the 50-year period following the intake.

Committed effective dose equivalent (CEDE) (HE,50)
The sum of the products of the weighting factors applicable to specific body organs or tissues that are irradiated and the committed dose equivalent of the corresponding organs or tissues. (HE50,=SwtHt,50).

Controlled area
An area, outside of a restricted area but inside an installation boundary, access to which can be limited by the commander for any reason.

Critical organ
That organ which will sustain the greatest absorbed dose and whose associated damage by a radionuclide entering the human body will result in greatest potential impairment to the body due to the organ's radiosensitivity.

Declared pregnant woman
A woman occupationally exposed to ionizing radiation who has voluntarily informed, in writing, her employer and the RPO of her pregnancy and the estimated date of conception.

Deep dose equivalent (H(d))
This dose applies to *external, whole-body* exposure and is the dose equivalent at a tissue depth of 1 centimeter (cm)(1000 mg/cm^2) below the outer skin surface.

Derived air concentration (DAC)
The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2000 hours (40 hours per week for 50 weeks) under conditions of light work(inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in appendix B, 10 CFR 20.

Derived air concentration-hour (DAC-hour)
A DAC-hour is the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours. 2000 DAC-hours may be taken to represent one ALI, equivalent to a CEDE of 5 rems (0.05 Sv).

Dose (D)
A generic term that can variously mean absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, CEDE, or TEDE.

Dose equivalent
The product of the absorbed dose in tissue (D) and the quality factor (Q) at the location of interest where H(T) &equals. (D)(Q). The units of dose equivalent are the rem and the sievert (Sv). The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor; 1 rem &equals. 0.01 Sv. The dose equivalent in sieverts is equal to the absorbed dose in Gys multiplied by the quality factor; 1 Sv &equals. 100 rems. Its purpose is to have a single unit, regardless of the type of radiation, describing the radiation effect on man.

Dosimeter
A device intended to measure radiation or evaluate any quantity of irradiation for the purpose of determining an occupationally exposed individual's ionizing radiation dose.

Effective dose equivalent (HE)
The probability of a stochastic effect, for example, cancer induction, in any tissue is proportional to the dose equivalent to that tissue. The value of the proportionality factors differs amongst various tissues because of the differences in tissue radiosensitivity. If radiation dose is uniform throughout the body(whole-body irradiation), then the total risk factor is one (1).For nonuniform irradiation (such as partial body exposure to an external radiation field or from internal exposure where the isotope concentrates to different degrees in various tissues), WT, which are based on the relative susceptibility of the tissues to stochastic effects, may be used to calculate an HE. The HE is thus the sum of the products of the dose equivalent to

the organ or tissue(HT)and the WT. applicable to each of the body organs or tissues that are irradiated. (HE=SwT HT).

Embryo or fetus
The developing human organism from conception until the time of birth.

Entrance or access point
Any location through which an individual could gain access to radiation areas or to radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

Exposure
Ionizing radiation may be either produced from machines (X-ray machines, accelerators, etc.), or spontaneously emitted by radioactive material. An individual located near such machines or materials may be "exposed" to the ionizing radiation emitted therefrom; hence, sustain an exposure.

External dose
The portion of the dose equivalent received from radiation sources or devices outside the body.

Extremity
The hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

Eye-dose equivalent
The dose equivalent to the lens of the eye from external exposure of the lens of the eye to some ionizing radiation source. It is measured at an eye lens tissue depth of 0.3 cm (300 mg/cm^2).

High radiation area
An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem/hr (1 mSv/hr) at 30 cm from the radiation source or from any surface that the radiation penetrates.

Individual
Any human being.

Individual (personnel) dosimetry
The assessment of dose equivalent by the use of devices designed to be worn by an individual; the assessment of CEDE by bioassay or by determination of the time-weighted air concentrations to which an individual was exposed or the assessment of dose equivalent by the use of radiation survey data.

Individual dosimetric devices
The devices designed to be worn by a single individual for the assessment of dose equivalent, such as TLDs, pocket ionization chambers, and personal air sampling devices.

Intake
The amount of radioactive material taken into the body by inhalation, absorption through the skin, injection, ingestion, or through wounds.

Internal dose
The portion of the dose equivalent received from radioactive material taken into the body.

Investigational level
The CEDE from radioactive material taken into the human body or dose equivalent from an external radiation source to which the worker is occupationally exposed which justifies further investigation. Such an investigation generally includes a review of the circumstances associated with the apparently abnormal internal or external personnel dose equivalent, assessment of the consequences, and mitigation or prevention of such a personnel dose equivalent of similar magnitude in the future.

Ionizing radiation
Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly in its passage through matter.Ionizing radiation includes gamma rays, X rays, alpha particles, beta particles, neutrons, protons, and other particles and electromagnetic waves capable of producing ions.

Limits
The permissible upper bounds of personnel radiation doses.

Lower limit of detection
The lowest level of radioactivity that a system can detect with a given level of certainty. For further information, see NCRP Report 58, Section 7.1.3.

Member of the public
An individual, such as a visitor, in a controlled or unrestricted area who normally does not work at that particular installation or activity. An individual is not, however, a member of the public during any period in which the individual receives a dose equivalent in the course of routinely working with ionizing radiation sources or devices as part of their normal occupation.

Minor
An individual less than 18 years of age.

Monitoring
Also known as radiation monitoring or radiation protection monitoring. Monitoring includes the—

a. Measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material.

b. Use of such data to evaluate or document actual or potential personnel occupational exposures to ionizing radiation sources or devices.

Nonstochastic effect
Also called a deterministic effect. A health effect, the severity of which varies with dose, and for which a threshold is believed to exist. Radiation induced cataract formation and skin erythema are examples of nonstochastic effects.

NRC
The Federal Nuclear Regulatory Commission or its authorized representatives.

Occasionally exposed individual
An individual whose work is not normally performed in a restricted area and whose duties do not normally involve exposure to ionizing radiation or radioactive material. Such individuals may, however, have reason to enter a restricted area in the performance of their duties. Examples are messengers, deliverypersons, and maintenance workers.

Occupational dose

a. The dose received by an individual in a restricted area or in the course of employment in which the individual's assigned duties involve exposure to ionizing radiation from NRC- and nonNRC-licensed radioactive material as well as from machine produced ionizing radiation, whether in the possession of the owner of the radiation source (licensee) or other individual.

b. Occupational dose does NOT include dose received from background radiation, as a patient from medical or dental procedures, from voluntary participation in human research programs, or as a member of the general public.

Occupationally exposed individual
Any individual who receives an occupational dose of radiation as a result of employment in an occupation involving the use of radioactive material or equipment capable of producing ionizing radiation.

Planned special exposure (PSE)
An infrequent exposure to radiation, separate from and in addition to the prevailing permissible annual dose limits.

Protective action guide
The projected dose to reference man, or other defined individual, from an unplanned release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended.

Public dose
The dose received by a member of the public from exposure to ionizing radiation from radionuclide or machine sources or devices for which the Army or DLA is responsible.

Quality factor (Q)
The factor used for radiation protection purposes that accounts for differences in biological effectiveness between different radiations. Such a factor (Q) when multiplied by the absorbed dose(D) yields a quantity (dose equivalent) which equates to a common scale the dose equivalent of any type of ionizing radiation to which an individual is exposed. These factors are specified in 10 CFR 20.

Radiation
For purposes of this pamphlet, a generic term that may variously refer to alpha particles, beta particles, gamma rays, X rays, neutrons, high-speed protons, and other particles capable of producing ionization. This term is NOT intended to connote nonionizing radiation, such as radiofrequency, microwave, visible light, infrared, or ultraviolet.

Radiation area
Any area to which access is limited as deemed necessary by the cognizant authority and in which appropriate precautionary measures are taken to protect personnel from exposure to radiation or radioactive material. A radiation area includes any area accessible to individuals in which ionizing radiation dose rate levels could result in an individual receiving a dose equivalent in excess of 0.005 rem/hr (0.05 mSv/hr) at 30 cm from the radiation source or from any surface that the radiation penetrates.

Radiation protection officer (RPO)
A technically competent person designated by management to evaluate safety procedures and supervise the application of radiation protection regulations.

a. For installations and activities possessing NRC licenses—

(1) An individual who meets the training and experience criteria specified in 10 CFR; or

(2) An individual who has been formally approved by the NRC to serve as the Radiation Safety Officer incident to NRC review of the individual's radiation protection training and experience credentials.

b. For installations and activities NOT possessing NRC licenses: an individual whose radiation protection training and experience documents the equivalent minimum radiation protection training provided by—

(1) The Radiological Safety Course conducted by the U.S.Army Chemical School (for industrial, nonmedical RPOs);

(2) The Radiation Protection Course conducted by the AMEDD (for medical RPOs); or

(3) Other sources deemed acceptable by radiation protection professional staff at major Army command level or OTSG.

Radiation sources
Material, equipment, or devices which spontaneously generate or are capable of generating ionizing radiation. They include the following:

a. Nuclear reactors.

b. Medical or dental radiographic or fluoroscopic X-ray systems.

c. Particle generators and accelerators.

d. Certain electromagnetic generators, such as klystron, magnetron, rectifier, cold-cathode, and other electron tubes operating at electrical potentials that result in the production of X rays of such energy as to be of radiological concern.

e. X-ray diffraction, industrial radiographic, and spectrographic equipment.

f. Electron microscopes.

g. Electron-beam welding, melting, and cutting equipment.

h. Nuclear moisture and density gauges.

i. Radioactive materials.

(1) Natural or accelerator produced radioactive materials.

(2) Byproduct materials.

(3) Source materials.

(4) Special nuclear materials.

(5) Fission products.

(6) Materials containing induced or deposited radioactivity.

(7) Radioactive commodities.

Radiation work permit
A locally developed form completed by the area supervisor and countersigned by the RPO prior to the start of any work in a restricted area. It describes the potential radiation hazards and protective clothing and equipment requirements for a given work assignment. It also provides a record of radiation exposures received by individuals during a given work assignment. The radiation work permit will be initiated by the area supervisor or the RPO when required to minimize the exposure of the radiation worker.

Radionuclide
A radioactive species of atom characterized by its mass number (A), atomic number (Z), and nuclear energy state, provided that the mean life of that state is long enough to be observable.

Reference man
A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used to standardize results of experiments and to relate biological insult to a common base.

Respiratory protective device
An apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive material.

Restricted area
An area, access to which is limited by the commanders of DA and DLA installations and activities for the purpose of protecting individuals from undue risks associated with exposure to ionizing radiation producing sources and devices and radioactive materials.Restricted areas do not include areas used as residential quarters;however, a separate room in a residential building may be set aside as a restricted area.

Roentgen
The special unit of exposure. One roentgen equals 2.58 X 10^{-4} coulombs per kilogram of air. It applies only to electromagnetic radiation, that is, nonparticulate radiation, of photon energies between several kev and 3 million electron volts (MeV) that produce ionization in*air* only.

Shallow-dose equivalent (H(S))
The external exposure of the skin or an extremity which is taken as the dose equivalent at a tissue depth of 0.007 cm (7 mg/cm^2—average depth of the germinal cell layer) averaged over an area of 1 cm^2.

Source material
a. Uranium or thorium, or any combination of uranium or thorium in any physical or chemical form; or

b. Ores which contain by weight one-twentieth of 1 percent (0.05&percnt.) or more of uranium, thorium, or any combination of uranium and thorium.

c. Source material does not include special nuclear material.

Special nuclear material
Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235. Any other material the NRC determines to be special nuclear material as defined by 10 CFR 20. Special nuclear material does not include source material.

Stochastic effects
Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

Survey
An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of ionizing radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations, or quantities of radioactive material present.

System international units
These units have been established by the International Commission on Radiological Units and are used by many countries. As such, they may be encountered in the scientific literature. Historical, so-called "traditional" units of the rem, rad, and curie, equate to system international units in the following manner:

One gray (Gy) &equals. 100 rad

One sievert (Sv) &equals. 100 rem

One becquerel (Bq) &equals. 2.7 X 10^{-11}curie (Ci); or &equals. One disintegration/second

One rad &equals. One centigray (cGy); or &equals.1 &times. 10^{-2} gray (Gy)

One rem &equals. One centisievert (cSv); or &equals.1 X 10^{-2} sievert (Sv)

One curie (Ci) &equals. 3.7 X 10^{10} becquerel (Bq)

Termination
The end of employment with DA, ARNGUS,

USAR, or DLA. Also, the end of a work assignment in a restricted area.

Total effective dose equivalent (TEDE)
The sum of the H(d) (for external exposures) and the CEDE (for internal exposures) expressed in units of either rems or sievert(Sv).

Unrestricted area
Any area access to which is neither limited nor controlled for purposes of radiation protection by commanders of DA and DLA installations and activities that possess and use ionizing radiation sources and devices to include any area used for residential quarters.

User
An individual who has been delegated the authority for the use, operation, or storage of radiation sources and devices.

Very high radiation area
An area, accessible to individuals, in which there exists ionizing radiation at such levels that an individual could receive in excess of 500 rads/hr (5 Gys/hr) at 1 meter from a radiation source or from any surface that the radiation penetrates.

Visitor
See Member of the public.

Weighting Factor (W(T))
The decimal fraction specified for an organ or tissue whose magnitude is the quotient of the risk of stochastic effects resulting from irradiation of that organ or tissue (T) to the total risk of stochastic effects when the whole body is irradiated uniformly. The W(T) values for calculating the H(E) are specified in 10 CFR 20.

Whole-Body
The head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Section III
Special Abbreviations and Terms
This section contains no entries.

Index

This index is organized alphabetically by topic and by subtopic.Topics and subtopics are identified by paragraph number.

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