

Chapter 5. Dose Limits and ALARA.

5-1. Occupational Dose Limit structure.

As described in Chapter 4, doses to Authorized Users' Assistants are regulated by the NRC or Agreement State, OSHA, and DA and USACE regulations. To ensure compliance with all regulatory agencies, USACE has established a three tiered approach to worker dose limits. Tier 1 is the NRC regulatory dose limits which are never to be exceeded. Tier 2 is the USACE dose limits which are effectively 10% of the NRC limits. The USACE limits will ensure that USACE workers will be in compliance with OSHA regulations and Agreement State regulations. Tier 3 is project specific dose goals which will be set below the USACE dose limits. Project specific dose goals are used to promote the concept of ALARA; keeping the dose as low as is reasonably achievable, taking social, technical and financial considerations into account. Army and NRC regulations require a radiation protection program that promotes ALARA. Descriptions and examples of the technical definitions of the various dose items are explained in paragraph 3-5 of this manual. Table 5-1 highlights the dose limits put forth in the three-tiered approach.

5-2. USACE Dose Limits.

a. Tier 1; NRC dose limits. Each user of radioactive material or radiation generating devices shall limit occupational doses to individuals to the following limits:

(1) An annual limit which is the more limiting of:

(a) 5 rems (5000 millirem (mrem))(0.05 sieverts (Sv)) TEDE,

(b) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 50 rems (50000 mrem)(0.5 Sv),

(c) 15 rems (15000 mrem)(0.15 Sv) to the lens of the eye, or

(d) 50 rems (50000 mrem)(0.5 Sv) shallow dose equivalent to the skin, or any extremity.

(2) The TEDE to the fetus of a declared pregnant worker will be kept below 0.5 rem (500 mrem)(0.005 Sv) during the entire gestation period. Should the worker declare pregnancy after the fetus has received 0.5 rem, the fetus will be limited to no more than an additional 0.05 rem for the remaining gestation period, as per 10 CFR 20.1208.

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b. Tier 2 USACE annual dose limits. Without the written approval of the RPSO the annual occupational dose shall not exceed the more limiting of:

(1) 0.5 rems (500 mrem) (0.005 sieverts (Sv)) TEDE,

(2) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 5 rems (5000 mrem)(0.05 Sv),

(3) 1.5 rems (1500 mrem)(0.015 Sv) to the lens of the eye,

(4) 5 rems (5000 mrem) (0.05 Sv) shallow dose equivalent to the skin, or any extremity, or

(5) The TEDE to the fetus of a declared pregnant worker will be kept below 0.5 rem (500 mrem)(0.005 Sv) during the entire gestation period. Should the worker declare pregnancy after the fetus has received 0.5 rem, the fetus will be limited to no more than an additional 0.05 rem for the remaining gestation period.

c. Tier 3 project specific dose goals. To keep doses ALARA, the user shall set administrative action levels below the USACE annual dose limits. The ALARA action levels shall be realistic and attainable. ALARA action levels can be set at any level, but need to take the particulars of each project into account. Example action levels for a small project involving little radioactive material could be:

(1) Shall not exceed the more limiting of:

(a) 0.1 rems (0.001 sieverts (Sv)) TEDE,

(b) The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue of 0.5 rems (0.005 Sv),

(c) 0.15 rems (0.0015 Sv) to the lens of the eye, or

(d) 0.5 rems (0.005 Sv) shallow dose equivalent to the skin, or any extremity.

Table 5-1
Dose Limits

Body Part	NRC Annual Limits	USACE Annual Limits	Example Annual ALARA Limits
Whole Body	5 rem	0.5 rem	0.1 rem

Body Part	NRC Annual Limits	USACE Annual Limits	Example Annual ALARA Limits
Individual Organ	50 rem	5.0 rem	0.5 rem
Lens of eye	15 rem	1.5 rem	0.15 rem
Skin	50 rem	5.0 rem	0.5 rem

d. Planned special exposures (see definitions) shall not be used without the written consent of the RPSO.

e. Persons under the age of 18 shall not be allowed occupational exposure to radiation on USACE sites.

f. Because the embryo/fetus is very radiosensitive, the NRC has set lower dose limits. The dose to an embryo/fetus shall not exceed 0.5 rem (0.005 Sv) during the entire gestation period. To accomplish this, and to ensure privacy and working rights, the NRC has defined regulations for the control of doses to a Declared Pregnant Worker (DPW).

(1) A declared pregnant worker means a women who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

(2) A declared pregnant worker will be provided with a declaration of pregnancy form which the RPO will use to

calculate the dose received from the date of conception until the date of declaration. Exposure limits for the remaining allowable dose will be set at that time. A declared pregnant worker may "un-declare" at any time.

(3) The RPO will give the DPW a copy of the DPW statement (see Appendix H for an example (if Social Security Number is used, ensure proper privacy act statement is included)), a copy of NRC Regulatory Guide 8.13, and enroll the DPW in a fetal monitoring program (See chapter 7).

5-3. NRC and Agreement State Dose Limits.

a. NRC dose limits are the Tier 1 limits. NRC regulates only NRC licensed source, byproduct or special nuclear materials. Most Agreement States have the same dose limits as the NRC, but most include regulation of NORM and NARM materials and radiation generating devices.

b. Under NRC regulations,

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each user of licensed radioactive material shall limit occupational doses to individuals as stated in paragraph 5-2a.

c. Note that compliance with the USACE dose limits will comply with the NRC and Agreement State dose limits.

5-4. OSHA Dose Limits.

a. OSHA adopted the NRC dose limits as they were written before the new 10 CFR 20 was issued in 1991. Note that OSHA regulations apply to all radioactive materials including NORM and NARM, as well as radiation generating devices such as X-ray machines.

b. No employer shall use radioactive materials or radiation generating devices in a manner which would cause any individual to receive a dose during one calendar quarter in excess of:

(1) 1.25 rem to the whole body; head and trunk; active blood forming organs; lens of eyes or gonads.

(2) 18.75 rem to the hands and forearms; feet and ankles.

(3) 7.5 rem to the skin of the whole body.

Note that compliance with the USACE dose limits will meet this requirement.

5-5. Monitoring Requirements.

Both OSHA and NRC have requirements to monitor dose to individuals who can reasonably be expected to receive a dose greater than 10% of the maximum permissible dose. Compliance with USACE Tier 2 dose limits will keep workers at doses below 10% of the maximum permissible doses. The RPO will issue dosimetry to occupationally exposed individuals as deemed necessary to demonstrate compliance with Federal, Army and USACE regulations, and to ensure that doses are kept ALARA.

5-6. Doses to the Public.

a. NRC and Agreement States presently require that a licensee restrict dose to the public to 100 mrem/year TEDE from licensed activities. The EDE in any unrestricted area may not exceed 2 mrem in any one hour. The maximum allowable dose to the public from effluents from a licensed facility is 50 mrem/year and listed in Appendix B of 10 CFR 20 as a calculated concentration for each specific radionuclide yielding 50 mrem/year. For decontaminated and decommissioned facilities to be released without restrictions, the dose from residual contamination must be below 25 mrem/year to the public.

b. The EPA has standards for radioactivity in community drinking water systems. The present standards are 5 picocuries per liter (pCi/l) of Ra-226 plus Ra-228, and 15 pCi/l of gross alpha particle activity, including Ra-226 but excluding uranium and radon. The present dose limits are 4 mrem/year from beta/gamma-emitting radionuclides to the whole body or any organ.

c. There are proposed rules from both the NRC and the EPA to limit dose to the public from radiation to 15 mrem/year. Note that this value is so far below natural background levels as to be unmeasurable by any instrumentation and only calculable through dose modeling.