

**The ALARA principle**  
**Charlene Bremer**

The ALARA principle currently refers to the management of radiation dose to the patient while ensuring the medical purpose is fulfilled. It's application is widely used when referring to medical exposures to radiation. This was not the initial intent of the use of the term ALARA. The initial intent of the principle was based on occupational radiation exposures and exposures to members of the public. It wasn't until ICRP publication 73 (1996) that the ALARA principle was applied to medical exposures. The publication introduced the use of diagnostic Reference Levels (DRLs) in place of dose limits.

Per 10 CFR 20.1003 (paraphrased): ALARA (acronym for "as low as is reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits with technologic advancements, economic and socioeconomic considerations taken into account.

The ALARA principle is equivalent to the principle of optimization of protection of the ICRP. The concept of reference levels, not limits, were discussed in ICRP publication 26. The most common forms of reference levels noted were recording levels, investigation levels and interventional levels. Each NRC licensee is responsible for setting their own ALARA action levels (called "Investigation Levels") below the occupational dose limits. In Nuclear Medicine, Investigation Levels are typically set at 10% and 30% of the annual occupational dose limits (see Reg. Guide 10.8, appendix G). These Investigational Levels have also been applied to occupational exposure due to ionizing radiation produced by radiation machines. The exposure to fluoroscopy accounts for most exposure from machine radiation.

Annual Occupational Exposure levels: (per 10 CFR 20.1201 and state of Michigan R 333.5057)

Effective dose equivalent – 5 rems (0.05 Sv)

Dose equivalent to an individual organ/tissue other than the lens of the eye – 50 rems (0.5 Sv)

Shallow dose equivalent – 50 rems (0.5 Sv)

Lens dose equivalent – 15 rems (0.15 Sv)

ALARA limits:

Dose Equivalent (location where assigned exposure was received)	ALARA I Notification (10% Regulatory limit) (per quarter)	ALARA II Notification (30% Regulatory limit) (per quarter)	Regulatory limit (per annum)
Deep Dose Equivalent <b>DDE</b> – 1 cm	125 mrem	375 mrem	5000 mrem
Lens Dose Equivalent <b>LDE</b> – 0.3 cm	375 mrem	1125 mrem	15000 mrem
Shallow Dose Equivalent <b>SDE</b> – 0.007 cm	1250 mrem	3750 mrem	50000 mrem

\*\*Note that the annual exposure level regulations are states in both SI units (Sv) and traditional (rem) but only reported in rem and mrem on the Occupational Dose Record (NRC Form 5).