

# Ionizing Radiation Dose Ranges (Rem)



**EPA emergency guideline for public relocation: 2 rem/yr**

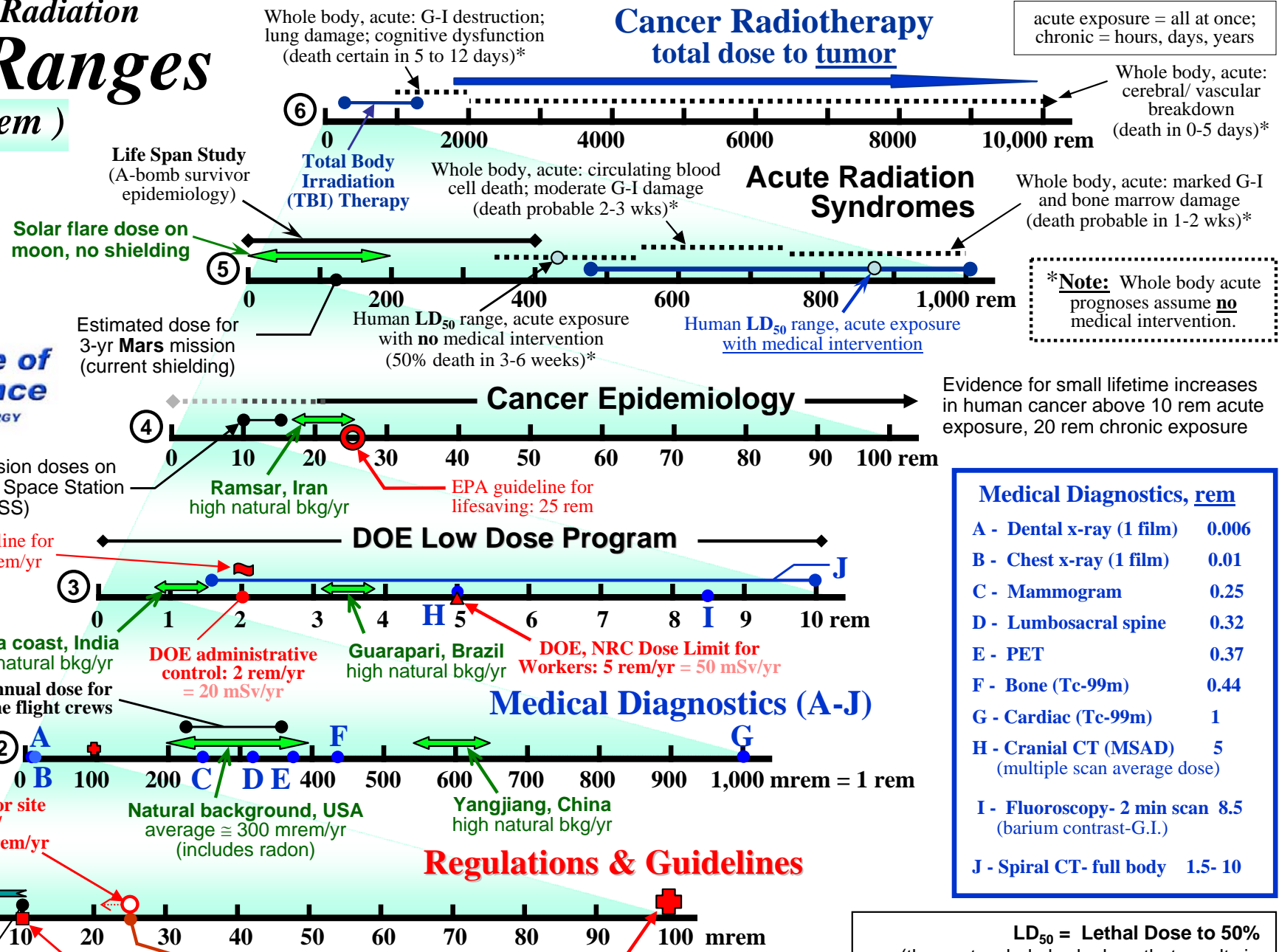
**NRC cleanup criteria for site decommissioning / unrestricted use: 25 mrem/yr**

**DOE facility releases**

**EPA dose limit applicable to public drinking water systems: 4 mrem/yr**

**Round-trip NY to London**

Note: This chart was constructed with the intention of providing a simple, user-friendly, "order-of-magnitude" reference for radiation quantities of interest to scientists, managers, and the general public. In that spirit, most quantities were expressed in the more commonly used radiation protection unit, the rem (or Sievert, 2nd page), and medical doses are not in "effective" dose. It is acknowledged that the decision to use one set of units does not address everyone's needs. (NRC—US Nuclear Regulatory Commission; EPA—US Environmental Protection Agency)  
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acute exposure = all at once; chronic = hours, days, years

Whole body, acute: cerebral/vascular breakdown (death in 0-5 days)\*

Whole body, acute: marked G-I and bone marrow damage (death probable in 1-2 wks)\*

**\*Note:** Whole body acute prognoses assume no medical intervention.

Evidence for small lifetime increases in human cancer above 10 rem acute exposure, 20 rem chronic exposure

Medical Diagnostics, rem	
A - Dental x-ray (1 film)	0.006
B - Chest x-ray (1 film)	0.01
C - Mammogram	0.25
D - Lumbosacral spine	0.32
E - PET	0.37
F - Bone (Tc-99m)	0.44
G - Cardiac (Tc-99m)	1
H - Cranial CT (MSAD)	5 (multiple scan average dose)
I - Fluoroscopy- 2 min scan	8.5 (barium contrast-G.I.)
J - Spiral CT- full body	1.5- 10

**LD<sub>50</sub> = Lethal Dose to 50%**  
(the acute whole body dose that results in lethality to 50% of the exposed individuals)

**Absorbed dose: 100 rad = 1 Gray**  
**Dose equivalent: 100 rem = 1 Sievert**  
**100 mrem = 1 mSv**  
(1 rem = 1 rad for x- and gamma-rays)

Chart compiled by NF Metting, Office of Science, DOE/BER "Orders of Magnitude" revised Oct 2008 <http://www.science.doe.gov/ober/>

# Ionizing Radiation Dose Ranges (Sievert)

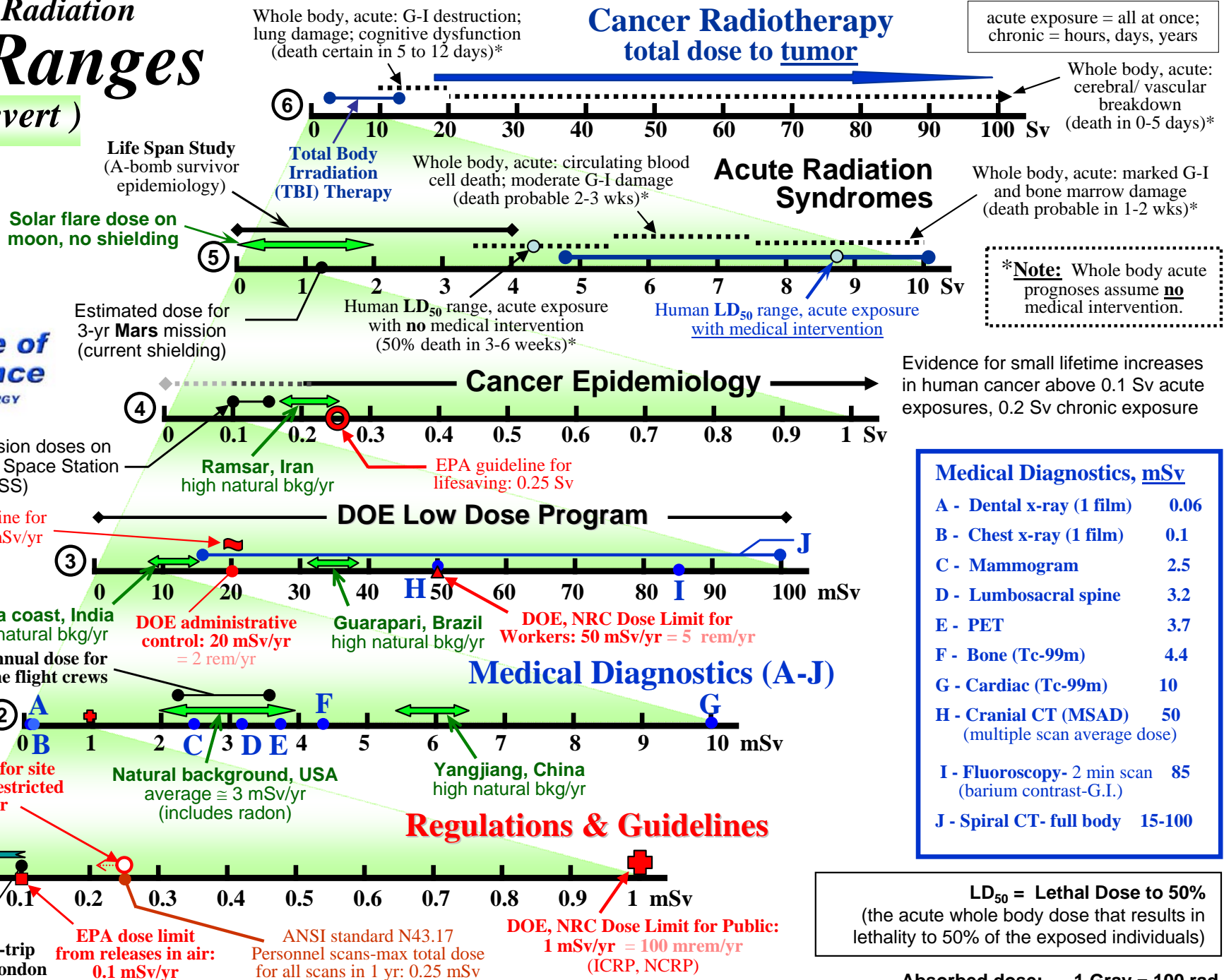


EPA emergency guideline for public relocation: 20 mSv/yr

NRC cleanup criteria for site decommissioning / unrestricted use: 0.25 mSv/yr

EPA dose limit applicable to public drinking water systems: 0.04 mSv/yr

**Note:** This chart was constructed with the intention of providing a simple, user-friendly, "order-of-magnitude" reference for radiation quantities of interest to scientists, managers, and the general public. In that spirit, most quantities were expressed in the more commonly used radiation protection unit, the rem (or Sievert, 2nd page), and medical doses are not in "effective" dose. It is acknowledged that the decision to use one set of units does not address everyone's needs. (NRC—US Nuclear Regulatory Commission; EPA—US Environmental Protection Agency)  
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Medical Diagnostics, mSv	
A - Dental x-ray (1 film)	0.06
B - Chest x-ray (1 film)	0.1
C - Mammogram	2.5
D - Lumbosacral spine	3.2
E - PET	3.7
F - Bone (Tc-99m)	4.4
G - Cardiac (Tc-99m)	10
H - Cranial CT (MSAD) (multiple scan average dose)	50
I - Fluoroscopy- 2 min scan (barium contrast-G.I.)	85
J - Spiral CT- full body	15-100

**LD<sub>50</sub> = Lethal Dose to 50%**  
(the acute whole body dose that results in lethality to 50% of the exposed individuals)

**Absorbed dose: 1 Gray = 100 rad**  
**Dose equivalent: 1 Sievert = 100 rem**  
**1 mSv = 100 mrem**  
(1 Sv = 1 Gy for x- and gamma-rays)

Chart compiled by NF Metting, Office of Science, DOE/BER  
"Orders of Magnitude" revised May 2008  
<http://www.science.doe.gov/ober/>