

# Ionizing Radiation Dose Ranges (Rem)



Whole body, acute: G-I destruction; lung damage; cognitive dysfunction (death certain in 5 to 12 days)\*

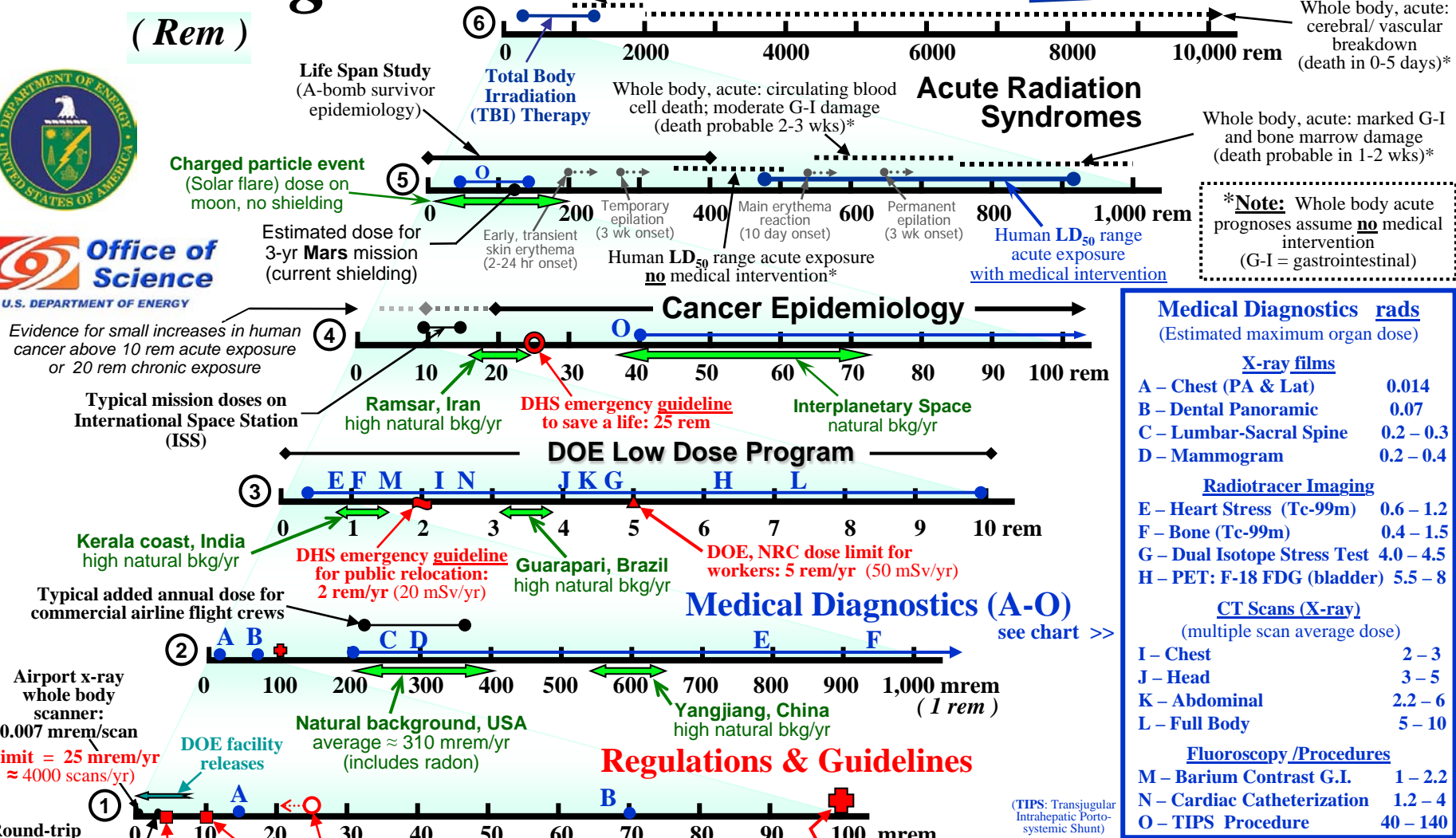
**Cancer Radiotherapy**  
total doses to tumor

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 (G-I = gastrointestinal)



**Medical Diagnostics rads**  
(Estimated maximum organ dose)

X-ray films

A - Chest (PA & Lat)	0.014
B - Dental Panoramic	0.07
C - Lumbar-Sacral Spine	0.2 - 0.3
D - Mammogram	0.2 - 0.4

Radiotracer Imaging

E - Heart Stress (Tc-99m)	0.6 - 1.2
F - Bone (Tc-99m)	0.4 - 1.5
G - Dual Isotope Stress Test	4.0 - 4.5
H - PET: F-18 FDG (bladder)	5.5 - 8

CT Scans (X-ray)  
(multiple scan average dose)

I - Chest	2 - 3
J - Head	3 - 5
K - Abdominal	2.2 - 6
L - Full Body	5 - 10

Fluoroscopy /Procedures

M - Barium Contrast G.I.	1 - 2.2
N - Cardiac Catheterization	1.2 - 4
O - TIPS Procedure	40 - 140

**LD<sub>50</sub> = Lethal Dose to 50%**  
(whole body dose that results in lethality to 50% of exposed individuals in 30-60 days)

**Dose Equivalent: 100 rem = 1 Sievert**  
= (absorbed dose x radiation quality)  
**Absorbed Dose: 100 rad = 1 Gray**  
1 rem ≈ 1 rad for x- and gamma-rays  
(“≈” stands for “approximately equal to”)

Chart compiled by NF Metting, Office of Science, DOE/BER. "Orders of Magnitude" revised June 2010  
<http://www.lowdose.energy.gov/>

**NOTE:** This chart was constructed with the intention of providing a simple, user-friendly, "order-of-magnitude" reference for radiation exposures of interest to scientists, managers, and the general public. In that spirit, most quantities are expressed as "dose equivalent" in the more commonly used radiation protection units, the rem and Sievert. Medical diagnostics are expressed as estimated maximum organ dose; as they are not in "effective dose" they do not imply an estimation of risk (no tissue weighting). Dose limits are in effective dose, but for most radiation types and energies the difference is numerically not significant within this context. It is acknowledged that the decision to use these units is a simplification, and does not address everyone's needs. (NRC = Nuclear Regulatory Commission; EPA = Environmental Protection Agency; DHS = Department of Homeland Security)  
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Source: Office of Biological and Environmental Research (BER), Office of Science, U.S. Department of Energy  
<http://www.science.doe.gov/ober/>

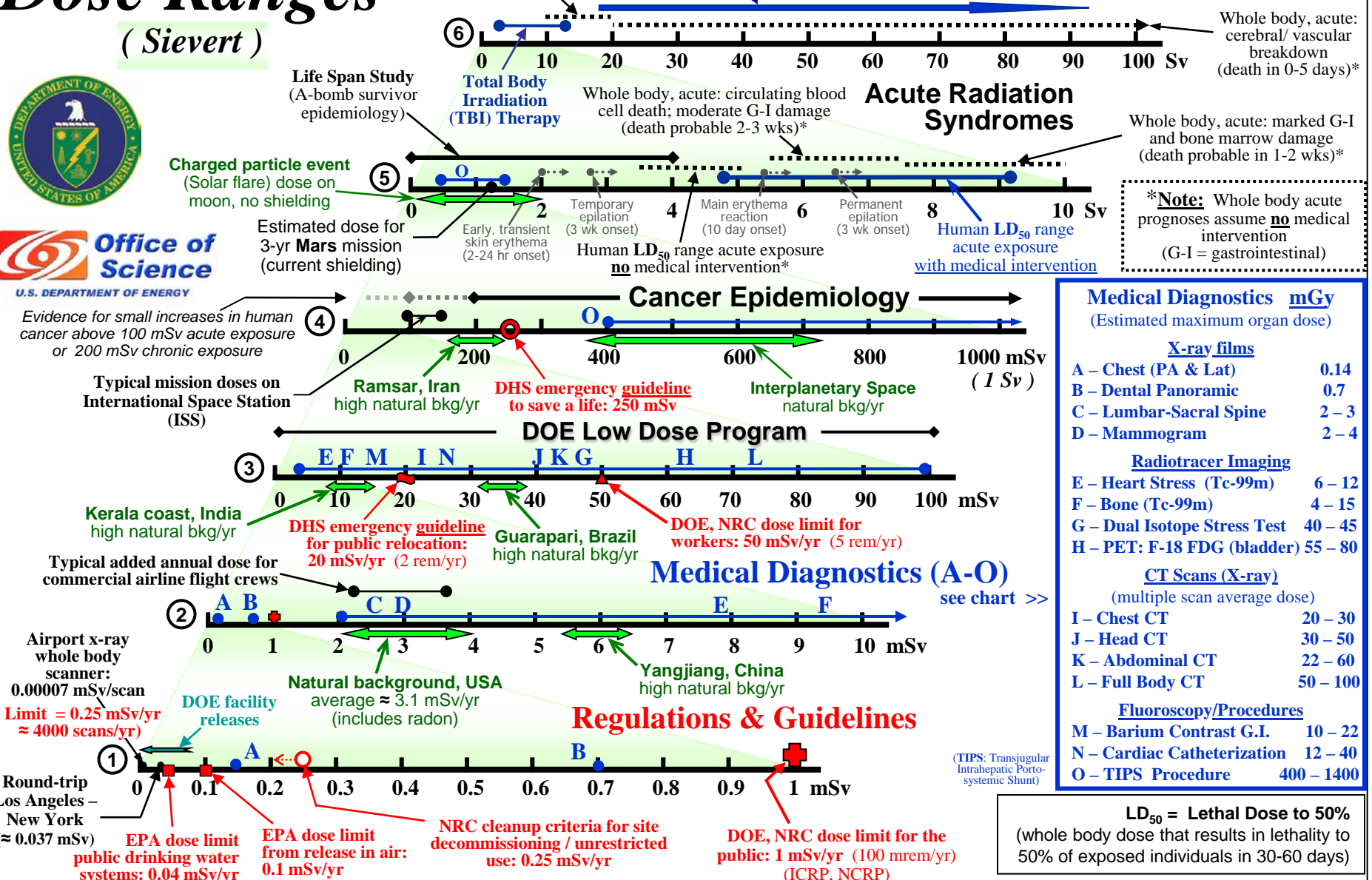
# Ionizing Radiation Dose Ranges (Sievert)



Whole body, acute: G-I destruction; lung damage; cognitive dysfunction (death certain in 5 to 12 days)\*

## Cancer Radiotherapy total doses to tumor

acute exposure = all at once; chronic = hours, days, years



### Medical Diagnostics mGy (Estimated maximum organ dose)

X-ray films

A - Chest (PA & Lat)	0.14
B - Dental Panoramic	0.7
C - Lumbar-Sacral Spine	2 - 3
D - Mammogram	2 - 4

Radiotracer Imaging

E - Heart Stress (Tc-99m)	6 - 12
F - Bone (Tc-99m)	4 - 15
G - Dual Isotope Stress Test	40 - 45
H - PET: F-18 FDG (bladder)	55 - 80

CT Scans (X-ray) (multiple scan average dose)

I - Chest CT	20 - 30
J - Head CT	30 - 50
K - Abdominal CT	22 - 60
L - Full Body CT	50 - 100

Fluoroscopy/Procedures

M - Barium Contrast G.I.	10 - 22
N - Cardiac Catheterization	12 - 40
O - TIPS Procedure	400 - 1400

**LD<sub>50</sub> = Lethal Dose to 50%**  
(whole body dose that results in lethality to 50% of exposed individuals in 30-60 days)

**Dose Equivalent: 1 Sievert = 100 rem = (absorbed dose x radiation quality)**  
**Absorbed Dose: 1 Gray = 100 rad**  
1 Sv ≈ 1 Gy for x- and gamma-rays  
(“≈” stands for “approximately equal to”)

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