

# Ionizing Radiation Dose Ranges (Sievert)



**Office of  
Science**  
U.S. DEPARTMENT OF ENERGY

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

## Cancer Radiotherapy total dose to tumor

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

Life Span Study  
(A-bomb survivor  
epidemiology)

Total Body  
Irradiation  
(TBI) Therapy

Whole body, acute: circulating blood  
cell death; moderate G-I damage  
(death probable 2-3 wks)\*

## Acute Radiation Syndromes

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.

Solar flare dose on  
moon, no shielding

Estimated dose for  
3-yr Mars mission  
(current shielding)

Human LD<sub>50</sub> range, acute exposure  
with no medical intervention  
(50% death in 3-6 weeks)\*

Human LD<sub>50</sub> range, acute exposure  
with medical intervention

## Cancer Epidemiology

Evidence for small increases in human  
cancer above 0.1 Sv acute exposure,  
0.2 Sv chronic exposure

Typical mission doses on  
Intl. Space Station (ISS)

Natural bkg /yr  
Ramsar, Iran

EPA guideline for  
lifesaving: 0.25 Sv

EPA radiological emergency  
guideline for public relocation

"Storefront" full-body  
CT screening (one scan)

Natural bkg /yr  
Kerala coast, India

DOE administrative control:  
20 mSv/yr = 2 rem/yr

DOE, NRC Dose Limit for Workers:  
50 mSv/yr = 5 rem/yr

Typical annual doses for  
commercial airline flight crews

Natural background,  
U.S. average = 3 mSv/yr  
(includes radon)

## Medical Diagnostics (A-J)

Natural bkg /yr  
Yangjiang, China

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

Max releases  
DOE facilities

Round-trip  
NY to London

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

EPA dose limit  
from releases in air:  
0.10 mSv/yr

ANSI Standard N43.17 Limit  
Security Personnel Scanners  
0.25 mSv/yr /person  
(0.1-10 µSv /scan)

DOE, NRC Dose Limit for Public:  
1 mSv/yr = 100 mrem/yr  
(ICRP, NCRP)

## Medical Diagnostics, mSv

|  |        |
|--|--------|
| A- Chest x-ray (1 film)                              | 0.1    |
| B- Dental oral exam                                  | 1.6    |
| 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)<br>(multiple scan average dose) | 50     |
| I- Barium contrast G-I<br>fluoroscopy (2 min scan)   | 85     |
| J- Spiral CT- full body                              | 30-100 |

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)

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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Chart compiled by NF Metting, Office of Science, DOE/BER  
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