Atomic Energy Merit Badge

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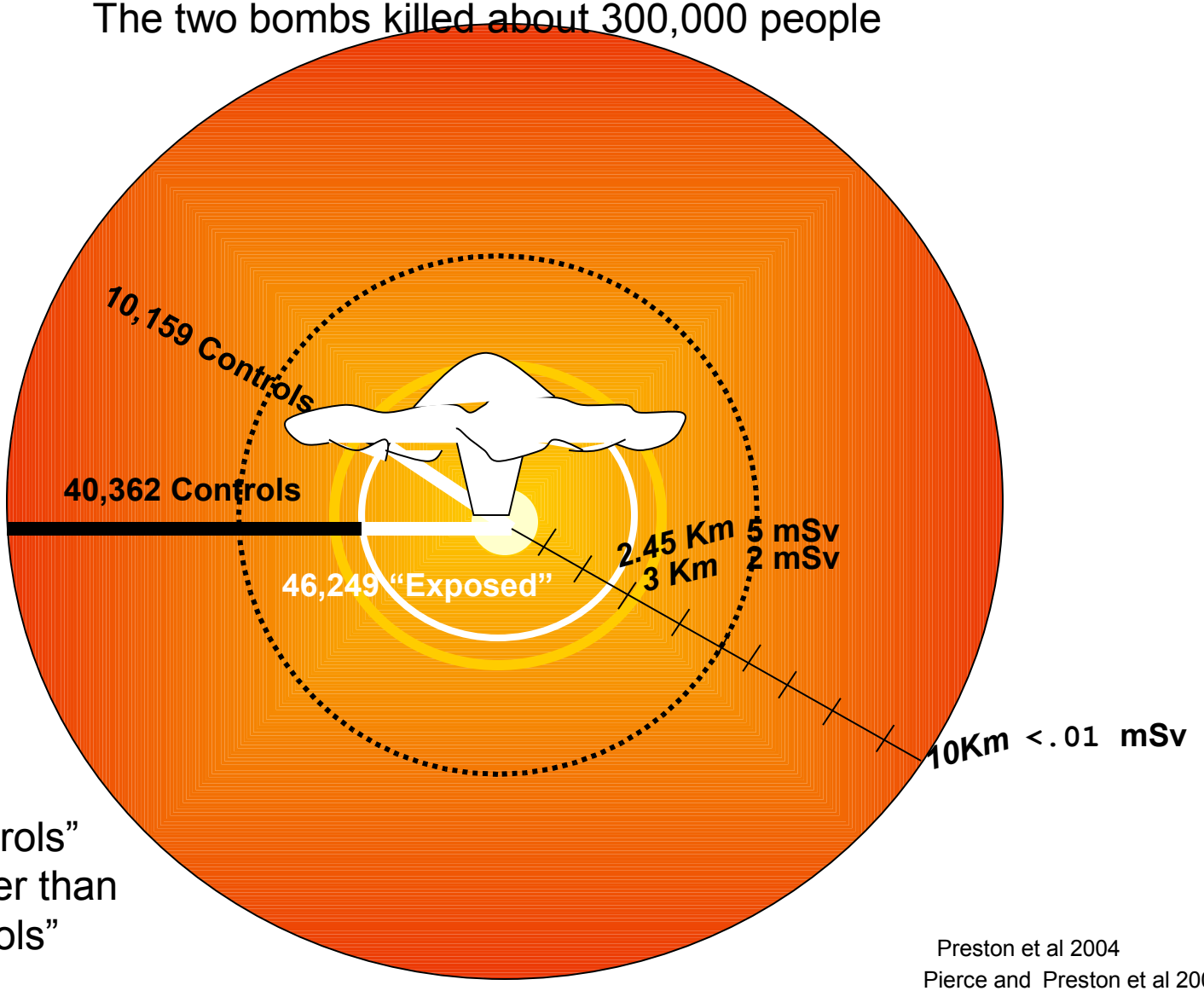
March 11, 2006

A-BOMB SURVIVOR STUDIES

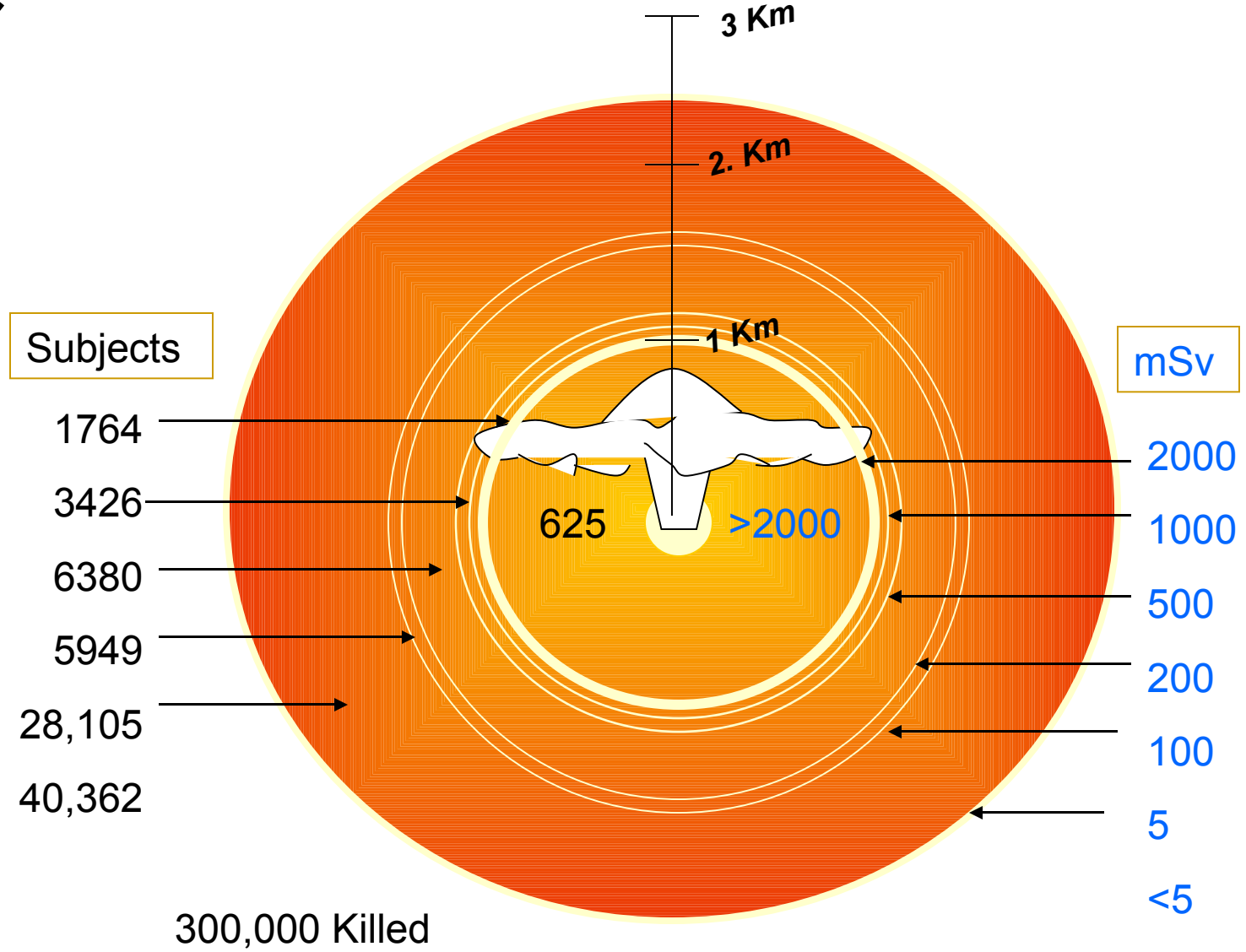
The two bombs killed about 300,000 people



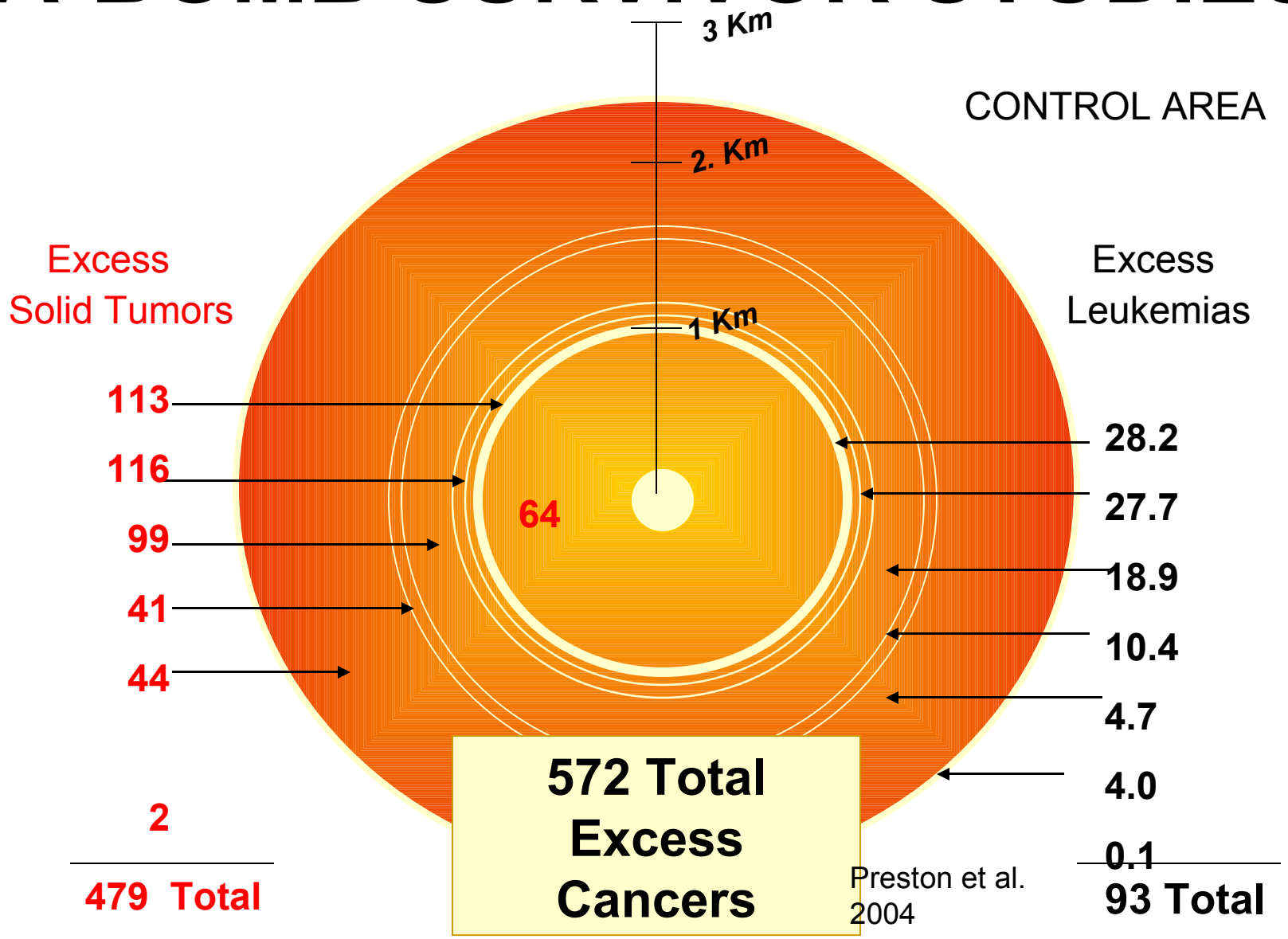
"Close in controls"
5% less cancer than
"Distant controls"

Preston et al 2004
Pierce and Preston et al 2000

A-BOMB SURVIVOR STUDIES



A-BOMB SURVIVOR STUDIES



Atomic Bomb Survivor Excess Cancer

Population of Survivors Studied **86,611**

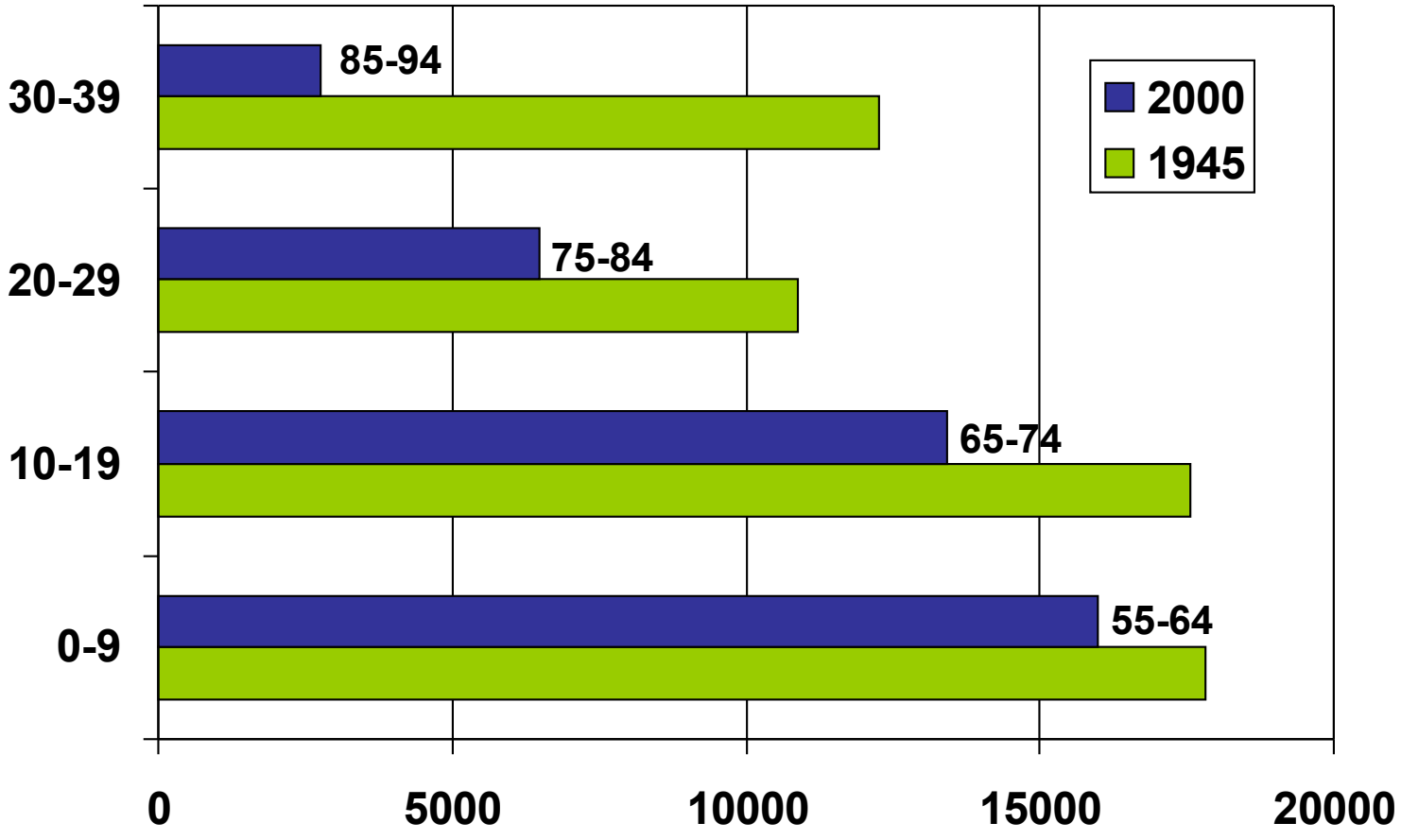
Total Solid Cancers observed after the Bomb	10, 127 Total
Solid Cancers Expected without Bomb	9, 647

Total Solid Cancer Excess **479**

Excess Tumor **479** + **Excess Leukemia** **93** = **572**

Preston et al. 2004

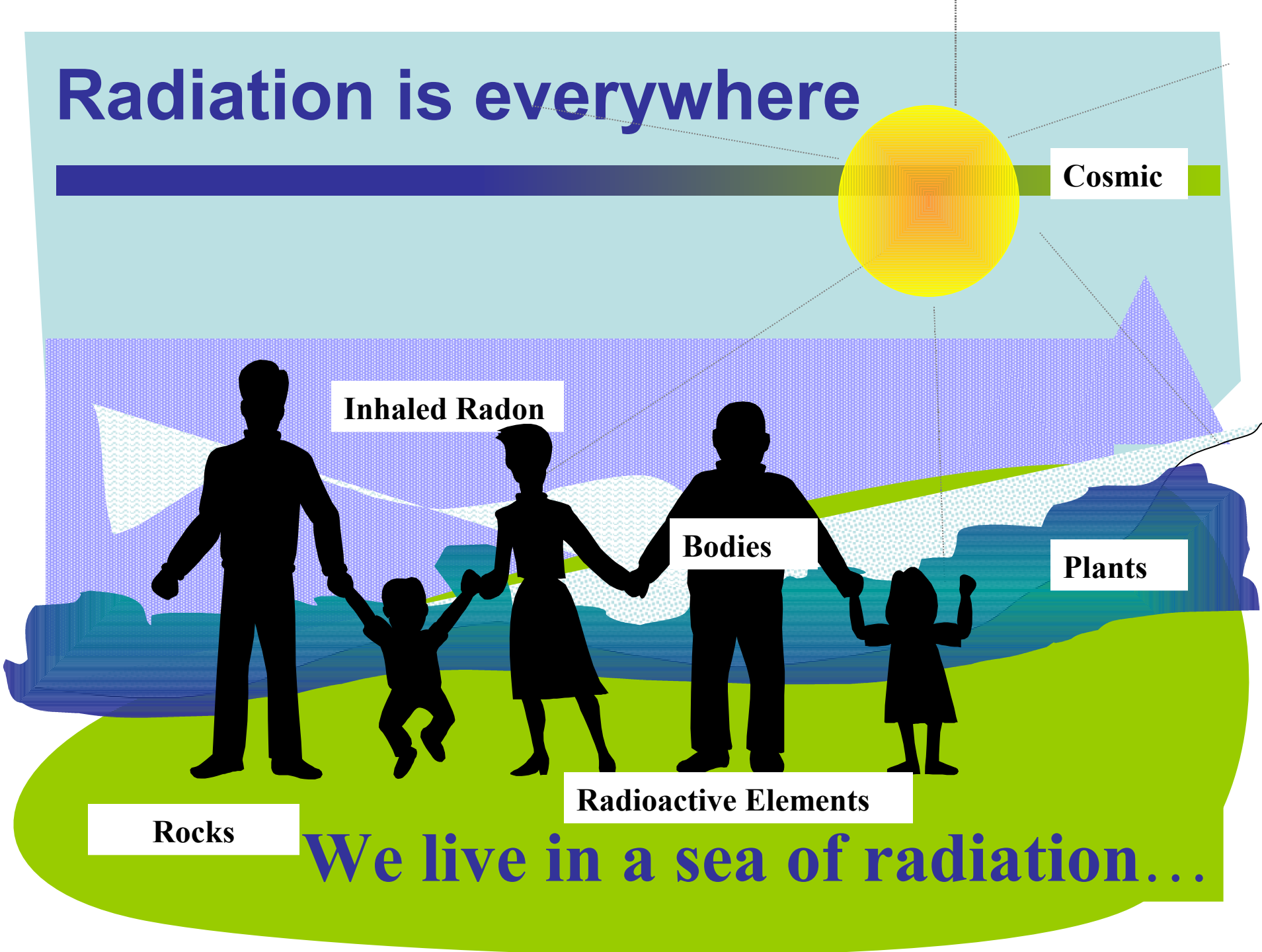
Age Groups of A-Bomb Survivors



Preston et al. 2004

Background Radiation

Radiation is everywhere



We live in a sea of radiation…

Normal annual exposure from natural radiation

About 240 mrem/yr

▪ Radon gas	140 mrem
▪ Human body	40 mrem
▪ Rocks, soil	30 mrem
▪ Cosmic rays	30 mrem

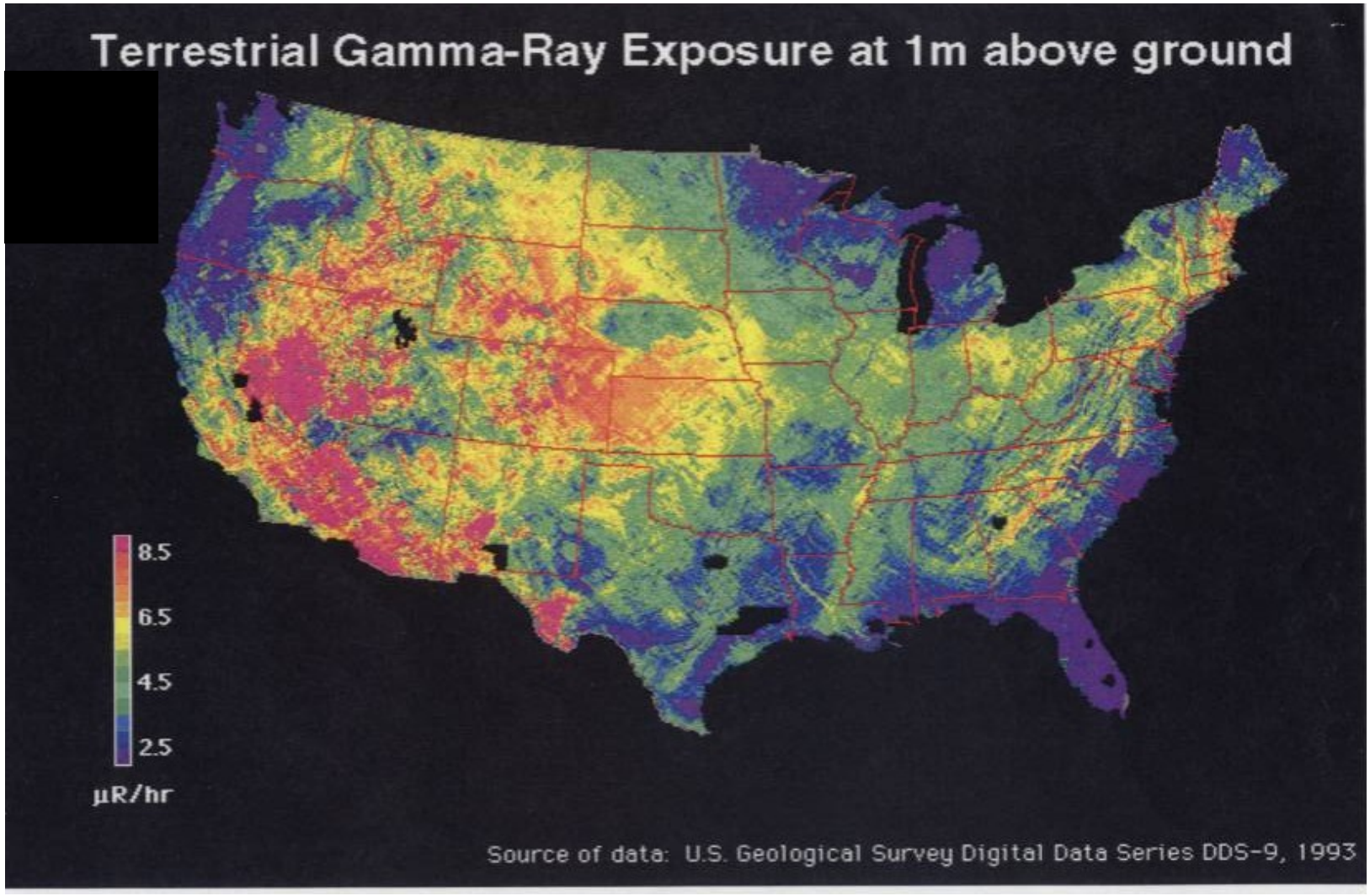
Normal annual exposure from man-made radiation

About 165 mrem/yr

▪ Medical procedures	150 mrems
▪ Consumer products	10 mrems
▪ One coast to coast airplane flight	2 mrems
▪ Watching color TV	1 mrem
▪ Sleeping with another person	1 mrem
▪ Weapons test fallout	less that 1 mrem
▪ Nuclear industry	less than 1 mrem

Background Cancer

U.S Radiation Dose Rates from Natural Background



Nevada Test Fallout

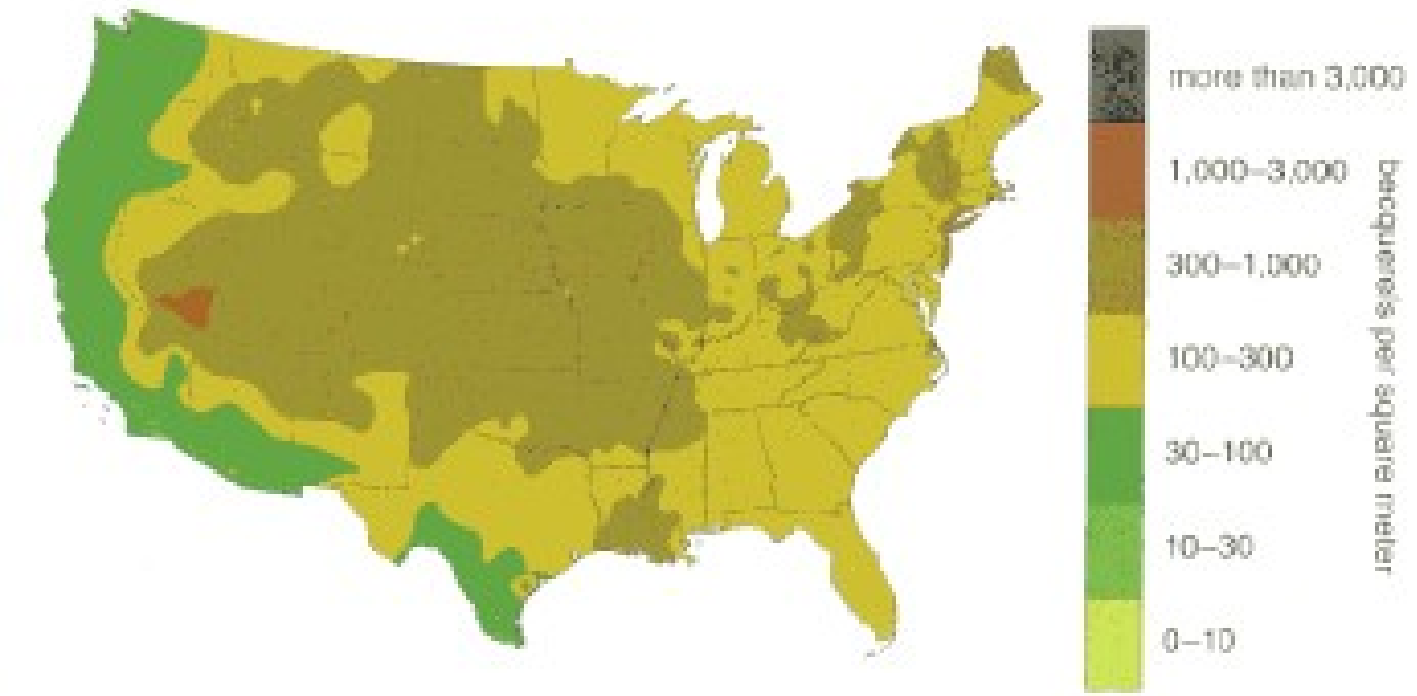
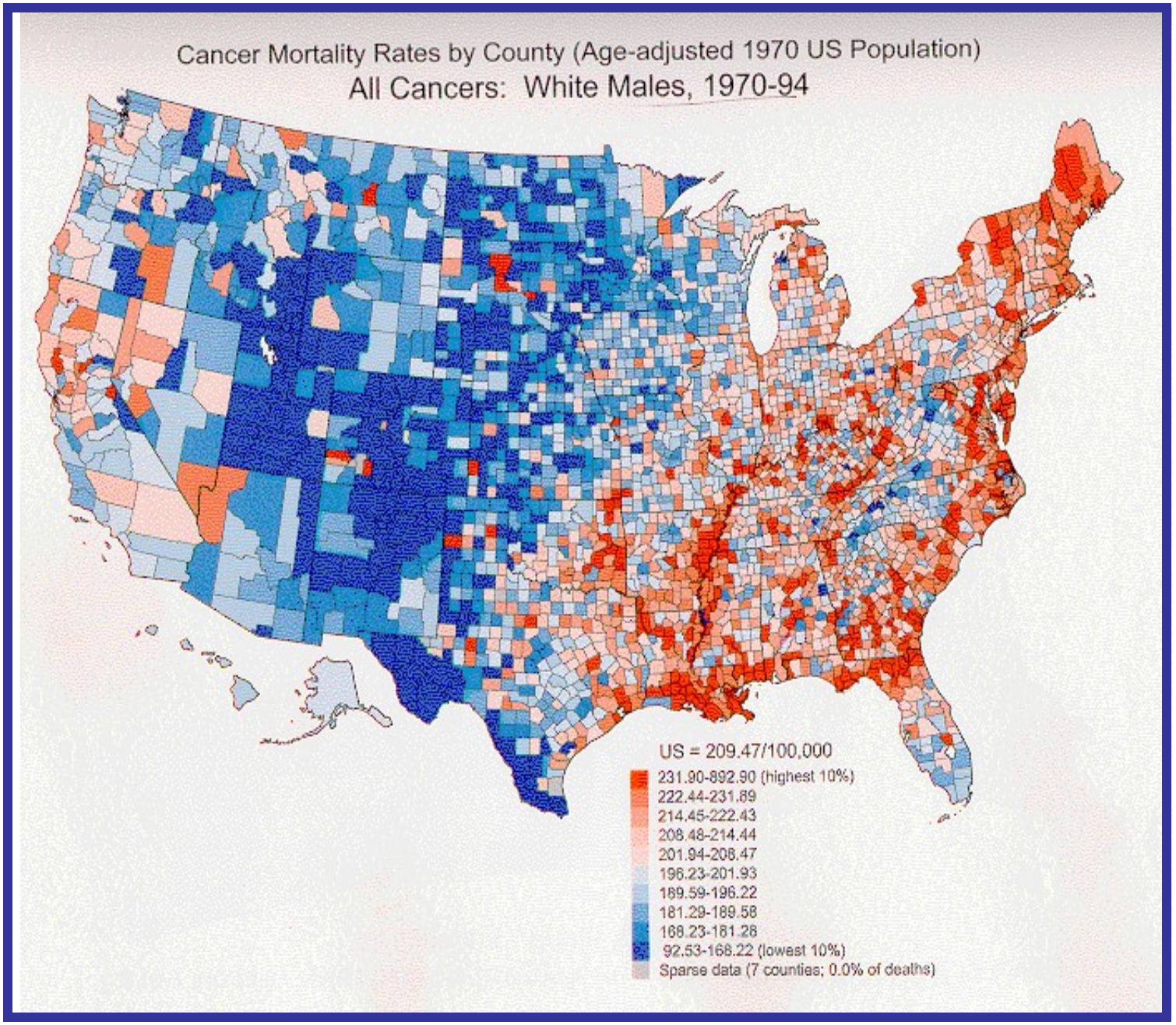
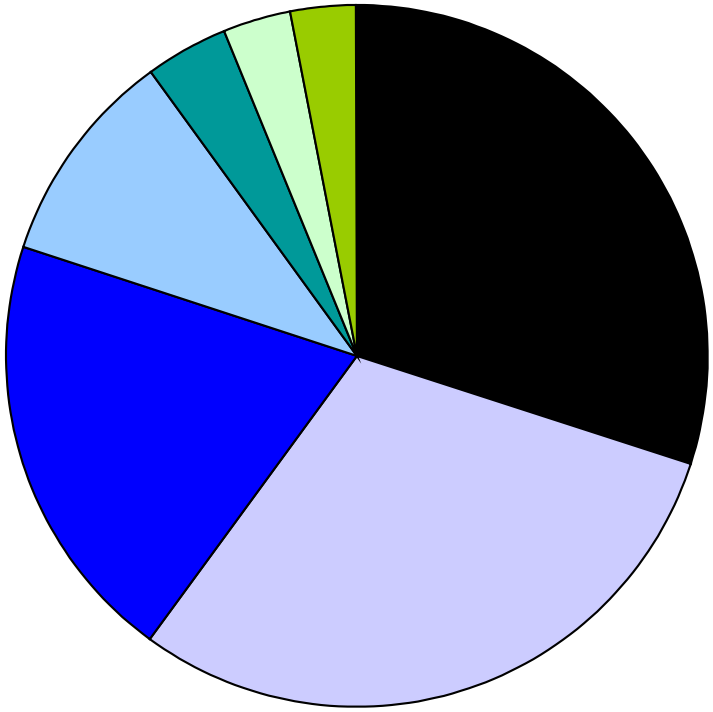


Figure 7. Cesium-137 deposition density resulting from the cumulative effect of the Nevada tests generally decreases with distance from the test site in the direction of the prevailing wind across North America, although isolated locations received significant deposition as a result of rainfall.

Simon et al. 2006


Cancer Mortality Rates by County (Age-adjusted 1970 US Population)
All Cancers: White Males, 1970-94
US = 209.47/100,000
231.90-892.90 (highest 10%)
222.44-231.89
214.45-222.43
208.48-214.44
201.94-208.47
196.23-201.93
189.59-196.22
181.29-189.58
168.23-181.28
92.53-168.22 (lowest 10%)
Sparse data (7 counties; 0.0% of deaths)

What Causes Cancer?



- Cigarette smoke
- Diet & nutrition
- Chronic infection
- Occupational exposure
- Genetic
- Alcohol drinking
- Environmental factors including radiation

WHO

How expensive is radio-phobia?

- Fear of radiation is widespread and picked up very early in life.
- Fear of health effects from radiation is the prime reason limiting the use of nuclear power.
- Modifying or protecting against the fear of radiation radiation is very, very expensive.

Comparative money spent to prevent one death

Health care ₵

Nuclear safety

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International Risk Governance Council (2006)

Beneficial Uses of Radiation

- Electricity
  - 25% of our power comes from Nuclear Plants
- Medicine
  - Hundreds of thousands of Lives Saved by Radiation therapy
- Smoke Detectors
- Manufacturing

Why does it take a lot of radiation to make a cancer?

- Ionization is what causes damage.
- Most damage is repaired.
- When cell can't repair itself, it usually dies.
- Dead cells are usually replaced.
- If enough cells in a tissue or organ, cannot be repaired or die, the organ fails.

NO CANCER

SICKNESS AND DEATH

Summary

- Radiation induced cancer is hard to detect
  - High and variable radiation background
  - High and variable cancer background
- Radiation is a good cell killer
- High doses of radiation kill people
- Radiation is a poor mutagen and carcinogen
- It takes a lot of radiation to produce a cancer