Monterey Institute
of International Studies
A Graduate School of Middlebury College

IPOL 8552 A Nuclear Trafficking

Significant Reactor Accidents

- **Windscale**
- **SL-1**
- **TMI**
- **Chernyobyl**
- **Fukushima**

- **How does a reactor accident compare to a bomb?**
  - ❑ **Rules of Thumb**
    - ➢ **18 kT / kg**
    - ➢ **1 gm / MW Day**
  - ❑ **Other factors to consider**
    - ➢ **Burndown**
    - ➢ **Proximity of bomb to ground**

- **Dangers of Radiation to Humans**
  - **Dose**
    - **Rems vs. Sieverts**
    - **Contamination vs. Dose**
    - **LD_{50}**
  - **Cancer Causation**
    - **2500 Rem to cause a cancer**
    - **~.05 x Dose in Sieverts**
    - **Cancer Deaths vs. Cancers**

- **Background Radiation**
- **Exposure Standards (public vs. radiation workers)**
- **Specific hazards such as I-131**

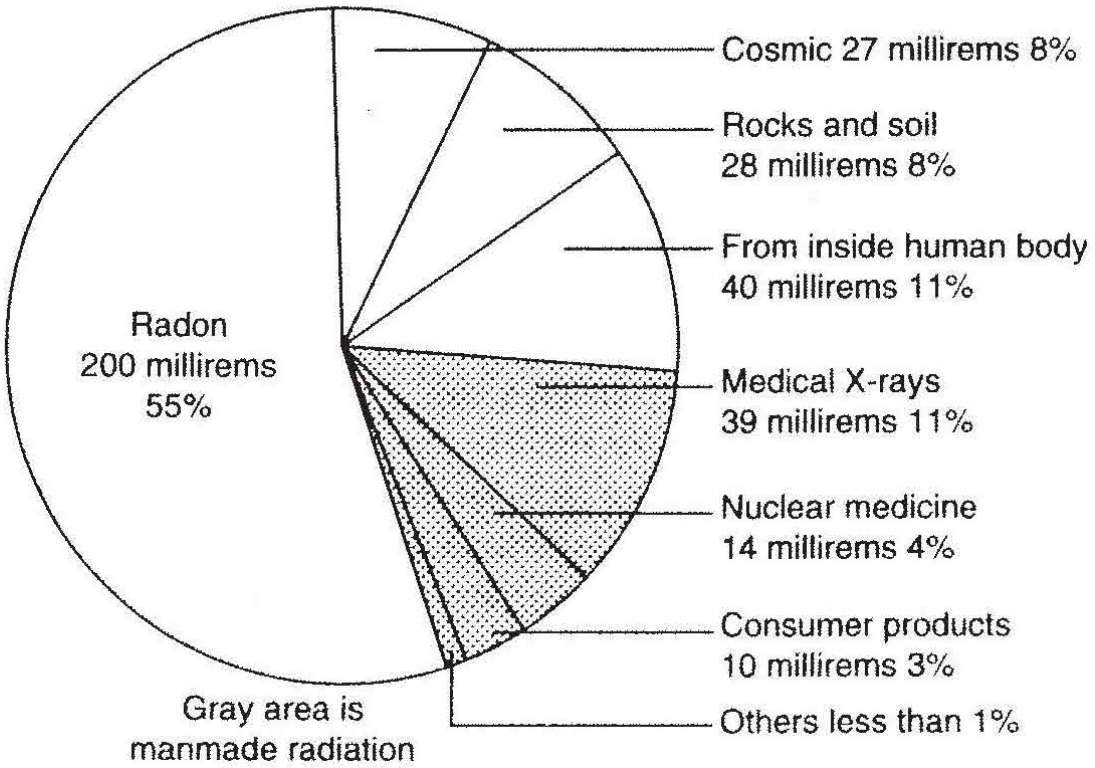


FIGURE 16.1 Annual average radiation exposure to an individual in the United States. The total is 360 millirems (NCRP 93, 1988).

- **Radiation and Cancer**
- **Linear Effect?**

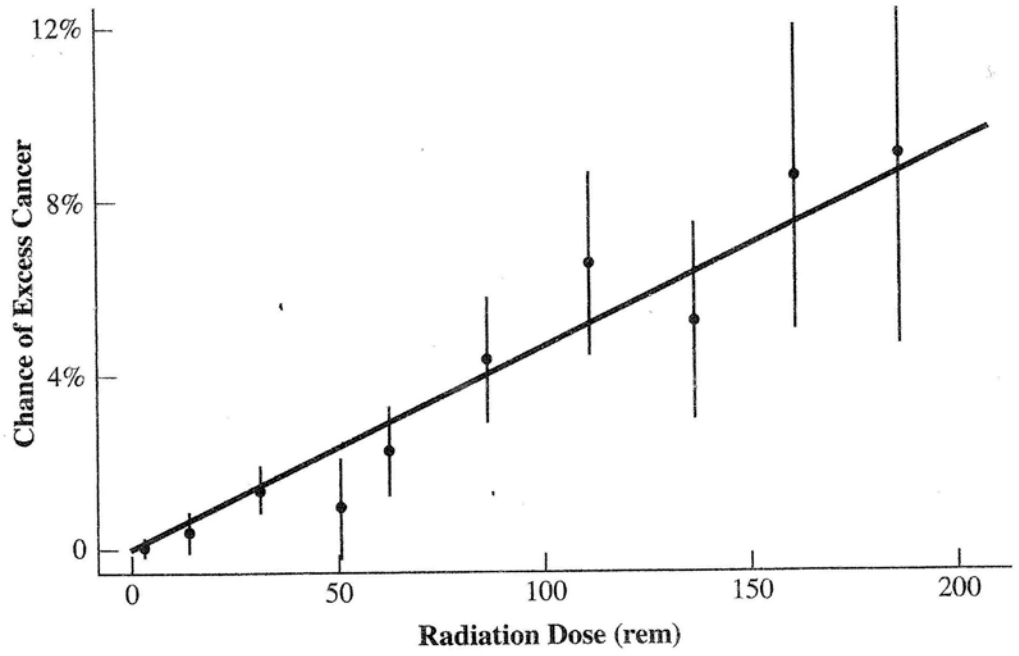


Figure 8.1. Cancer from radiation: the linear effect.

- **Ionizing vs. non-ionizing radiation**
- **Linear Hypothesis**

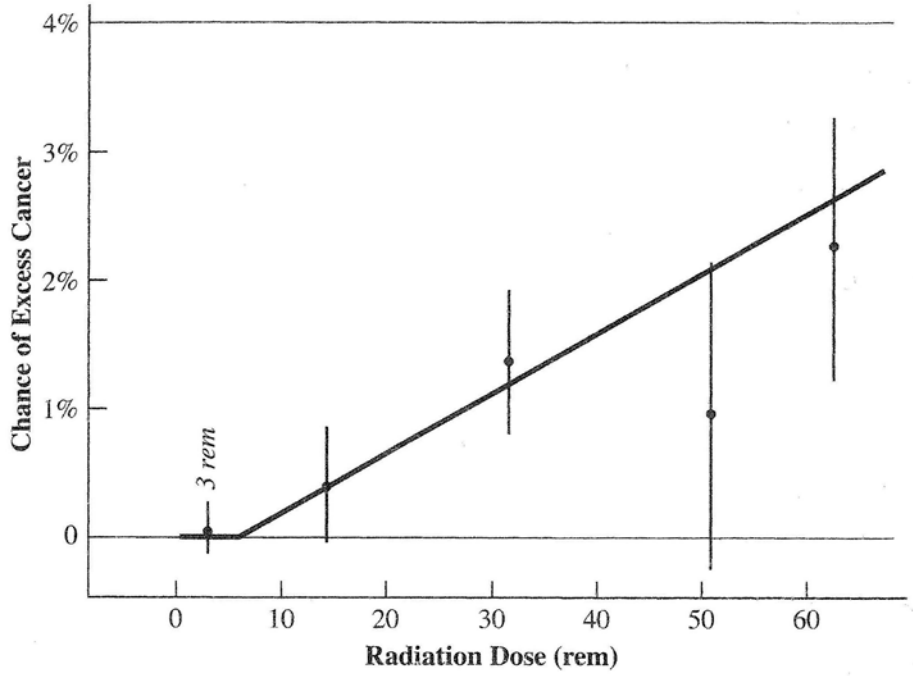
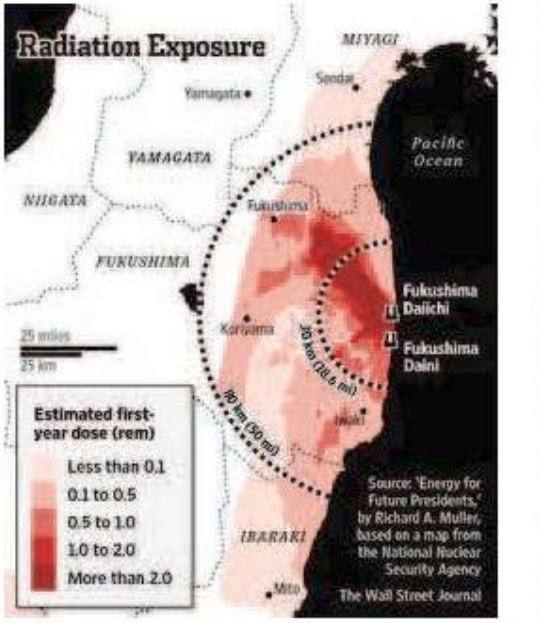


Figure 8.3. Low-dose region of the cancer dose plot, enlarged from Figure 8.2. The bent line is drawn to show what we would expect if there were a cancer threshold of 6 rem.

- **Do you believe in LNT (Linear Non-Threshold)??**
- **What do the numbers look like for Fukushima?**
  - **Muller WSJ article**
    Rings
    Inner 22,000 people
    max dose = 22 Rem
    Next ring 40,000 with
    avg. dose = 1.5 Rem



- **Garwin = 1,500 deaths**
- **Comparison to Denver**
- **Well, what about ocean food chain, concentration?**
- **Finally, how do the numbers compare with Chernobyl?**
- **Is Fukushima “sabotage by nature?”**