Radiation Protection: How Did We Get Here; Where Should We Have Gone?

US Customs and Border Protection’s Approach to Radiation Protection

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Disclaimer

Remarks here represent the historical radiation protection development (1996-2008) used by U.S. Customs & Border Protection.

This presentation is from my recollection.
Historical Perspective

Perspective of three decades of experience:

38 U.S. Nuclear Regulatory Commission Licenses;
 Broad Industrial, SNM, Specific Licenses
 Medical, Irradiator and Homeland Security Uses

2 U.S. Department of Energy SNM Permits; &
2 Canadian Nuclear Safety Commission Licences;
Historical Perspective

Occupational Exposure Protection:

• Material Handlers (e.g., Radiographers)

• Medical Personnel

• Public
Pre and Post 2001 Radiation Protection Priorities

- Handlers & Users
- Medical Personnel
- Public
- Medical Personnel & Patient
- Public
- Handlers & Users

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Roentgen: X-rays Discovered

Marie and Pierre Curie: Radioactive Material

Injuries from both X-ray and Radioactive Material

Protective Devices for X-rays defined

X-ray damage noted

X-ray protection and tests specified

X-ray Lethality noted
Occupational Limits Over Time

- Ionization Units Proposed
- X-ray Mutations Demonstrated
- British Roentgen Ray Adopt Protection Methods
- World War I
- UK X & Material Protection
Occupational Limits Over Time

- **Tolerance Dose Proposed**
- **Tolerance Dose Proposed 0.01 SED/Month**
- **Dutch 1. SED per 90,000 working hours**
- **Roentgen unit adopted**
- **US Advisory Committee X-Ray & Radium**
- **USACXRP Recommends .2R/day**
- **USACXRP 5R/day for Hands**

1921 1925 1930 1935 WW2
Occupational Limits Over Time

- MANHATTAN Project
  - NCRP lowers MPD to .3 R/week & Risk/Benefit
  - ICRP Adopts .3 R/week
- ICRP Recommends MPD of 5 R/year (Occupational)
- NCRP Recommends MPD of 5 R/year (Occupational) & 0.5 R/year for General Population

- US 100 mR Public
  - 500 mR Pregnant

WWII 1950 1960 1990

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Recent

Europe: < 0.05 Sievert/year [5 REM], recommended <0.02 for most years

General Public Exposure: <1 milli-Sievert/year [100milli-REM]
Anti-Terrorism Applications >2001

1) Rapid growth in gamma and x-ray scanning
   - No longer “just in labs or hospitals”

2) Many more uses for Non-Radiation Workers

3) Introduction of Human Scanning
Rapid Fielding of Systems
Non-Radiation Workers

• Goal: To keep below 1milli-Sievert/year
  [100 milli-REM/year]

1 milli-Sievert/year
2,000 hours/year → 0.5 microSv/hour
History

- Exposure levels are verified by:
  - Simulations prior to fielding
  - Control of Training and Trainers
  - Regular verification during use
  - National Treasury Employee Union participation
  - Periodic review by Field Health Physicists
  - Quarterly Radiation Safety Committee