Radiation Safety – Health Physics

Neutron Scattering Summer School 2015

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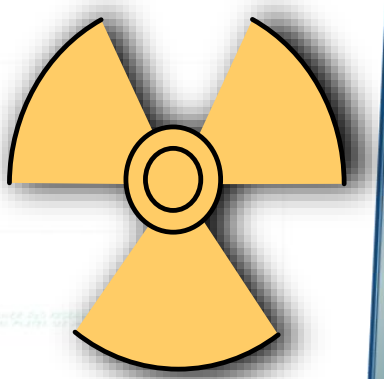
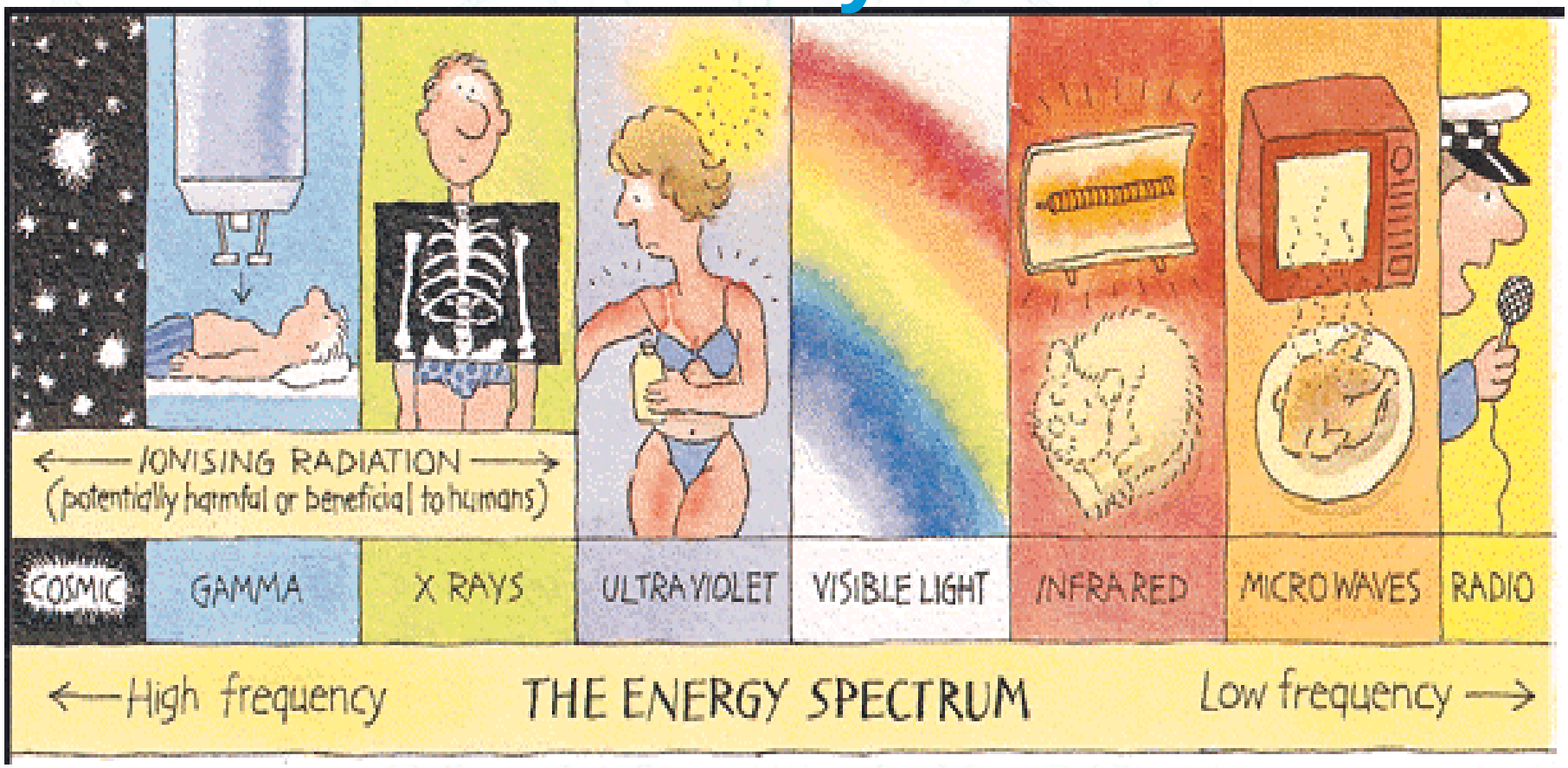
Training Outline



- Radiation, Ionization and Radioactivity
- Radiation Dose
- Radiation Safety
- Questions: x5810, x5815

Electromagnetic Radiation: Gammas and X-Rays



THE ELECTROMAGNETIC SPECTRUM

Radiation Basics

What is Radiation?

Radiation

- Energy moving through space as invisible waves

Non-ionizing Radiation

- Light, sound, heat or infrared waves, microwaves, radio waves, low frequency power line radiation

Ionizing Radiation

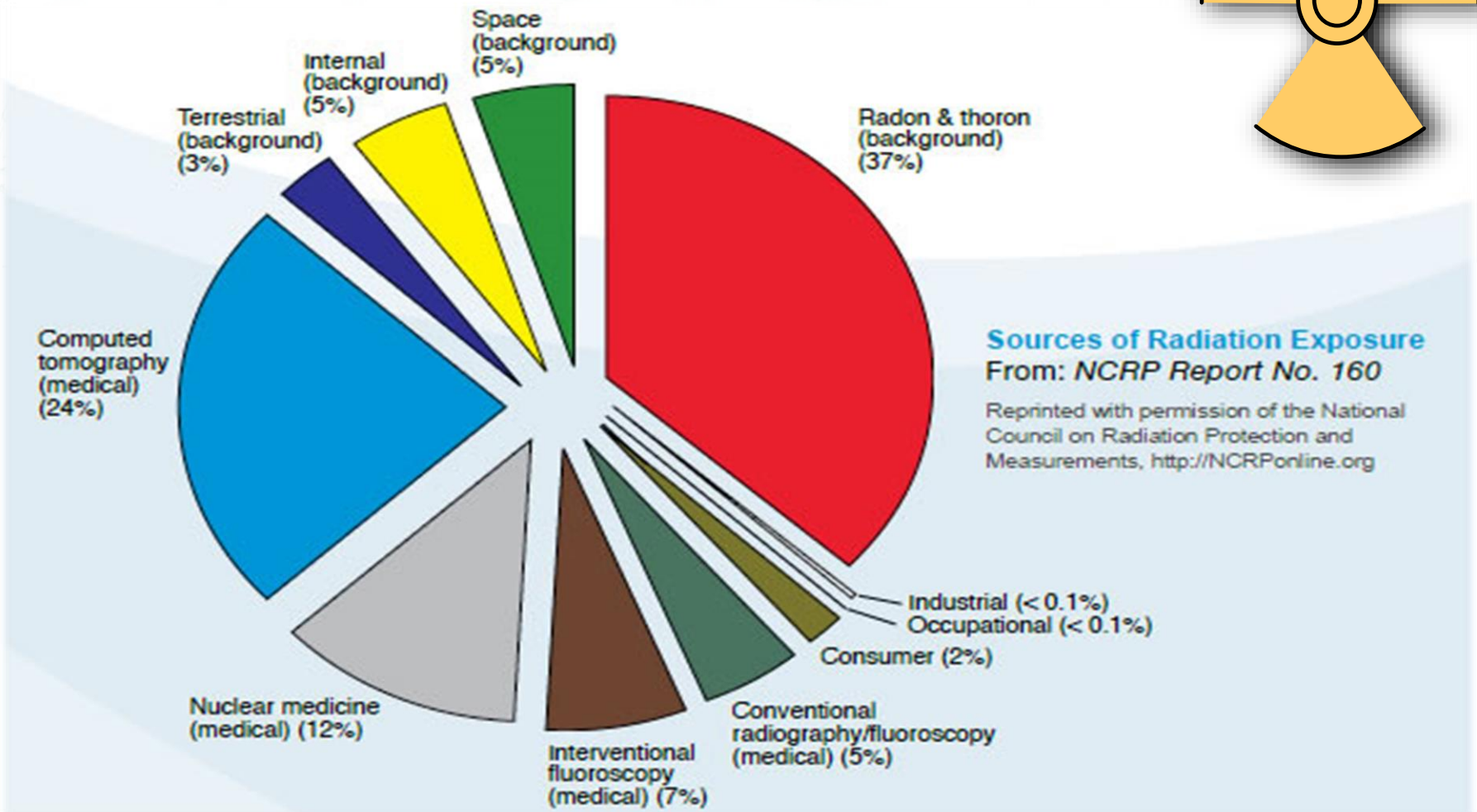
Alpha particles
(Fast moving helium nucleus)

Beta particles
(Fast moving electron)

Neutrons

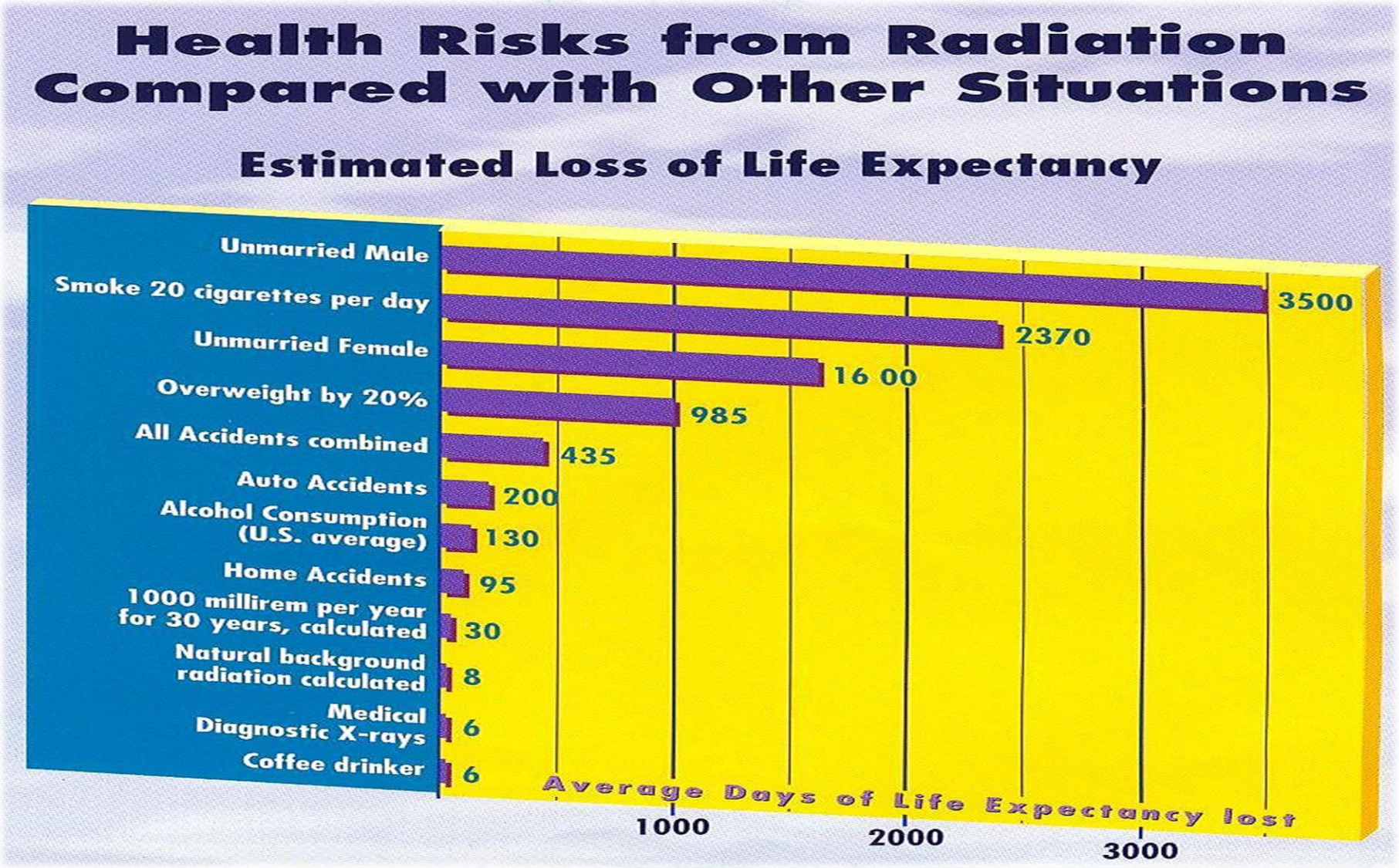
Gamma, X-ray

Background Radiation

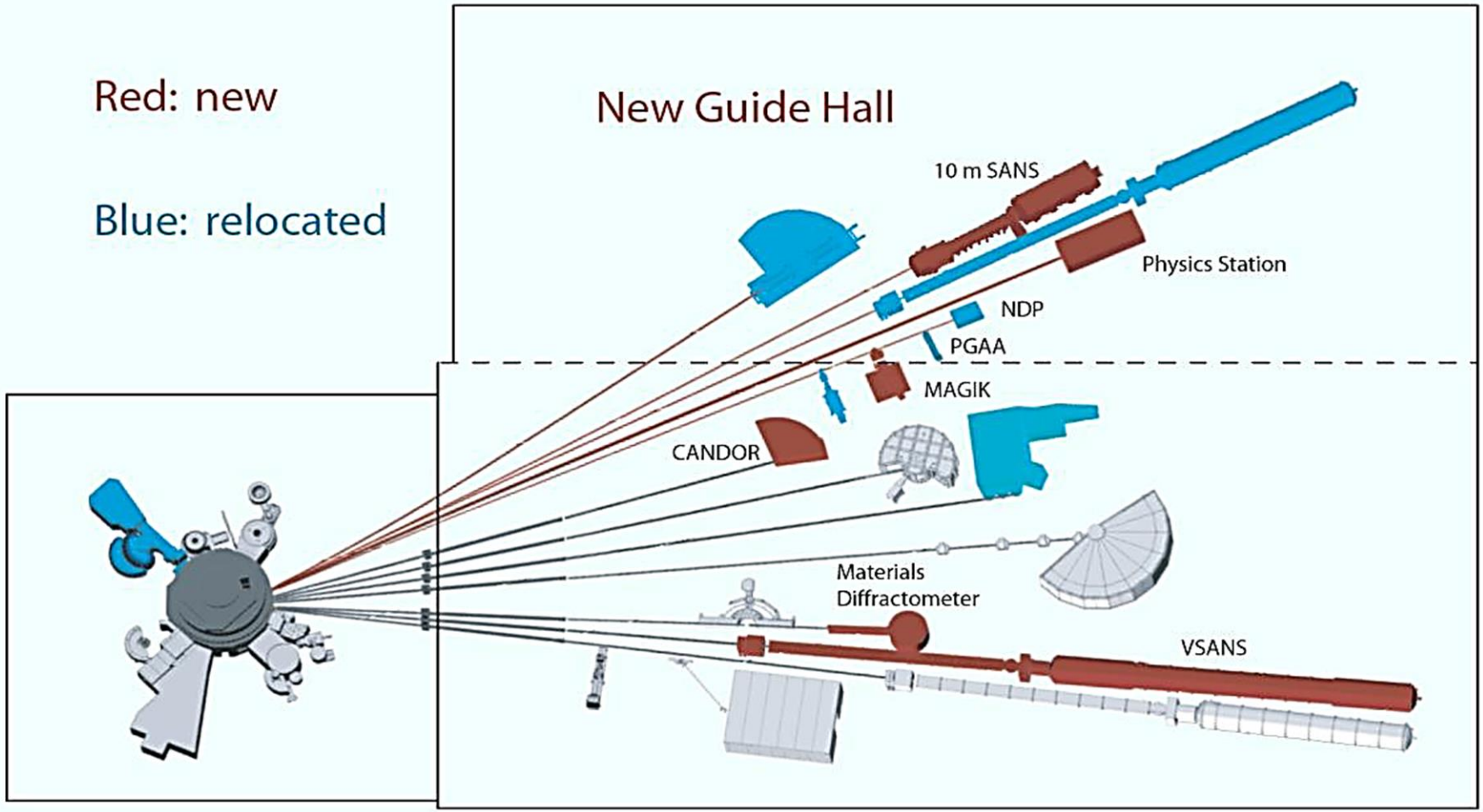


US Average ~ 620 mrem/y

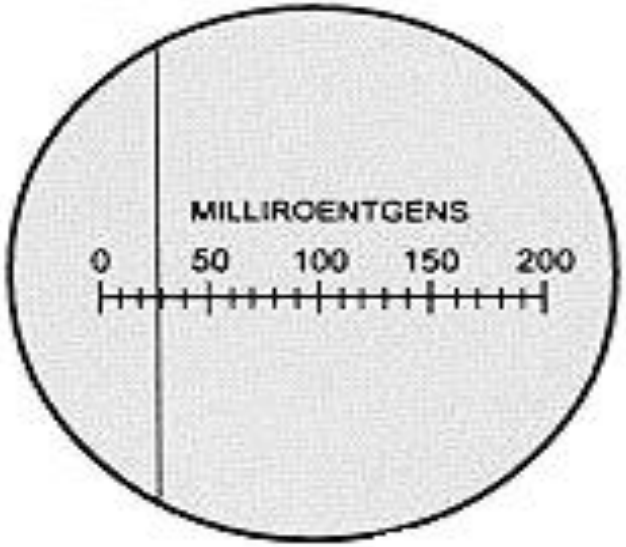
For Comparison



The NCNR Layout



Radiation Dosimetry



Occupational Dose Limit = 5,000 mrem/y

General Public Dose Limit = 100 mrem/y
Average Dose to US Public = 620 mrem/y

Average Dose to NIST Researcher ~ 50 mrem/y

Health Physics Labels/Signs

>5 mrem/h (whole body dose rate)

>100 mrem/h (whole body dose rate)

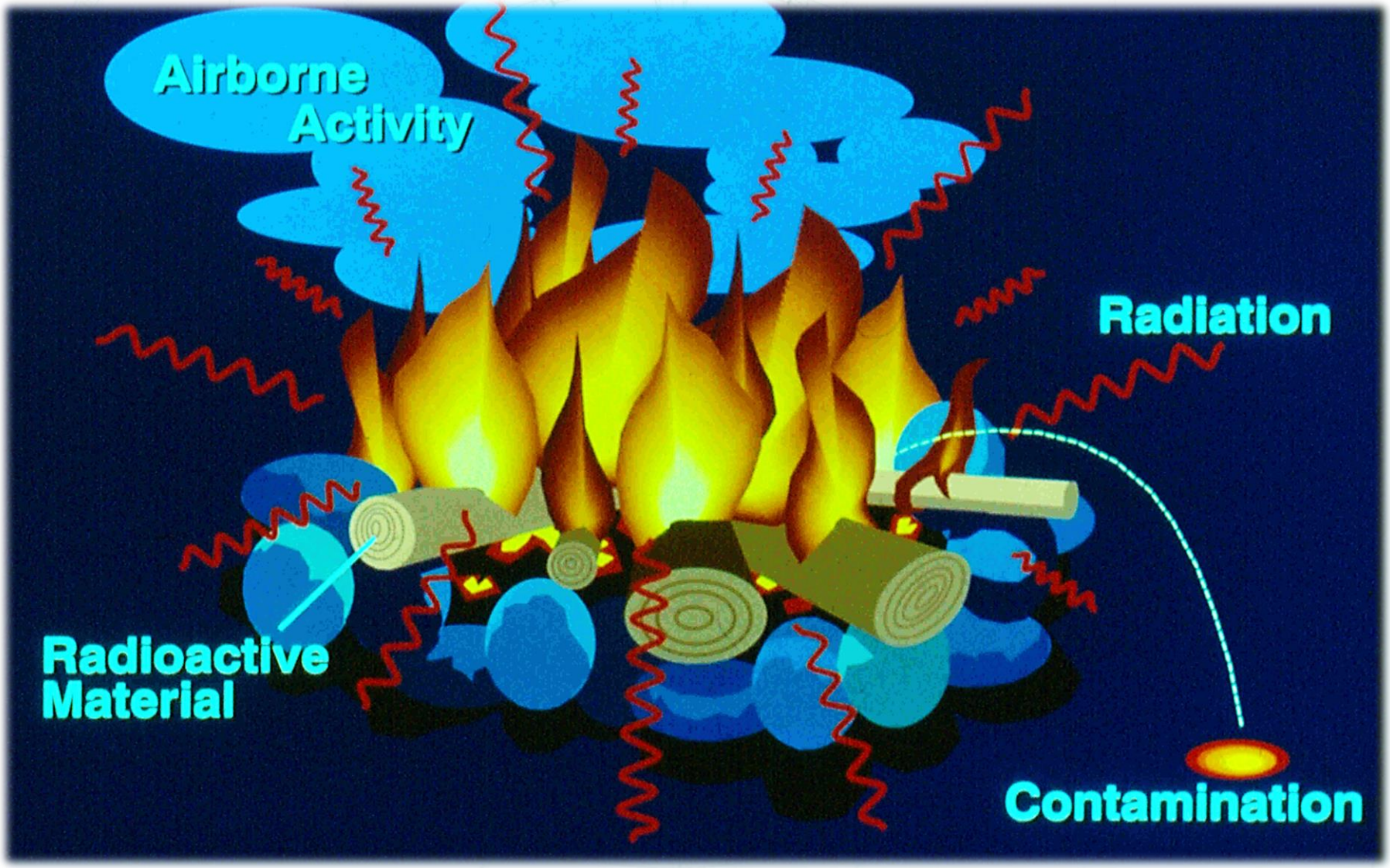
~100,000 mrem/h (localized dose rate)

Contamination Control

Always monitor yourself and items you have with you when leaving a controlled area.

Radiation Detection / Measurement

Campfire Analogy



Time, Distance, and Shielding

Time, Distance, Shielding...

Time	Reduce the duration of exposure
Distance	Increase distance between and the source
Shielding	Place shielding between personnel and the source

Shielding Formula

$$I = I_0 e^{-\mu x}$$

- I = Radiation intensity after shielding
- I_0 = Radiation intensity before shielding
- e= logarithm base e (2.178)
- μ= linear attenuation coefficient
- x= thickness of shielding material in centimeter(s)

Ionizing Radiation

Questions?

x5810, x5815