



**Radiation Safety  
Institute of Canada**  
Institut de radioprotection du Canada



Lunch, Learn, & Dance  
Wellness Webinars

February 11, 2021

# **Radiation Awareness for Health Care Workers**

Followed by STEPs Dance

**Good Science in Plain Language®**



- Audio and video
  - Will be from the presenters only
  - Use computer or telephone (call in)
  - Computer seems to give the best sound quality
- Use the “Chat” feature to enter comments
- Use the “Questions” feature to ask questions
- Posted on webinar page
  - Video, Q&A answers, copy of the slides
- Follow up email will be sent
  - Topics covered, time of attendance
- It may be possible to change your Zoom view if the controls are hiding the closed captioning.

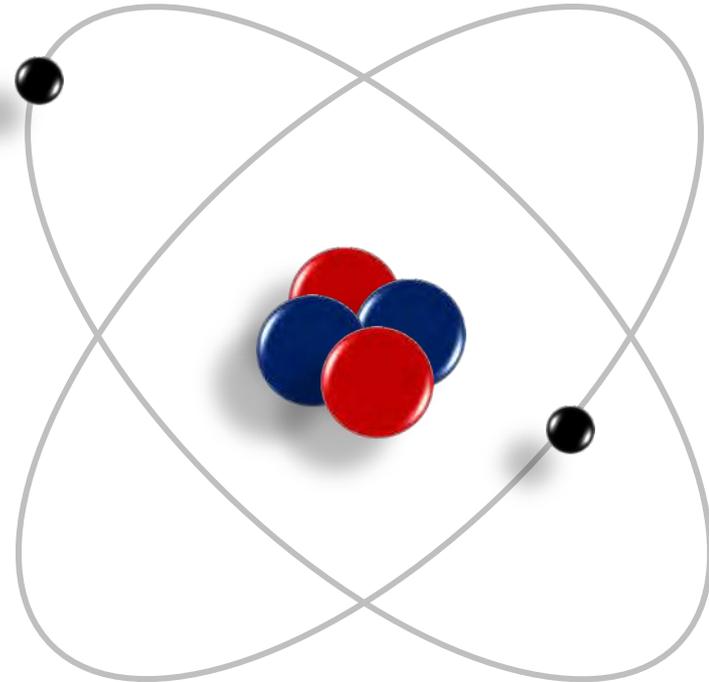


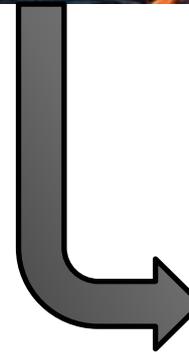
- Overview of radiation
- Effects of radiation on people
- Background radiation
- Radiation in medicine
- Radiation protection
- Types of exposures
- Regulatory bodies and regulation
- Contacts
- Find out more



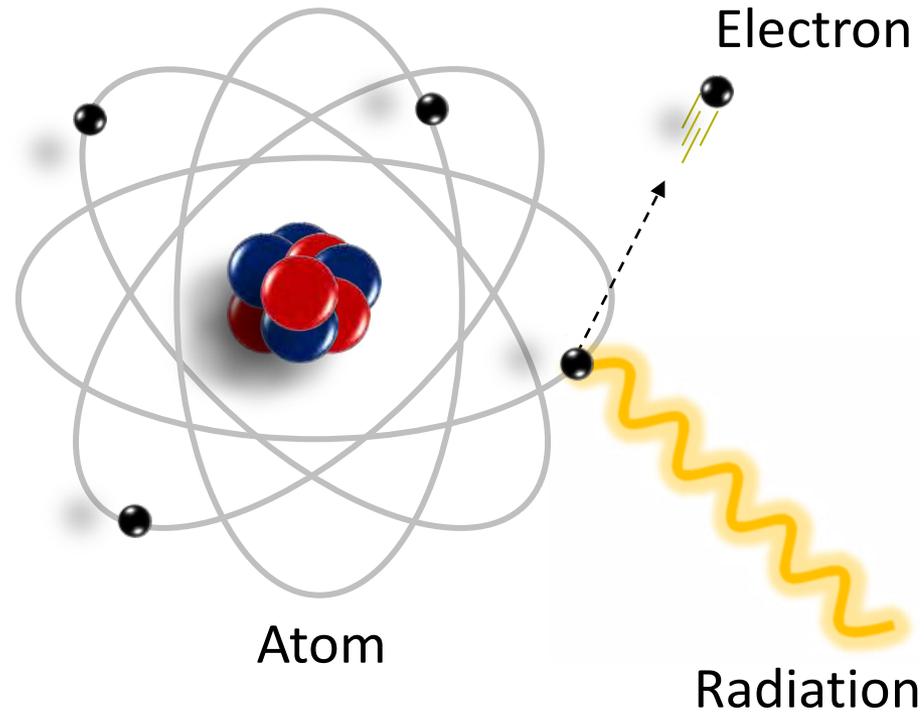
The atom is composed of:

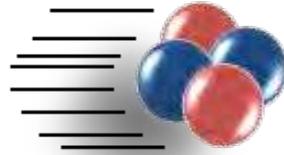
-  **protons (+),**
-  **neutrons (0),**  
and
-  **electrons (-).**











**Roughly 7 cm in air**



**Stopped by a sheet  
of paper**



**Absorbed in dead  
layer of skin**



**Roughly 200 cm in  
air**



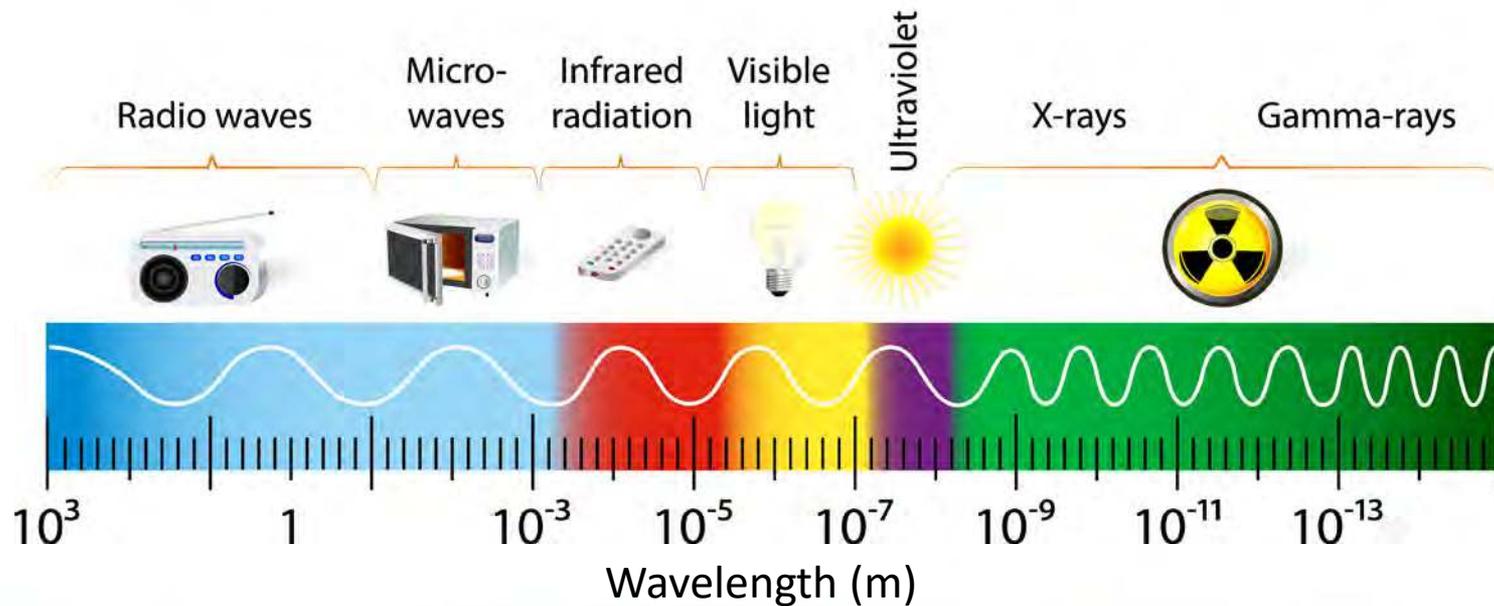
**Stopped by a glass  
and plastic**

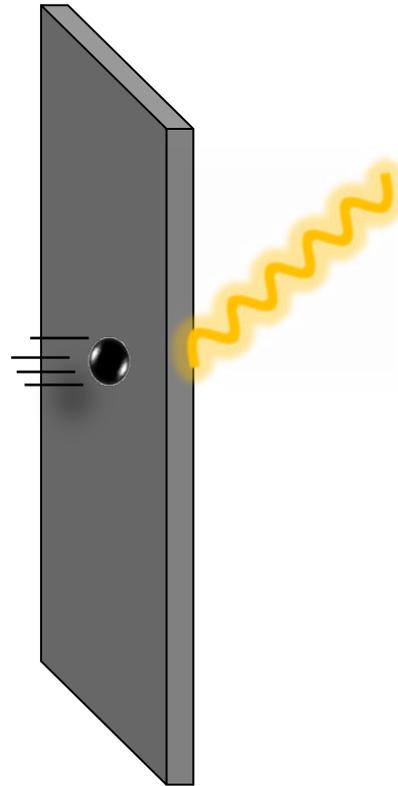


**Can reach the living  
layer of skin**



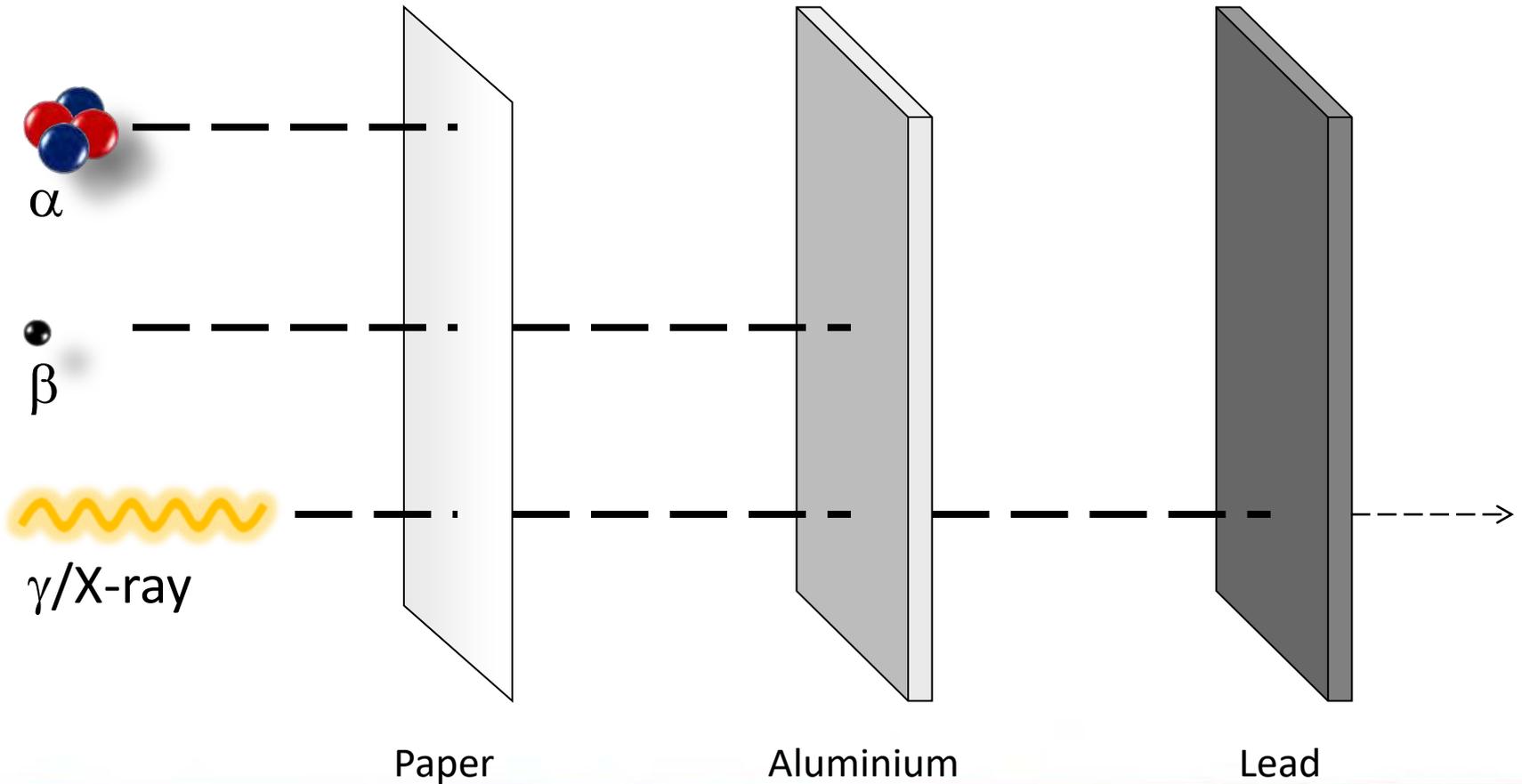
## THE ELECTROMAGNETIC SPECTRUM

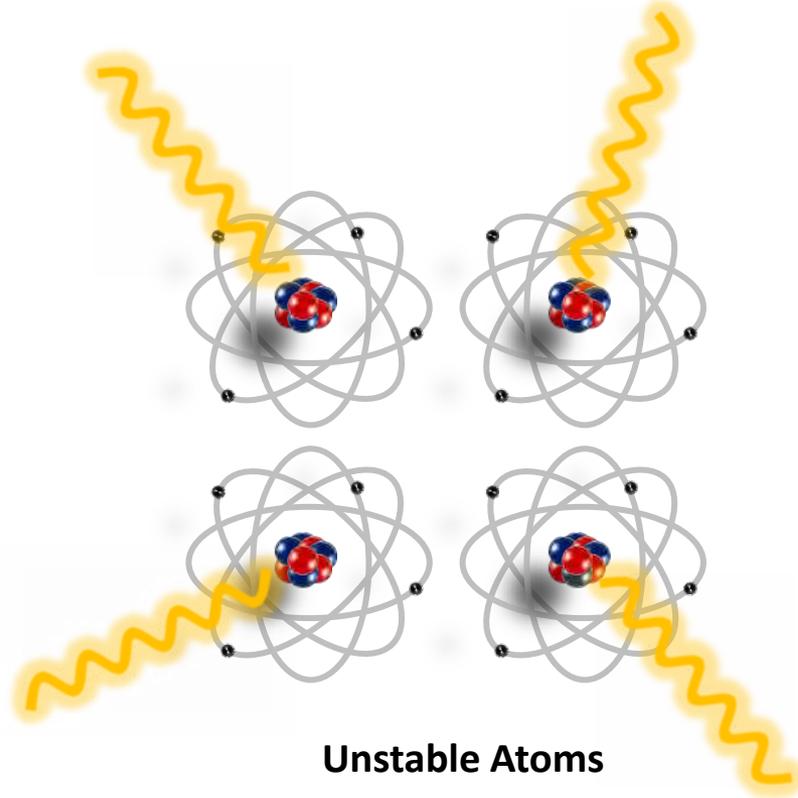




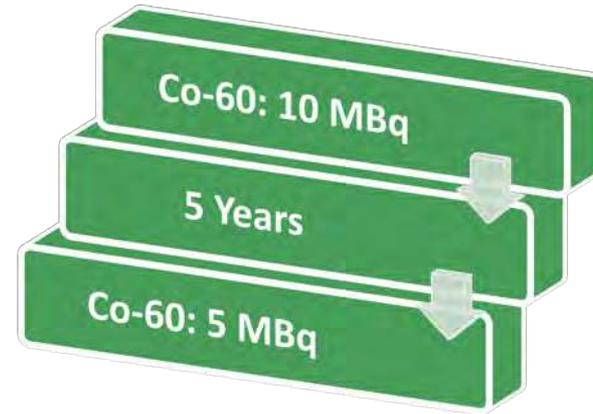
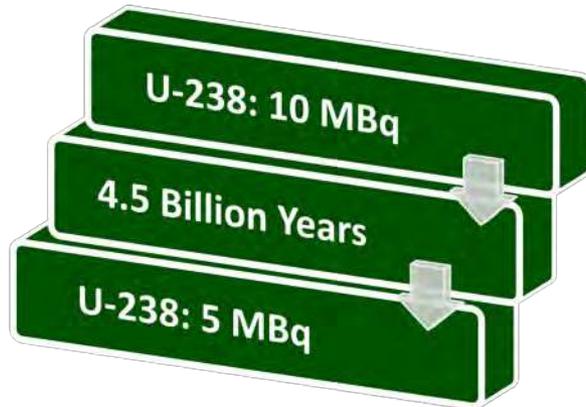


# Radiation Penetrating Power





**Unstable Atoms**



## Rule of Thumb

7 half-lives leaves only 1% of the initial activity remaining.  
10 half-lives leaves only 0.1% remaining.

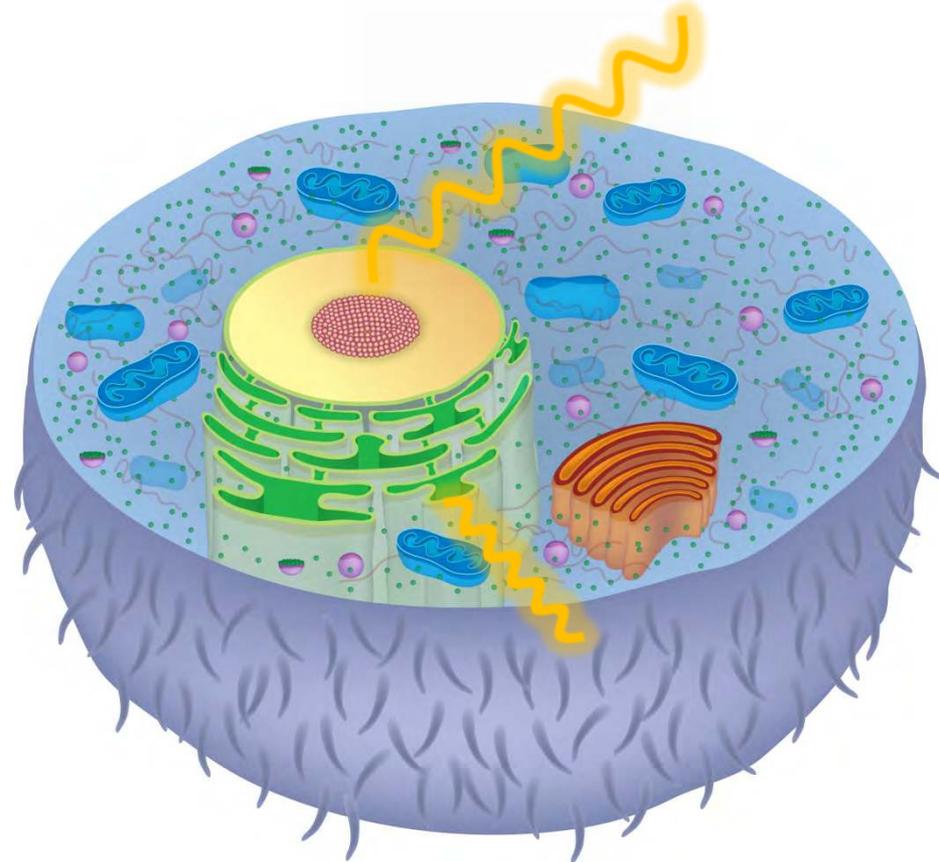


- High energy radiation
  - Can remove electrons from atoms
- Living things have trillions and trillions of atoms
- Radiation interacts the same with atoms in living and non-living things
- Damaging atoms in a person may lead to detrimental health effects
- Effects depend on
  - Energy
  - Amount
  - Duration





- Possible outcomes:
  - No damage
  - Damage, but repaired,
  - Damage, cell dies
  - Damage to DNA, causing a mutation





- Energy given to the body by radiation per unit mass
- Measure in Gray (Gy)

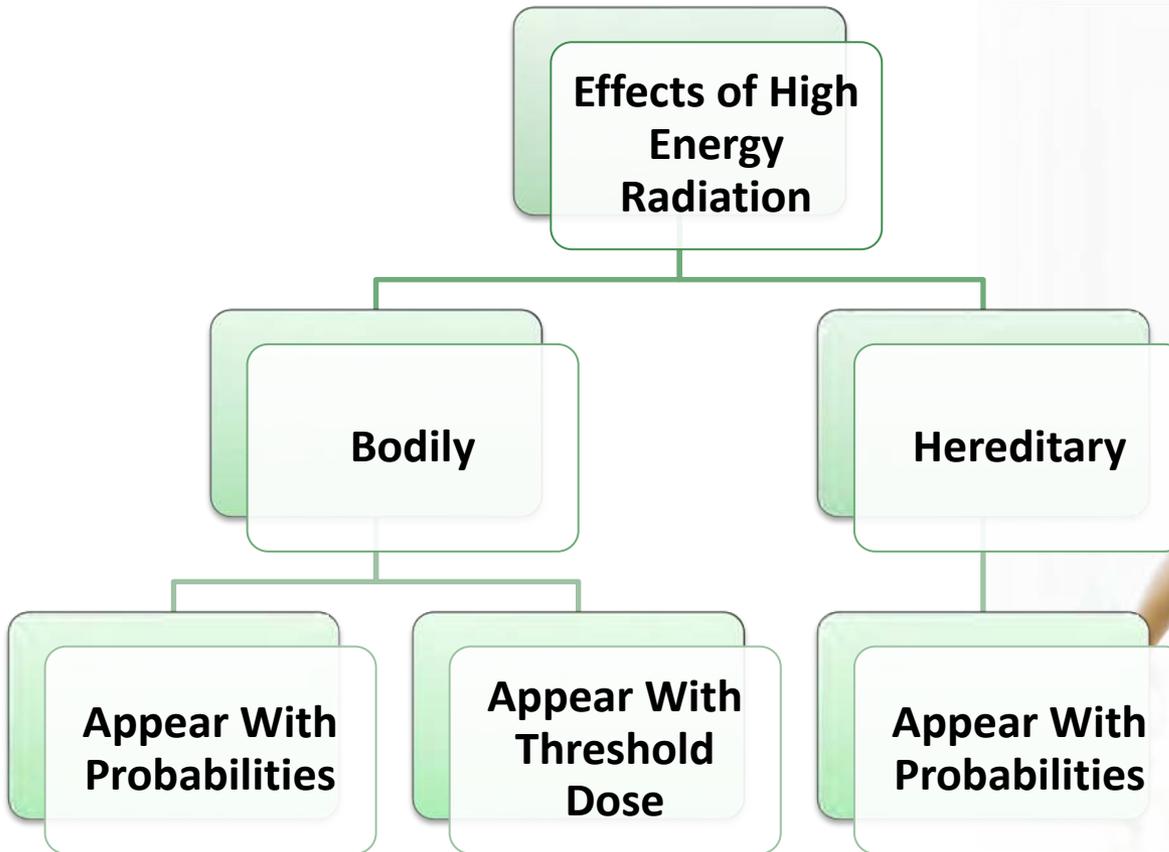
## Absorbed Dose

## Equivalent Dose

- Absorbed dose that also takes the type of radiation into account.
- Measure in Sieverts (Sv)

- Equivalent dose that also looks at the sensitivity of specific tissues to radiation.
- Measure in Sieverts (Sv)

## Effective Dose





## Threshold Effects

Effects do not appear until a minimum amount of dose is received, above the threshold effects will occur.

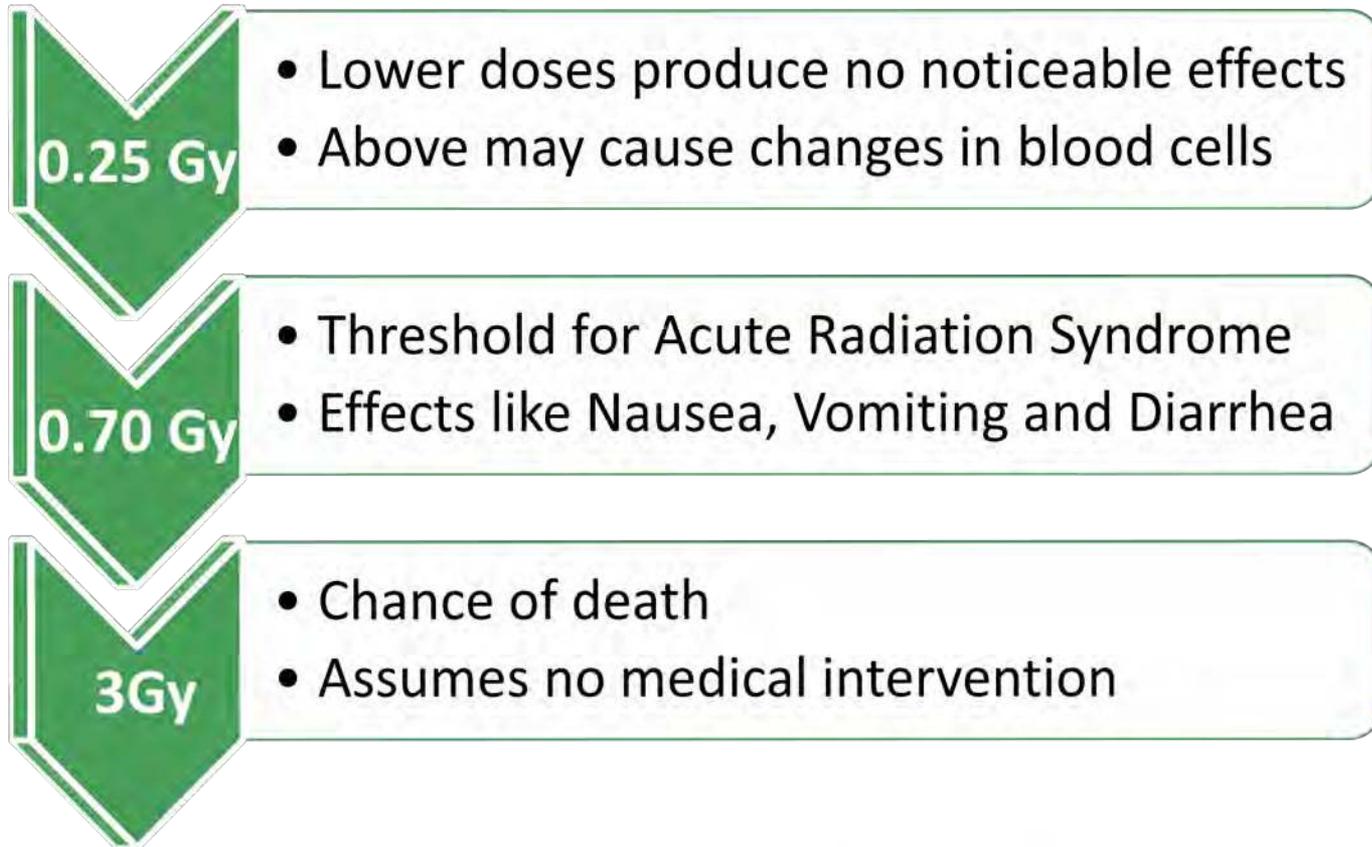
Common examples are effects like nausea, burns or death. Thresholds are very high above typical occupational doses.

## Probabilistic Effects

Any increase in radiation dose increases the chance of observing the effect.

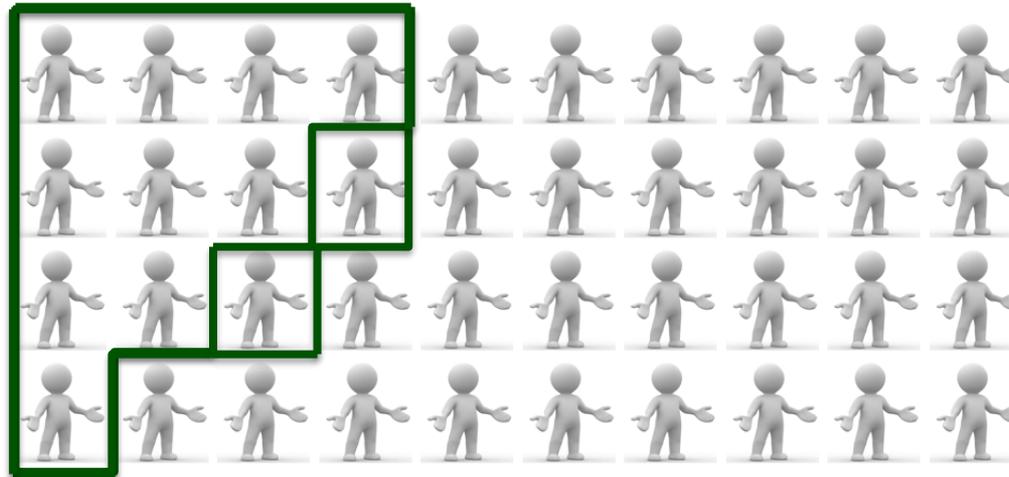
Most common example would be developing a fatal cancer from an exposure to radiation.







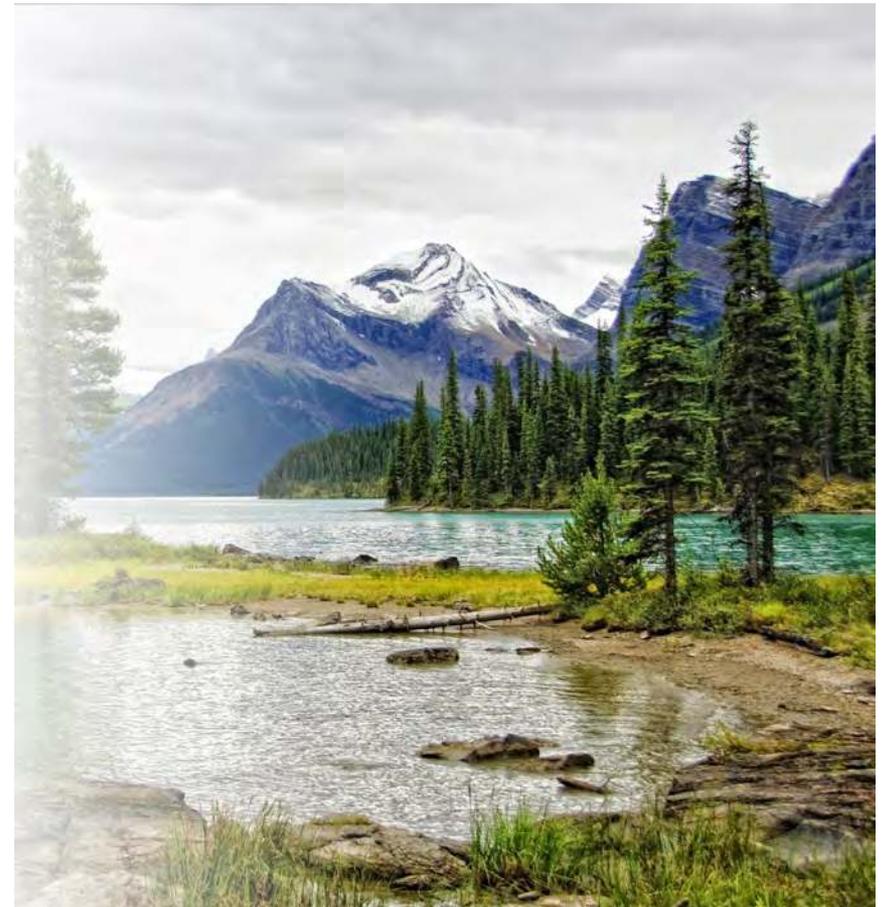
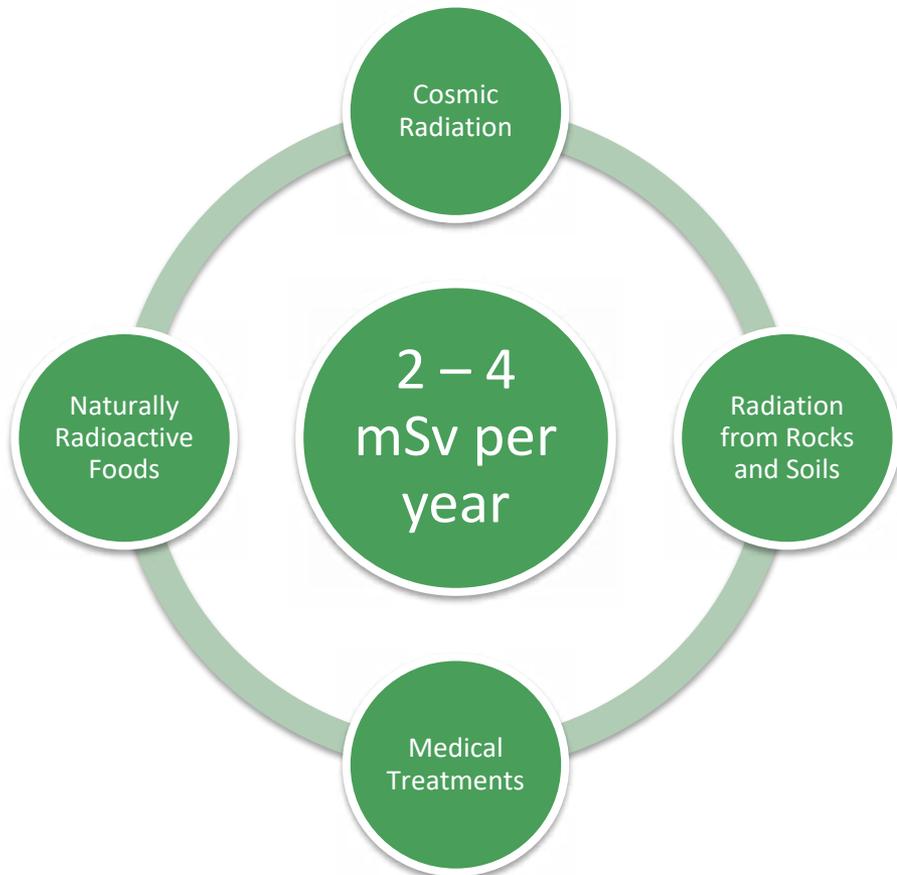
- 1 Sv (1000 mSv) corresponds to 4% increase in risk
- In Canada – 25% to 29% risk of fatal cancer





- Potential health effects to unborn child and their offspring
- Could happen as a result of egg or sperm mutating as a result to exposure to radiation
  - Then child conceived with this egg or sperm
- Has never been measured in humans
- Has been observed in mice studies





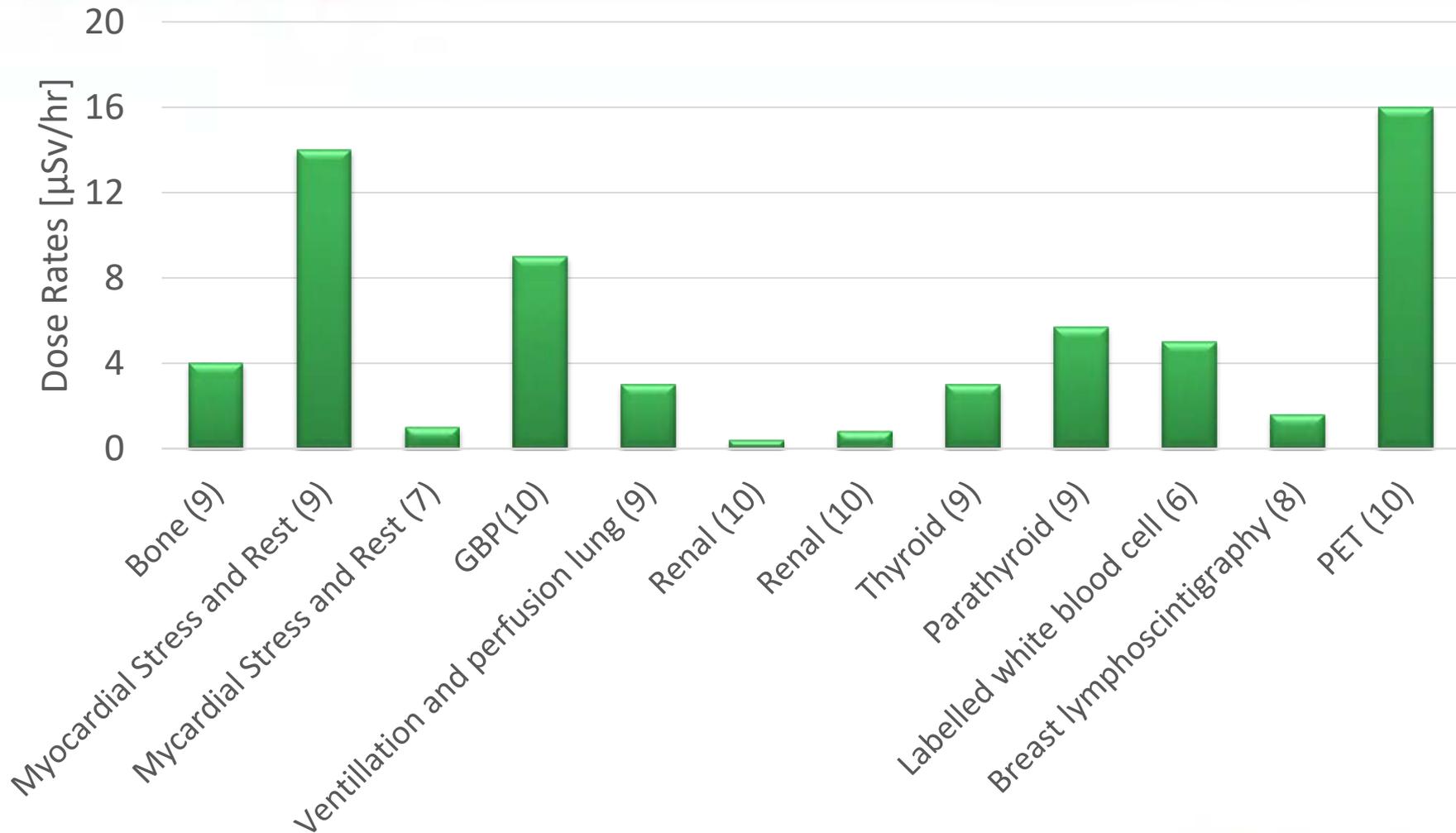


- Radiation used throughout modern medicine
  - Diagnostic x-ray
  - Nuclear medicine
  - Radiation therapy
- 28,000 nuclear medicine procedures per week
  - 80% use technetium-99m
- External sources
  - Beta, x-ray, or gamma
- Internal sources
  - Nuclear medicine or brachytherapy



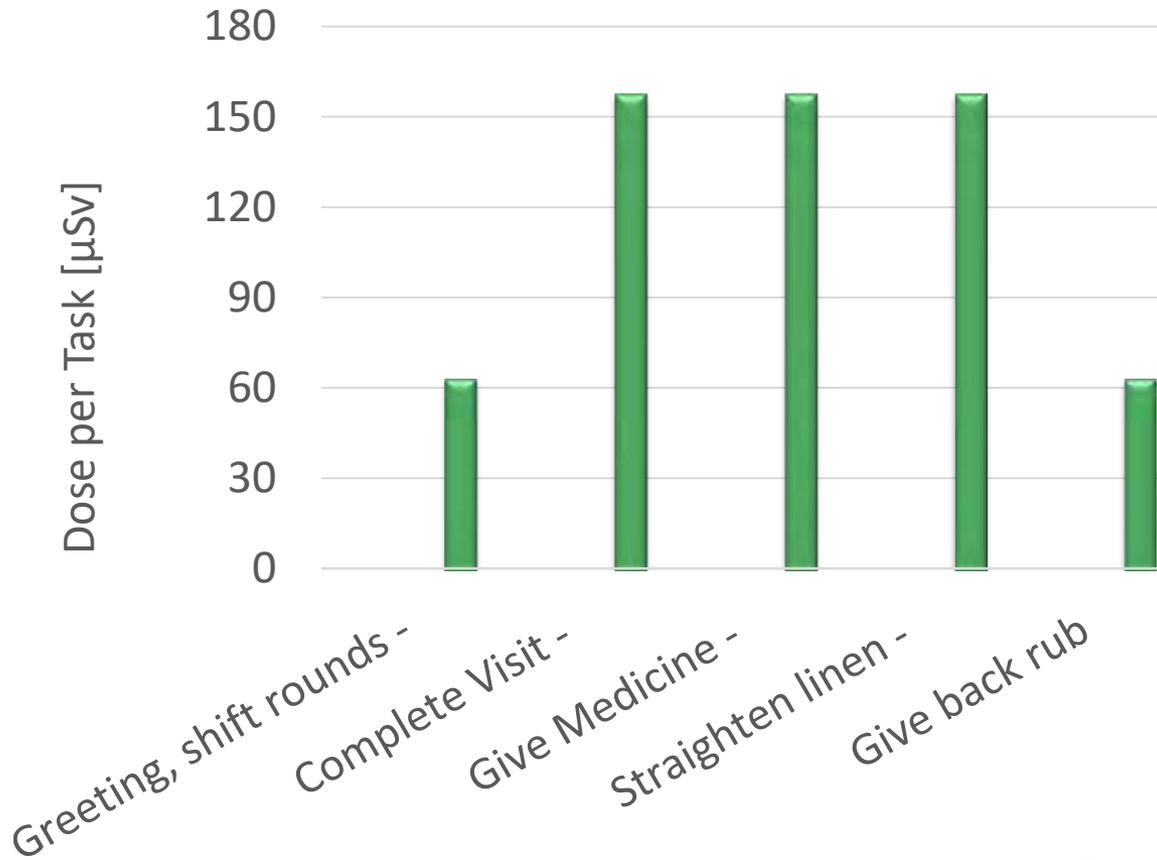
# Dose Rates for Medical Medicine Patients

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# Typical Doses to Care Providers





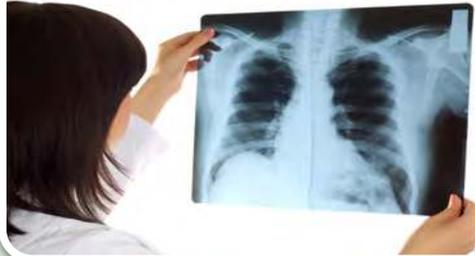
- Designated areas for nuclear medicine, x-rays, etc.
- Rooms that contain sources must have symbol posted
- Primary means of protection
  - May not be needed if dose rate below 25  $\mu\text{Sv/h}$  or quantity is below a certain level
- First responders look for additional information if they see the sign
  - Source, dose rate
- Rayonnement – Danger – Radiation
- Black/Magenta symbol on yellow





# Once You Become Aware of The Radiation





## External Exposure

- Outside source
- Ex: close proximity to patient
- Exposure lowers or ends with enough distance kept



## Internal Exposure

- The body contains a source
- Exposed from within
- Source was ingested, inhaled, absorbed or inserted
- Cannot walk away from source



## Radiation Protection Principles:

Time

Distance

Shielding





# Shielding to Reduce Exposure



## Lead

- Commonly used to shield gamma radiation
- Included in apron liners or room construction



## Glass and Plastic

- Not very effective shield for gamma radiation
- More common for beta radiation



## Water

- Poor shield for gamma radiation
- Similar to concrete: a lot needed to make a difference



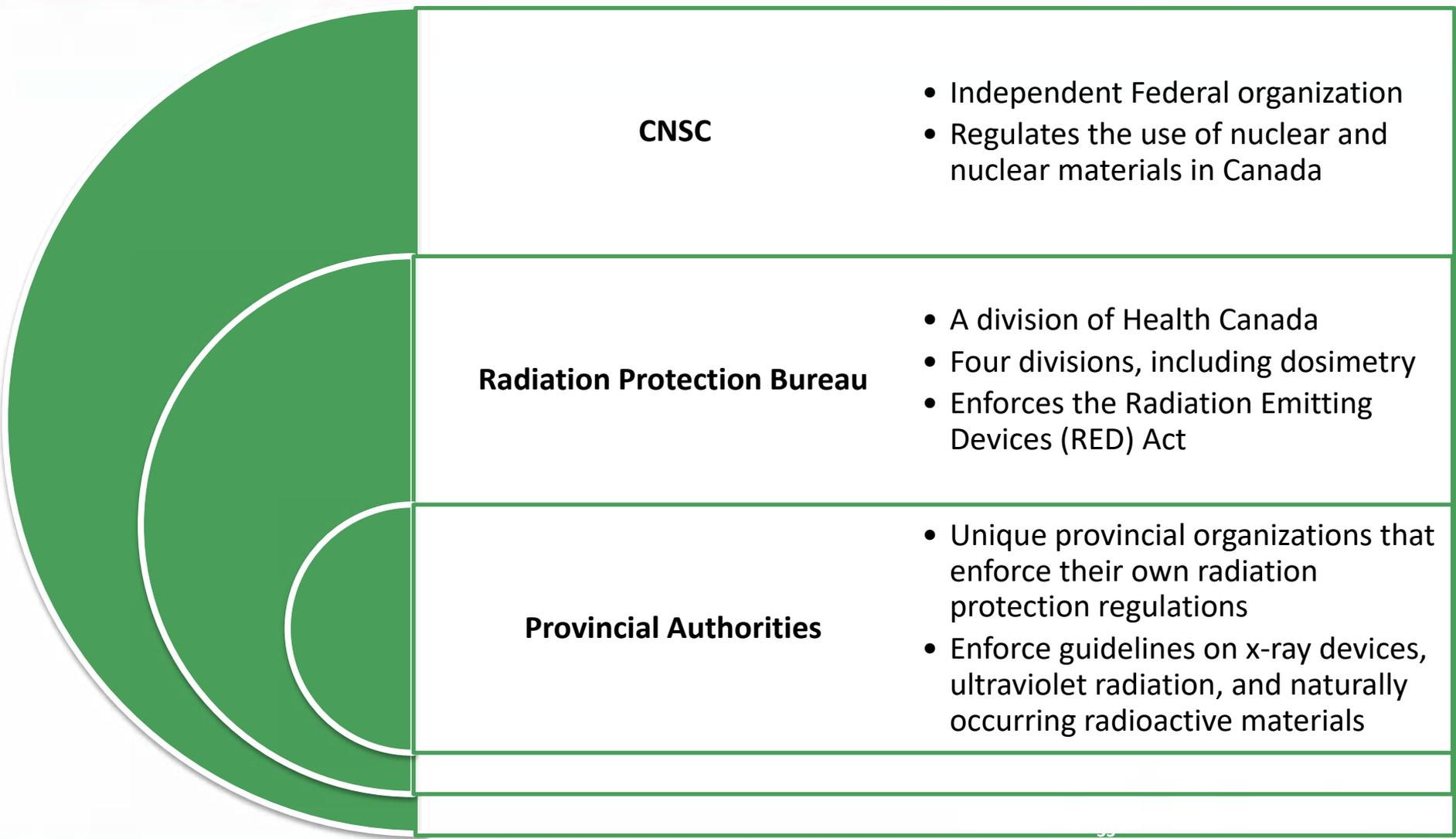
**Wash your hands**

**Wear PPE**



# Radiation Protection Authorities

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## Nuclear Safety and Control Act (NSCA est. May 31, 2000)

### Limits the risks to:

- National Security,
- Health and Safety of Persons, and
- the Environment

### With respect to:

- Nuclear Energy,
- Nuclear Substances,
- Prescribed Equipment,
- Prescribed Information

### Regulator:

- Canadian Nuclear Safety Commission (CNSC)





The CNSC provides licences

Include obligations for

- License holder
- Management
- Workers



In order to protect

- People
- Environment
- National security

For example, must make available

- Health and safety info
- Copies of licence







**Canadian Nuclear Safety Commission**

website: <http://www.cnsccsn.gc.ca/>  
phone: 1-800-668-5284  
email: [info@cnsccsn.gc.ca](mailto:info@cnsccsn.gc.ca)



**Radiation Protection Bureau**

website: <http://www.hc-sc.gc.ca/ahc-asc/branch-dirgen/hecs-dgsesc/sep-psm/rpb-br-eng.php>  
phone: 1-866-225-0709  
email: [ccrpb-pcrpcc@hc-sc.gc.ca](mailto:ccrpb-pcrpcc@hc-sc.gc.ca)



**Radiation Safety Institute of Canada**

website: <http://www.radiationsafety.ca/>  
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- For further information on all types of radiation contact us at:

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