



**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.

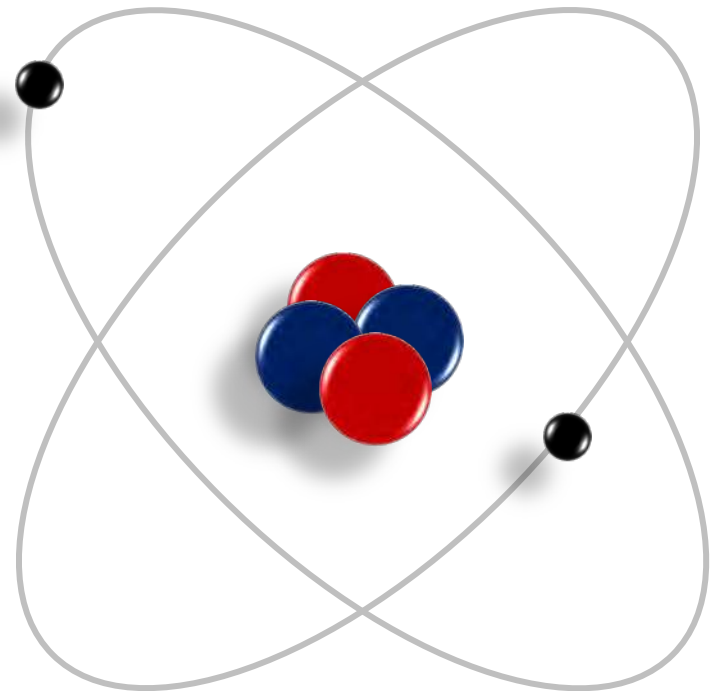


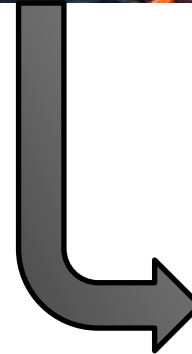
- Overview of radiation
- Effects of radiation on people
- Background radiation
- Radiation in medicine
- Radiation protection
- Types of exposures
- Regulatory bodies and regulation
- Contacts
- Find out more



The atom is composed of:

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



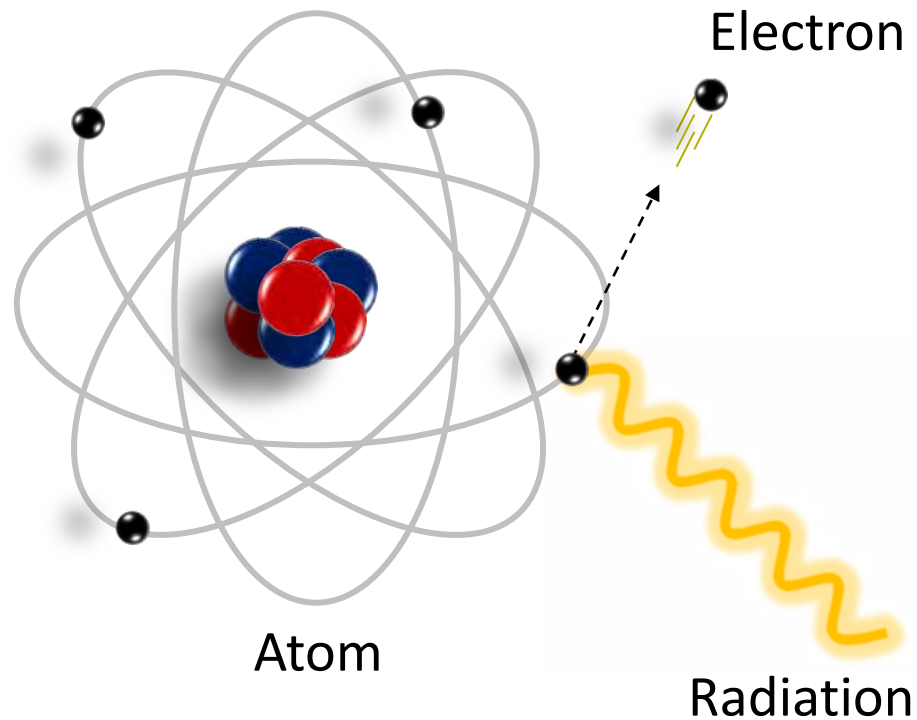


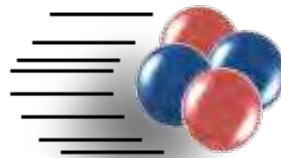


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Radiation and Energy







Roughly 7 cm in air



**Stopped by a sheet
of paper**



**Absorbed in dead
layer of skin**



**Roughly 200 cm in
air**



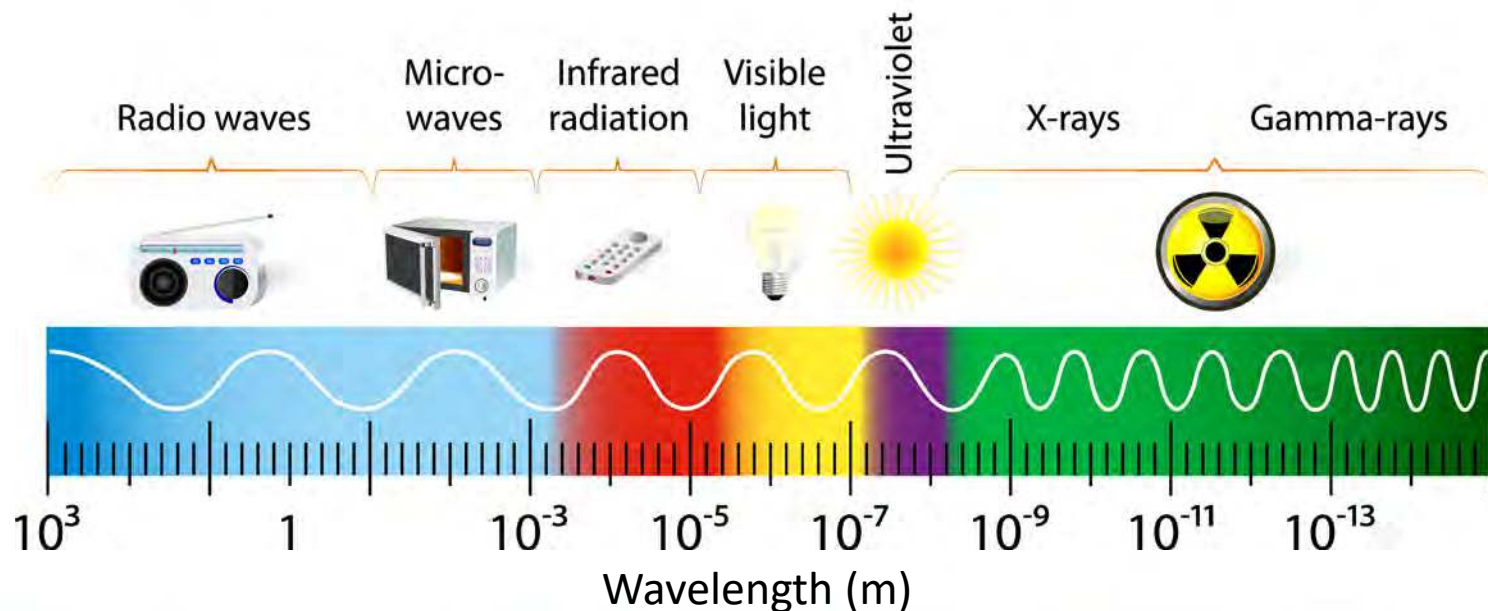
**Stopped by a glass
and plastic**

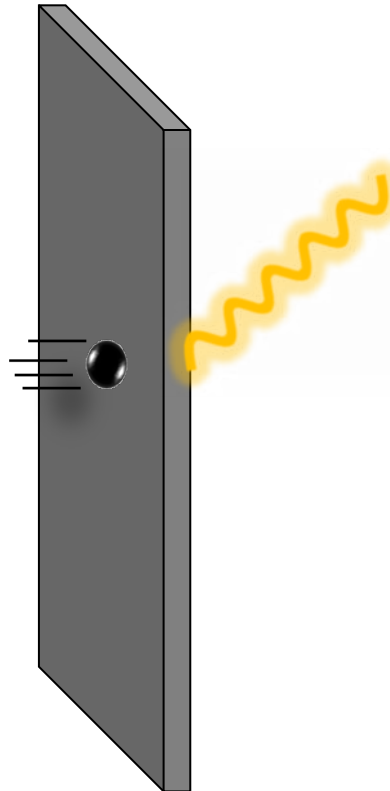


**Can reach the living
layer of skin**



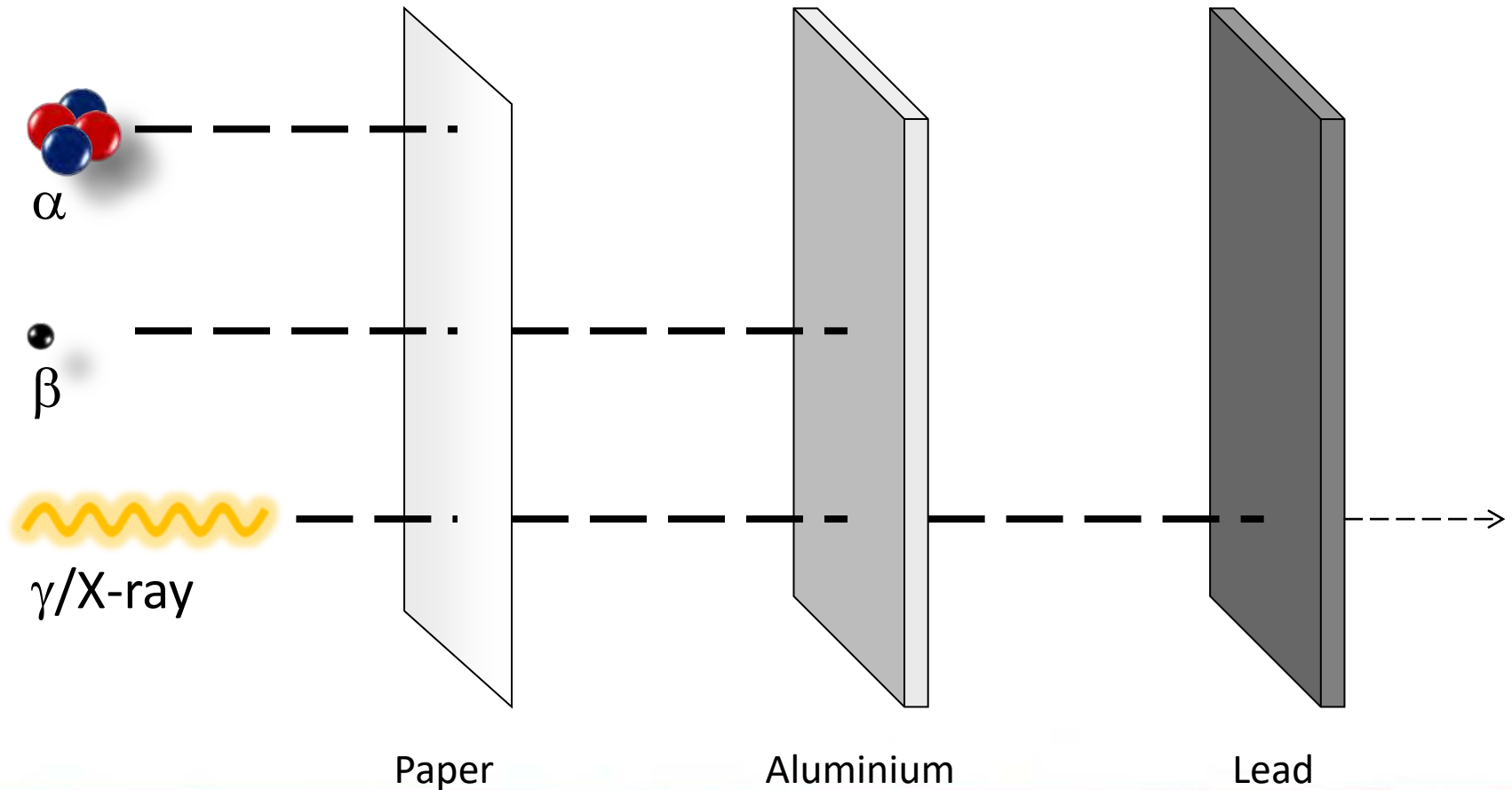
THE ELECTROMAGNETIC SPECTRUM

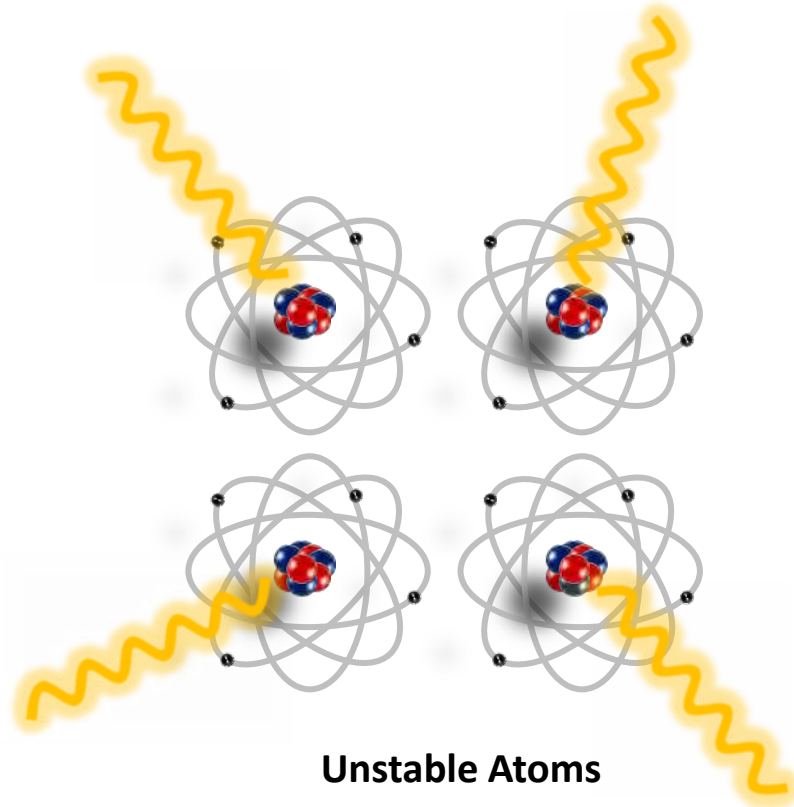


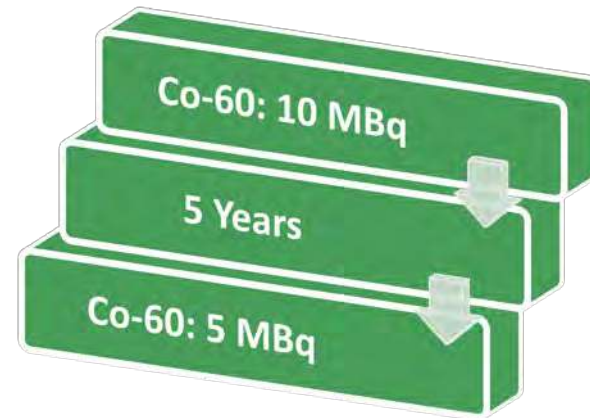
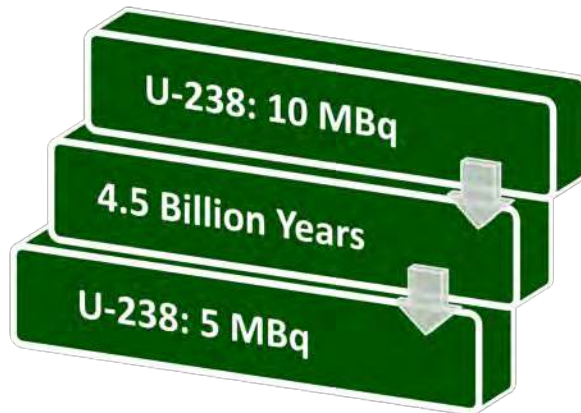




Radiation Penetrating Power







Rule of Thumb

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

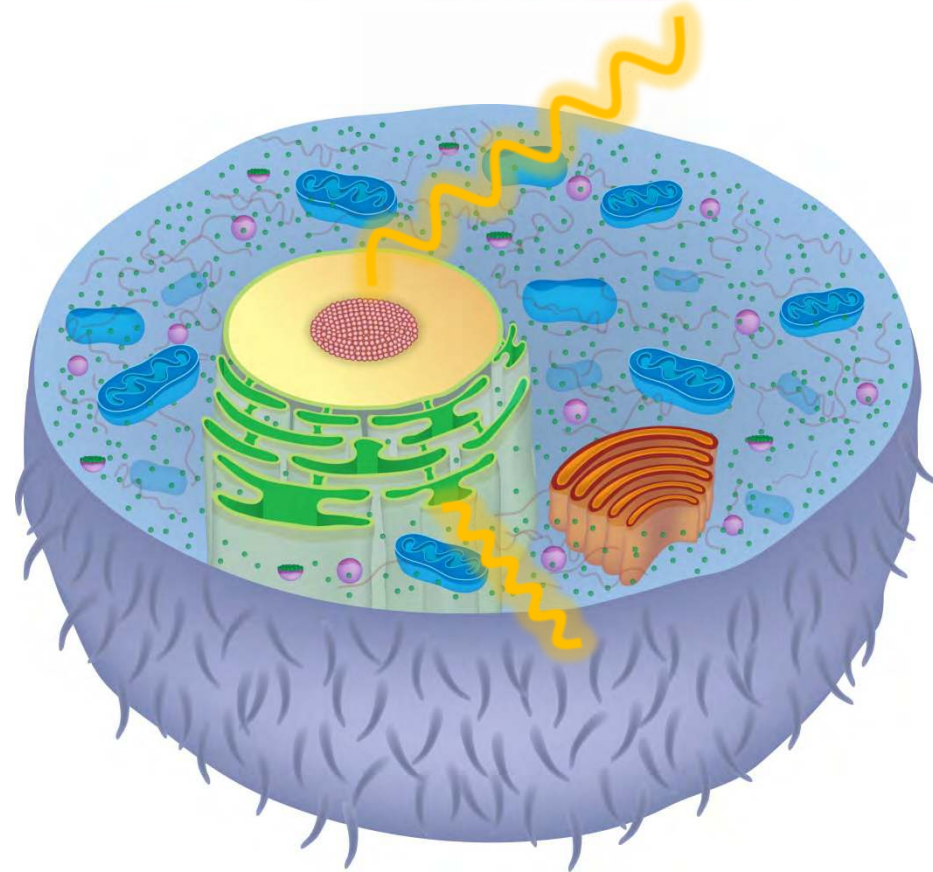


- High energy radiation
 - Can remove electrons from atoms
- Living things have trillions and trillions of atoms
- Radiation interacts the same with atoms in living and non-living things
- Damaging atoms in a person may lead to detrimental health effects
- Effects depend on
 - Energy
 - Amount
 - Duration





- 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

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

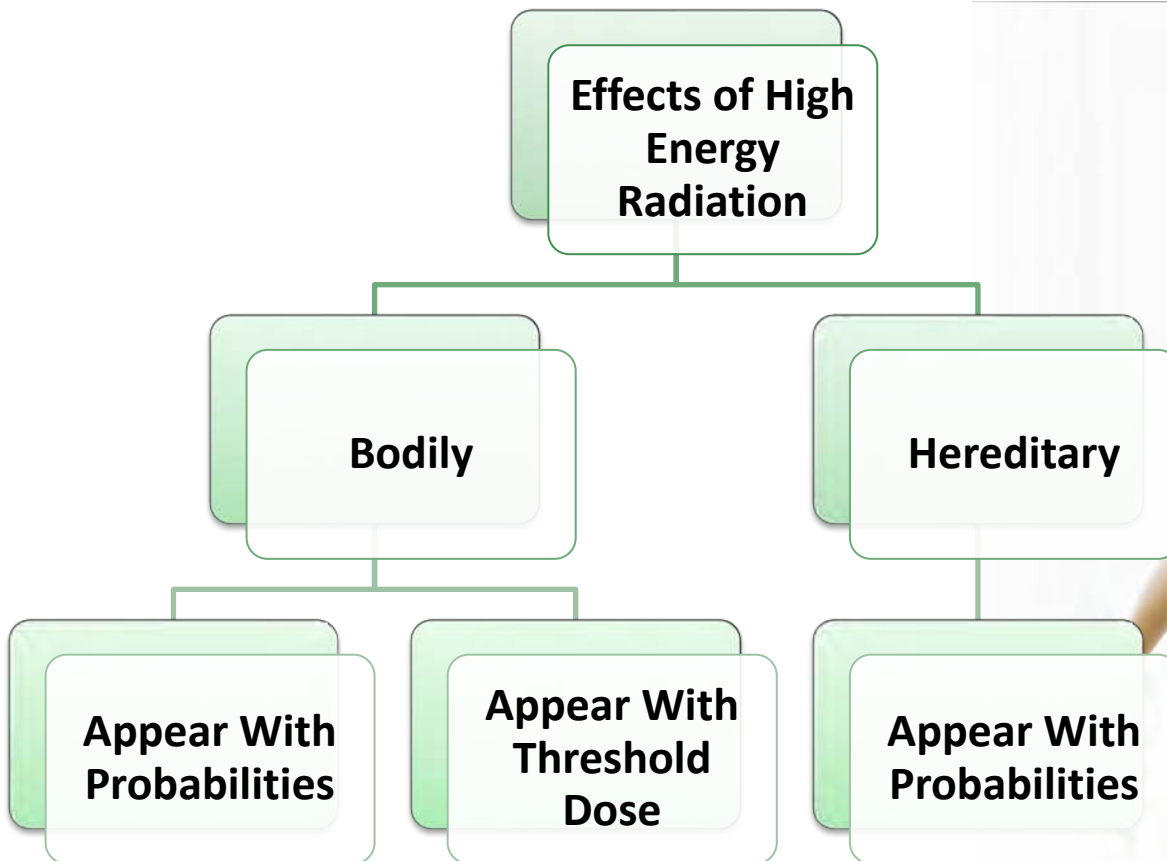
Equivalent Dose

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

Effective Dose



Effects of Radiation on People





Threshold Effects

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

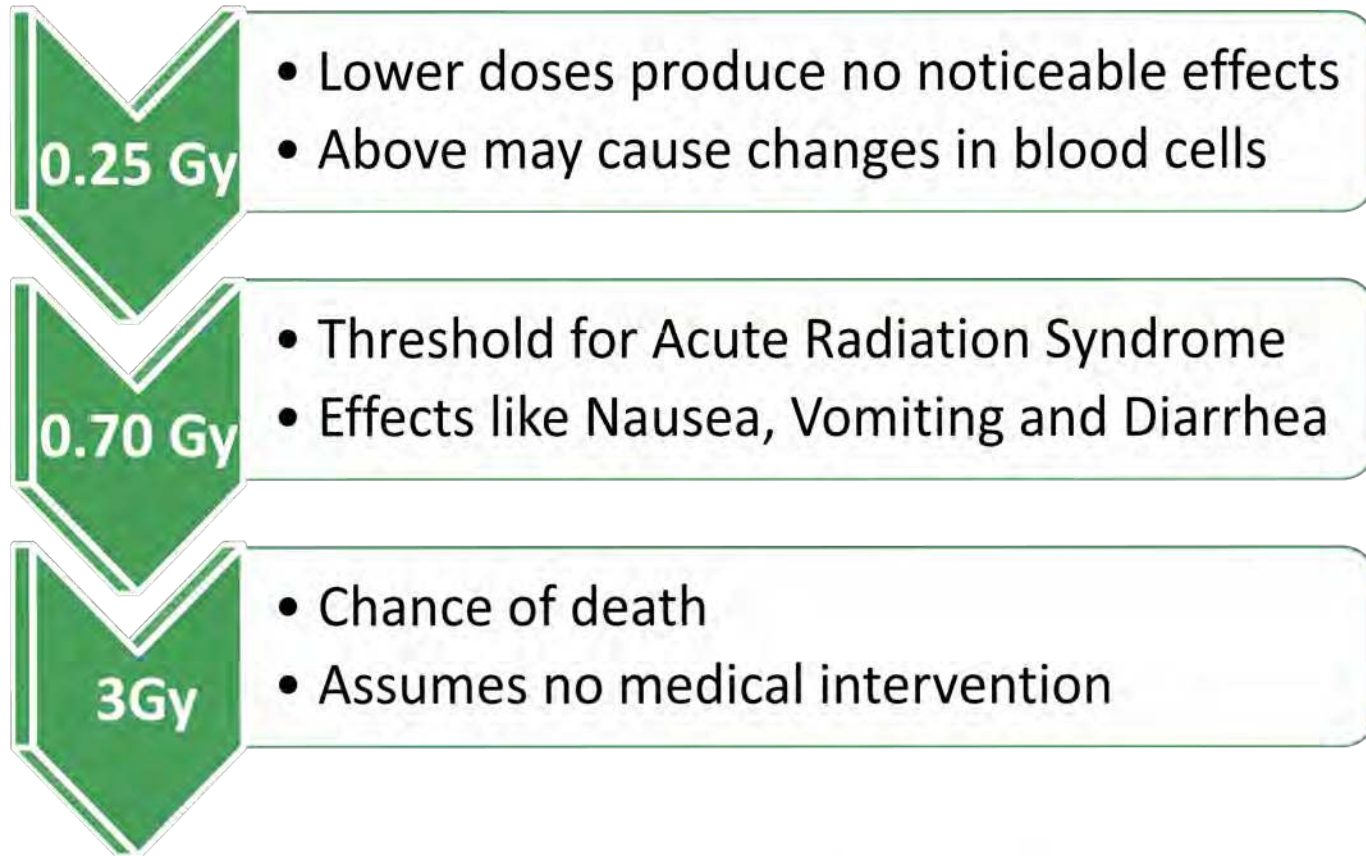
Common examples are effects like nausea, burns or death. Thresholds are very high above typical occupational doses.

Probabilistic Effects

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

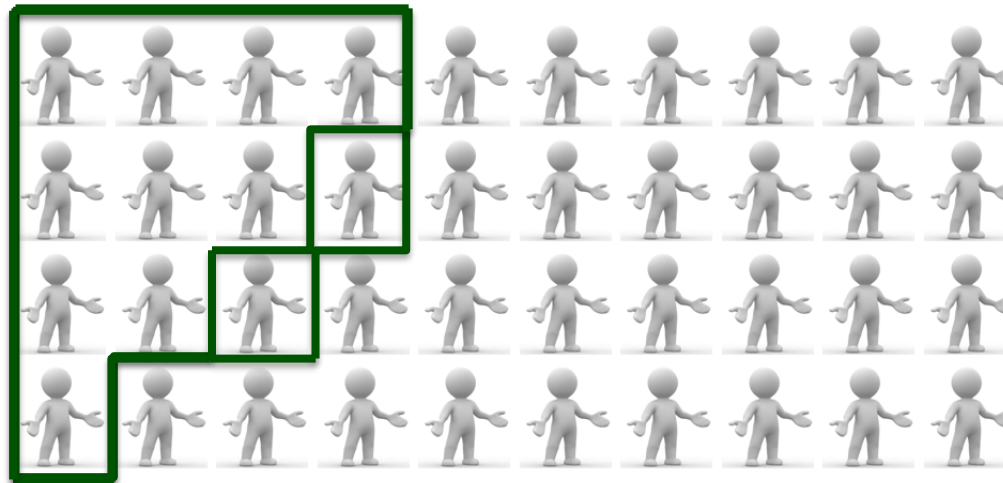
Most common example would be developing a fatal cancer from an exposure to radiation.







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



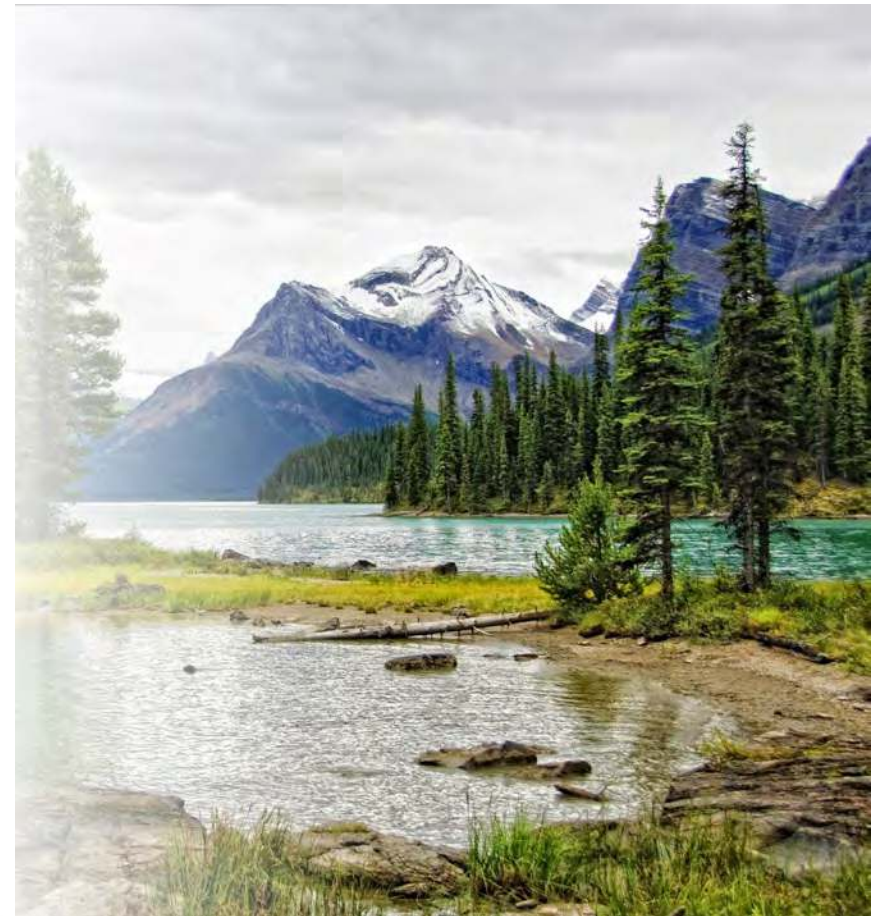
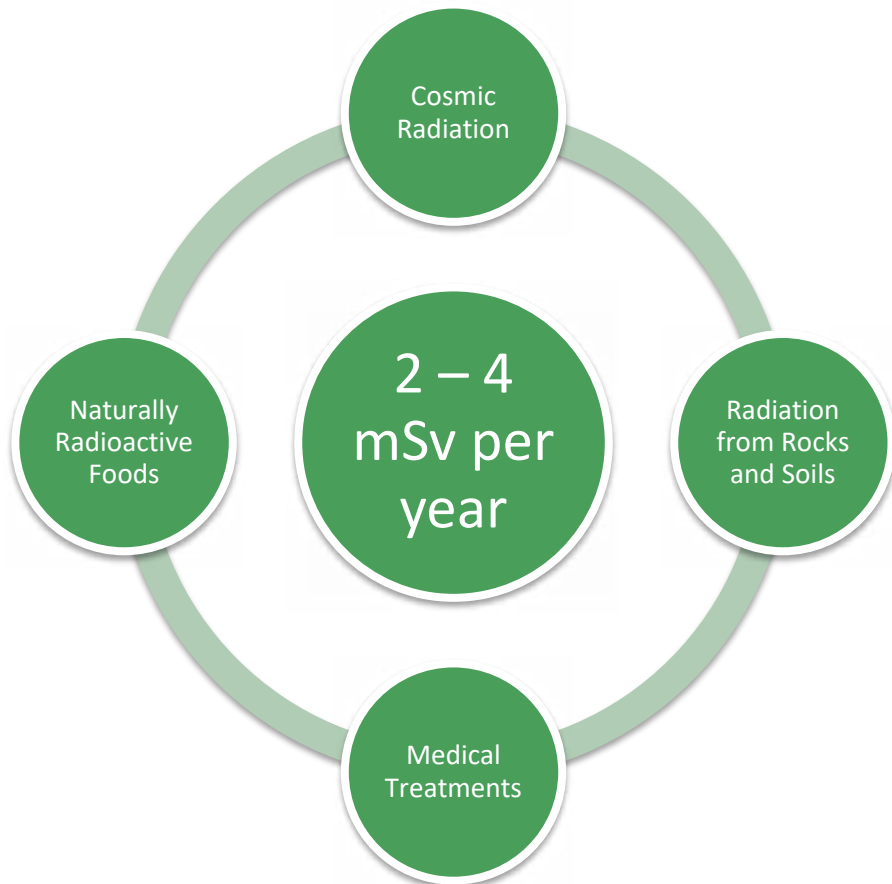


- Potential health effects to unborn child and their offspring
- Could happen as a result of egg or sperm mutating as a result to exposure to radiation
 - Then child conceived with this egg or sperm
- Has never been measured in humans
- Has been observed in mice studies





Background Radiation



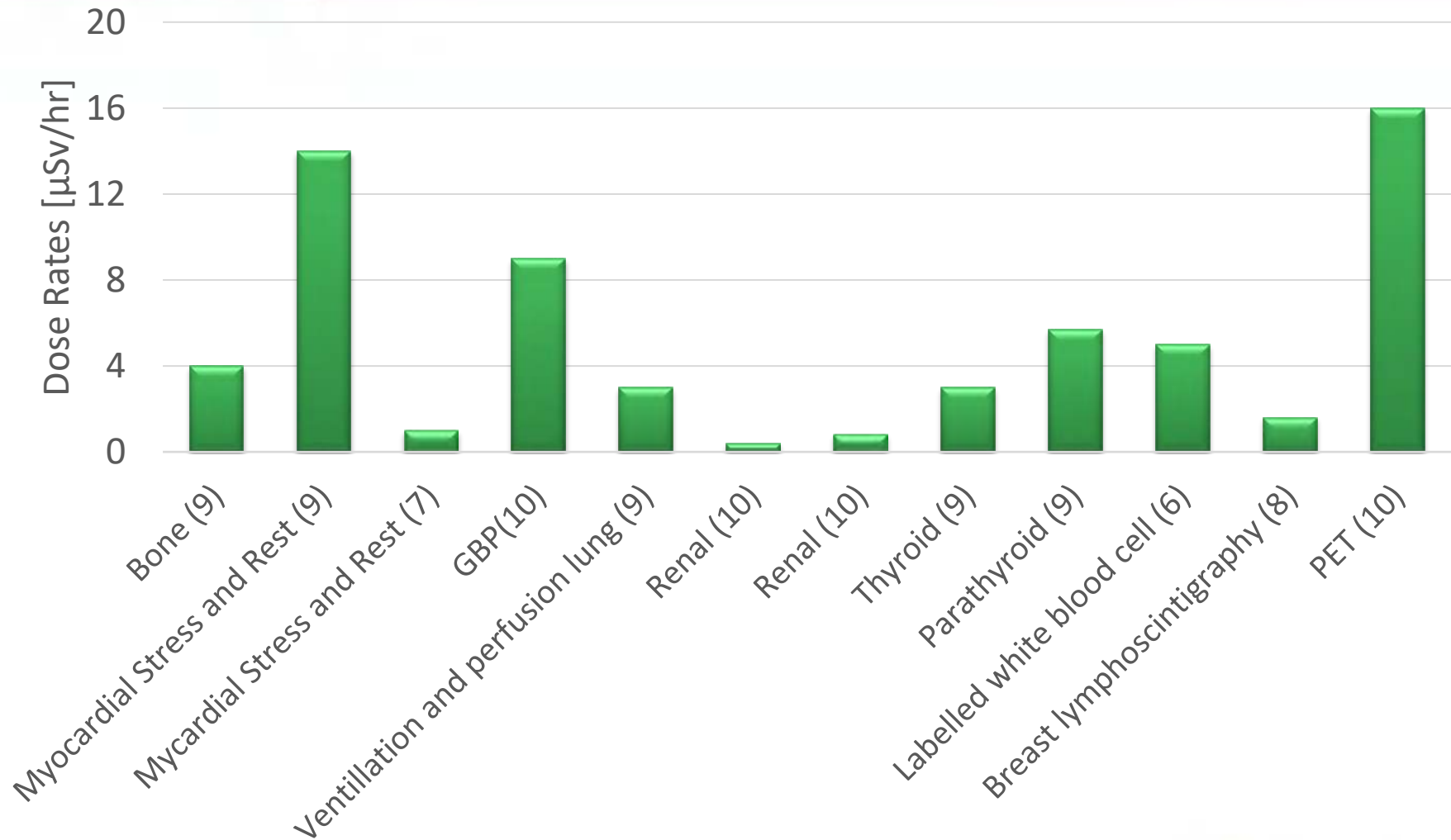


- Radiation used throughout modern medicine
 - Diagnostic x-ray
 - Nuclear medicine
 - Radiation therapy
- 28,000 nuclear medicine procedures per week
 - 80% use technetium-99m
- External sources
 - Beta, x-ray, or gamma
- Internal sources
 - Nuclear medicine or brachytherapy



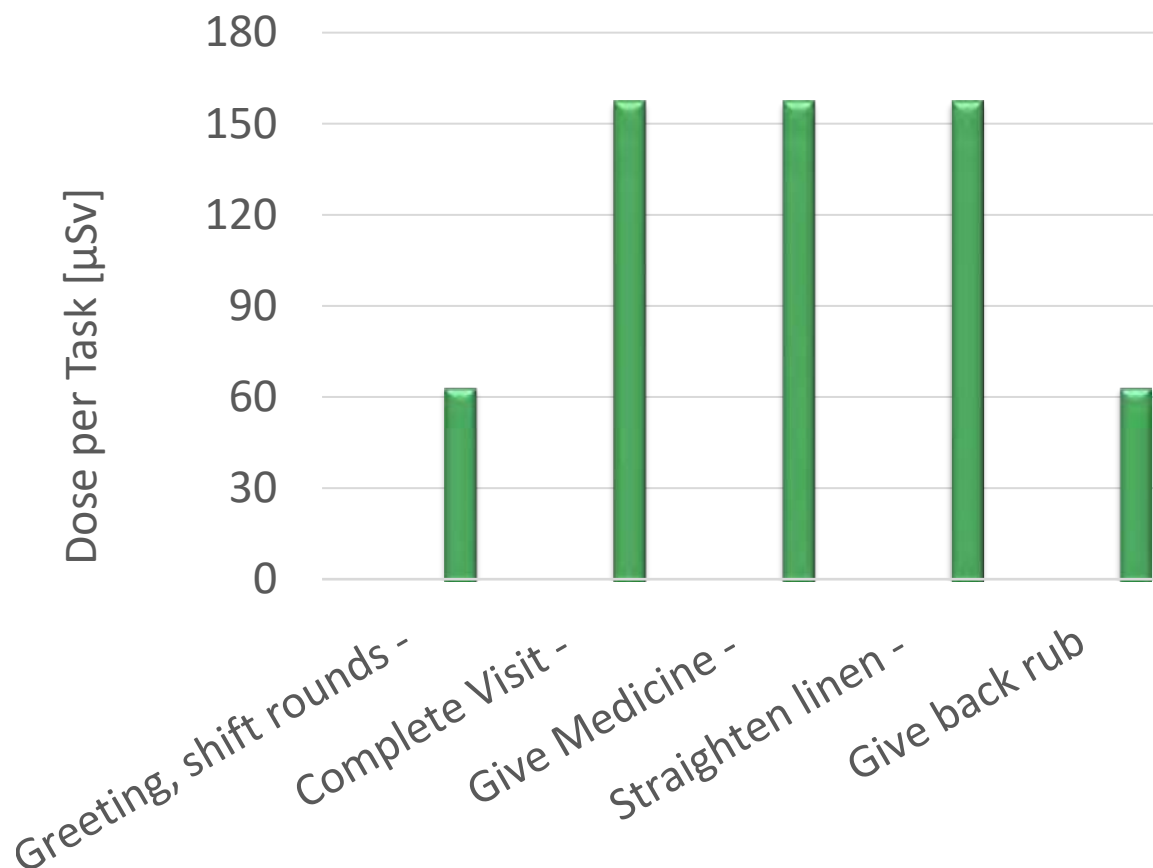
Dose Rates for Medical Medicine Patients

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Typical Doses to Care Providers





Identifying the Signs

- 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

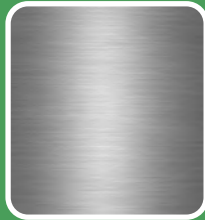
Distance

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



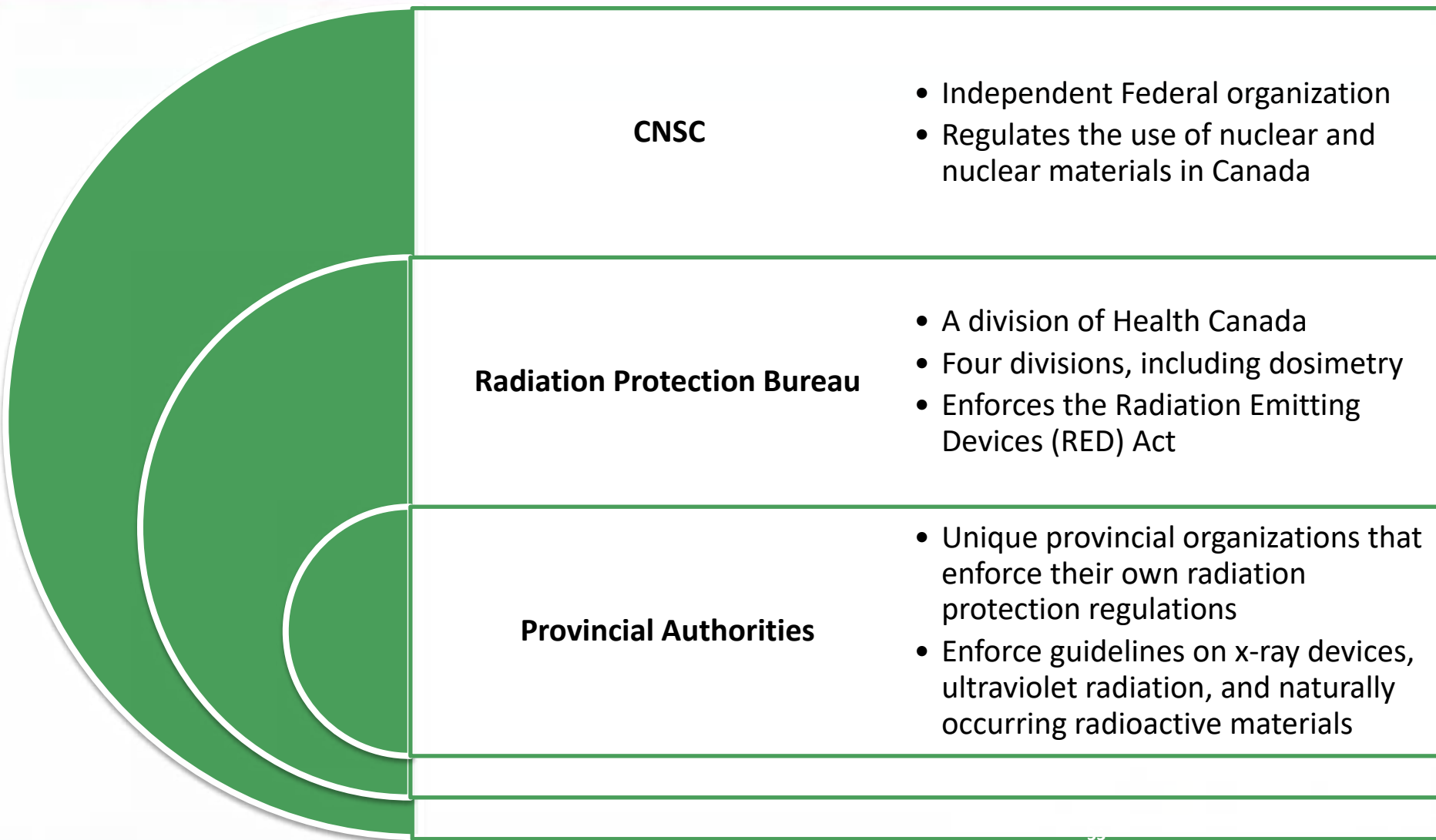
Wash your hands

Wear PPE



Radiation Protection Authorities

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

Limits the risks to:

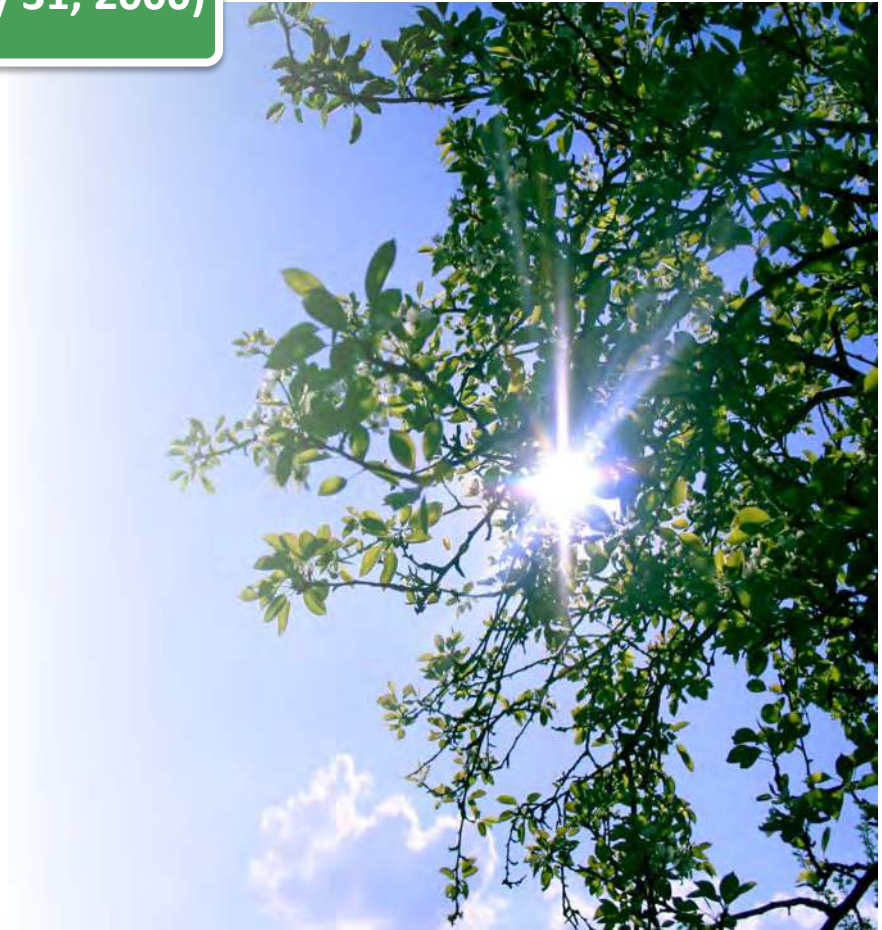
- National Security,
- Health and Safety of Persons, and
- the Environment

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



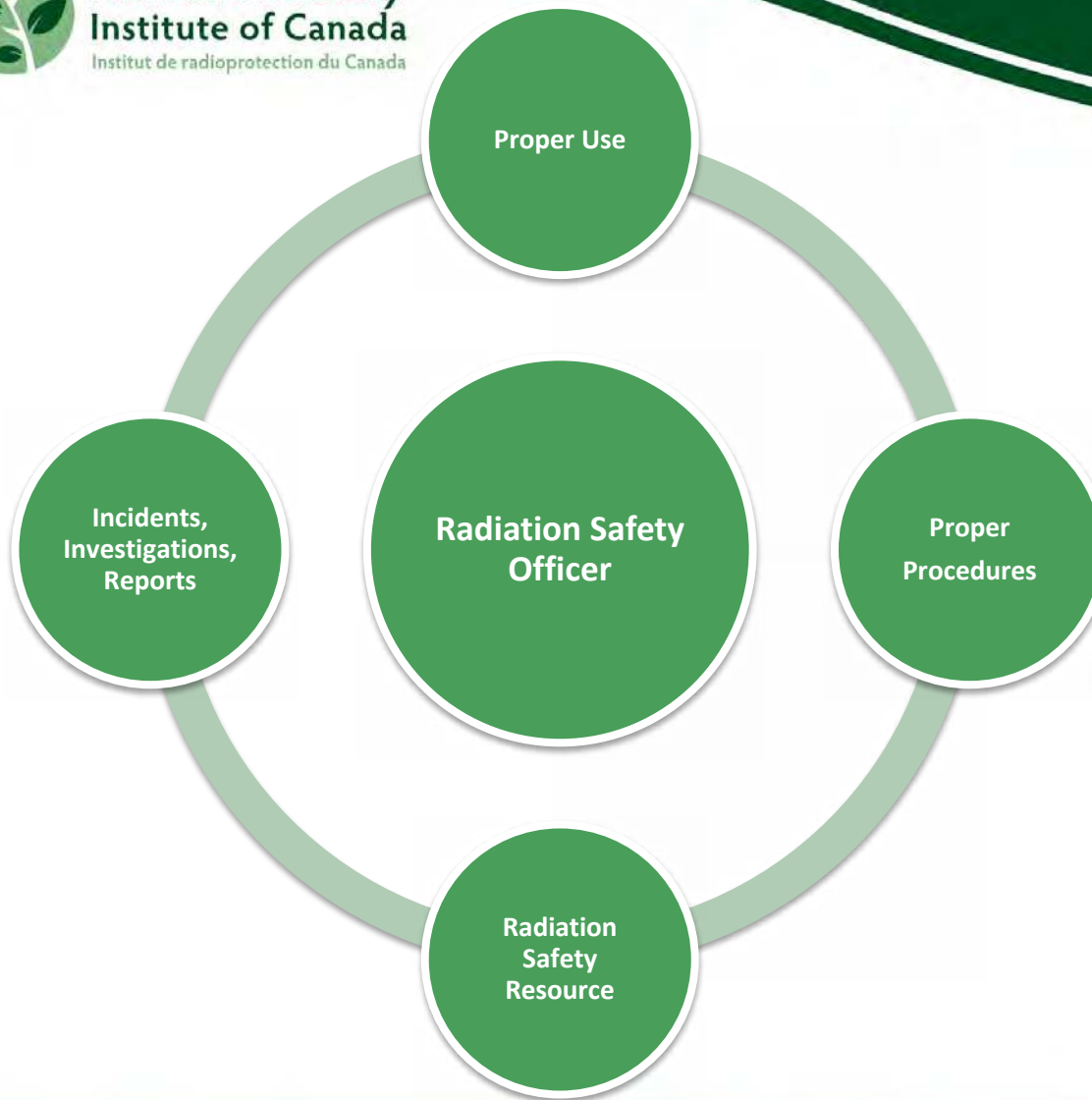
In order to protect

- People
- Environment
- National security

For example, must make available

- Health and safety info
- Copies of licence







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Contact Information



Canadian Nuclear Safety Commission

website: <http://www.cnscccsn.gc.ca/>
phone: 1-800-668-5284
email: info@cnscccsn.gc.ca



Radiation Protection Bureau

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



Radiation Safety Institute of Canada

website: <http://www.radiationsafety.ca/>
phone: 1-800-263-5803
email: info@radiationsafety.ca



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- The Radiation Safety Institute of Canada is an independent, not-for-profit organization specializing in radiation safety.
- For further information on all types of radiation contact us at:

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info@radiationsafety.ca

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