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Nuclear Energy in Canada

Presentation to GPAC

Sharon Maddock, P.Eng.,
Senior Project Manager, Energy Division
Wardrop Engineering Inc., a Tetra Tech Company

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Presentation Outline

- Overview of Nuclear Industry
- Fuel Cycle
  - Uranium Mining & Processing of Fuel
  - Power Generation
  - Used Nuclear Fuel
- Safety, Regulation, Environmental
- Numerous Applications including Oil Sands

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Canada's Nuclear Industry

- 47 years of electricity from CANDU nuclear plants
- Today: 17 reactors in service, 3 reactors being refurbished, 2 reactors being placed in safe storage

Gentilly, QC

Bruce, ON

Pt. Lepreau, NB

Pickering, ON

Darlington, ON

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Nuclear Industry Economics

- $ 6.6 billion/year industry
  - $ 1.5 billion in federal and provincial tax revenues
- In 2008, $1.2 billion in exports
- Over 150 nuclear related firms in Canada.
  - Total direct and indirect full-time employment from nuclear power production in Canada: **67,000** jobs.
  - The uranium mining industry in Canada generates employment of **5,000** people.

Source: Canadian Nuclear Association

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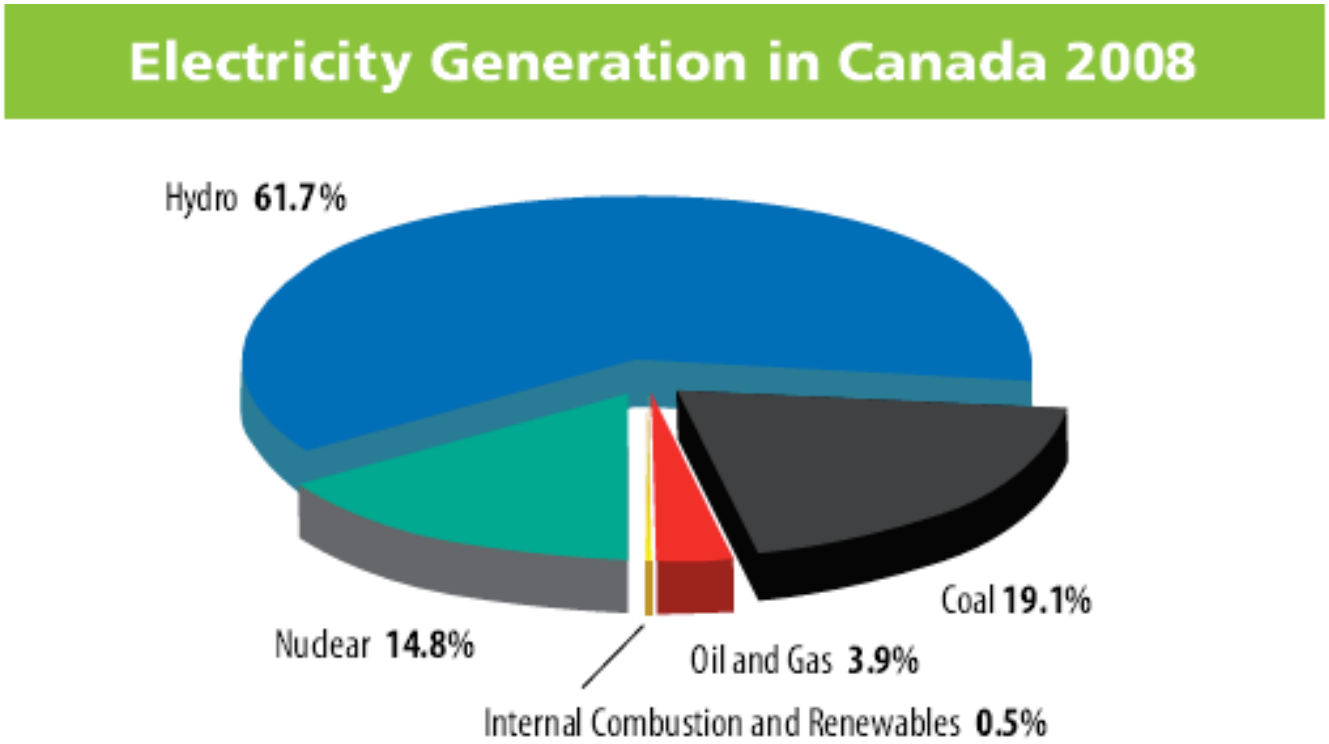
Electricity Generation Mix in Canada



Source: Natural Resources Canada (NRCan), 2009

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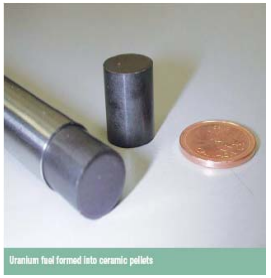
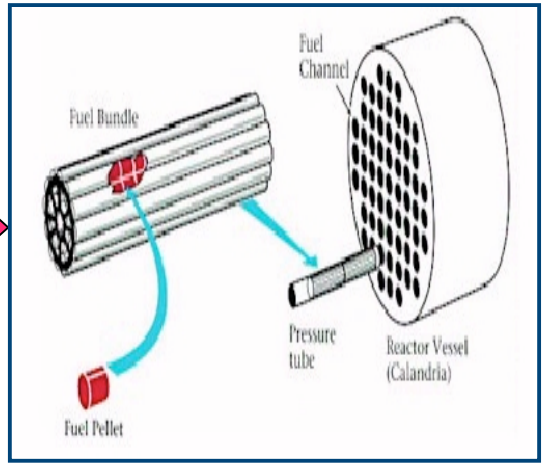
Nuclear Fuel



1. Uranium ore extracted through conventional mining
2. U2O converted to pellets
3. Pellets are put into thin zirconium tubes
   Zirconium tubes with pellets – **Elements**
4. Elements arranged in different configurations of 28, 37, and 43 called **Fuel Bundles**
5. Fuel bundles inserted into Fuel Channels in the Reactor Core – **Calandria**



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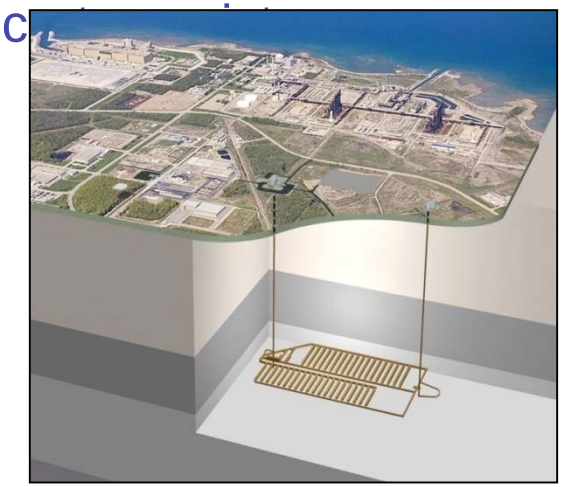
Energy Comparison by Fuel Type

- Eight of these uranium fuel pellets can power an average 2000 square-foot home for almost a year

Used Fuel Storage In Canada

- **Small Volume:** Total volume of used fuel can be stored in 6 ice rinks
- **Well Defined Process for Used Fuel:**
  - Initially stored in water-filled bays at nuclear power reactor sites and then safely stored in conc



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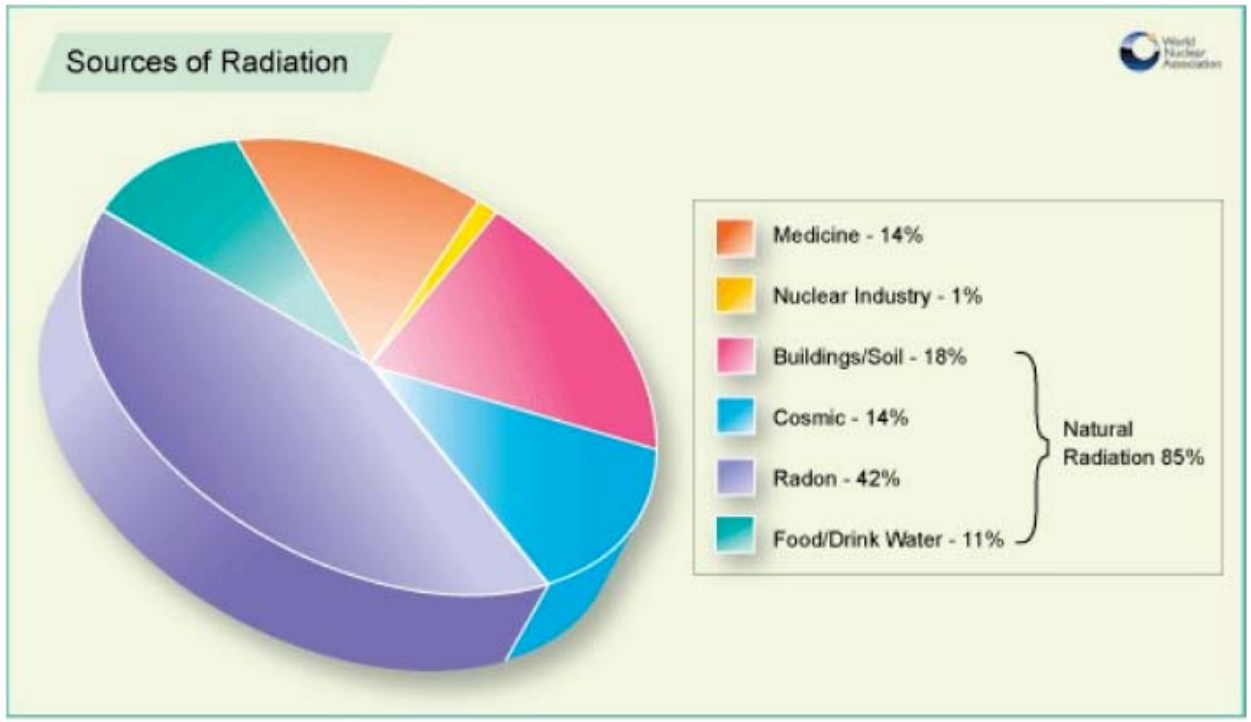
Radiation from Nuclear Generation



- 1% of radiation sources

Source: World Nuclear Association

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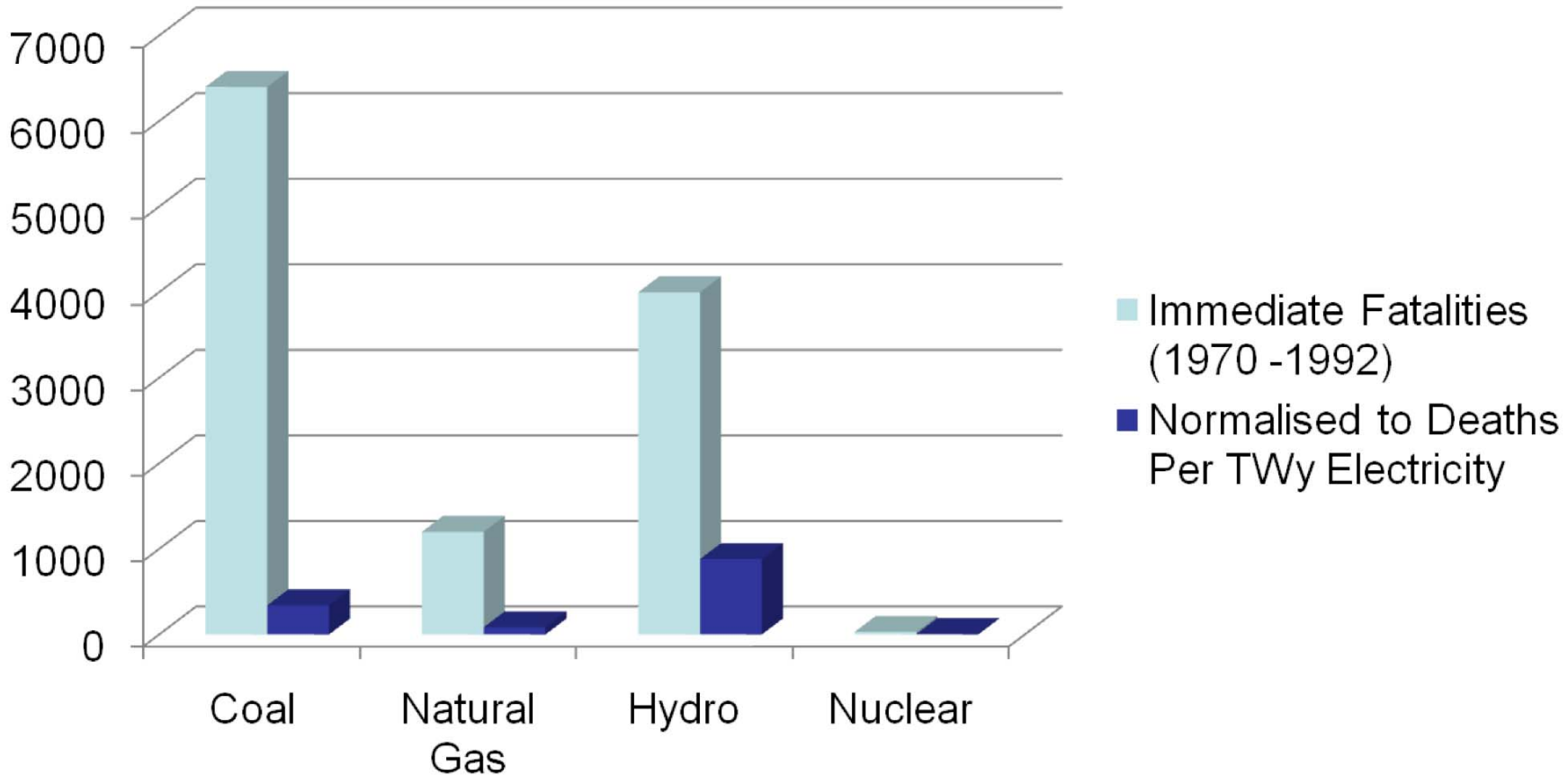
Nuclear Industry is Safe

•Comparison of Fatalities by Generation Type



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Industry is Regulated by CNSC

- CNSC is a Independent Regulator
  - Nuclear Safety and Control Act
  - Oversight of Operating Licenses in Canada
  - Set Requirements for Nuclear Safety, Training, Security and Safeguards
  - Entire fuel cycle (mining, transport, generation, used fuel)

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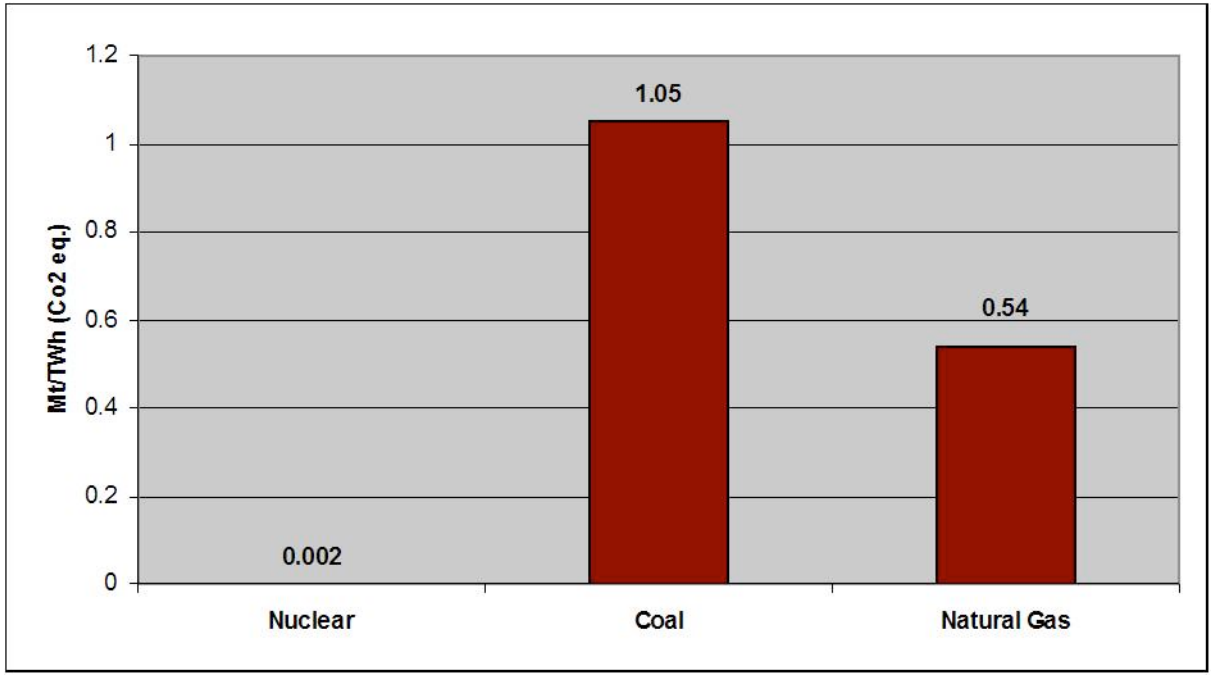
Low Emissions Source of Power

Life-Cycle GHG Emissions for Ontario Electricity Generation Sectors



- This study concludes that life cycle GHG emissions per one TWh of nuclear electricity are effectively zero.

Source: Canadian Energy Research Institute 2008

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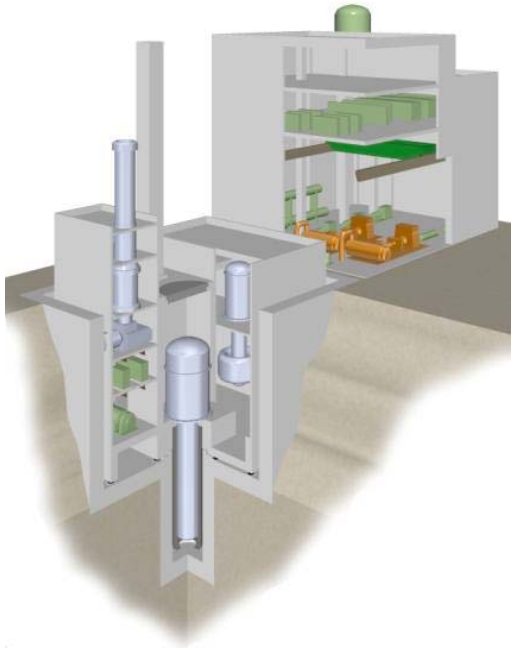
Nuclear Medicine for Canadians

- In 1951 the first two cancer-treatment machines using Co-60 (radioisotopes) were built in Canada.
- 20 million medical diagnostic procedures using radioisotopes in N.A.
- Used for cancer treatment, sterilization and food irradiation

Oil Sands Applications for Nuclear

- **Nuclear could be a substitute for natural gas saving this premium fuel for uses in transportation, heating or chemical export**



Small Reactors Ideal for Oil Sands

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In Closing

- Nuclear Energy Has Numerous Benefits
  - ✓ Part of the Energy Solution in Canada (and Globally)
  - ✓ Electricity, Nuclear Medicine
  - ✓ Safe, Regulated and Environmentally Responsible
- Future of Nuclear is Optimistic
  - ✓ Nuclear “Renaissance” globally
  - ✓ New applications being developed including oil sands

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QUESTIONS?

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Additional Information

- Canadian Nuclear Society, www.cns-snc.ca
- Canadian Nuclear Association, www.cna.ca
- Canadian Nuclear Safety Commission, www.nuclearsafety.gc.ca
- Atomic Energy of Canada Limited www.aecl.ca
- Bruce Power www.brucepower.com
- Ontario Power Generation, www.opg.ca
- International Atomic Energy Agency www.iaea.org