



The Canadian Nuclear Safety Commission Experiences in Adopting SI Units

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Workshop on Adopting the International System of
Units for Radiation Measurements
in the United States

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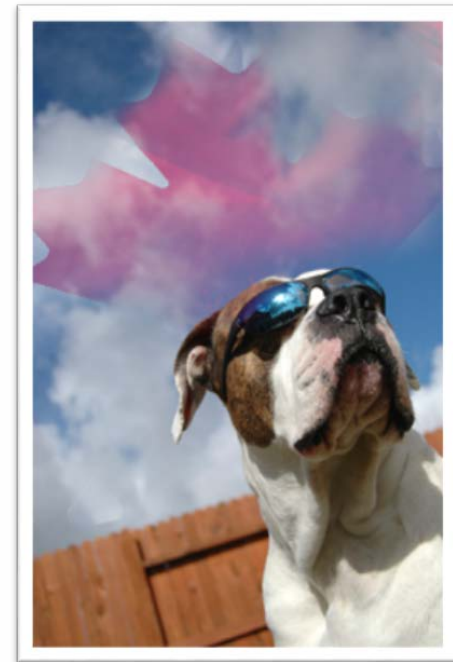




Canadian Nuclear Safety Commission (1)



- Regulates the use of nuclear energy and materials to protect the **health, safety** and **security** of Canadians and the **environment**
- Implements Canada's **international commitments** on the peaceful use of nuclear energy
- Disseminates objective **scientific, technical** and **regulatory information** to the public





Canadian Nuclear Safety Commission (2)

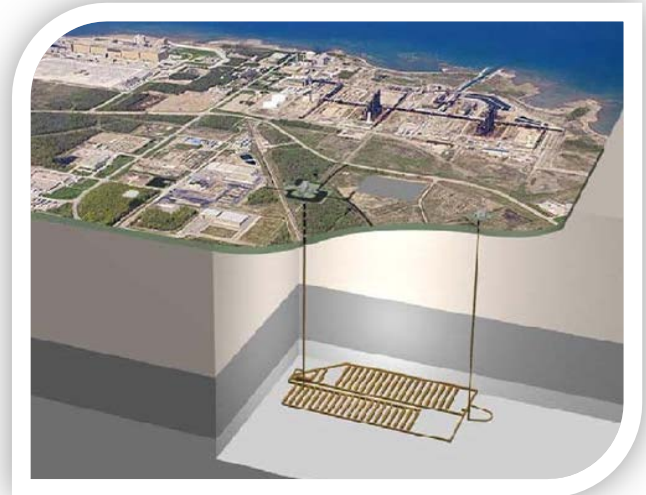
- Established in May 2000, under the ***Nuclear Safety and Control Act***
- Replaced the Atomic Energy and Control Board (AECB) under the 1946 ***Atomic Energy Control Act***



***Marking 70 years of
nuclear safety in 2016***

CNSC Regulates Nuclear-Related Facilities and Activities

- Uranium mines and mills
- Uranium fuel fabrication and processing
- Nuclear power plants
- Nuclear substance processing
- Industrial and medical applications
- Nuclear research and educational
- Export/import control
- Waste management facilities

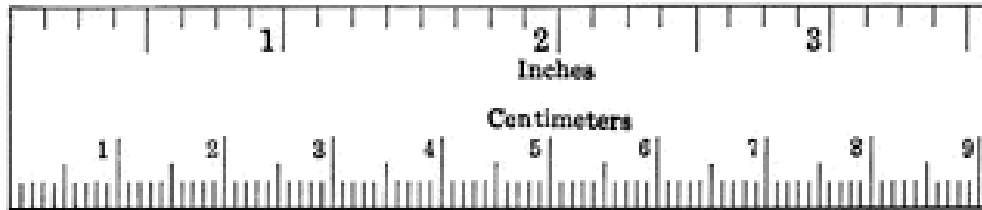


... From cradle to grave

Motivation for Canada's Conversion



- Canada is a bilingual country with strong connections to France and the United Kingdom

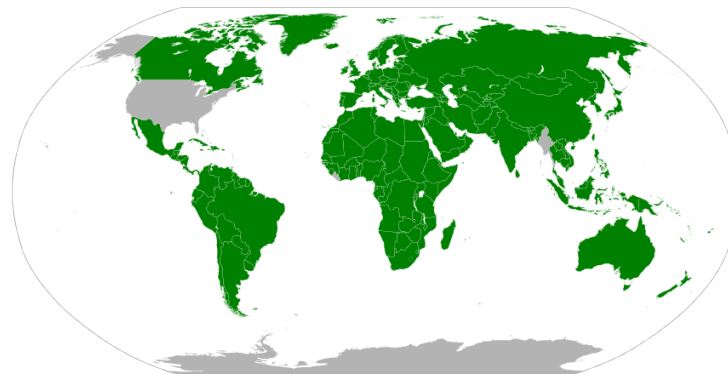


- Conversion would avoid ongoing communication challenges when dealing with units

How Canada Converted to International System of Units (SI)



- SI units have been adopted by the Atomic Energy Control Board (CNSC's predecessor) and other regulatory and advisory bodies in Canada as SI units became international practice



Implementation



- 1970 Canadian Government white paper on the adoption SI units
- 1977 The International Commission on Radiation Protection (ICRP) recommendations
- 1977 Advisory Committee on Radiation Protection
- 1980 SI being used by the Canadian Standards Association
- 1983 Some documents being used in SI and old units

Costs



- The costs were not captured as the political decision to move to SI had been taken
- Although it is possible to estimate the cost of the transition for comparison, it is important not to underestimate the continuous cost of conversion that takes place currently

Current Position



Canada now almost always uses SI units

- However, the working level month (WLM) is still used to monitor radiation in mines
- It measures the potential alpha energy from a range of nuclides
- Canada is considering a change to mSv, but not at this time, as the conversion from WLM to mSv is currently uncertain

Conversions: Activity



Conventional units

- 1 curie $\equiv 3.7 \times 10^{10}$ disintegrations per second
- Based on radioactivity equal to the activity of 1 gram of radium-226
- Radium-226 is not used elsewhere

SI units

- 1 becquerel $\equiv 1$ disintegration per second

Conversions: Absorbed Dose and Related Quantities



Conventional units

- 1 rad \equiv 100 ergs per gram (1 erg \equiv 1g·cm²/s²)
= 0.01 gray (Gy)
- Related absorbed dose quantities are simply related in the same way
- 1 rem = 0.01 sievert (Sv)

SI units

- 1 Gy \equiv 1 J/kg
- 1 J \equiv kg m² s⁻²

Conversions: Exposure



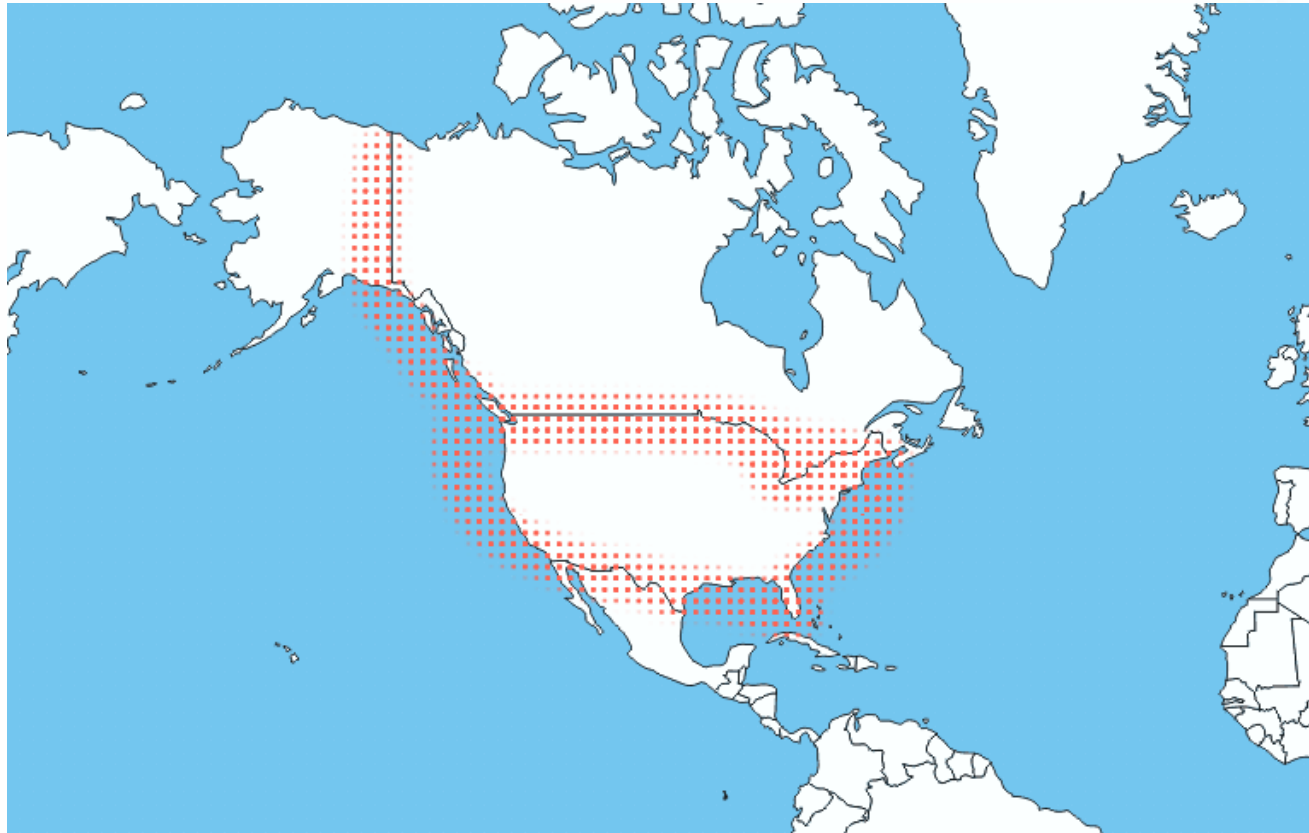
Conventional units

- Roentgen
- Based on the quantity of radiation which liberates by ionisation one esu of electricity per cm^3 of air under NTP
- There was a French roentgen, a German roentgen and a Russian roentgen

SI units

- C/kg
- $\text{C} \equiv 1 \text{ A} \times 1 \text{ s}$
- The ICRU recommended redefining the roentgen to be exactly $2.58 \times 10^{-4} \text{ C/kg}$ in 1971

Communication (1)



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Communication (2)



- There are risks in moving to a new system of units
- However, communication internationally is currently difficult, especially in the case of a nuclear incident

Coherence



- The SI units are coherent units used to minimize the use of extra factors and enables dimensional analysis to verify the validity of equations.
- That is not to say the U.S. system is incoherent!

Conclusions



- Safety is most important
- The transition to SI units has been very beneficial to Canada
- CNSC strongly recommends that the United States adopt SI units for radiation measurements

***We Will Never Compromise
on Safety...***



It's in our DNA!



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire



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