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Nuclear in a Nutshell

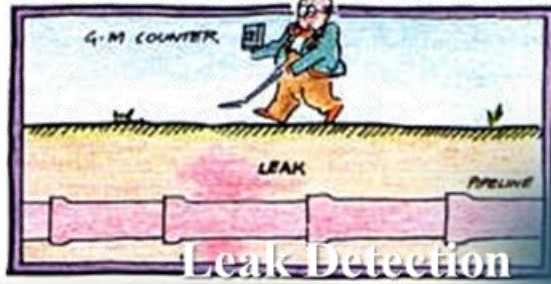
Dr Neil Alexander

Other Uses of Radiation, Radioactivity, and Products of the Nuclear Industry



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Leak Detection

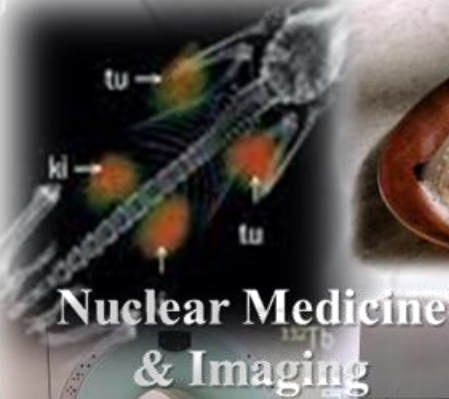


Compact
Fluorescents

DNA Sequencing

Quality and Safety
Inspections

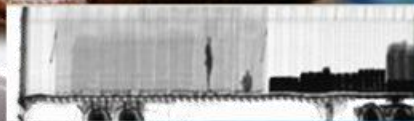
Materials Research



Nuclear Medicine
& Imaging



Preserving Foods



Detecting stowaways!



Sterilizing
Medical Equipment



Emergency Lighting



Smoke detectors




Fracking Tracers



Glow in the dark
toys

Tritium, Krypton,
Promethium

Diagnosis



A healthcare professional, a woman with glasses and curly hair wearing a blue scrubs top, is monitoring an elderly male patient on a treadmill. The patient is shirtless and has several ECG electrodes attached to his chest. The woman is holding a blood pressure cuff on the patient's arm. The patient is walking on a treadmill, and the woman is standing next to it, looking at a monitor. The background shows a clinical setting with medical equipment.



2 x 6 GBq
[¹⁷⁷Lu]Lu-PSMA-617

A patient is lying on a table inside a large medical imaging machine, likely a CT scanner. Two healthcare professionals, a woman in a white lab coat and a man in a light blue shirt, are attending to the patient. The machine is white and blue, with a large circular gantry. The patient is wearing a white t-shirt and blue jeans. The woman is adjusting the patient's head, and the man is standing at the end of the table.

A collection of medical supplies arranged on a white surface. In the foreground, a pair of white nitrile gloves is visible. Behind them, a white sharps container with a blue lid and two locking tabs stands. To the left of the container is a tube of white medical glue with a red cap and a label that includes the word 'Glue'. Several syringes and needles are scattered around: some are in their original packaging, while others are already assembled. The items are arranged in a circular pattern, casting soft shadows on the white background.

Irony



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People worry that the nuclear industry will cause them to have cancer, but it won't. What it will do is detect it early and possibly treat it.

More people are saved from cancer every minute by the nuclear industry than have been harmed by it over its entire history of existence.

(Unverified statement by Neil Alexander)



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Radiation in Context

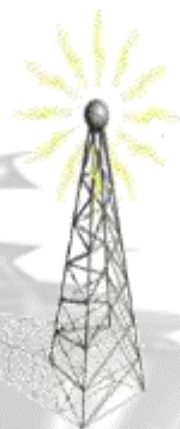
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Different Types of Radiation



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Radio



Micro
Waves



Infrared



Visible
Light



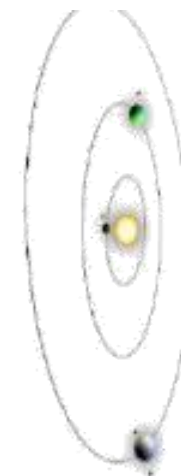
Ultra
Violet



X-Rays

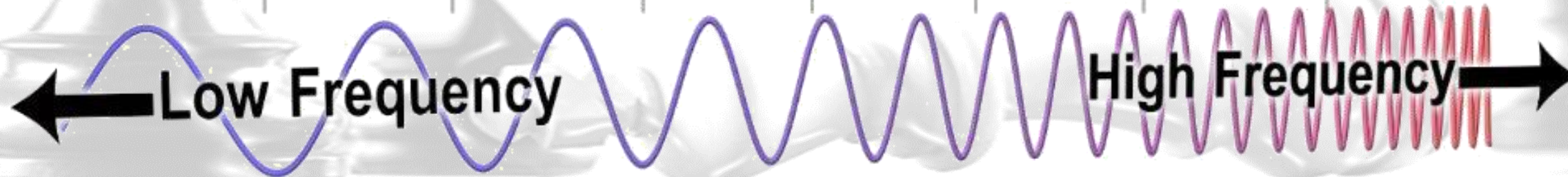


Gamma
Rays



Cosmic
Rays

Ionizing Radiation

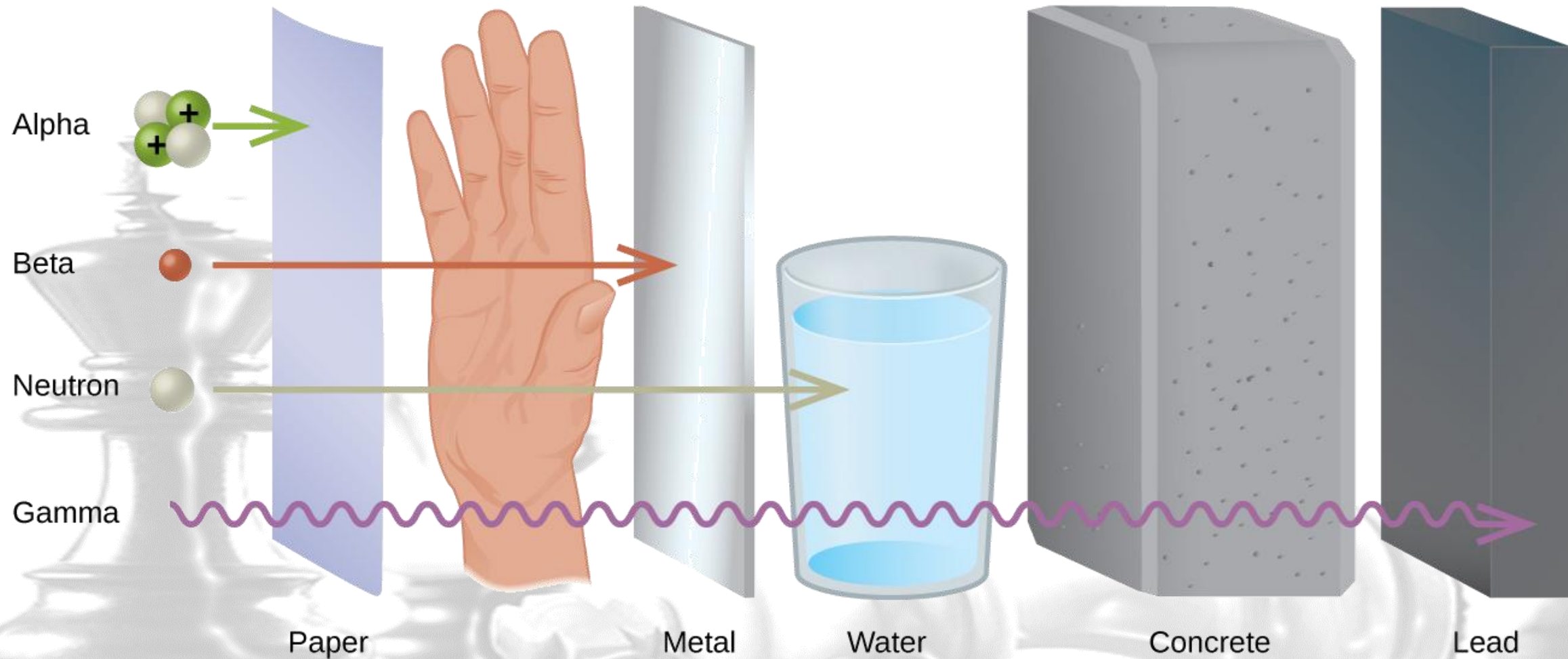


Different Types of Ionizing Radiation



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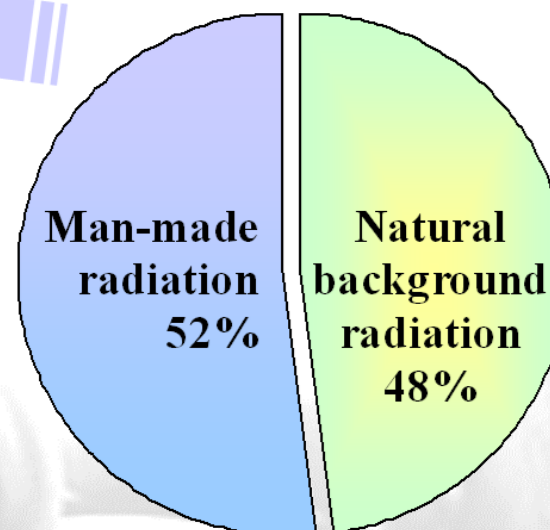
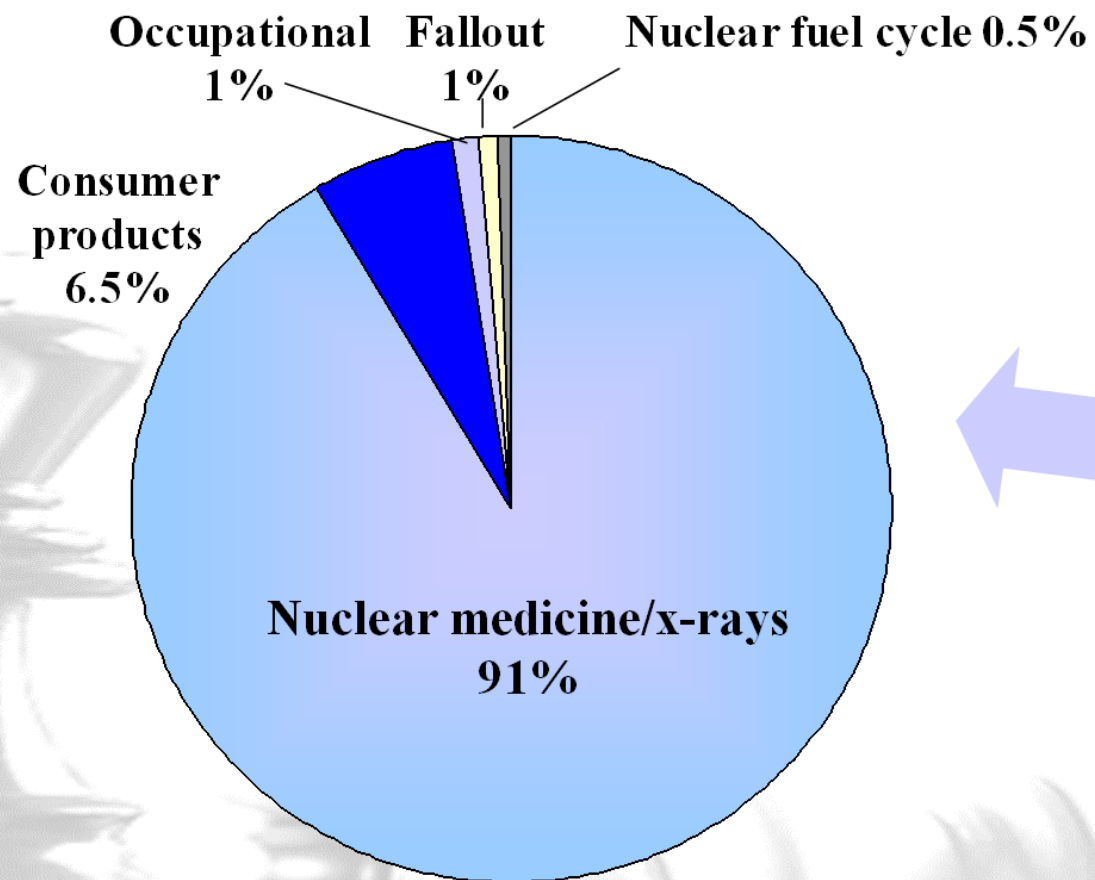
June 8, 2025

Man Made and Background Radiation



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Mettler 2007

Man Made and Background Radiation

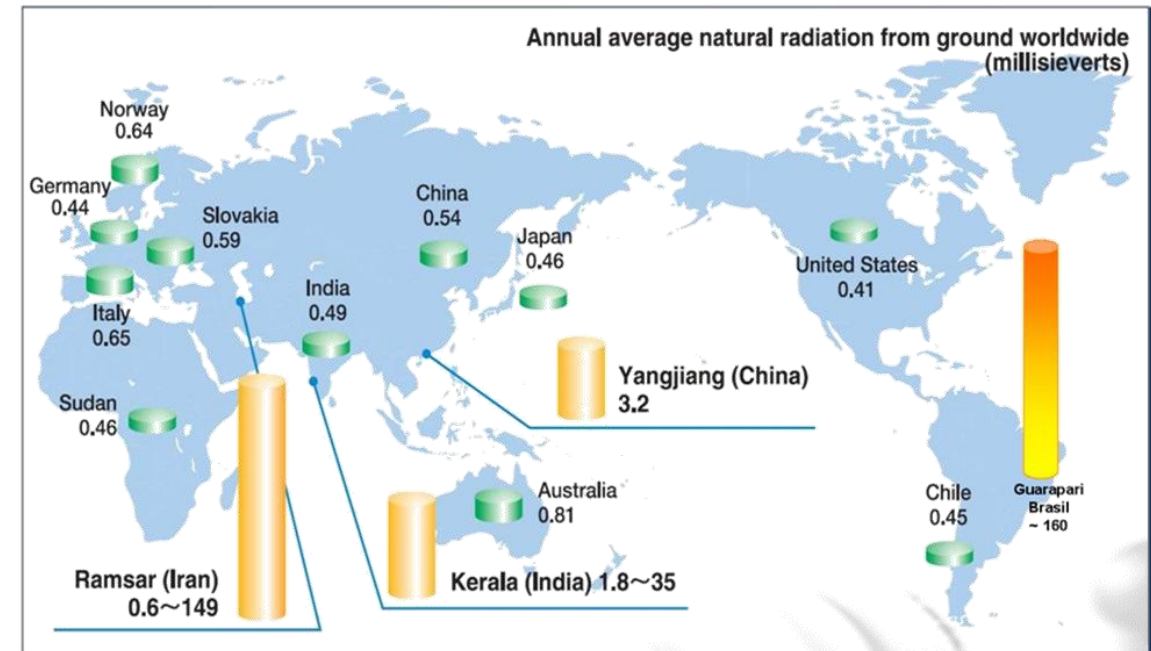
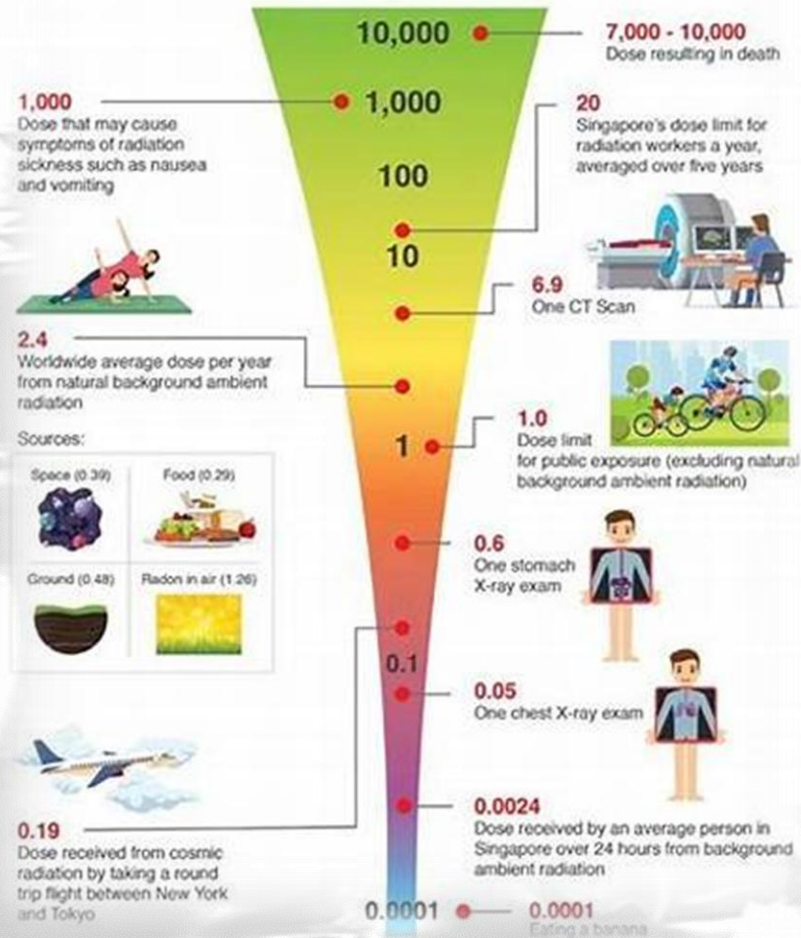


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Effective Radiation Dose

(Unit: millisievert = mSv)



Misconceptions



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There is no “safe” level of Radiation

Do you sleep in a
lead Coffin?



You consider the levels of
radiation you live in to be safe

Do you eat Brazil nuts from
Brazil?



From a radiological point of
view, you think it is safe to eat
Low Level Radioactive Waste

Hazard and Mitigation



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Shielding



Containment



Bufohygen Monoclonal



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Hazard: Something that has the potential to cause harm.

Danger: Something that has the potential to do harm and has a credible mechanism by which that harm could occur.

Risk: A complex conflation of the likelihood something might cause harm and the magnitude of the harm it might cause.

Fear: An unpleasant, often strong, emotion caused by anticipation or awareness of danger (may be real or imagined).

Used Fuel



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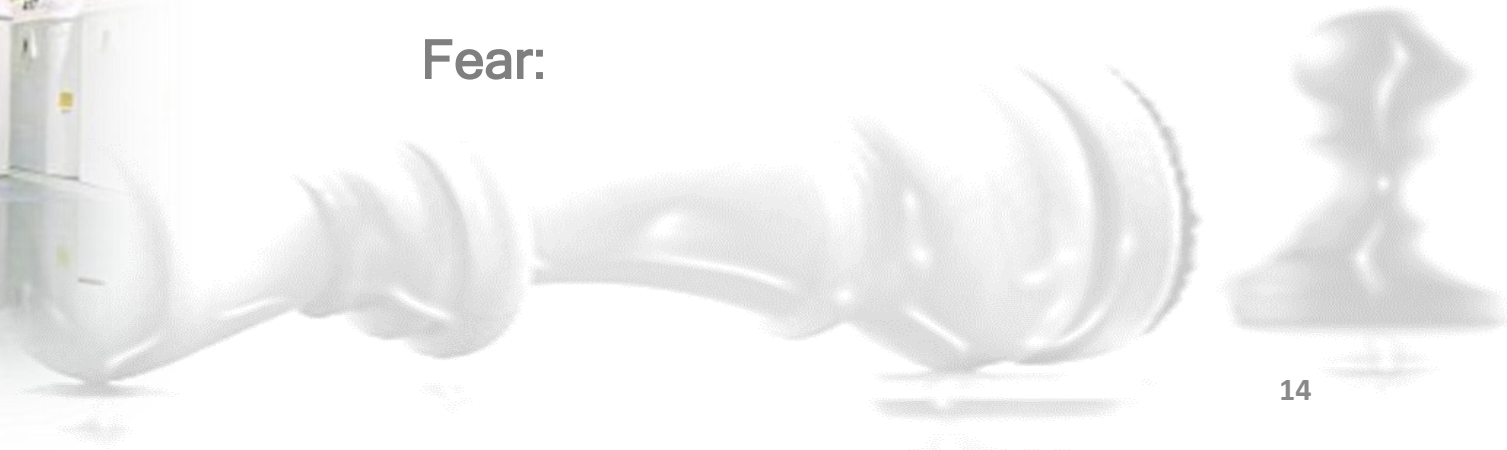
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Hazard:

Danger:

Risk:

Fear:



Things to watch out for



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- So What?
- Misleading information – especially the use of big numbers to create fear (easily disproved using common sense)
- Misuse of information – e.g. CNSC not saying no to projects and Home Insurance
- Suggestions that information is missing or being withheld when it isn't time for the information to be provided anyway (notable in the run up to a new nuclear project)
- Scaremongering using inappropriate imagery

As an example of a master class in unscrupulous misinformation, misdirection and trickery try to find a presentation by Gordon Edwards and then read my fact check on the CNS website..... <https://www.cns-snc.ca/core-business/fact-checking-gordon-edwards/>

Scaring people with big meaningless numbers



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News

FUKUSHIMA'S NEW NIGHTMARE: A MILLION TONS OF RADIOACTIVE WATER

April 28, 2018 Science

Things to watch out for



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Fear by Inappropriate Imagery



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Inside the Danger Zone

Japanese authorities are telling people to stay away.
Not everybody is listening. NEWSWEEK heads toward Fukushima.

By Joshua Hammer
PHOTOGRAPHS BY DONALD WEBER



Comparing Apples with Oranges



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More renewable power coming to Ontario

The Independent Electricity System Operator (IESO) has informed us that they intend to only contract for **new projects** in their upcoming procurement aimed at securing 5,000 megawatts (MW) of renewable energy. Existing projects can put forward expansions, but only the additional generation developed will be considered toward the 5,000 MW target, the IESO says.

This is good news and the first sign that the dam has broken on Ontario's stonewalling of what is now our **lowest cost source of new electricity supply**.



But while 5,000 MW is a good start, it is far from enough. Ontario is **simultaneously planning to add 1,600 MW of polluting gas-fired generation and build or re-build 16,000 MW of expensive and slow-to-deploy nuclear energy**.

This plan makes little sense when you consider that solar and wind can supply power at less than half the cost of new nuclear and without the greenhouse gases and air pollution produced by burning gas.

A 5,000 MW increase in renewables would represent a 30% increase in Ontario's renewable electricity capacity. So this gets us only one-tenth the way toward the Dubai climate summit's goal of tripling renewable electricity.

Instead of waiting one to two decades for expensive and **risk nuclear projects** to be finished -- and relying on **polluting gas** in the meantime -- this province should be much more aggressively developing solar and wind power. Remember that while renewable energy production records have been smashed worldwide over the last five years, Ontario added not a single kilowatt of wind and solar power to its system.

We need to catch up with the rest of the world in tapping hugely beneficial and low cost solar and wind power. A good next step would be **lifting the pointless moratorium on offshore wind power in the Great Lakes, a source that could meet all of Ontario's current electricity needs**.

It's time for Ontario to make a commitment to **triple its wind and solar power by 2035** to phase-out gas power, lower our electricity bills, create good jobs and provide our manufacturing and mining companies with low-cost green power.

Please send Premier Ford, Energy Minister Todd Smith, Opposition Leaders and your MPP a message to TRIPLE wind and solar in Ontario by 2035!

Send your message to triple wind and solar in ON by 2035

Thank you!

Angela Bischoff, Director



This plan makes little sense when you consider that solar and wind can supply power at less than half the cost of new nuclear and without the greenhouse gases and air pollution produced by burning gas.

Nuclear apple:

- Nearly always available
- Under our control
- Available at times of peak load

Wind and Solar Oranges:

- Available about a quarter of the time
- Under the weather's control
- Never available at times of peak load.

When everything has failed the attack on the person



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“I make no apologies for aggressively harassing the individuals and institutions supporting the nuclear project”.

Pat McNamara, How we kicked nuclear out of Alberta



Colleen Evans-Keddy

Wow!! The federal government would do what?!?! How would they clean that up?!?!?!?!?!?

2d Like Reply Share



Neil Alexander

Colleen Evans-Keddy What exactly do you think they are going to have to clean up?

2d Like Reply Share



Neil Alexander

Noting that you have not responded I am hoping that you have indeed started to understand the issues and recognise that you were fearing something that could never happen. If you could let people know this you might encourage them to do the same

1d Like Reply Share



Colleen Evans-Keddy

Neil Alexander what?!?+?!?!? How much money do you get paid a year to lie about this?

1d Like Reply Share





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Nuclear in a Nutshell

Dr Neil Alexander

Why Nuclear Power in Canada?



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Axe the carbon tax

When the Opposition leader was asked if he wants to keep the carbon tax, he simply said "no."

Poilievre said his approach will be the exact reverse of the current NDP and Liberal Party's stance on the tax.

"They want to raise the price on the traditional energy we still need, (but) I want to lower the cost of emissions-free alternatives," he told Bray.

Poilievre said that means fast-tracking the safe approval of nuclear power using Saskatchewan's supply of uranium.

After one meeting in July, Smith [posted on social media](#): "Nuclear energy is key to providing reliable and affordable power for our province ... Now is the time for Albertans to harness this opportunity and continue to grow our province into the future!"

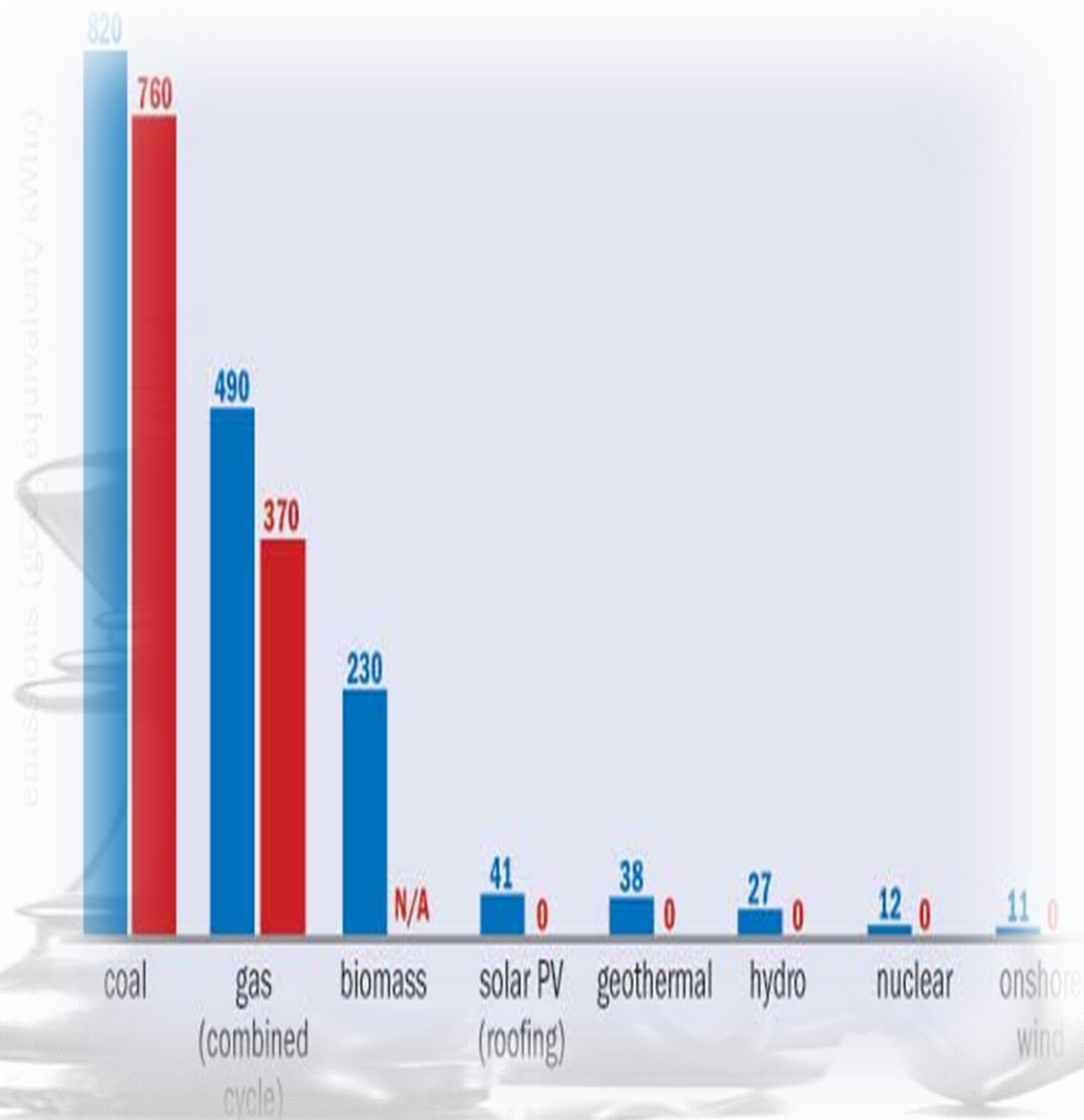


Emissions and Safety ?

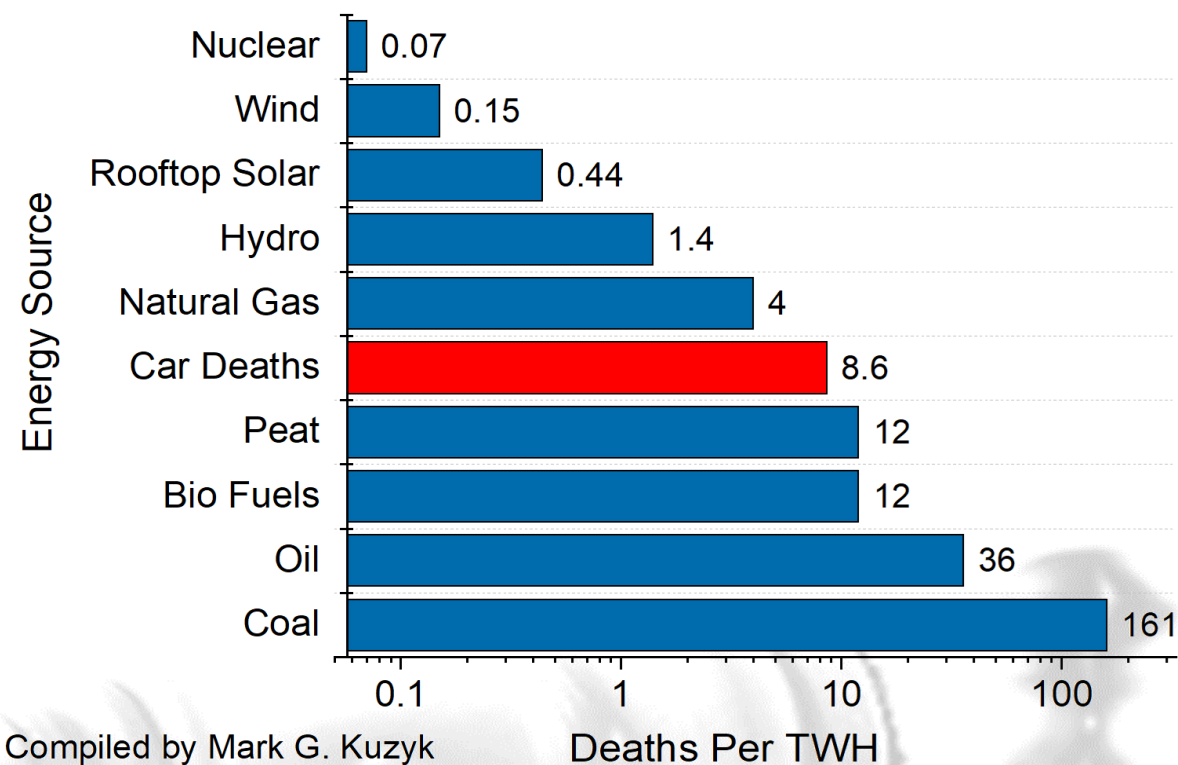


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Annual Estimated Worldwide Deaths by Energy Source



Compiled by Mark G. Kuzyk
from nextbigfuture.com

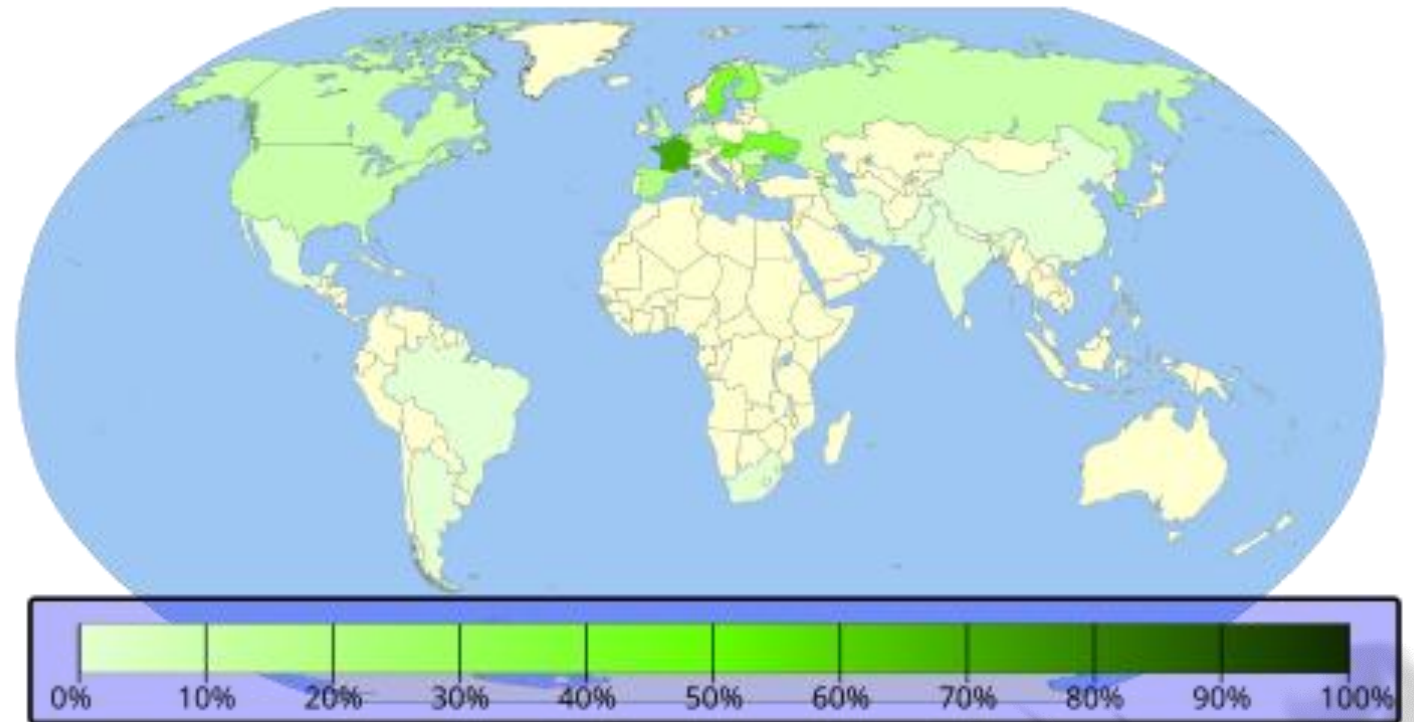
Nuclear Power around the World



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- The first commercial nuclear power stations started operation in the 1950s.
- Nuclear energy now provides about 9% of the world's electricity from about 440 power reactors.
- Nuclear provides about one-quarter of the world's low-carbon electricity.
- Nuclear is the world's second largest source of low-carbon power.
- Over 50 countries utilize nuclear energy in about 220 research reactors.



Nuclear Power in Canada

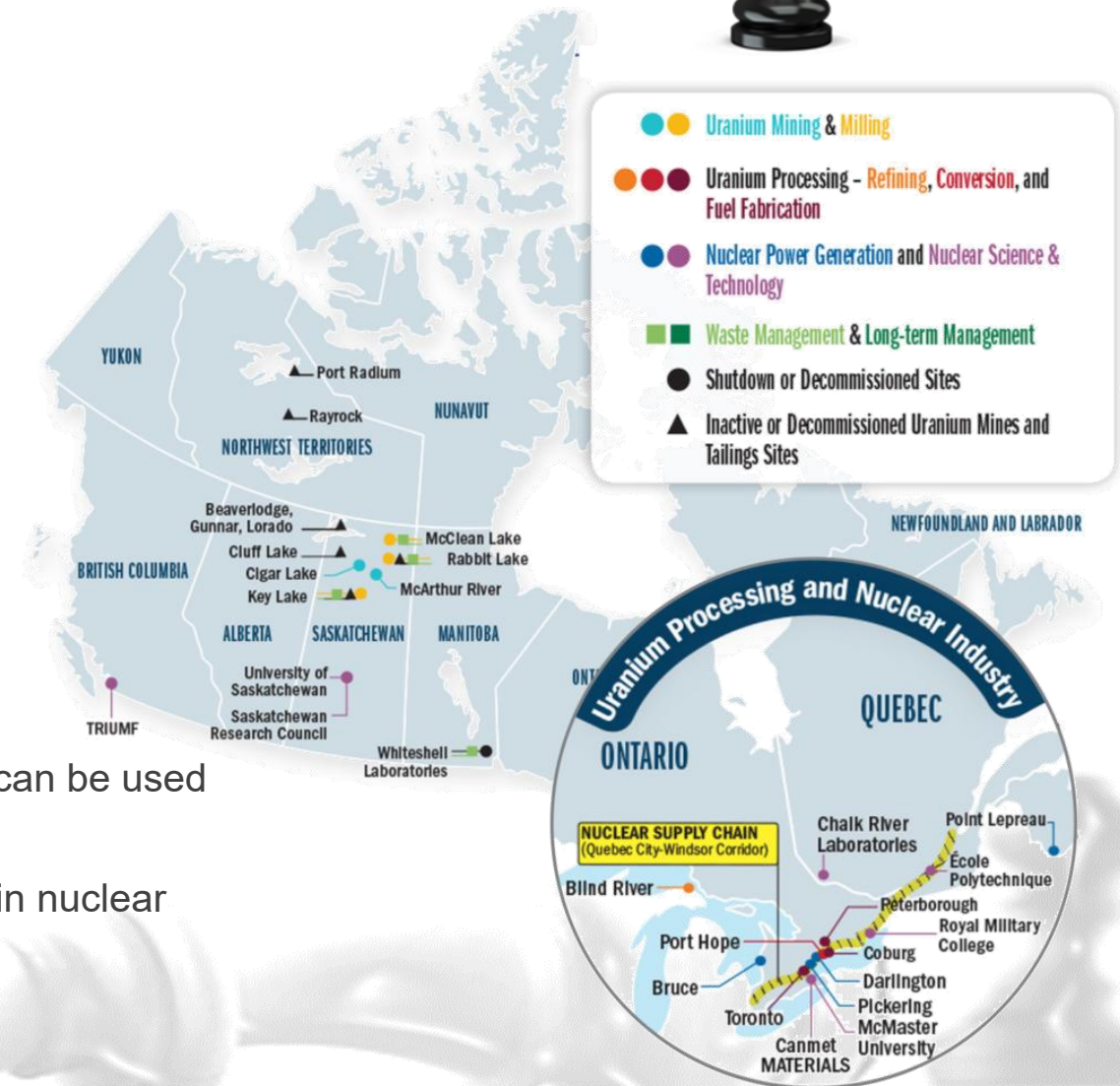


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Key facts

- Canada is the second largest producer and exporter of uranium in the world, with 15% of global production in 2022.
- Nuclear power generation, which is a source of energy that does not emit greenhouse gases, accounted for approximately 14% of Canada's electricity in 2021.
- Canada has developed a unique nuclear reactor technology, CANDU; there are 18 CANDU reactors in Ontario, 1 in New Brunswick and 11 in operation outside of Canada.
- Under Canada's nuclear non-proliferation policy, Canadian uranium can be used for peaceful purposes only.
- In 2022, 80% of Canada's uranium production was exported for use in nuclear power generation throughout the world.

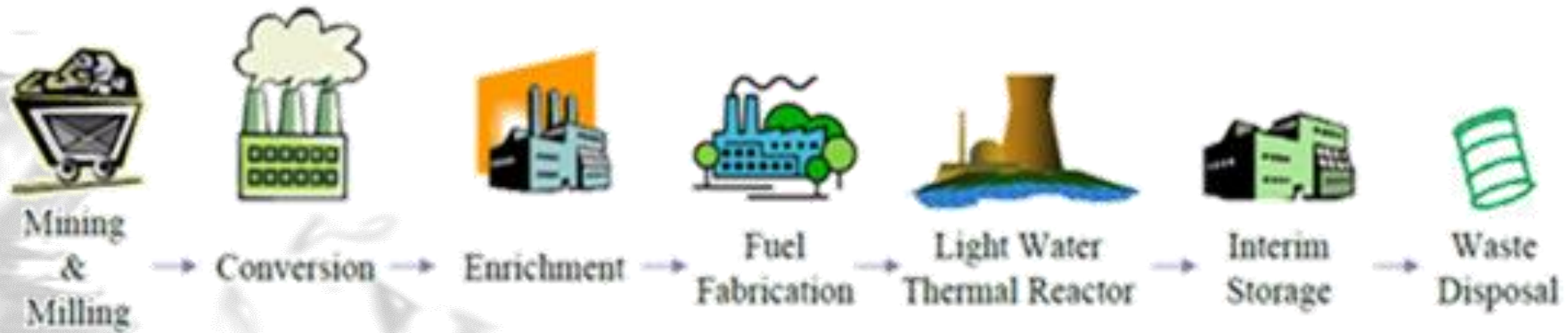


The Nuclear Fuel Cycle



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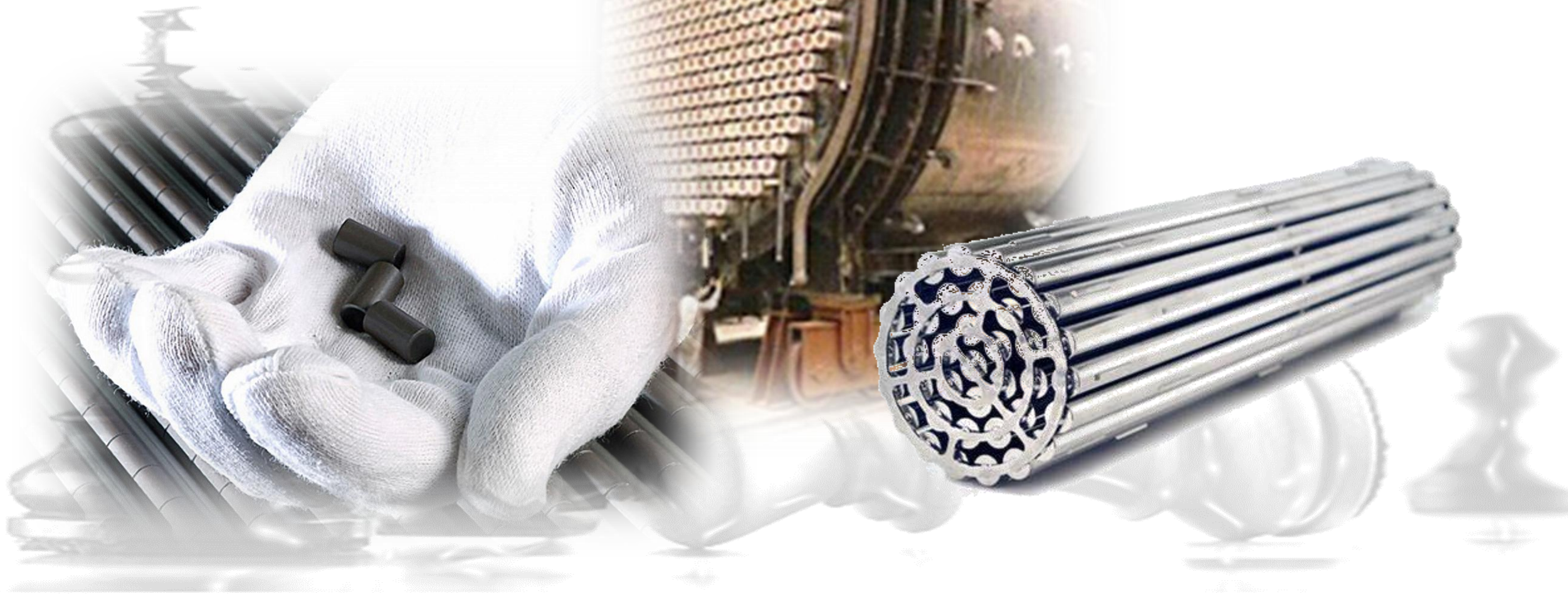
June 8, 2025

The Fuel



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What does a large-scale nuclear Station look like?



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And what might an SMR look like?



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Can Accidents Happen?



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Chernobyl - No Containment

Fukushima - Containment Structure



A bit of a mess ...caused human sickness

A bit of a mess ...A financial disaster but no real health impact



Stages of Development

Presentation kindly supported by:
 OCI
Promoting a Healthy Nuclear Industry



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Chernobyl

Three Mile Island Fukushima

Generation I

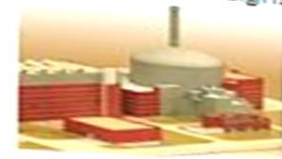
Generation II

Generation III

New Reactors

Generation III+
Evolutionary Designs

Generation IV
Revolutionary Designs



- Shippingport
- Dresden
- Magnox

- PWRs
- BWRs
- CANDU

- CANDU 6
- System 80+
- AP600

- ABWR
- ACR1000
- AP1000
- APWR
- EPR
- ESBWR

- Safer
- Sustainable
- Economical
- More Proliferation Resistant and Physically Secure



Interim Storage of Used Fuel, the Primary Waste



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Fuel Pool while Heat Output is High



Dry Storage Containers When Heat
Output has Declined

Final Storage

A Deep Geological Repository



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The Nuclear Waste Management Organization selects site for Canada's deep geological repository

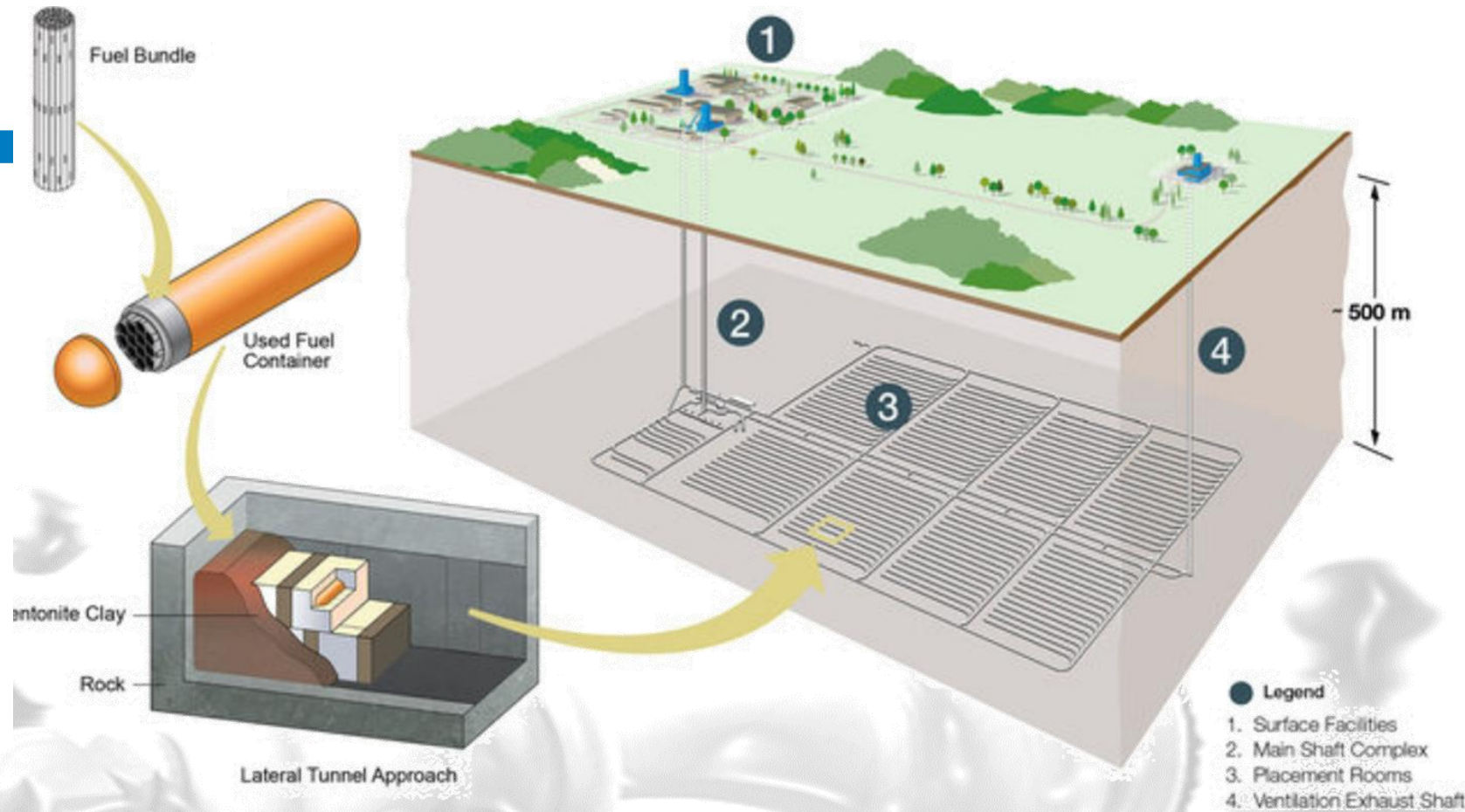


This safe, long-term management solution for used nuclear fuel will protect people and the environment

November 28, 2024

Toronto, ON

Today, the Nuclear Waste Management Organization (NWMO) announced it has selected [Wabigoon Lake Ojibway Nation \(WLON\)](#) and the [Township of Ignace](#) as the host communities for the future site for Canada's deep geological repository for used nuclear fuel.

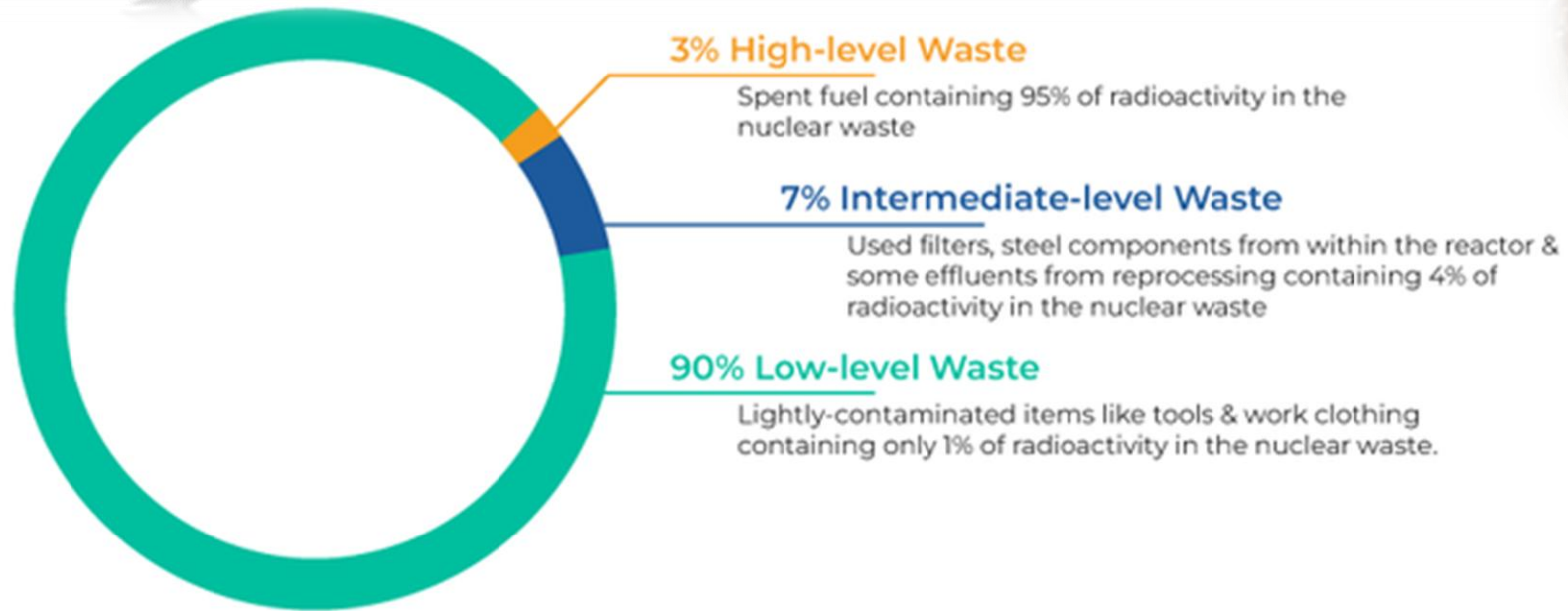


Other Wastes Produced by the Industry



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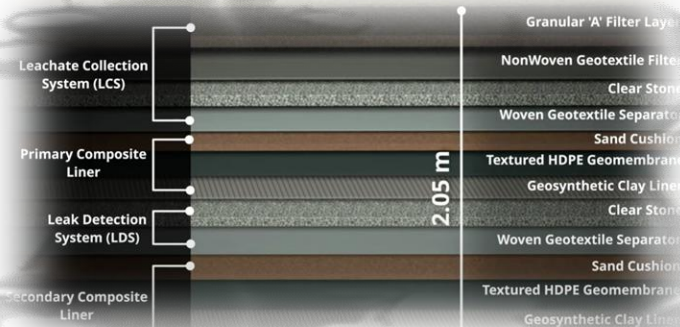
Low Level Waste Management



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- Decay Storage
- Decontaminate
- Sort and Segregate
- Incinerate
- Metal Melt
- Compact
- Size Reduce
- Dispose



Near Surface Disposal Facility



Processing, Volume Reduction and Diversion



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-Question-

