Uranium – The International Picture

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Model of a Uranium Atom

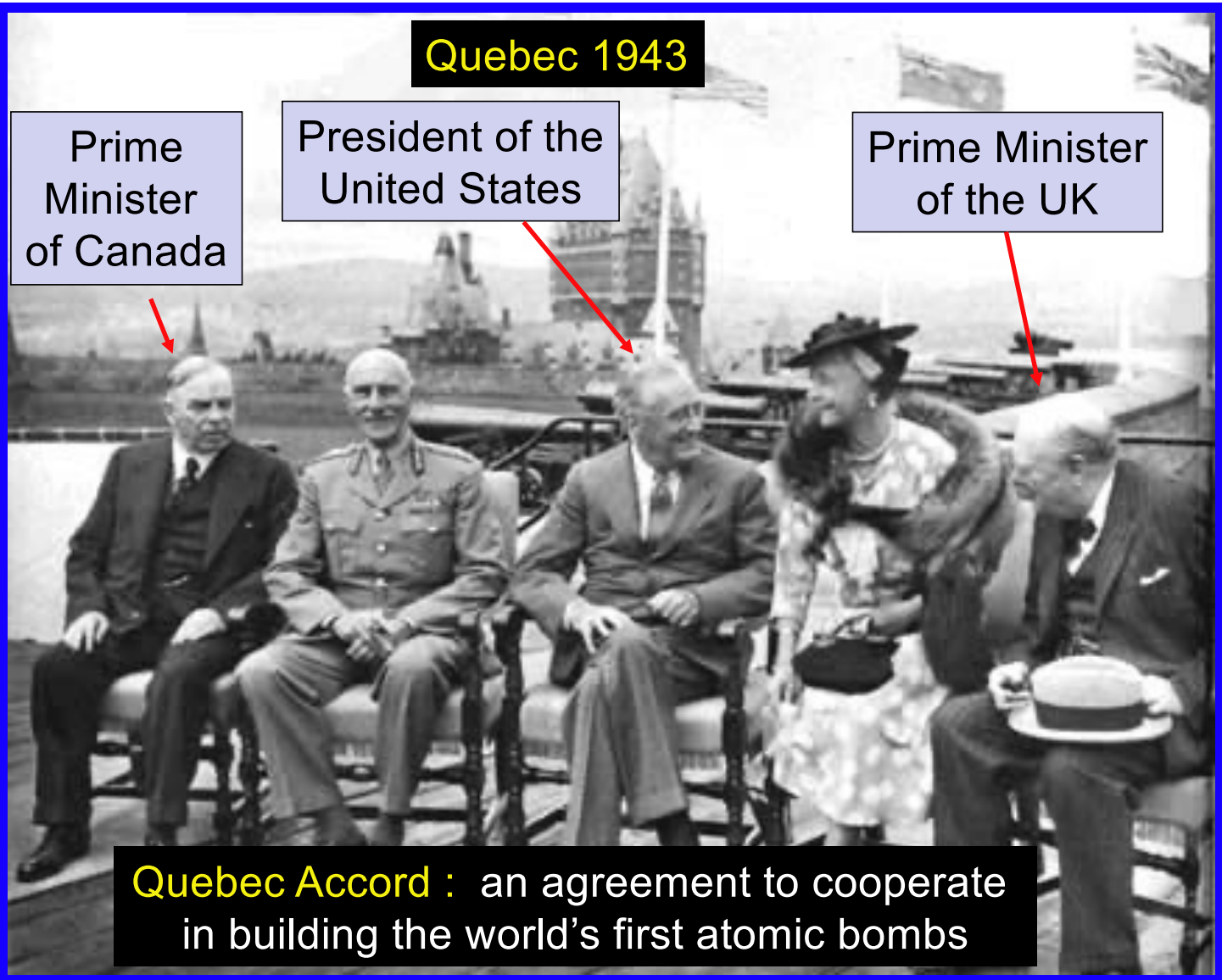
Uranium is
a heavy metal
discovered in 1789

Before 1939
It was used
as a colorant for
glass and pottery

Photo: Robert Del Tredici

Since 1939 it has been the key element in all nuclear fission technology

military &
civilian


Quebec 1943
Prime Minister of Canada
President of the United States
Prime Minister of the UK
Quebec Accord : an agreement to cooperate in building the world's first atomic bombs

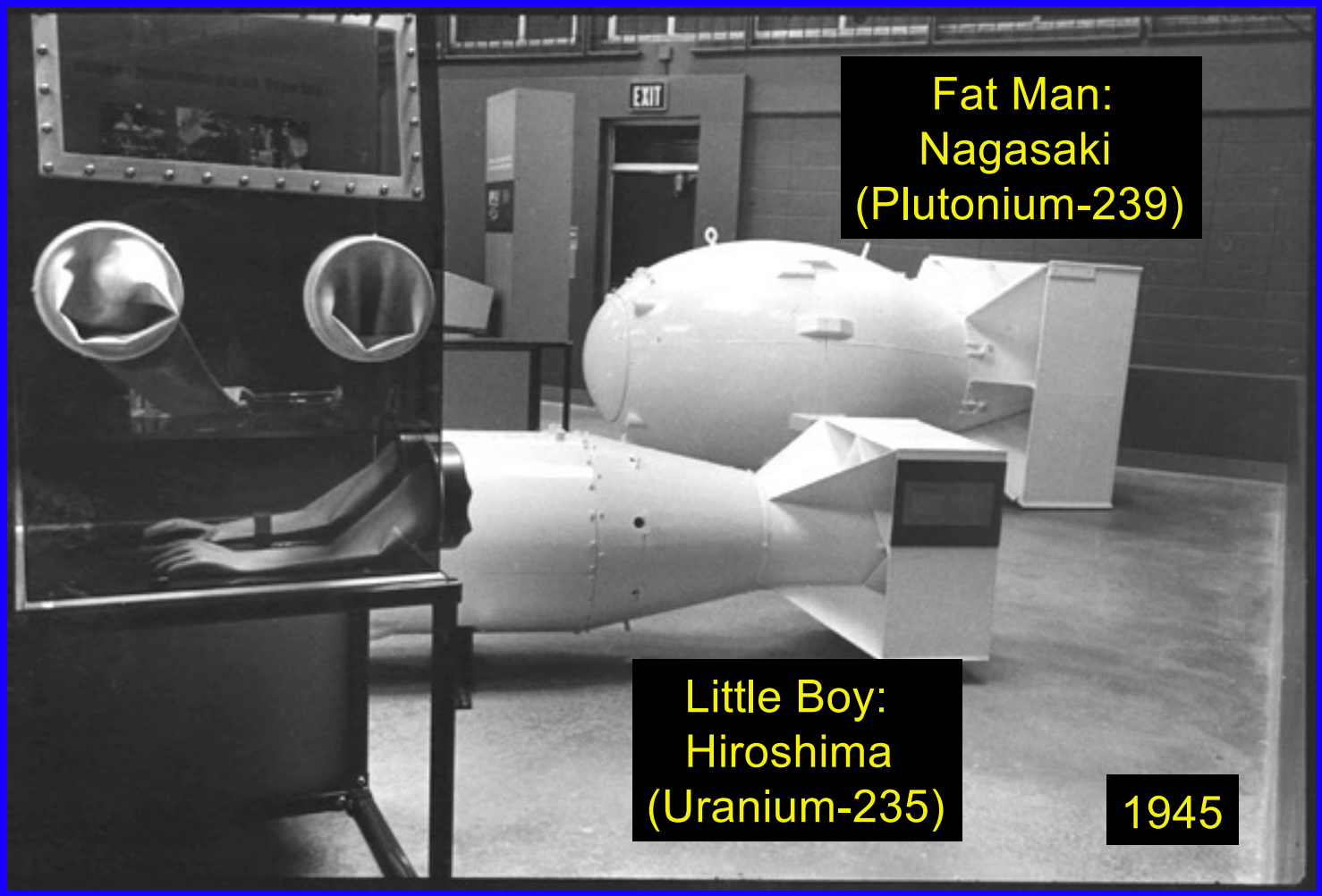


Photo: Robert Del Tredici

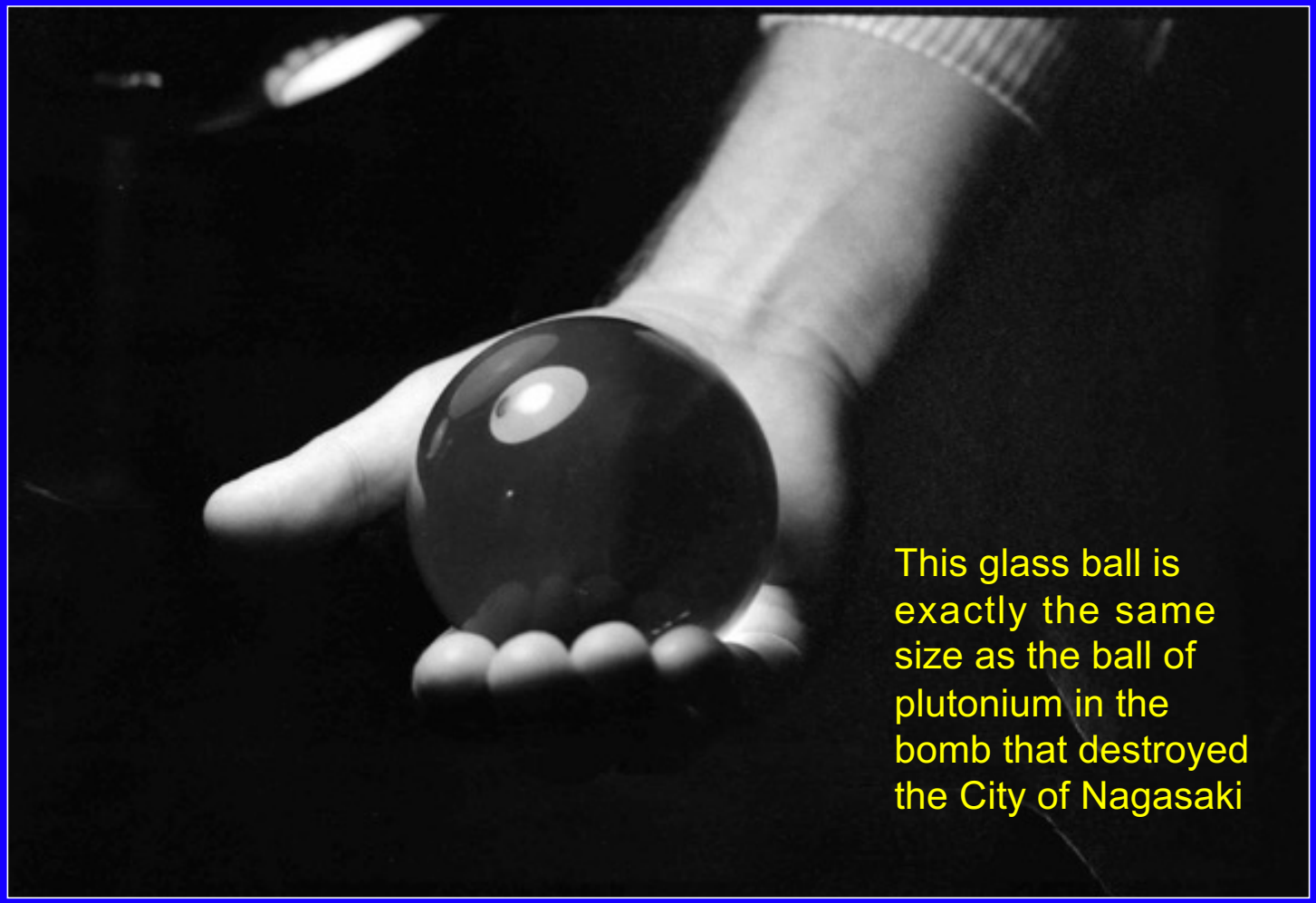


Photo by
Robert Del Tredici

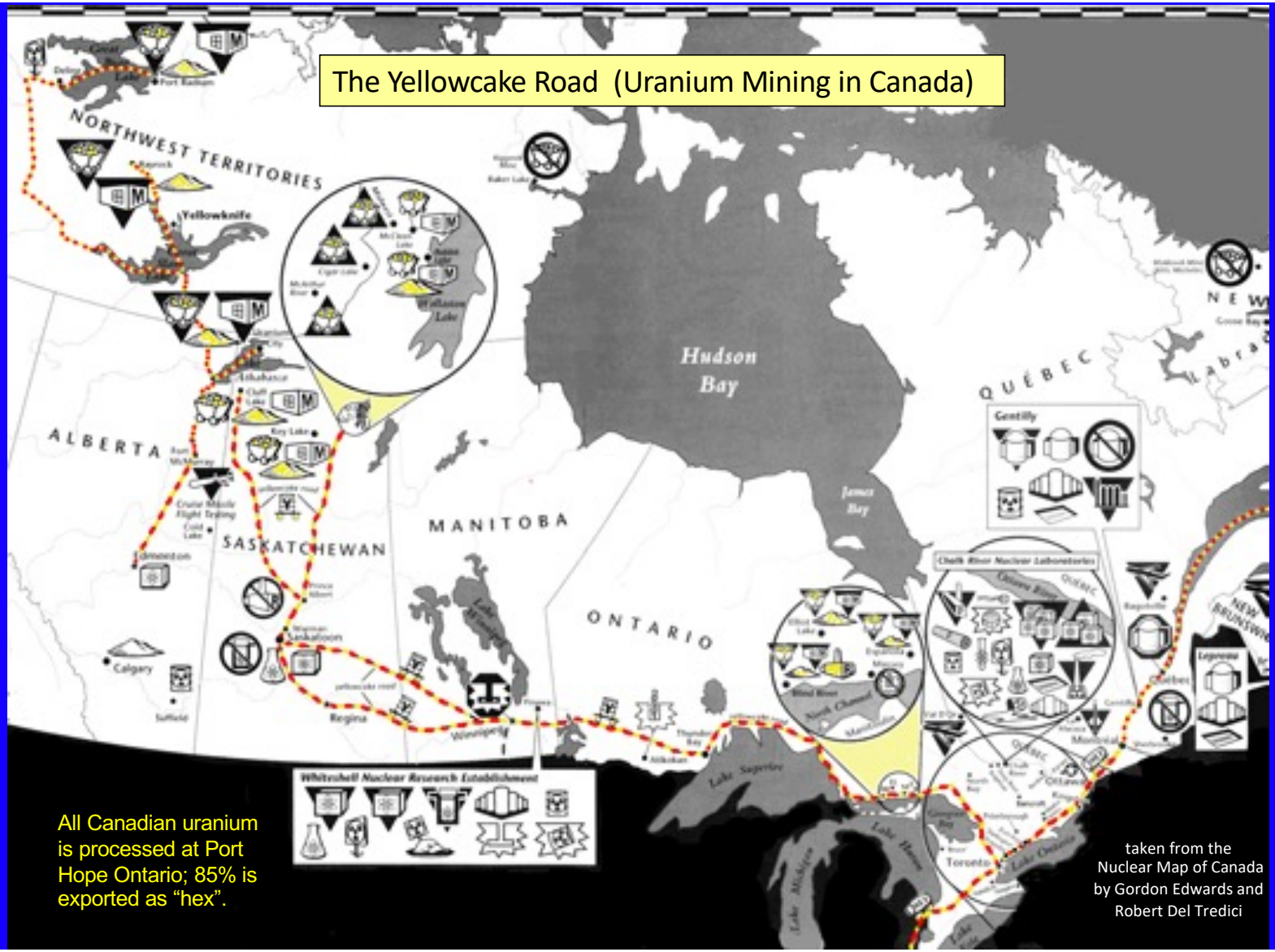
Oppenheimer 1945, quoting Vishnu:

"Now I am become death, the destroyer of worlds"

Above: 24 avatars of the Hindu God Vishnu

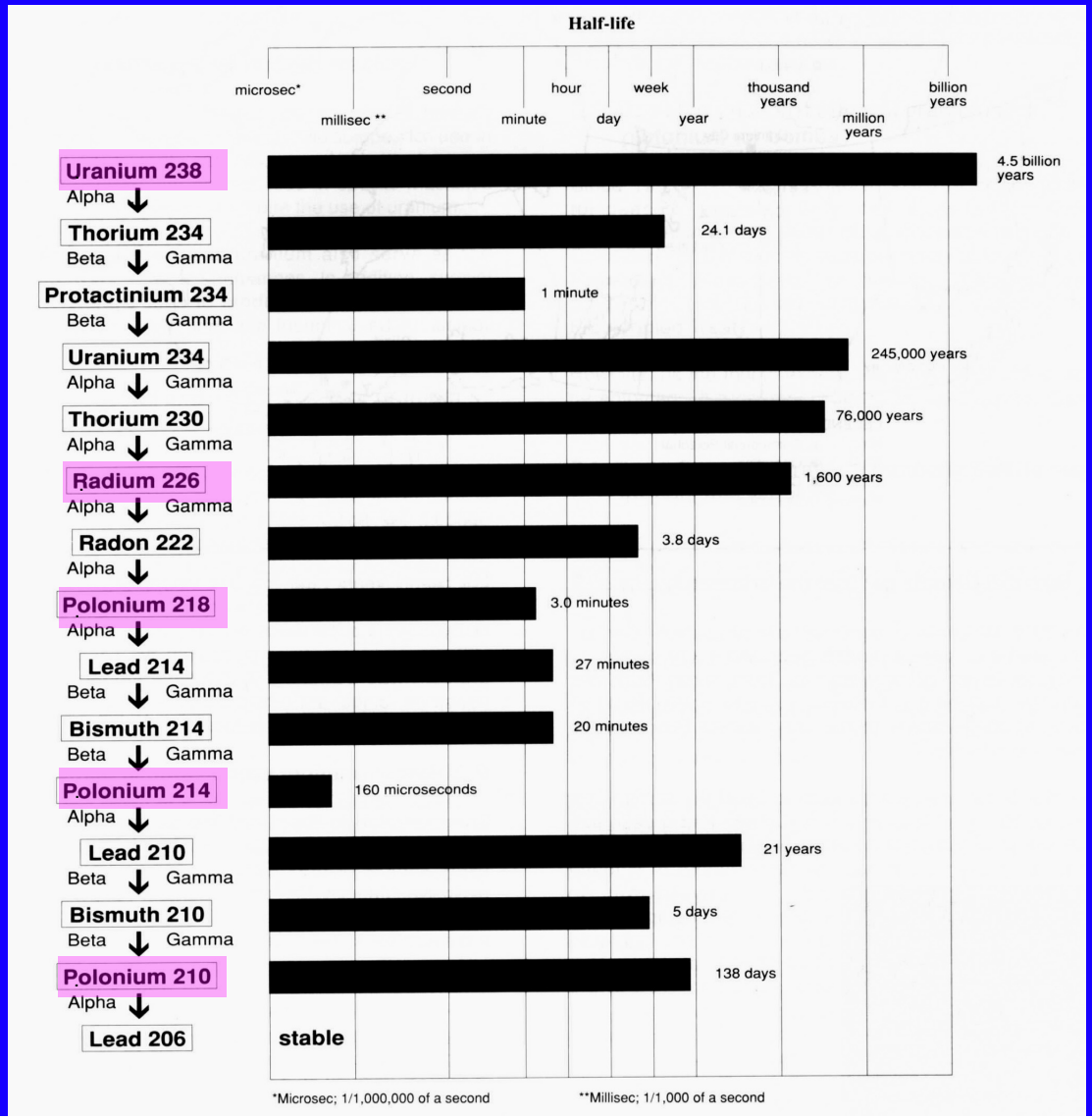
Uranium atoms undergo
THREE SHAPE-SHIFTING
TRANSFORMATIONS

1. Metamorphosis: DECAY PRODUCTS
2. Fragmentation: FISSION PRODUCTS
3. Impregnation: PLUTONIUM & OTHERS



All Canadian uranium is processed at Port Hope Ontario; 85% is exported as “hex”.

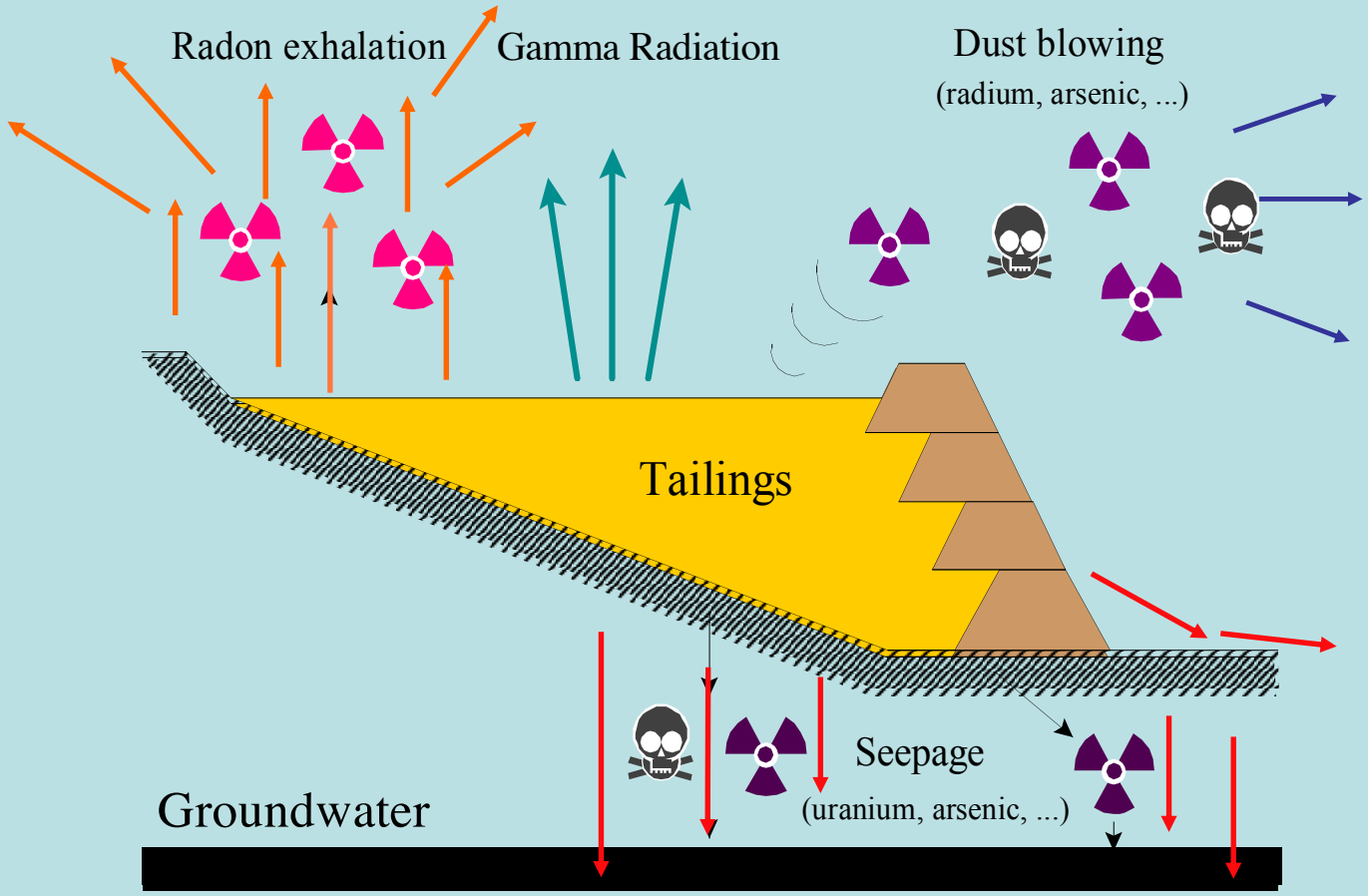
taken from the Nuclear Map of Canada by Gordon Edwards and Robert Del Tredici


Half-life
microsec*
millisec **
second
minute
hour
day
week
year
thousand years
million years
billion years
Uranium 238
Alpha
Thorium 234
Beta
Gamma
Protactinium 234
Beta
Gamma
Uranium 234
Alpha
Gamma
Thorium 230
Alpha
Gamma
Radium 226
Alpha
Gamma
Radon 222
Alpha
Polonium 218
Alpha
Lead 214
Beta
Gamma
Bismuth 214
Beta
Gamma
Polonium 214
Alpha
Lead 210
Beta
Gamma
Bismuth 210
Beta
Gamma
Polonium 210
Alpha
Lead 206
4.5 billion years
24.1 days
1 minute
245,000 years
76,000 years
1,600 years
3.8 days
3.0 minutes
27 minutes
20 minutes
160 microseconds
21 years
5 days
138 days
stable
*Microsec; 1/1,000,000 of a second
**Millisec; 1/1,000 of a second

Stanrock Tailings near Elliot Lake, Ontario

Photo: Robert Del Tredici

Uranium Mill Tailings Hazard



A Joint Report by the Nuclear Energy Agency
and the International Atomic Energy Agency

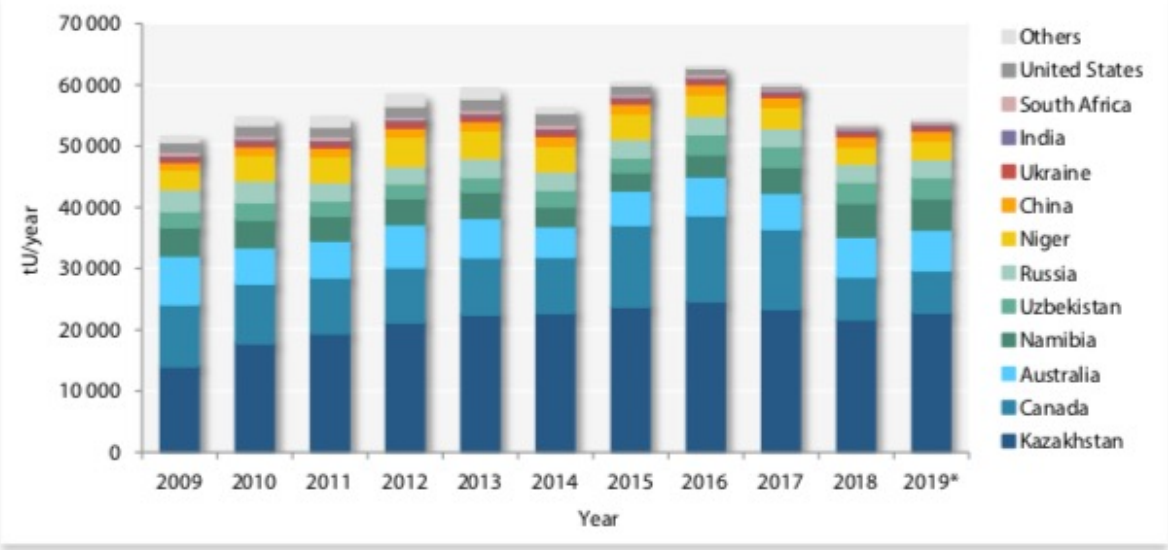
Uranium 2020 Resources, Production and Demand

Figure 1.1. **Global distribution of identified resources**
(<USD 130/kgU as of 1 January 2019)

* Secretariat estimate or partial estimate.
The global distribution of identified resources among 16 countries that are either major uranium producers or have significant plans for growth of nuclear generating capacity illustrates the widespread distribution of these resources. Together, these 16 countries are endowed with 95% of the identified global resource base in this cost category (the remaining 5% are distributed among another 21 countries). The widespread distribution of uranium resources is an important geographic aspect of nuclear energy in light of security of energy supply.

Figure 1.2. **Distribution of reasonably assured resources (RAR) among countries with a significant share of resources**

Figure 1.6. **Recent world uranium production (tU/year)**



"Others" includes the remaining producers (see Table 1.18 and previous Red Book editions).

* NEA/IAEA estimate.

Niger slipped to 7th place as 2018 production declined by 606 tU to 2 878 tU as production cuts continued at Somair, whereas Namibia solidified its 4th place ranking as Husab ramped up production after start-up in 2016. Official updated production figures for Uzbekistan moved it up to rank as the 5th largest producer in 2018 at 3 450 tU. The top five producing countries (Kazakhstan, Canada, Australia, Namibia and Uzbekistan) dominated uranium production, accounting for 83% of world production in 2018. Ten countries: Kazakhstan (40.6%), Canada (13.1%), Australia (12.2%), Namibia (10.3%), Uzbekistan (6.4%), Russia (5.4%), Niger (5.4%), China (3.0%), Ukraine (1.5%) and India (0.7%) accounted for over 98% of world production in 2018 (see Figure 1.5).

Figure 2.1. **World installed nuclear capacity: 396 GWe net**

(as of 1 January 2019)

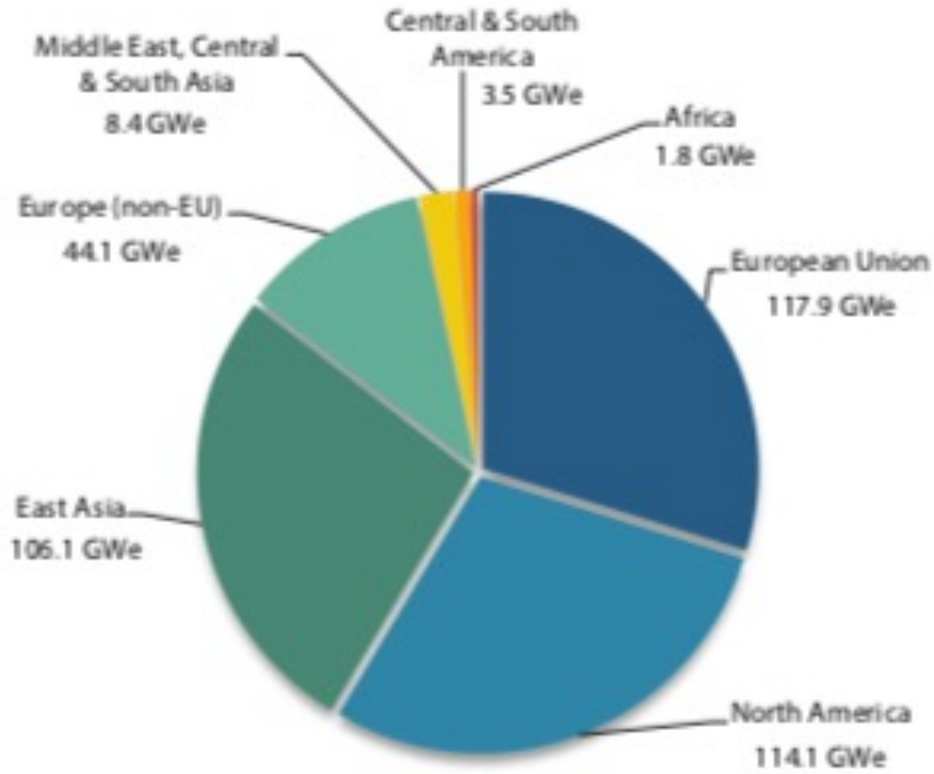


Figure 2.2. **World uranium requirements: 59 200 tU**
(as of 1 January 2019)

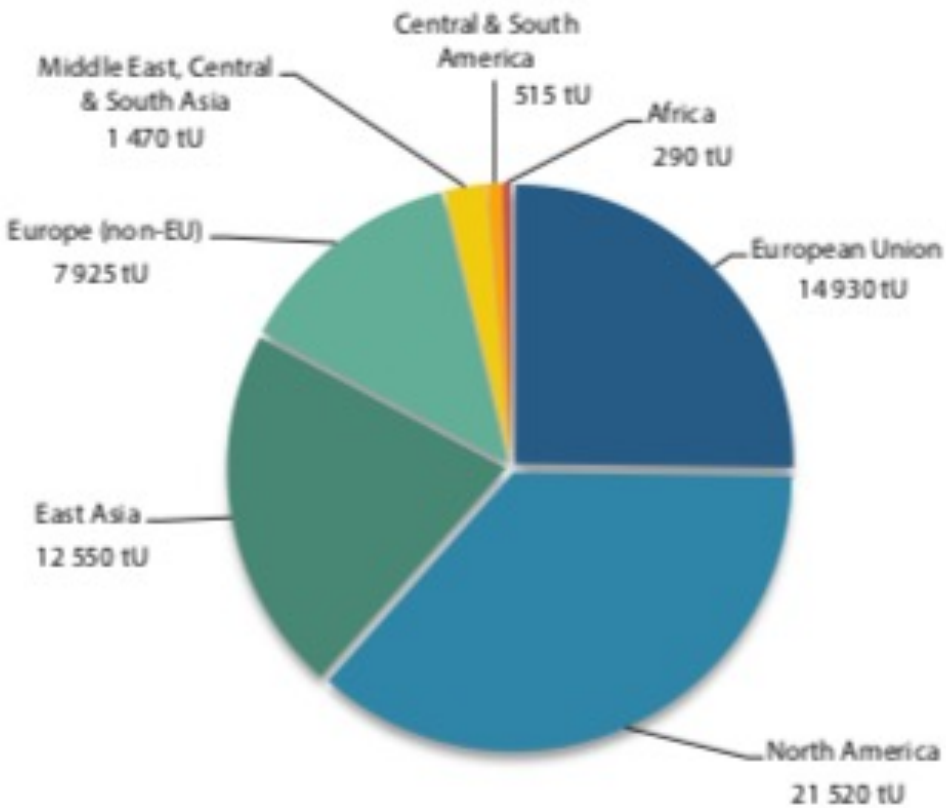


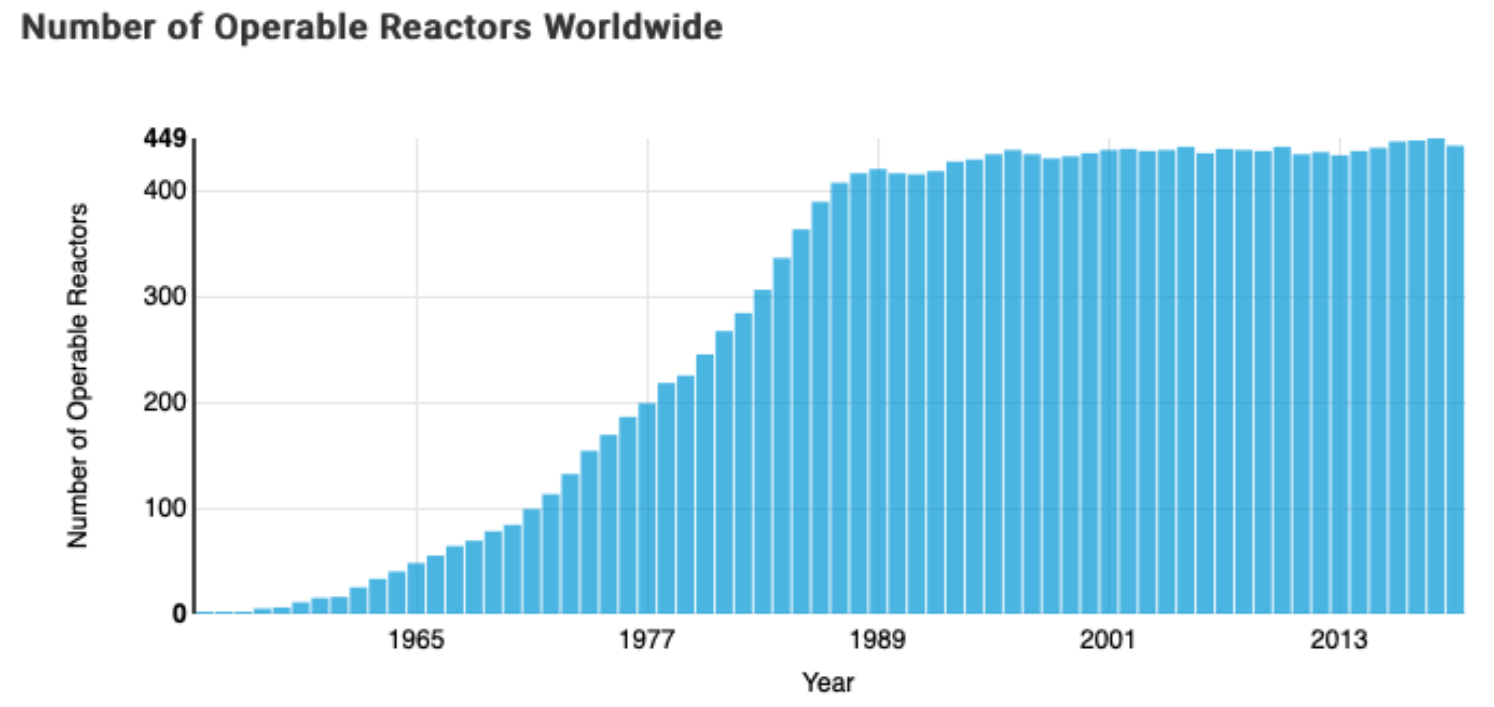
Figure 2.11. **Uranium spot price dynamics**
(TradeTech Exchange Value trend, 2002-2020)

Source: Trade Tech (www.uranium.info).

Note: The Exchange value is Trade Tech's judgement of the price at which spot and near-term transactions for significant quantities of natural uranium concentrates could be conducted as of the last day of the month.

In addition to this information from government and international sources, spot price ndicators for immediate or near-term delivery (less than one year) that typically amount to 15% o 25% of all annual uranium transactions, are provided by the industry trade press, such as

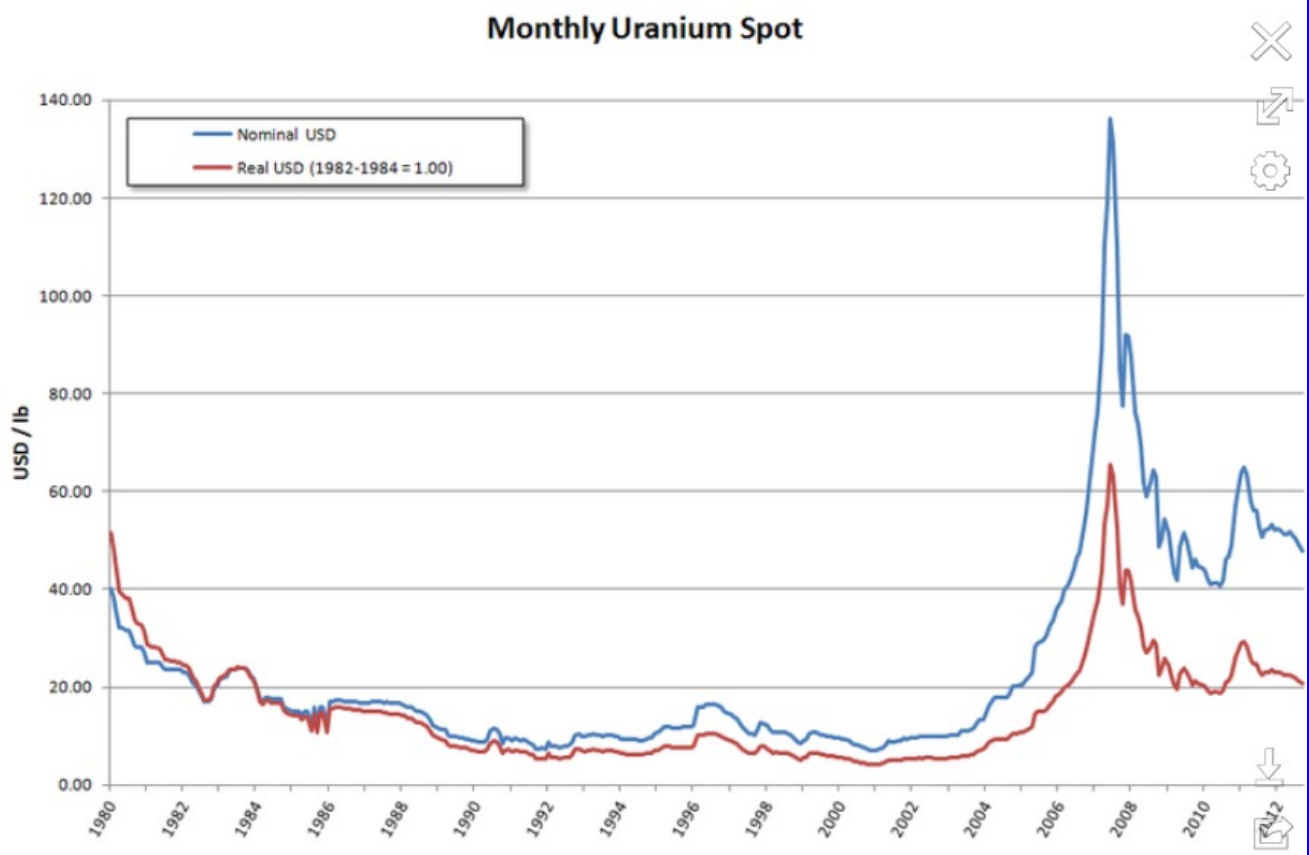
World Nuclear Association Data



1996 – 438 reactors
17% of global electricity
(< 3.3% of global energy)

2019– 442 reactors
10% of global electricity
(< 2% of global energy)

Bursting the Uranium Bubble



GEORGIA USA

February 2012 – U.S. Nuclear Regulatory Commission (NRC) approves Southern Company's application for two new reactors at its Vogtle plant in Georgia.

These are the first new reactors to receive construction approval in more than 30 years.

Vogtle Units 3 and 4	2 Westinghouse AP1000 reactors.
Planned in 2006; estimated cost	$14 billion in 2013; $25 billion in 2019.
Licence to build & operate 2012	first new reactors approved in >30 years
Westinghouse Bankruptcy 2017	directly related to the Vogtle plants.

TWO REACTORS FOR SOUTH CAROLINA CANCELLED: $9 billion loss, criminal charges

Figure 2.5. **Annual reactor uranium requirements to 2040**

(low and high projections)

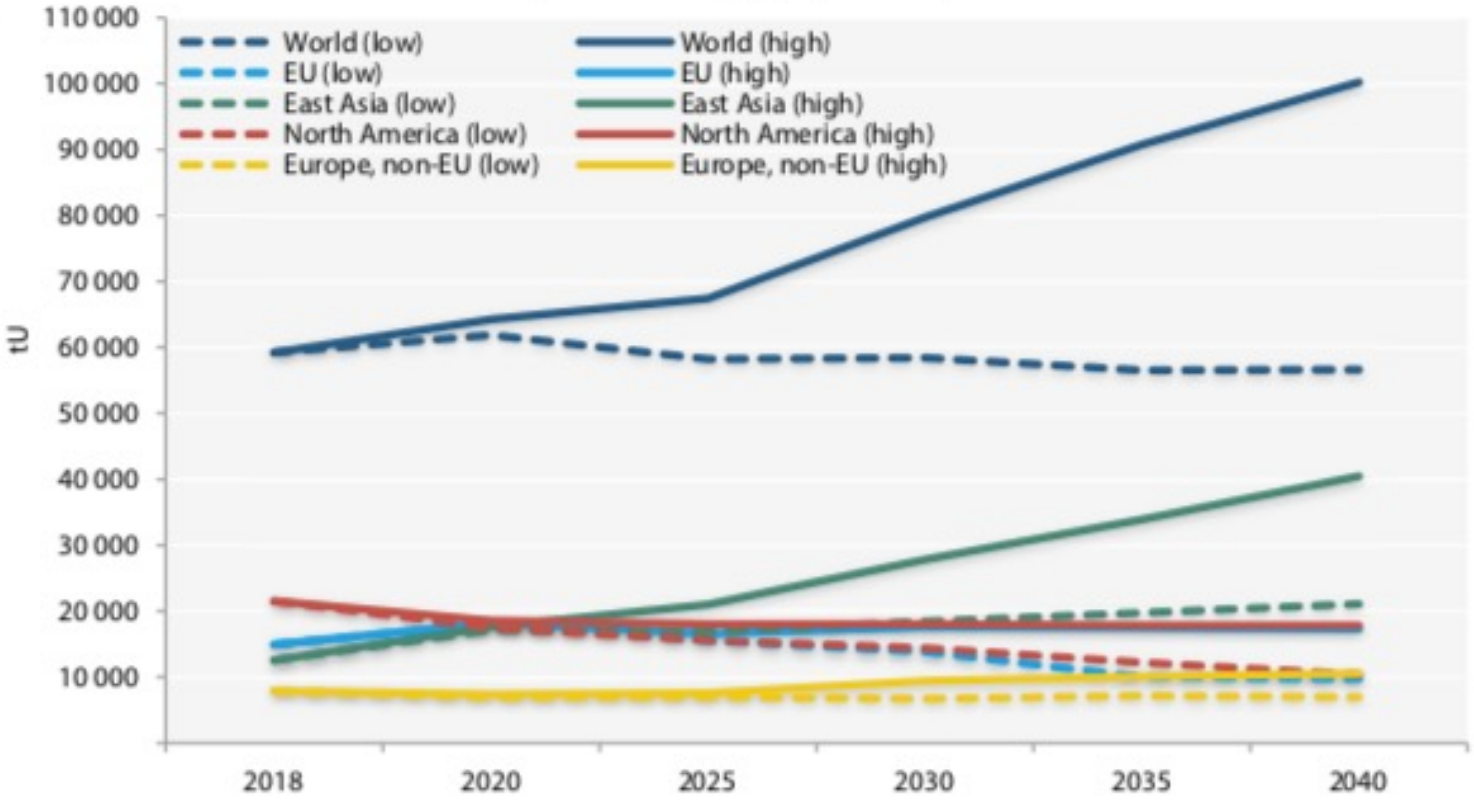
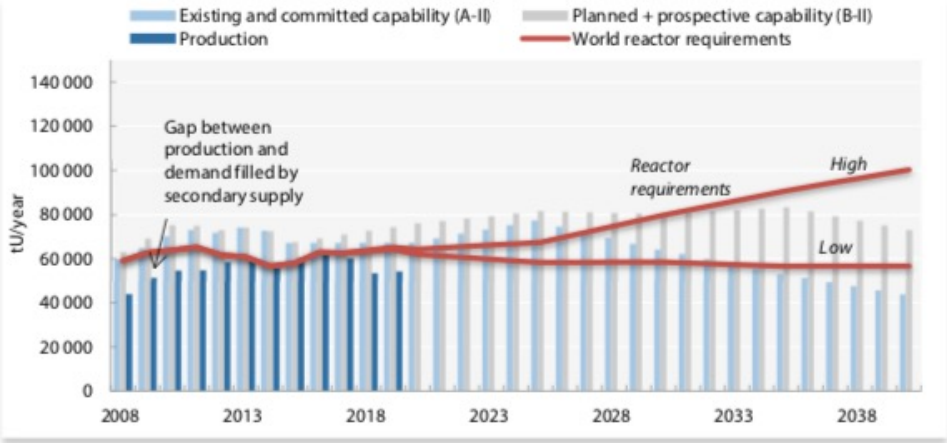
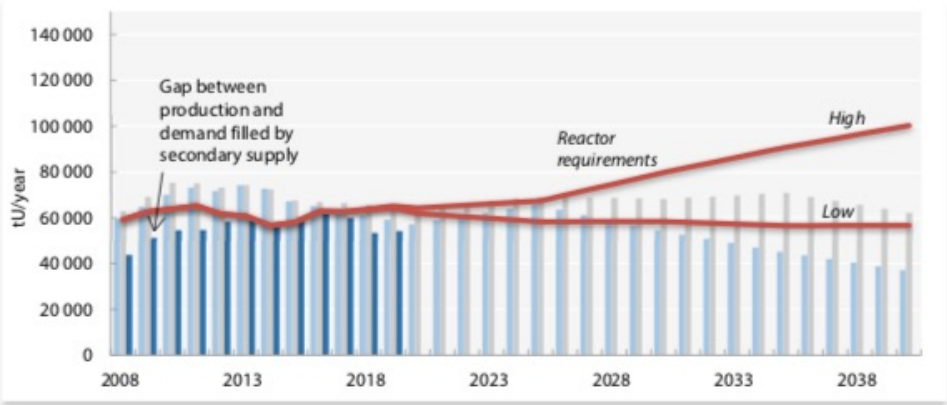


Figure 2.12. **Projected world uranium production capability to 2040 (supported by identified resources at a cost of <USD 50/lb U_3O_8) compared with reactor requirements***

(a) 100% of total production capability



(b) 85% of total production capability



CHINA – world leader in renewables

At the end of 2020, China had a nuclear power generation capacity of 49.6 GW from 50 reactors, with additional 17.1 GW under construction.

At the end of 2020, China had installed 281 GW of wind and 253 GW of solar power, making a total of 534 GW of non-hydro renewables.

A wind farm near Heyuan City in Guangdong, China. Credit: Haitong Yu/Getty

To meet its 2030 goals, China plans to more than double its wind and solar power generation capacity (over 1064 GW) in the coming decade.

So existing renewable capacity is already over 10 x nuclear capacity, and by 2030 renewable capacity will likely be more than 16 x nuclear.

The End

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