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Les enjeux de la filière uranifère au Québec
6211-08-012

Contre l'Uranium:

un dioparama

du Regroupement pour la surveillance du nucléaire

(Canadian Coalition for Nuclear Responsibility)

presenté par Gordon Edwards, Ph.D., président du RSN,
aux commissaires du BAPE, le 17 novembre, 2014

Regroupement pour la surveillance du nucléaire
www.ccnr.org/index_f.html

PART 1

Uses for Uranium

1. Nuclear Weapons
2. Fuel for Nuclear Reactors

A Model of the Uranium Atom

Photo: Robert Del Tredici

Every atom has a tiny "nucleus" at the centre, with electrons in orbit around it.

Uranium is special. It is the key element behind all nuclear technology, whether military or civilian.

When the uranium nucleus is “split” enormous energy is released.
And the broken pieces of uranium atoms are extremely radioactive.

Photo: Robert Del Tredici

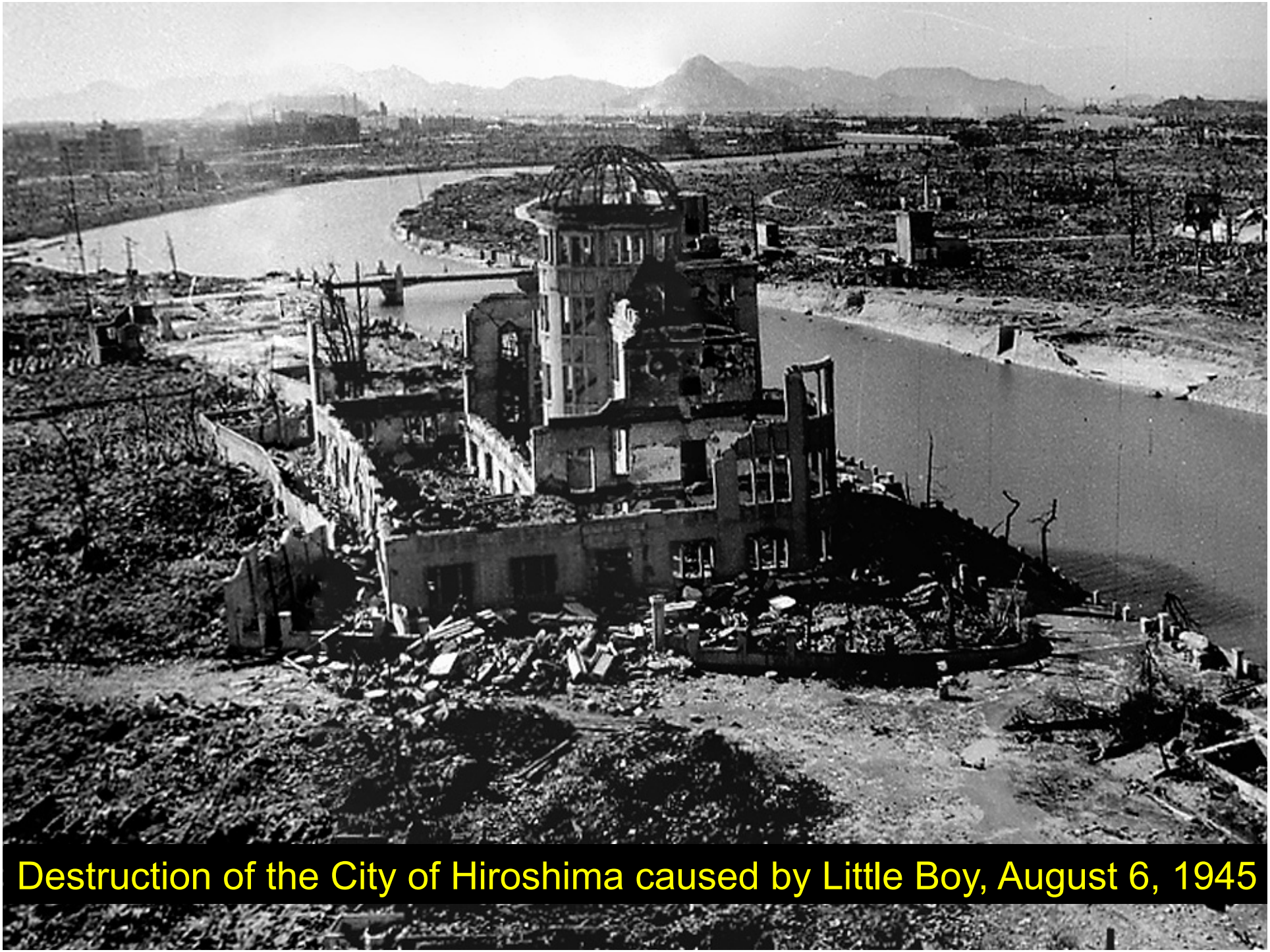
Canadian Uranium for Bombs

1941-1965

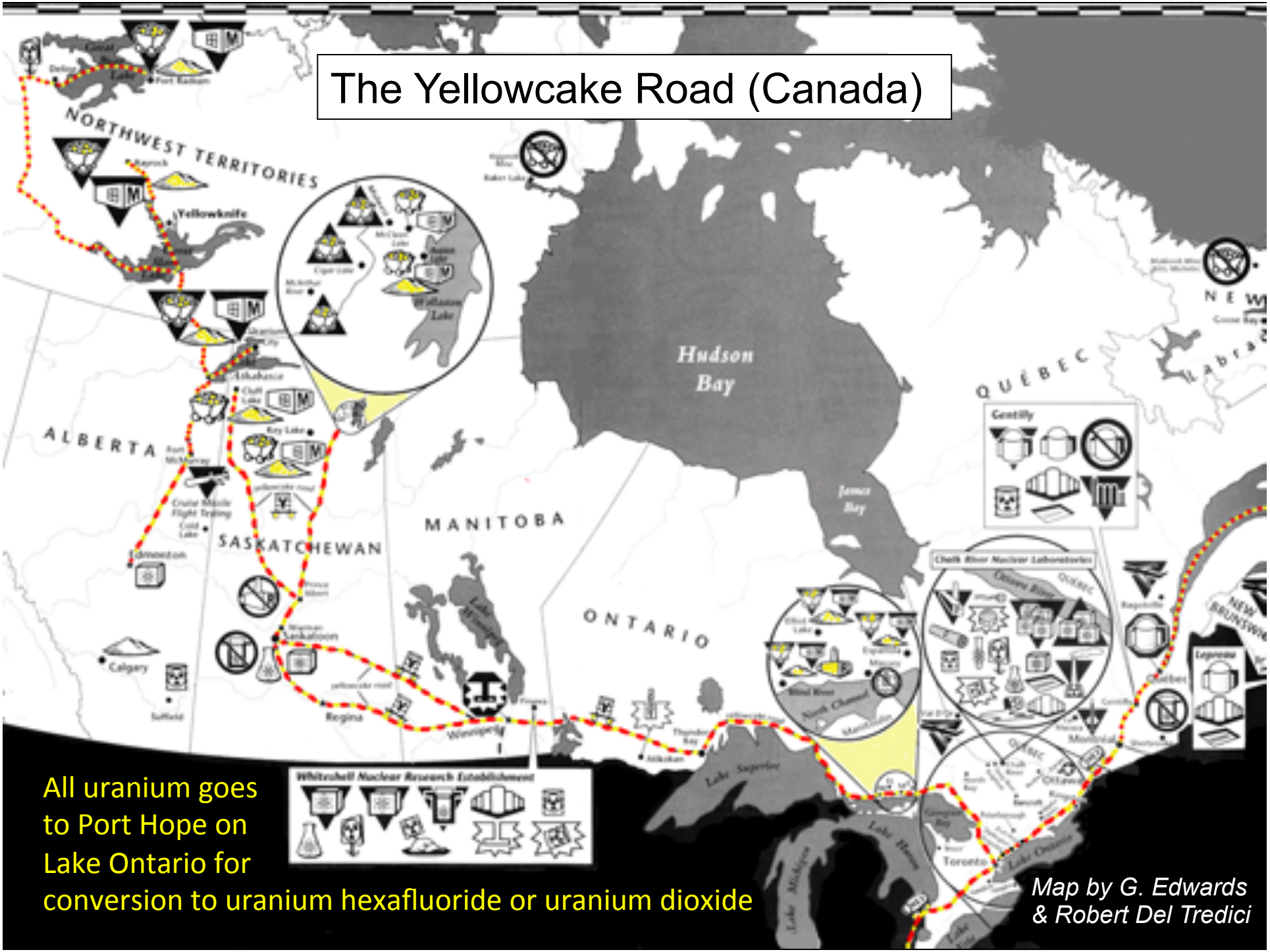

The Quebec Accord
CANADA – USA - UK
Quebec City
1943
Prime Minister of Canada
President of the U.S.A.
Prime Minister of Britain
Uranium from Canada to be used in WWII Atomic Bomb Project

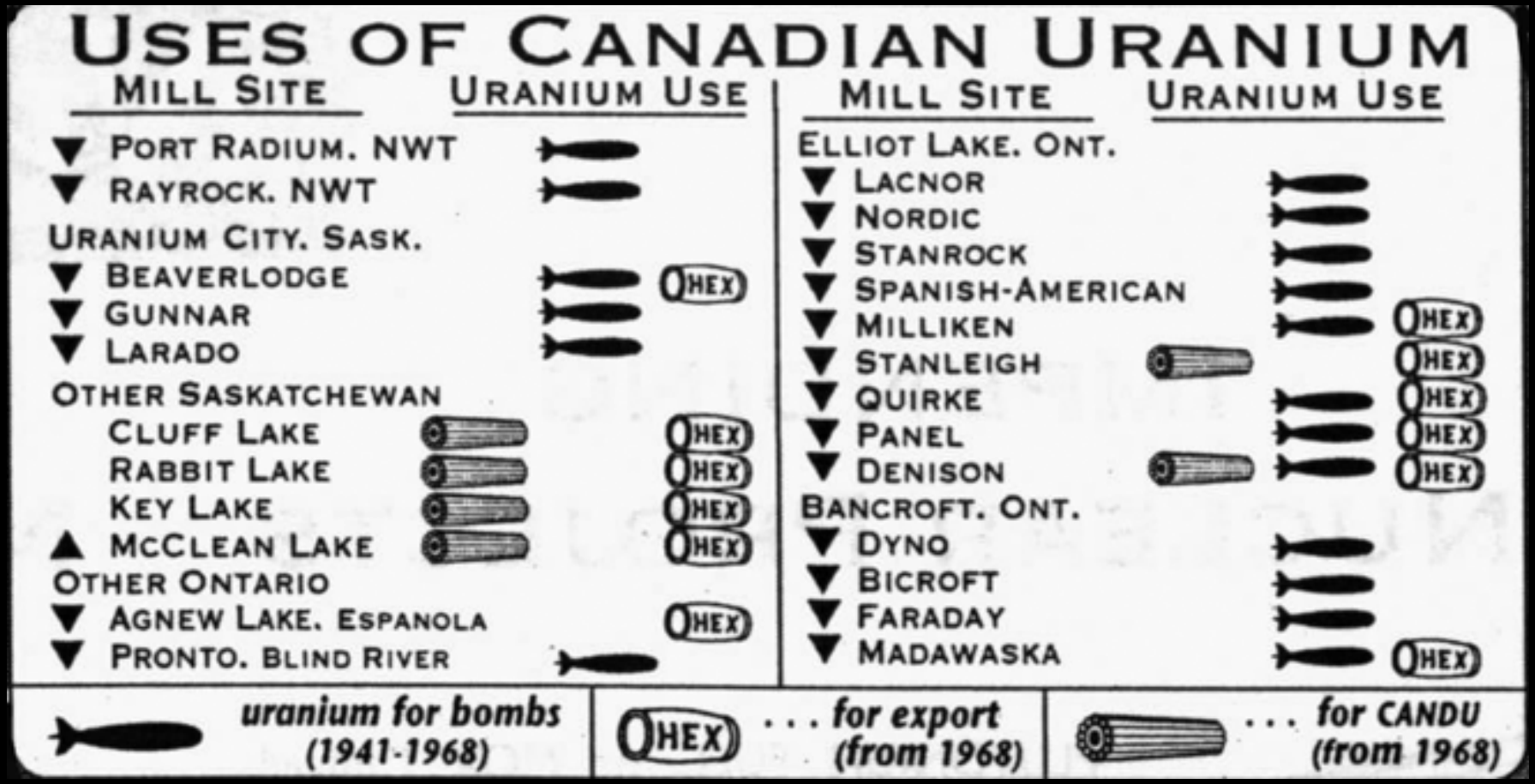
Models of the two Atomic Bombs dropped on Japan in 1945

Photo: Robert Del Tredici



Destruction of the City of Hiroshima caused by Little Boy, August 6, 1945


The Yellowcake Road (Canada)
NORTHWEST TERRITORIES
Yellowknife
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUÉBEC
Hudson Bay
James Bay
Saskatoon
Regina
Winnipeg
Calgary
Toronto
Ottawa
Montréal
Gentilly
Chalk River Nuclear Laboratories
Whiteshell Nuclear Research Establishment
All uranium goes to Port Hope on Lake Ontario for conversion to uranium hexafluoride or uranium dioxide
Map by G. Edwards & Robert Del Tredici



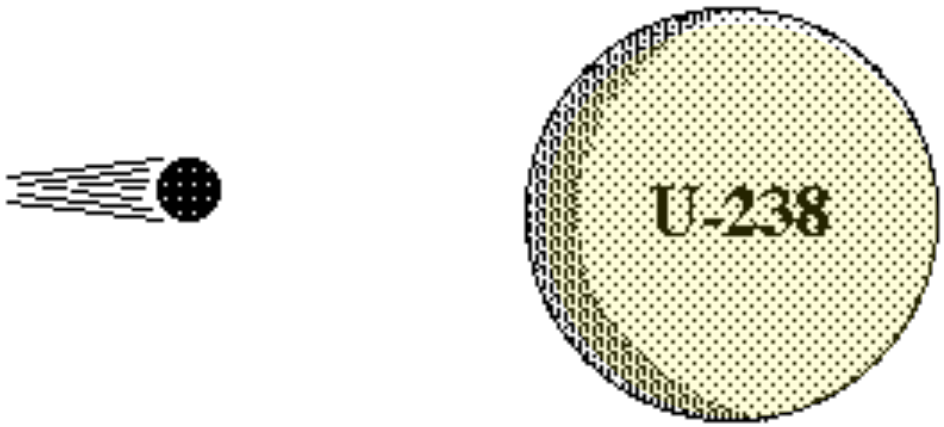
Until 1945, all Canadian uranium was sold to the US military for Bombs.
Although military sales ended in 1965, deliveries continued for a few more years.

Over 85% of Canada's uranium is exported to other countries.

Canadian Plutonium for Bombs

1945-1965

Creation of plutonium in a nuclear reactor…



when an atom of uranium-238 absorbs a neutron . . .

the atom of uranium-238 . . .

. . . is transformed into an atom of plutonium-239

This glass paperweight is the exact size of the plutonium ball that was used as a nuclear explosive in the Nagasaki bomb.

Photo: Robert Del Tredici

Howard Morland with a model of a hydrogen bomb

Photo: Robert Del Tredici

An H-Bomb is 50 to 100 times more powerful than the Hiroshima Bomb

All H-bombs use a plutonium "trigger" (at the top) to raise the temperature to 50 million degrees.

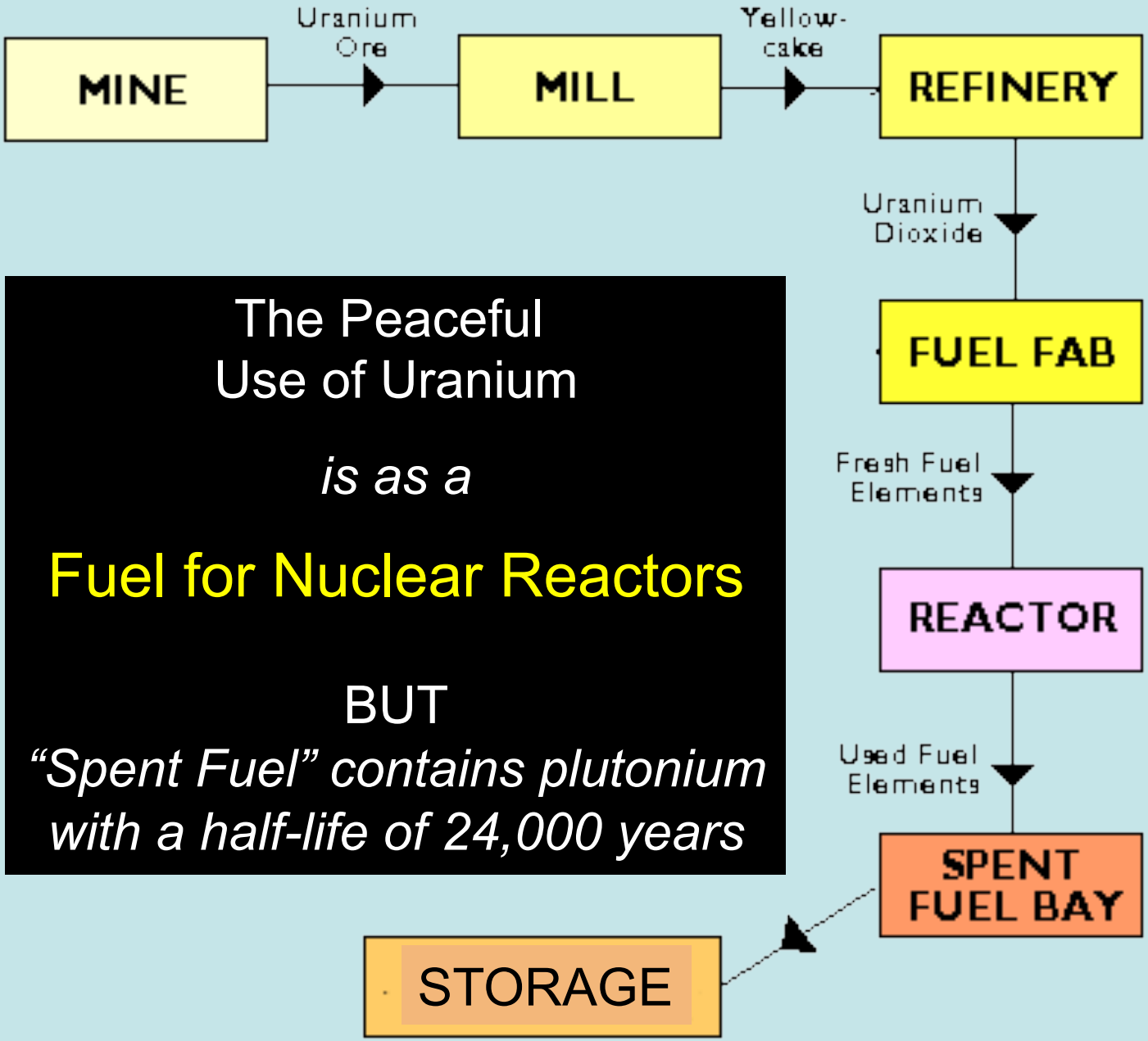
When an H-bomb is dismantled, the plutonium is removed – thus making the bomb harmless.

Bronze Plaque at
Chalk River Visitors' Centre

Photo: Robert Del Tredici

THE ZEEP REACTOR

A nuclear chain reaction was first initiated in Canada on September 5, 1945, when the ZEEP reactor went into operation here at Chalk River. Originally part of an effort to produce plutonium for nuclear weapons, the reactor was designed by a team of Canadian, British and French scientists and engineers assembled in Montreal and in Ottawa in 1942-43 under the administration of the National Research Council. Named Zero Energy Experimental Pile because it was developed to produce only one watt of heat, the ZEEP reactor was used to provide data for the design of the powerful NRX (National Research Experimental) reactor. In 1952 the project was transferred from NRC to Atomic Energy of Canada Limited.



The Peaceful
Use of Uranium

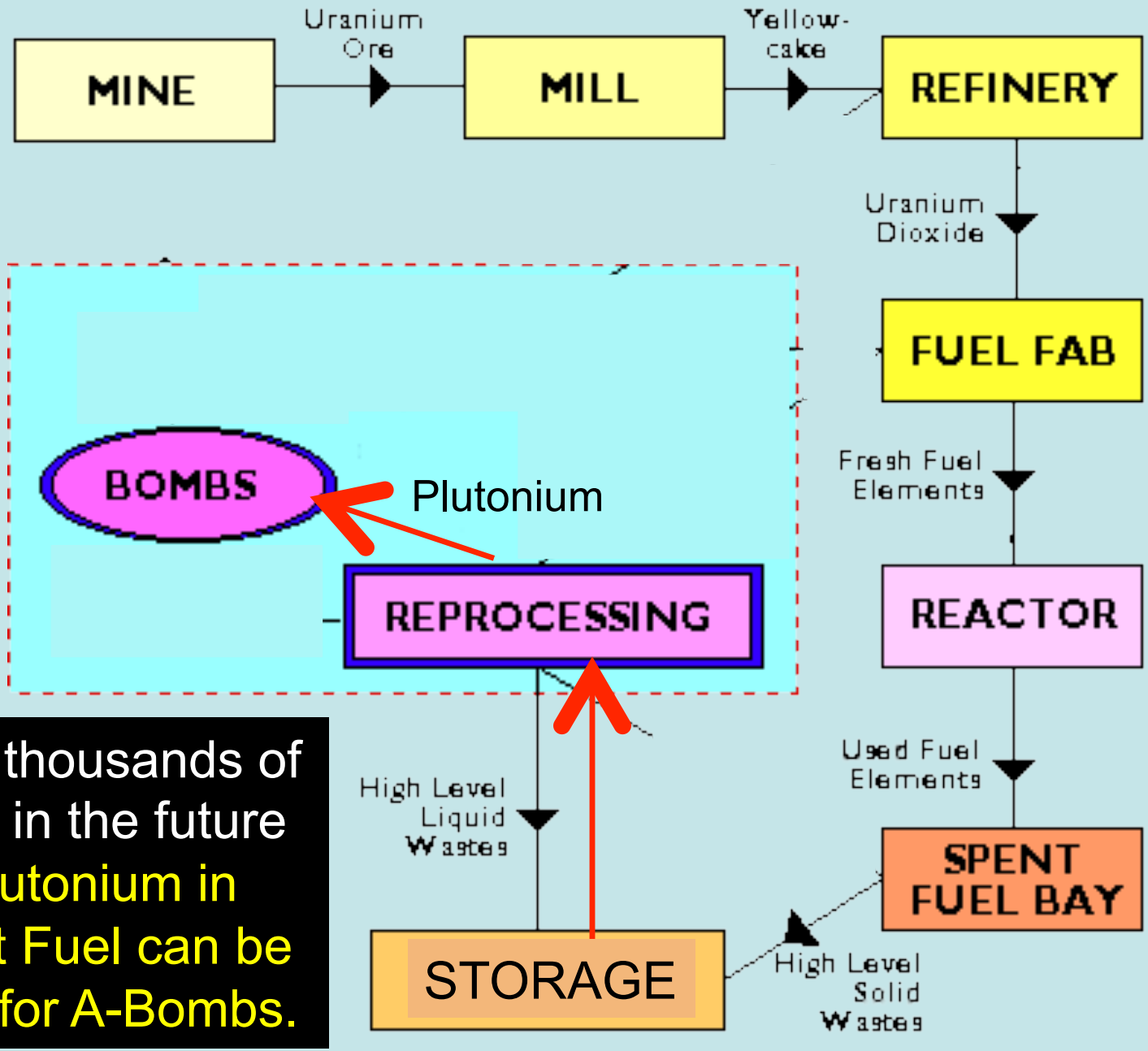
is as a

Fuel for Nuclear Reactors

BUT

"Spent Fuel" contains plutonium with a half-life of 24,000 years

High Level Nuclear Waste



Even thousands of years in the future the plutonium in Spent Fuel can be used for A-Bombs.

Summary:

Uranium can be used for nuclear weapons.
Or, it can be used for peaceful purposes.

Canada no longer sells uranium for Bombs.

But when uranium is used for peaceful purposes,
plutonium is always created as a byproduct.

Plutonium is a powerful nuclear explosive.
And it has a half-life of 24,000 years.

So thousands of years from now, someone
can take the leftovers of the peaceful atom
and use the man-made plutonium to make Bombs.

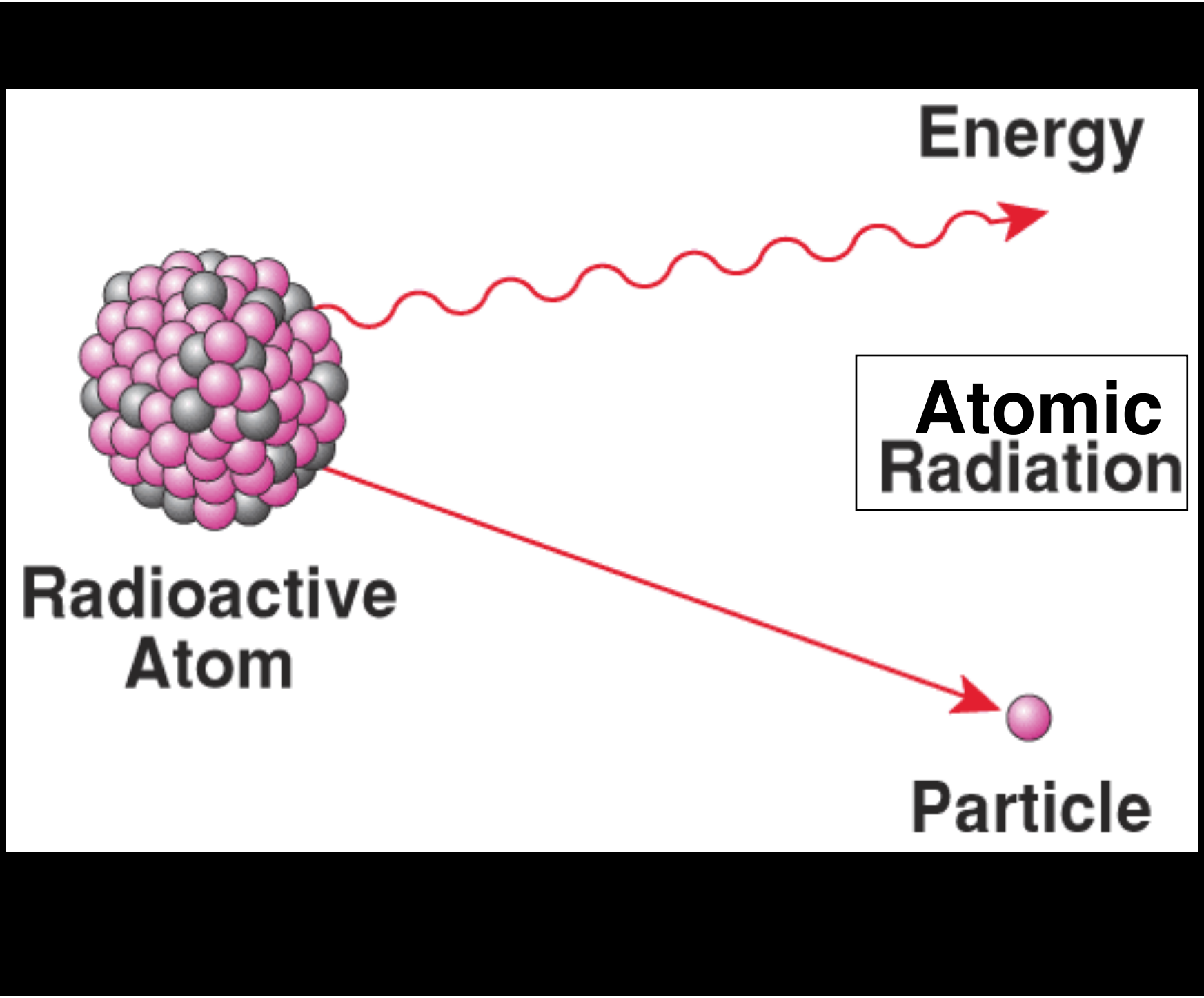
PART 2

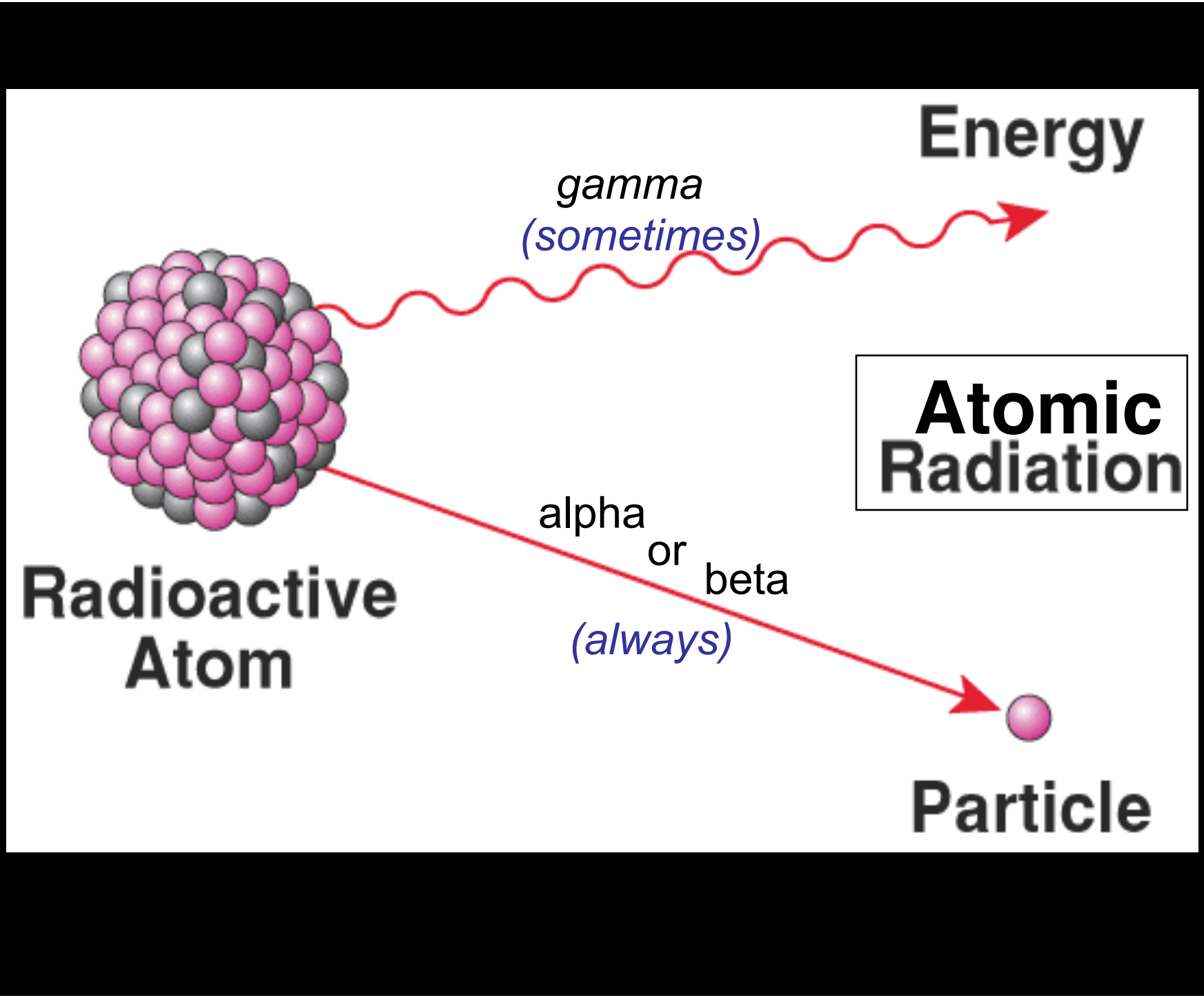
Uranium Mining Legacy

Radioactive Mill Residues

What is Radioactivity?

- Most materials have stable atoms (they *never* change).
- Radioactive materials have unstable atoms (they *will* change).
- Unstable atoms **disintegrate** **(suddenly and violently)**.
- The moment of disintegration is when biological harm is done.
- One “becquerel” indicates one disintegration per second.


Energy
Atomic Radiation
Radioactive Atom
Particle


Energy
gamma
(sometimes)
Atomic
Radiation
alpha
or
beta
(always)
Radioactive
Atom
Particle

A gamma ray is like an x-ray, but more powerful.
highly penetrating

A beta particle is like a sub-atomic bullet.
moderately penetrating

An alpha particle is like a subatomic cannon ball.
not very penetrating
~ but extremely damaging! ~

Alpha and Beta particles are INTERNAL hazards.

Alpha radiation ~ harmless outside the body, deadly inside.

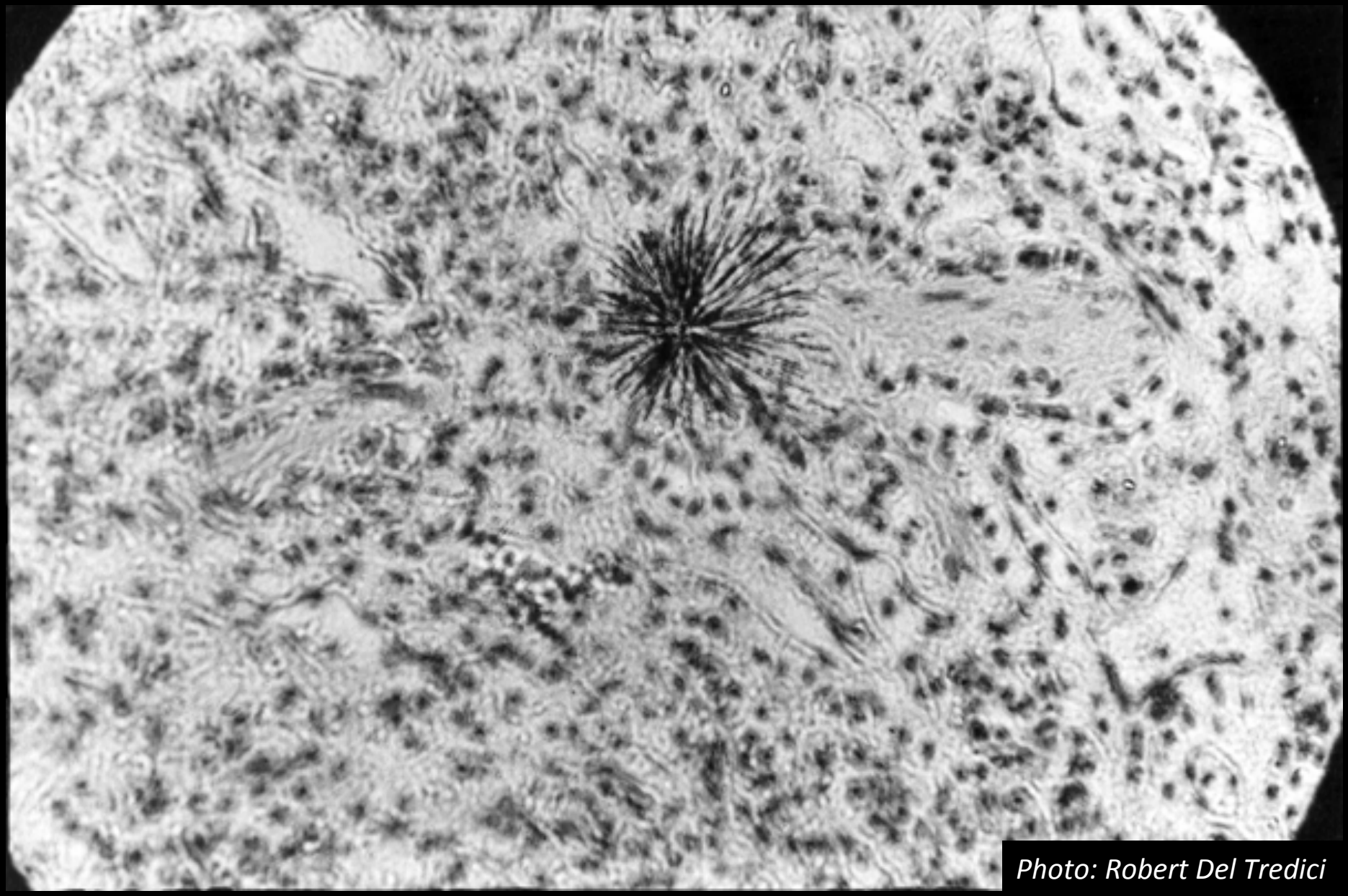
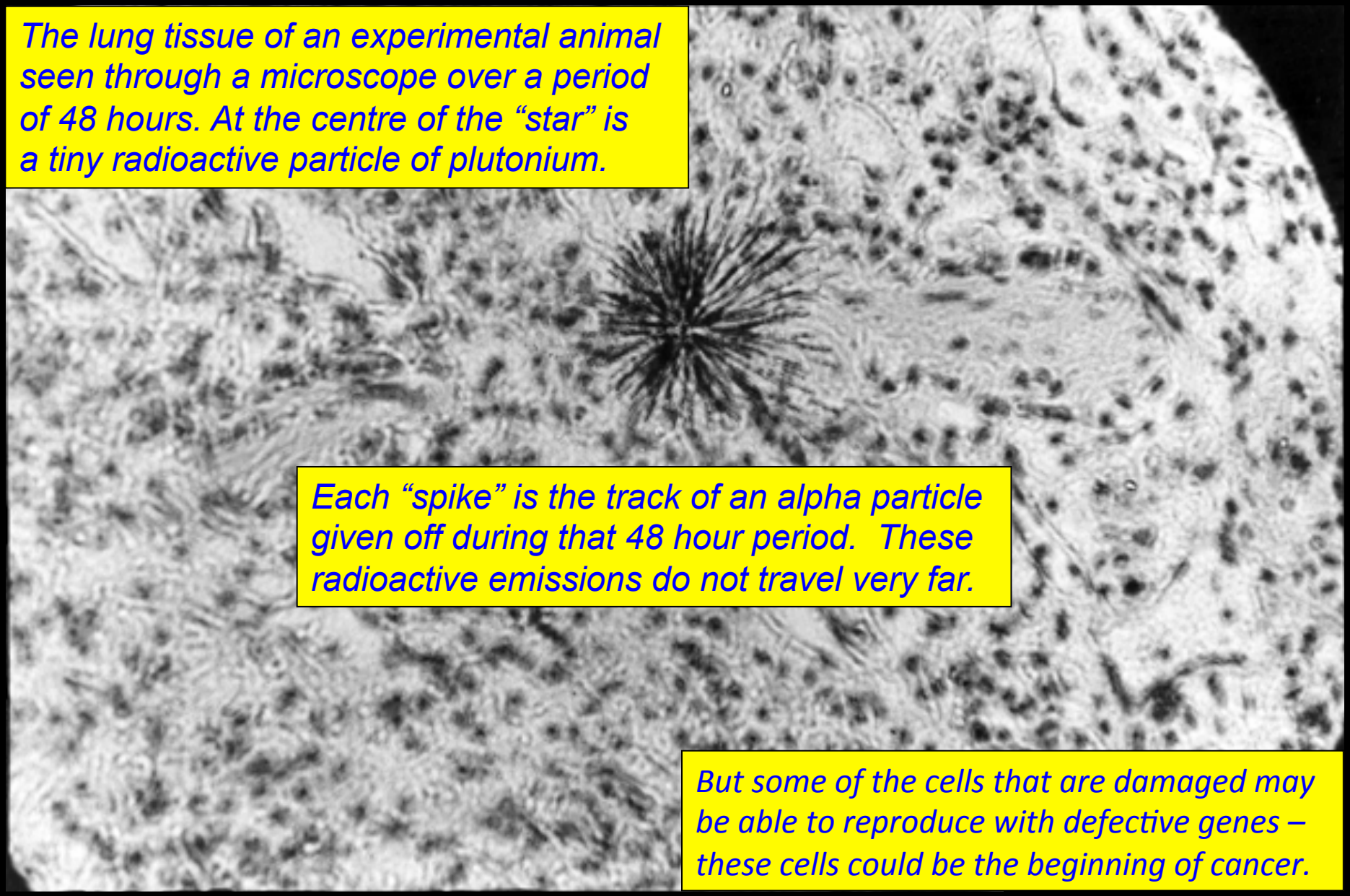


Photo: Robert Del Tredici

Radium, Radon, Polonium, Thorium, Uranium, Plutonium ~ all alpha emitters

Alpha radiation ~ harmless outside the body, deadly inside.



The lung tissue of an experimental animal seen through a microscope over a period of 48 hours. At the centre of the "star" is a tiny radioactive particle of plutonium.

Each "spike" is the track of an alpha particle given off during that 48 hour period. These radioactive emissions do not travel very far.

But some of the cells that are damaged may be able to reproduce with defective genes – these cells could be the beginning of cancer.

Radium, Radon, Polonium, Thorium, Uranium, Plutonium ~ all alpha emitters

Henri Becquerel 1896

accidentally discovered that uranium ore is radioactive

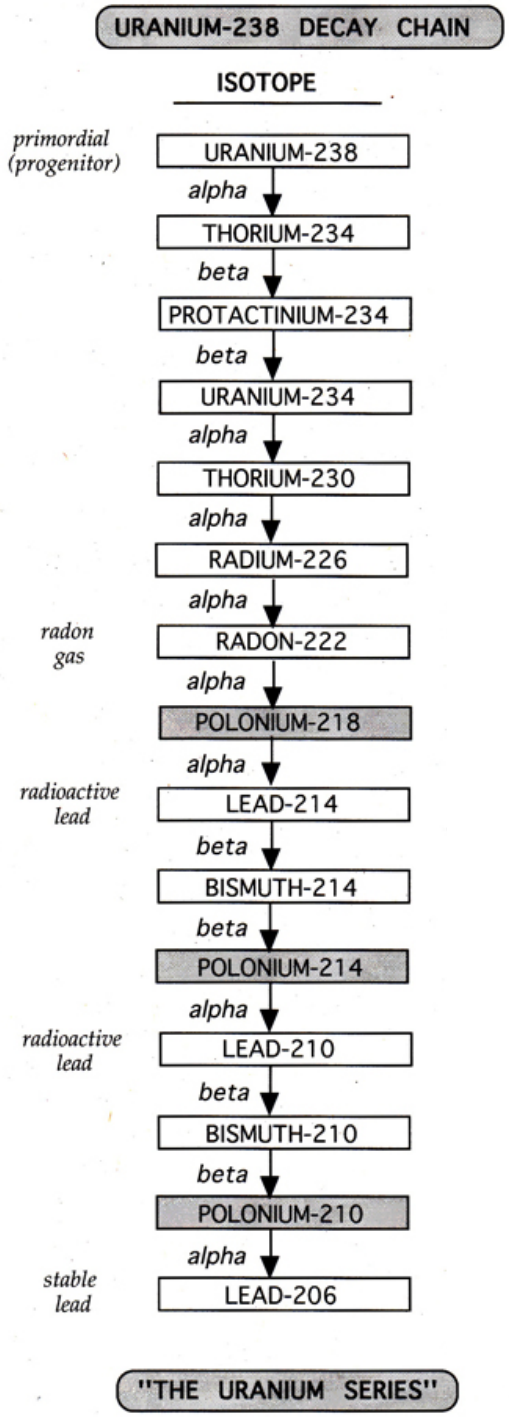
discovered radium and polonium,
two “decay products” of uranium

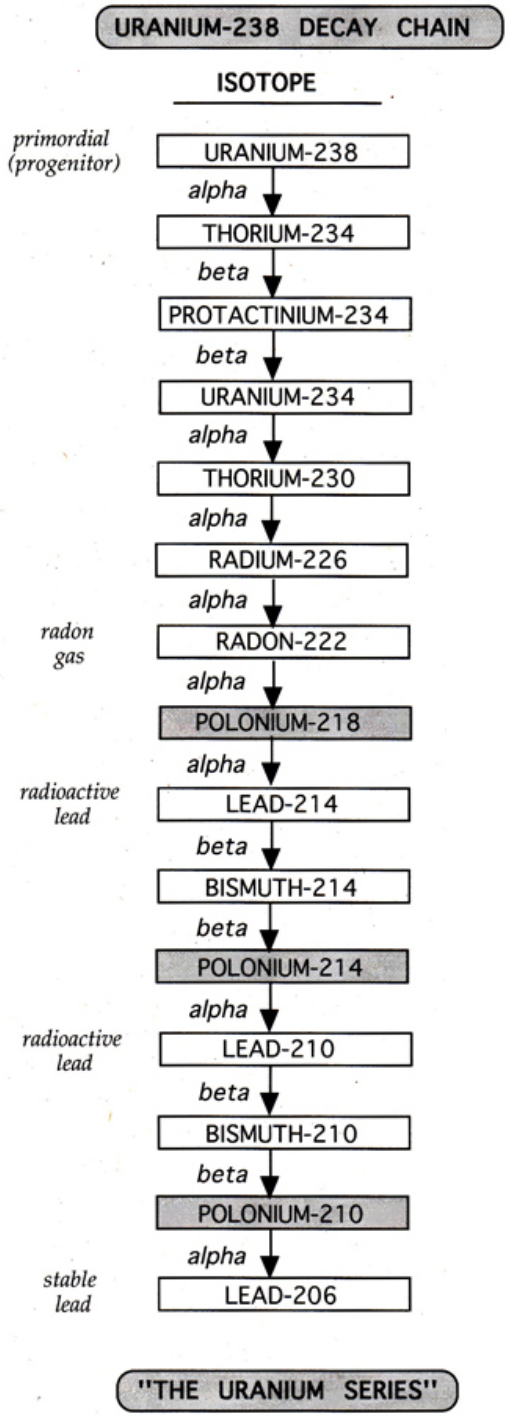
What is a Decay Product?

- When disintegration occurs, ***a radioactive atom is fundamentally altered – it becomes a new kind of atom***.
- So in any radioactive material, new atoms are created, called ***"decay products"*** or "progeny".
- If a given decay product is also radioactive, then it will have its own decay products, and so on and so on . . .

. . . this gives rise to a ***"decay chain"*** or "decay series".

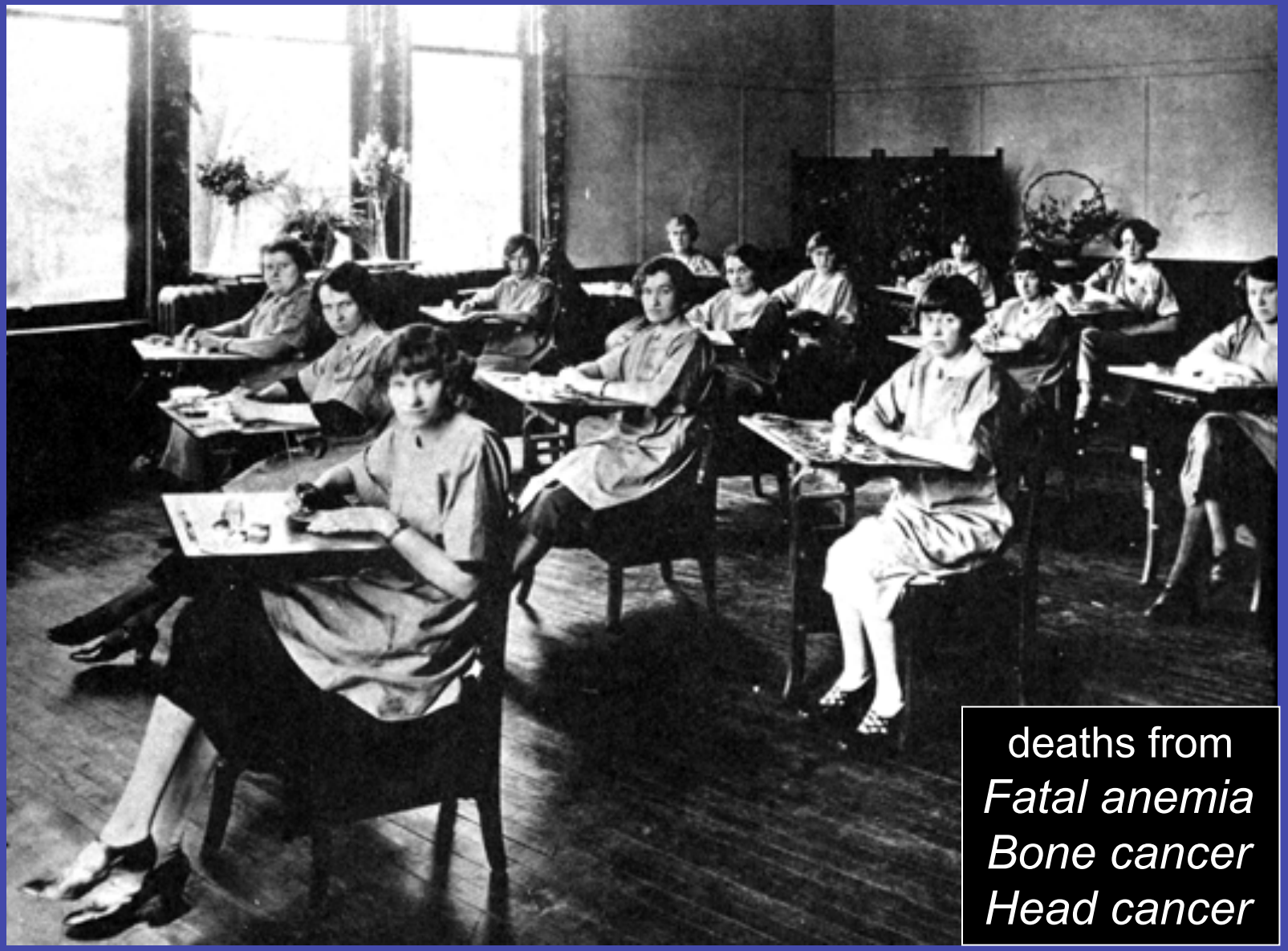
Here is the decay chain of uranium-238, the most common type of uranium found in nature





On a weight-by-weight basis, all of the uranium decay products are much more radioactive and much more dangerous than uranium itself.

The 3 types of polonium are the most dangerous of all.



Dial Painters 1920

Radium-226

Polonium-210

. . . billions of times more toxic than cyanide

. . . causes 90% of smoking deaths

Alexander Litvinenko 2006

murdered with

Polonium-210

Underground Miners

Radon Gas

This Navajo uranium miner has lung cancer

Radon

. . . kills 20-30 thousand Americans every year
- US EPA

. . . is the leading cause of lung cancer among non-smokers

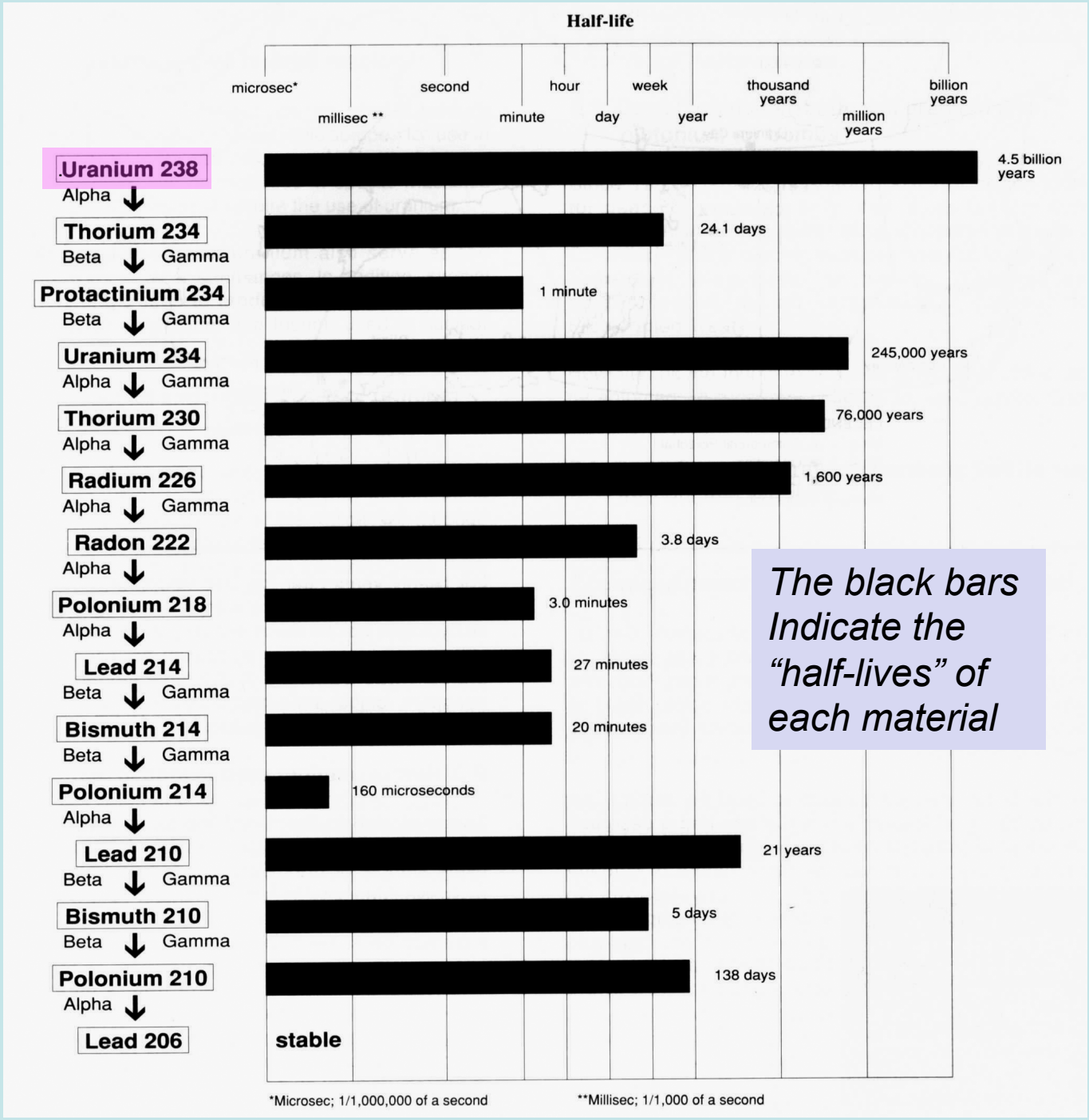
What is a Half-Life?

- The time it takes for HALF of the radioactive atoms to disintegrate is called the HALF-LIFE of the material.
- Each radioactive element has its own half-life – for radon gas it is 3.8 days; for radium-226 it is 1600 years.
- If you wait long enough for TWO half-lives to occur, there will still be one quarter of the material left.
- If you wait long enough for TEN half-lives to occur, there will be ONE THOUSANDTH of the material left.

URANIUM

When uranium atoms disintegrate they change into more dangerous radioactive elements.

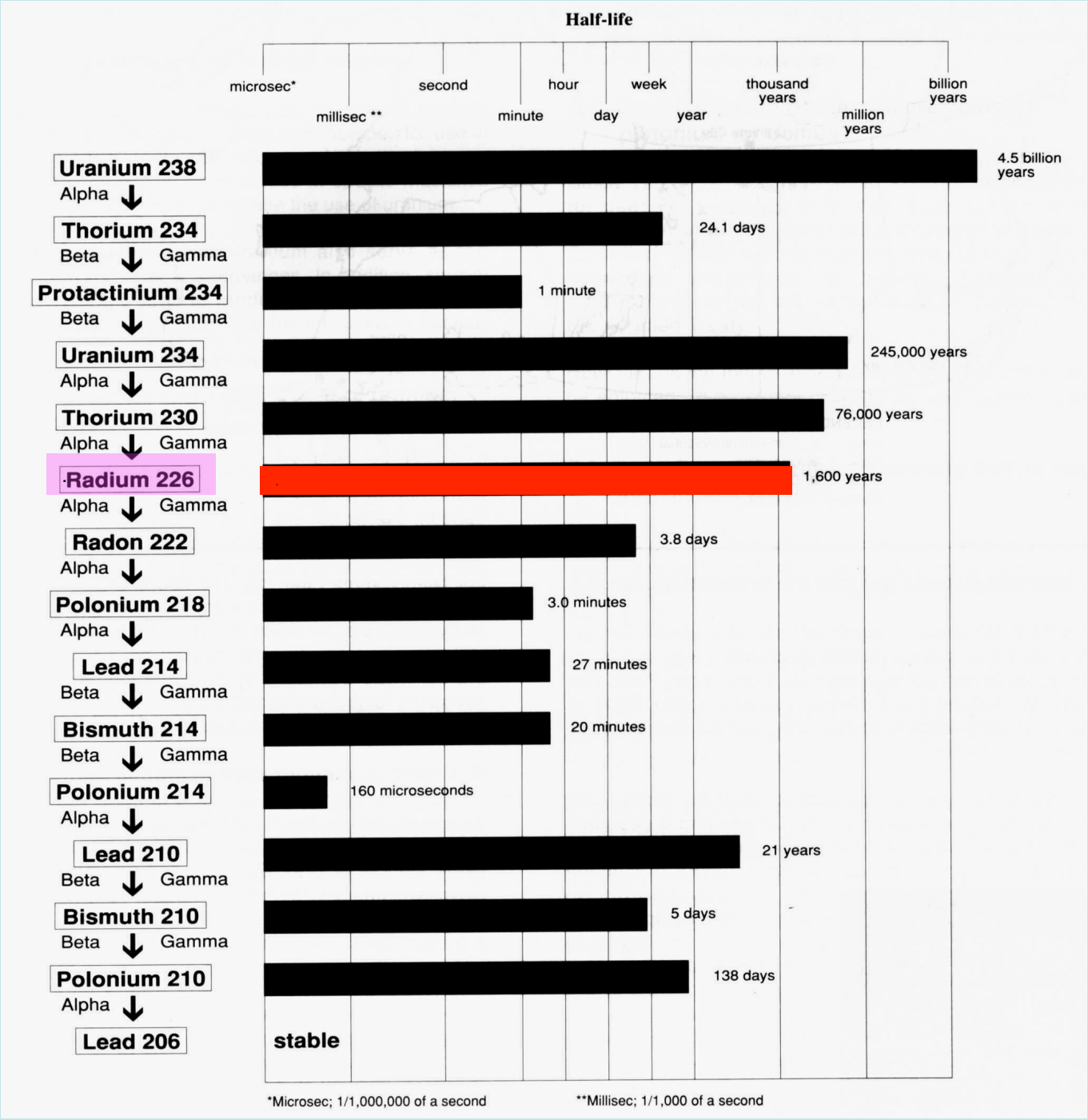
This is the "decay chain" of U-238. There is a similar decay chain for U-235.



RADIUM

In the first half of The 20th century, Radium-226 killed people with fatal anemia, bone cancer, and head cancer.

Radium is called a "superb carcinogen" by British Columbia Medical Association.

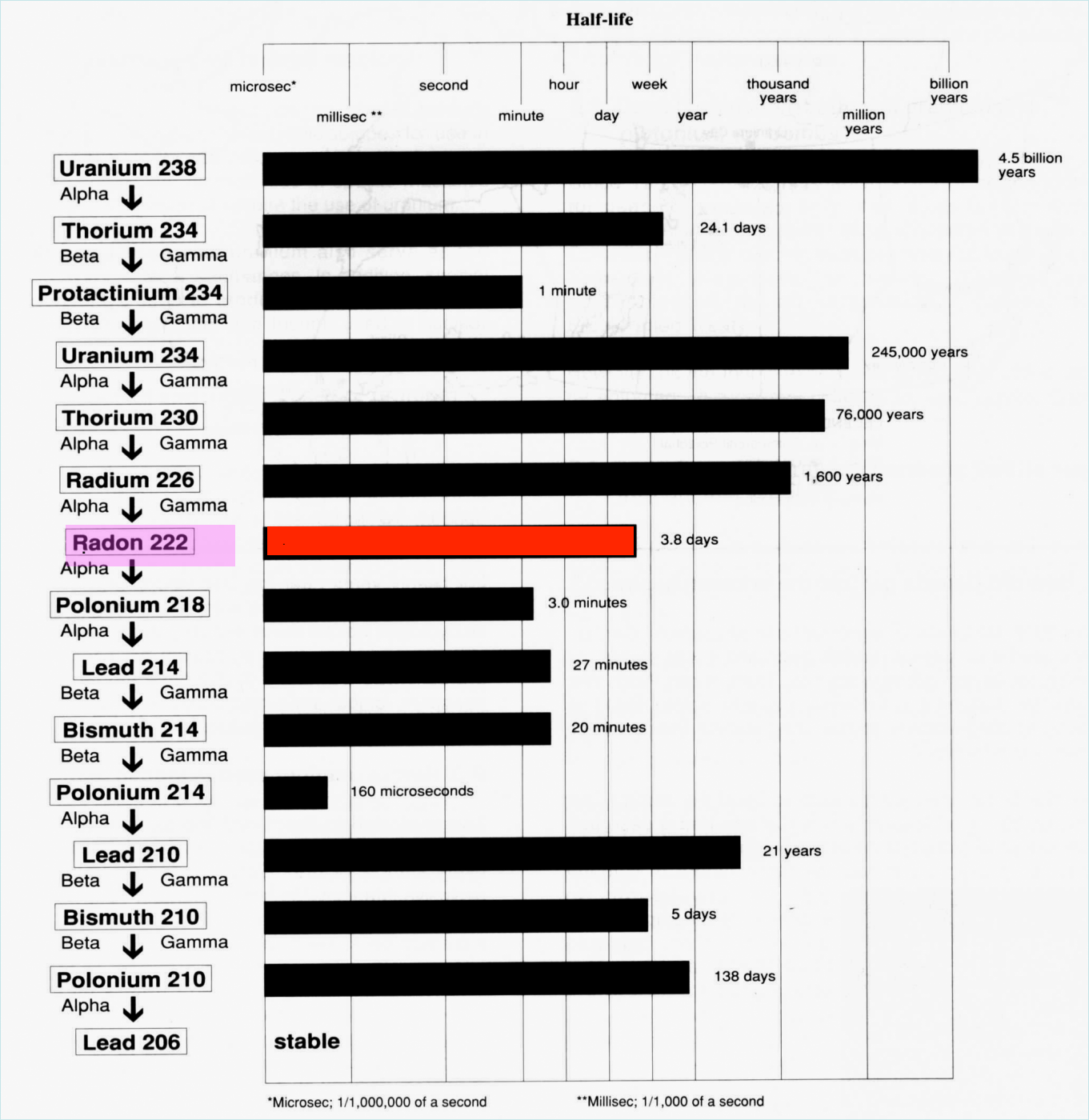


RADON GAS

Radon-222 (known as radon gas) has killed thousands of underground miners for centuries.

It is the leading cause of lung cancer among non-smokers.

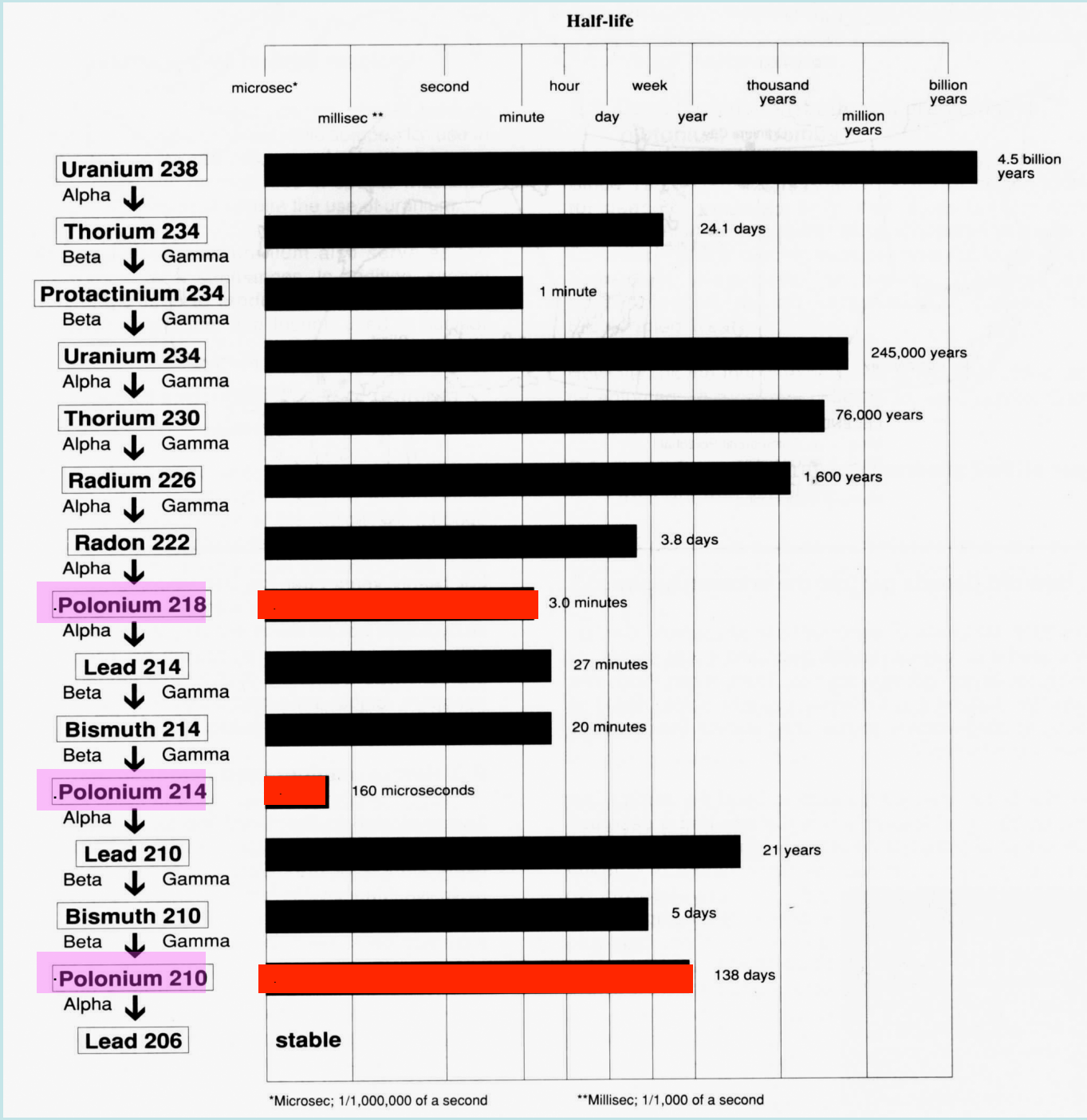
Indoor radon kills tens of thousands of American citizens every year according to the US EPA.



POLONIUM

Polonium is millions of times more toxic than cyanide. It was used to murder Alexandre Litvinenko.

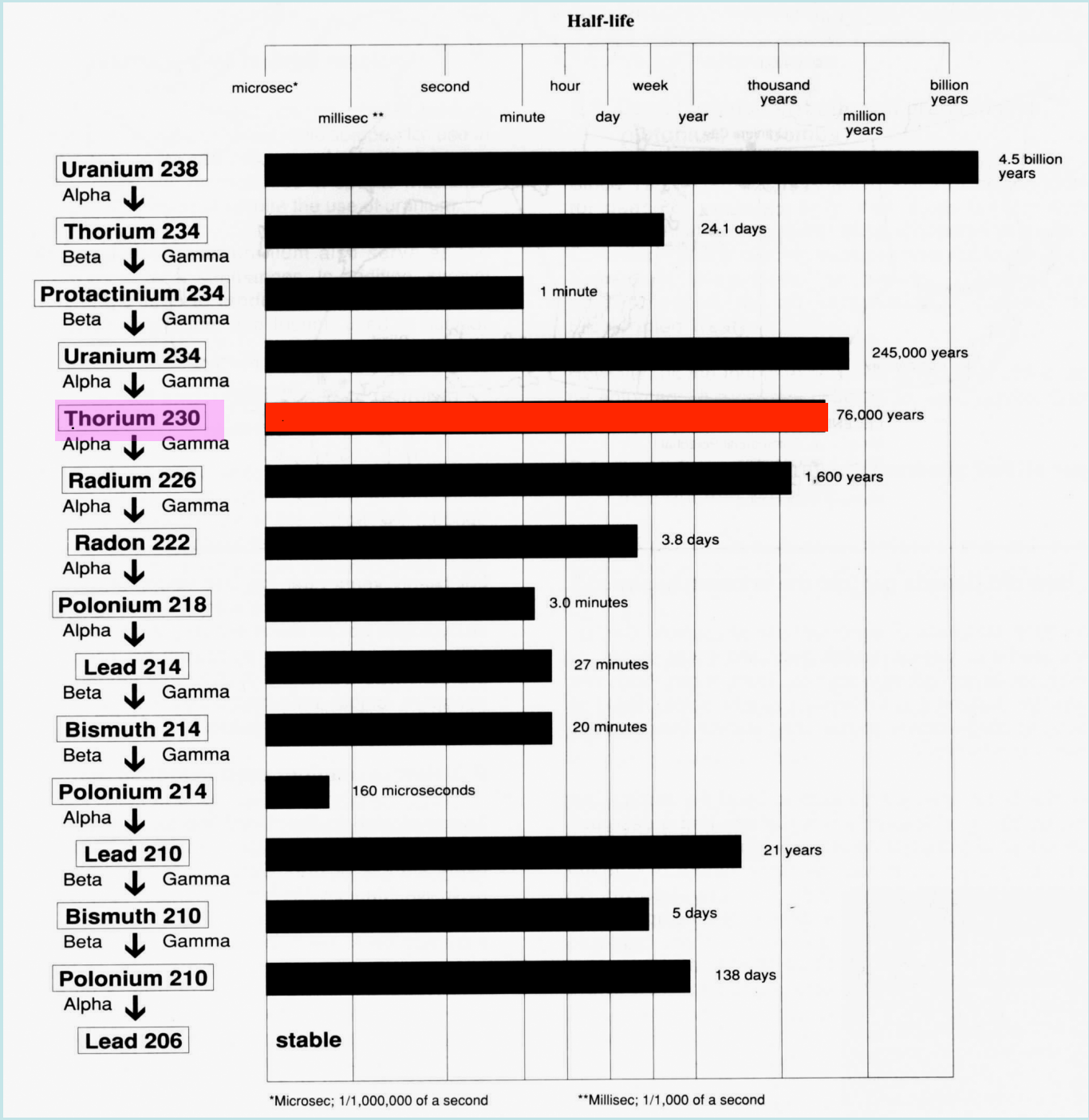
The American Health Physics Society states that up to 90 percent of deaths attributed to smoking are due to polonium-210.



THORIUM-230

Thorium-230 has a 76,000 year half life.

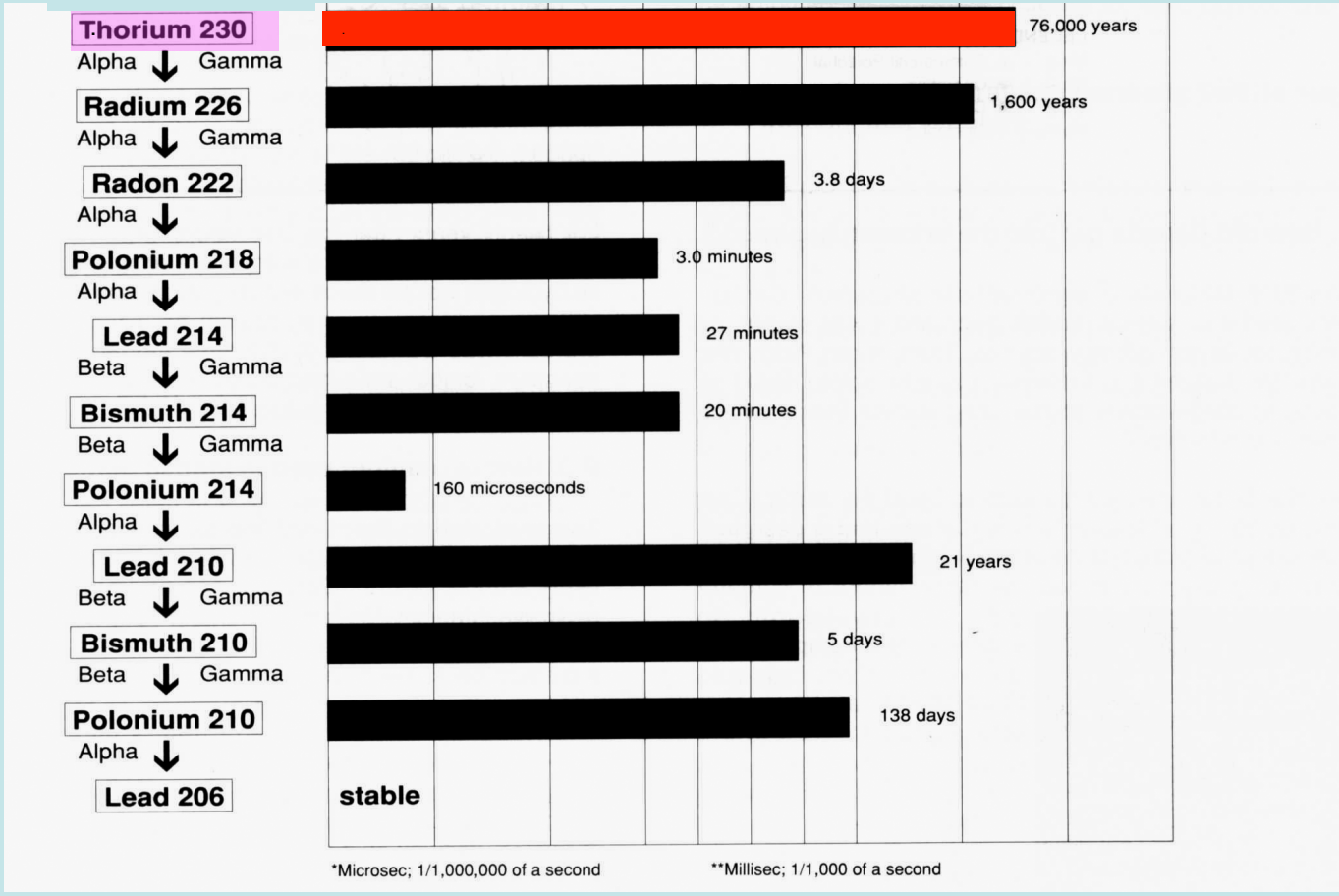
It remains dangerous for at least a million years.

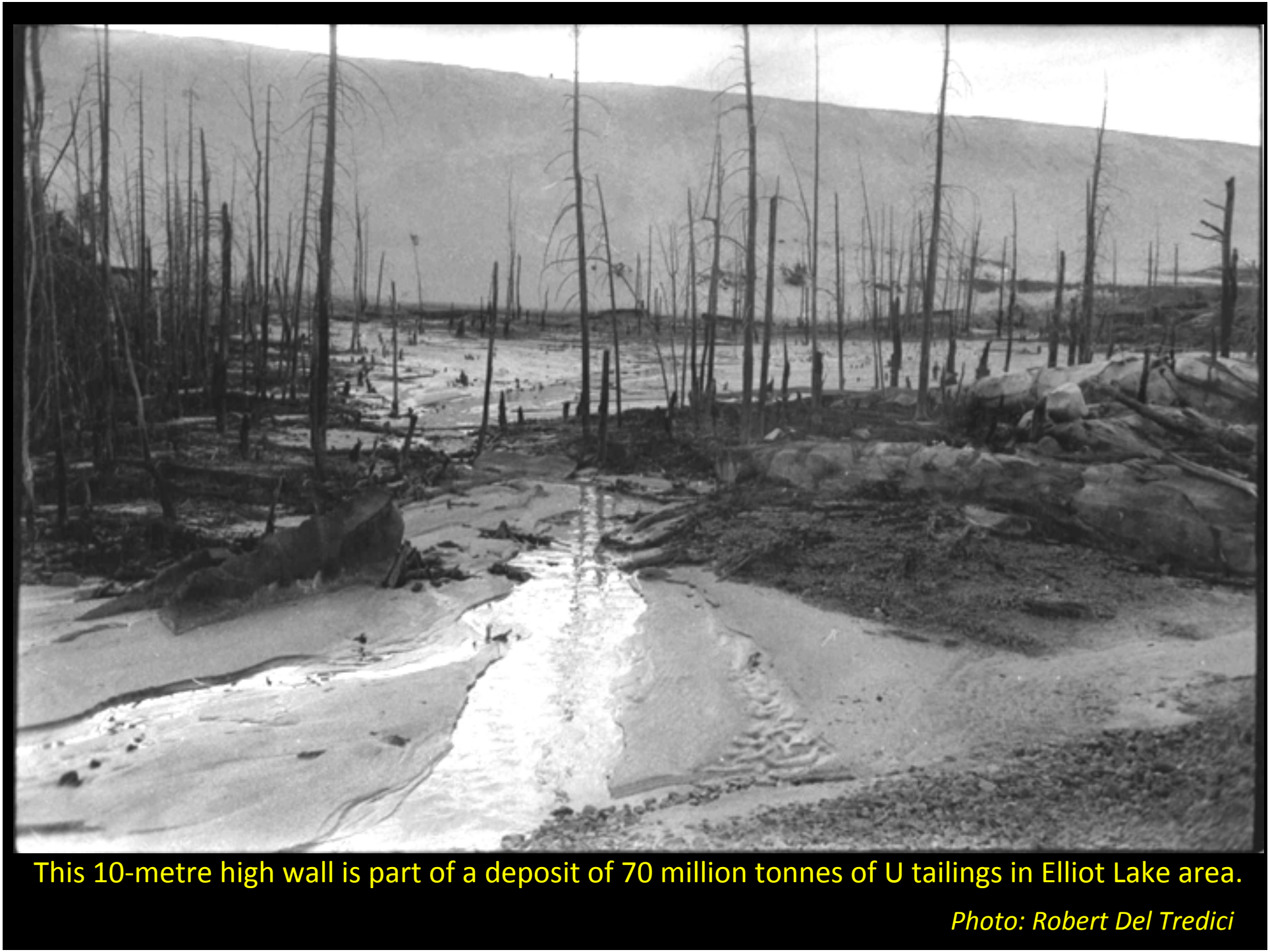


When uranium is extracted, the radioactive decay products are left in the mill tailings as radioactive wastes.

As thorium-230 atoms disintegrate, they continually replenish the supply of radium, radon, and polonium In the tailings.

Thus ALL of these radioactive poisons will remain present for hundreds of thousands of years.

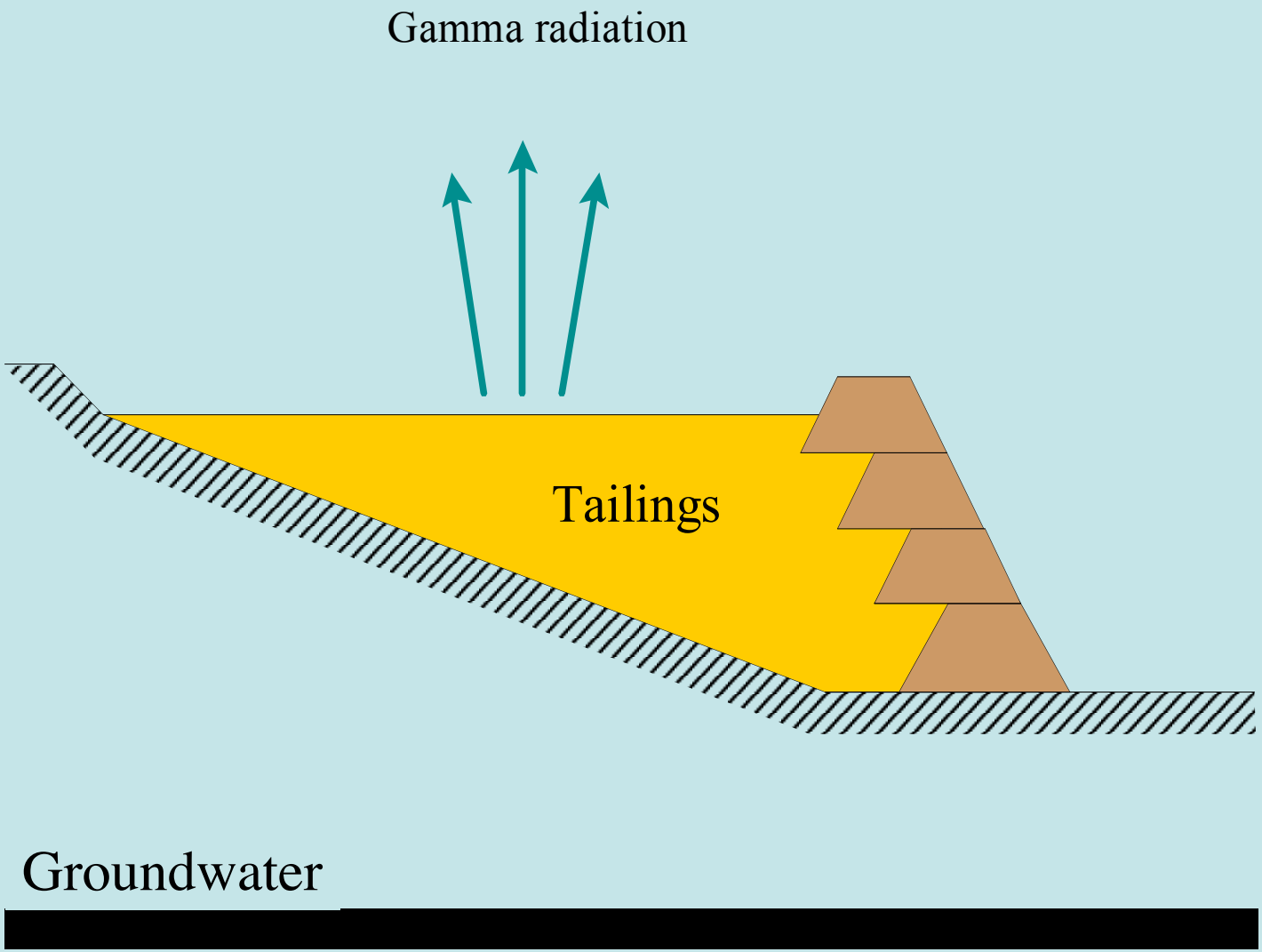




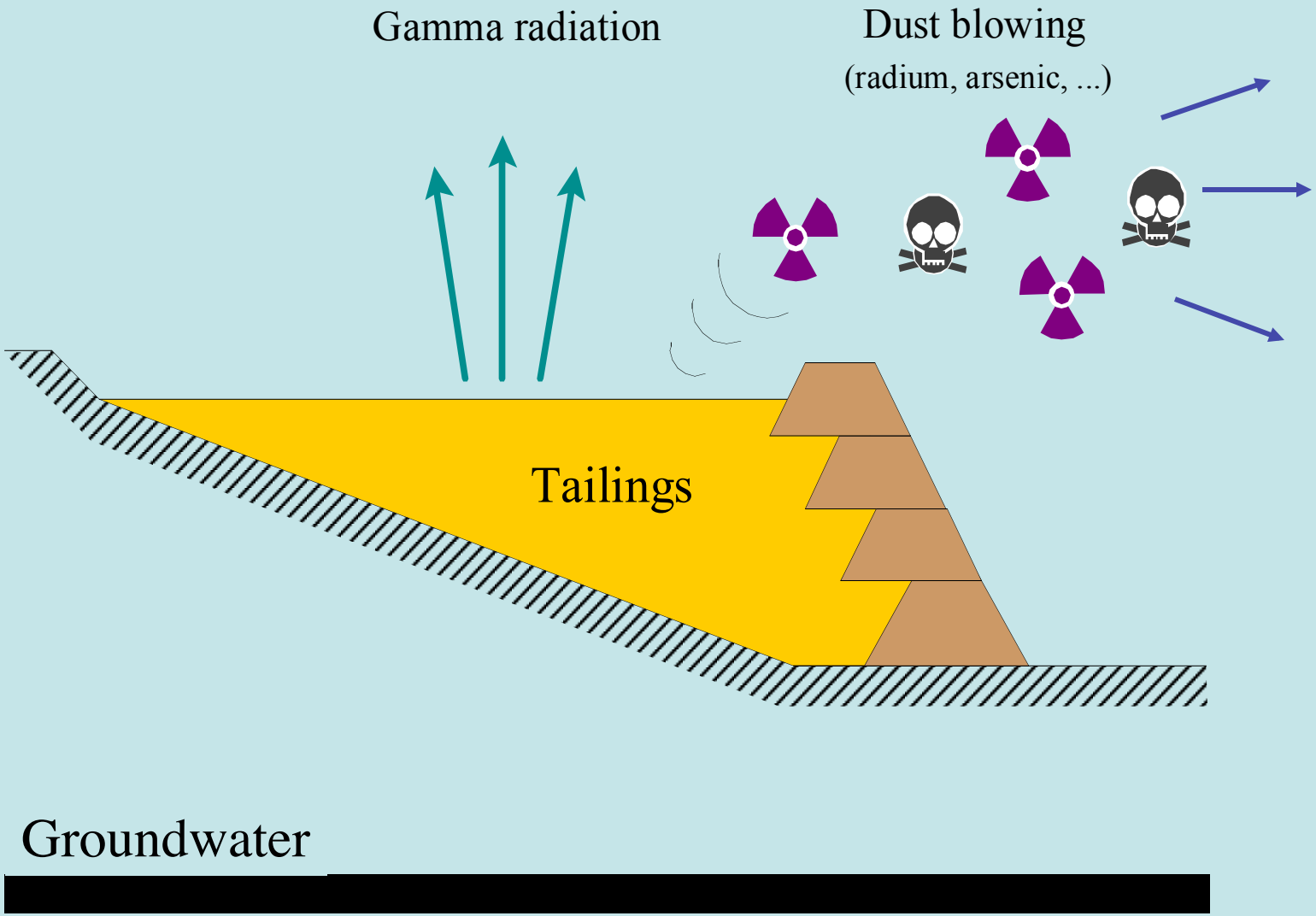
This 10-metre high wall is part of a deposit of 70 million tonnes of U tailings in Elliot Lake area.

Photo: Robert Del Tredici

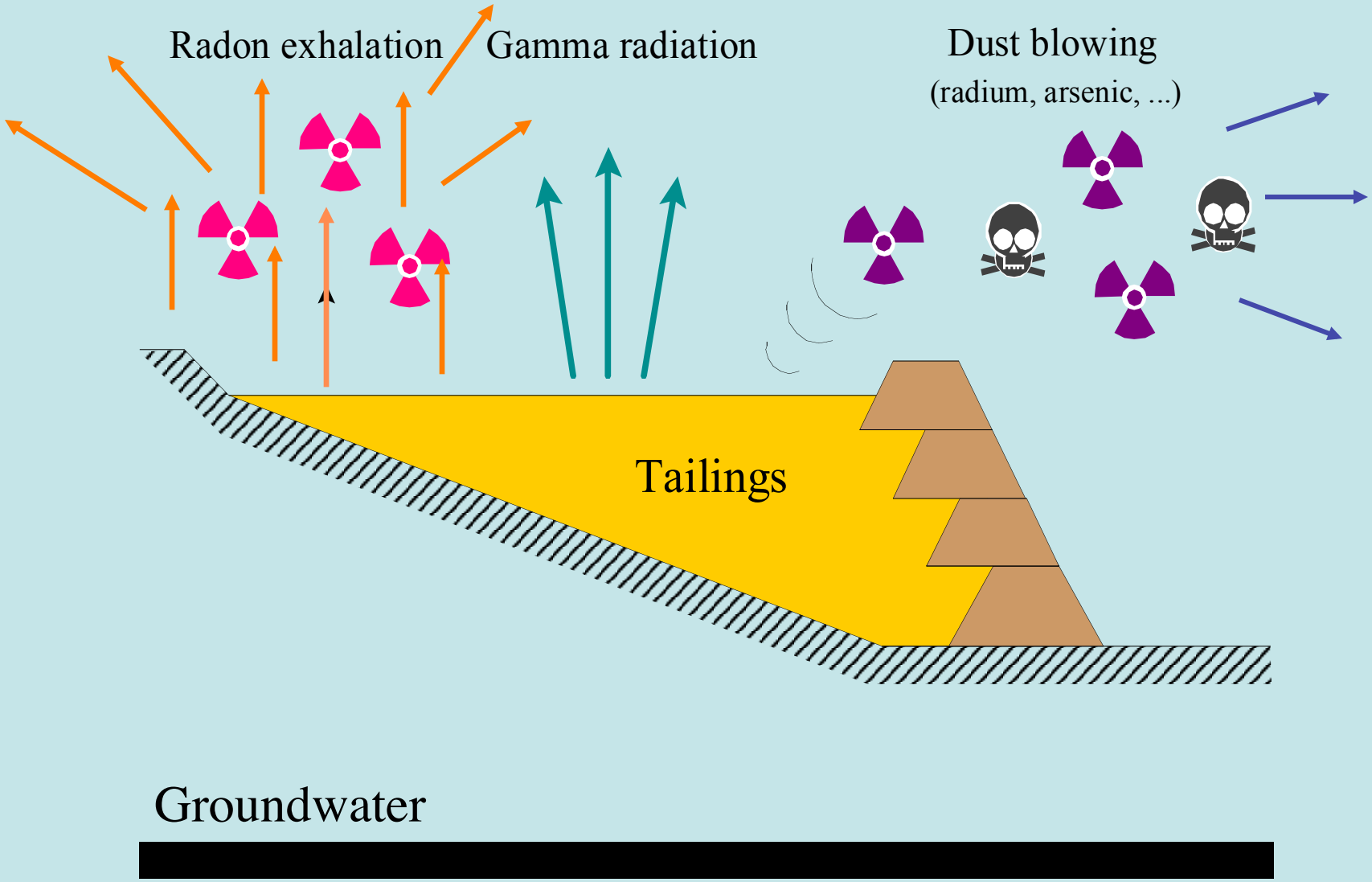
Uranium Mill Tailings Hazards



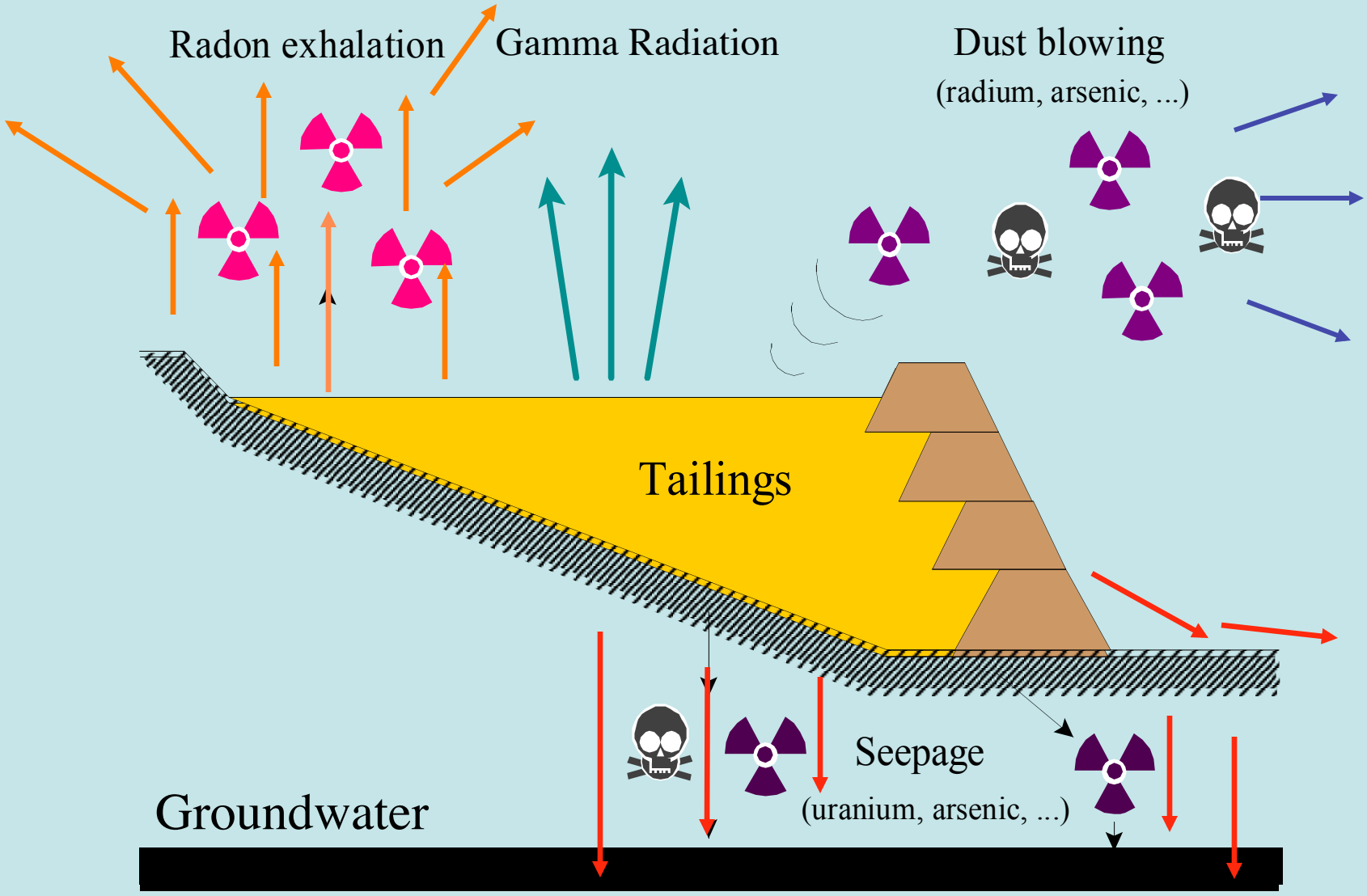
Uranium Mill Tailings Hazards



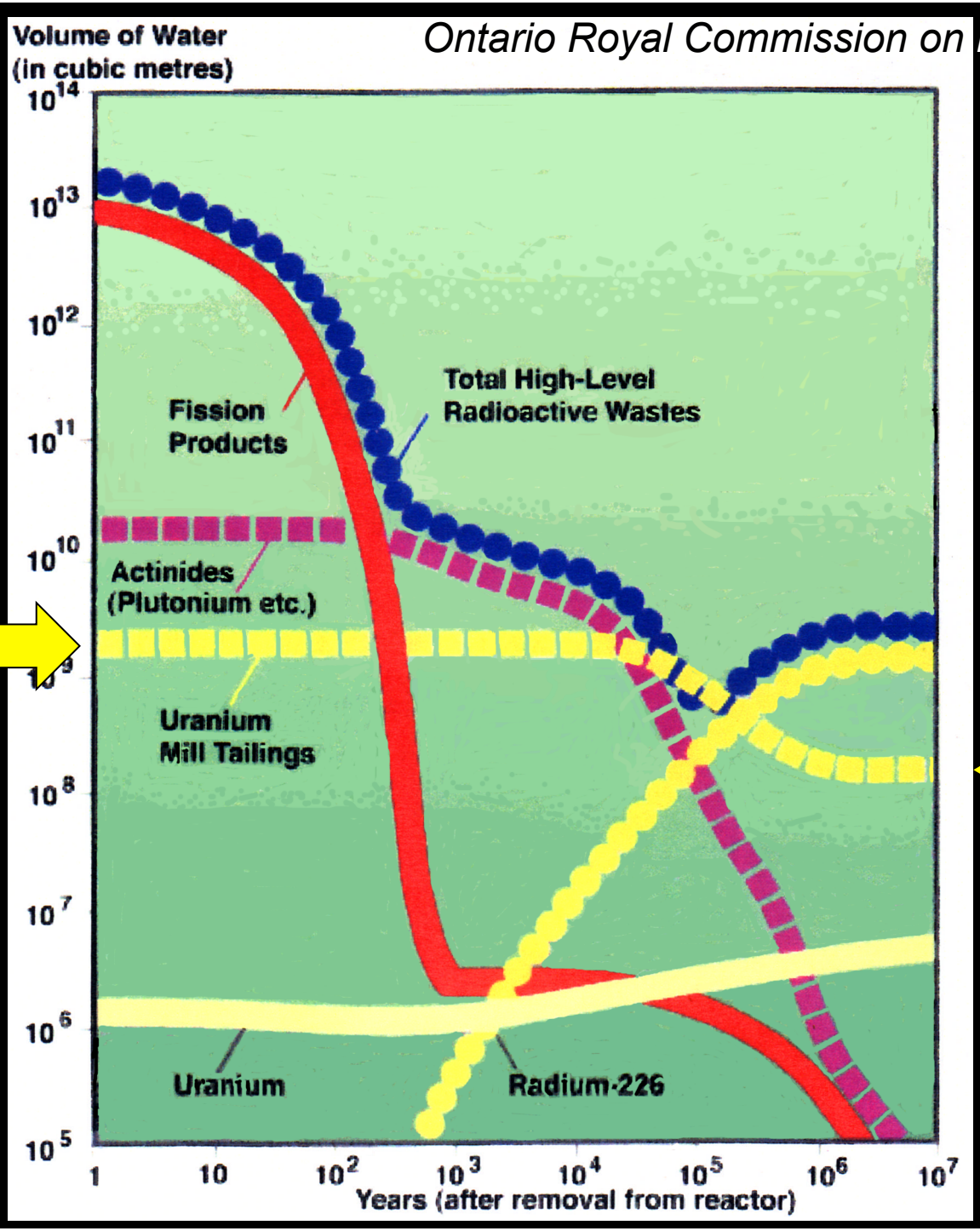
Uranium Mill Tailings Hazards



Uranium Mill Tailings Hazards



Ontario Royal Commission on Electric Power Planning (1978)



NOTE:
In the long term,
U mill tailings are about as toxic as high level waste

The toxicity of uranium mill tailings is indicated by the middle yellow line.

The red and blue lines represent the toxicity of spent nuclear fuel over 10 million years.

from "A Race Against Time", Royal Commission Report, 1978

Health Effects Depend On

The POPULATION Dose

At low levels of exposure, harmful biological effects like cancer do not occur until many years after exposure.

Radioactive materials enter into the air, water and soil.
They get into fish, plants, animals, and humans.

A small fraction of the population will develop cancer, years later. Infants and children are especailly vulnerable.

If a larger population is exposed to the same level of contamination, we say that the “population dose” is greater.

The greater the population dose, the more cases of adverse heath effects – like cancer – will be seen.

At low levels, radioactivity does not attack humans directly – it damages cells. A population is like an ocean of cells.

A fraction of those cells will develop into cancers.
It is largely a matter of chance whose body the cancer is in.

Summary:

Uranium has many dangerous decay products.
When uranium is mined, the decay products stay.

Once locked safely in a hard rock formation,
decay products are now crushed to a fine sand.

This makes them much more available to enter
the environment of living things – the food chain.

Radon gas travels thousands of miles in a light wind,
and deposits radioactive solids on the earth below.

If unsuspecting humans use this sand for building
purposes, it can cause a lot of sickness and death.

Challenges for our grandchildren's grandchildren:

Using uranium for nuclear weapons threatens the survival of all life – farewell to sustainable creation!

Using uranium for peaceful purposes plants seeds of future destruction by creating plutonium deposits – something that never existed on earth before humans.

That's where uranium goes; where does it come from?

You can't get uranium out of the ground without bringing to the surface the dangerous decay products.

Do scientists know how to keep 300 million tonnes of radioactive sand out of the environment – forever?

The End

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Canadian Coalition for Nuclear Responsibility.

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