Health Dangers

of Uranium Mining

by Dr. Gordon Edwards (Ph.D.)
on behalf of
Physicians for Global Survival (PGS)

Narsaq, Greenland
June 11 2016

Canadian Coalition for Nuclear Responsibility

www.ccnr.org


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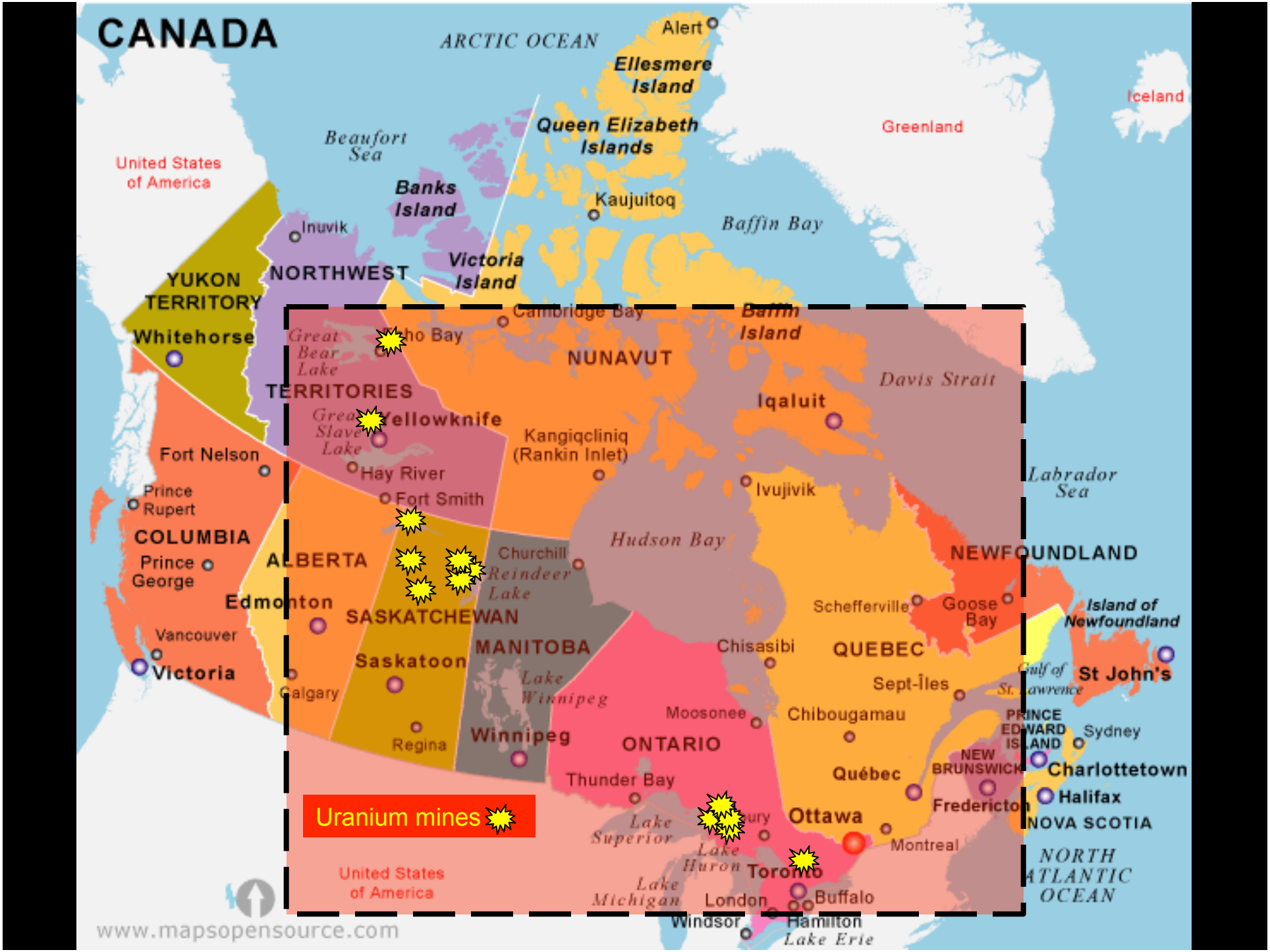
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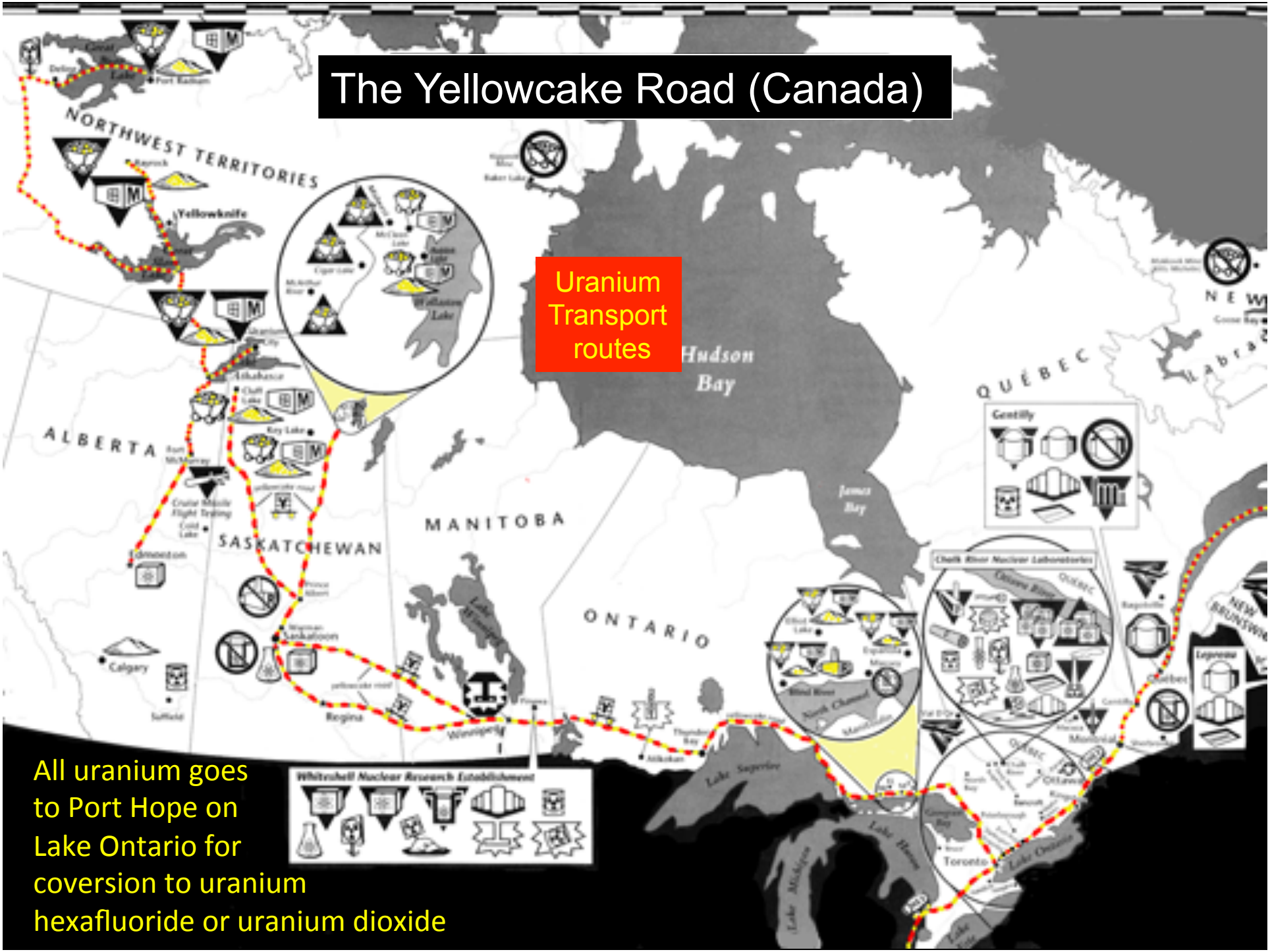
The Yellowcake Road (Canada)
Uranium Transport routes
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Whitehall Nuclear Research Establishment
All uranium goes to Port Hope on Lake Ontario for coversion to uranium hexafluoride or uranium dioxide

HEALTH DANGERS OF URANIUM MINING AND JURISDICTI0NAL QUESTIONS

The British Columbia Medical Association

A SUMMARY OF MATERIAL BEFORE THE BRITISH COLUMBIA ROYAL COMMISSION OF INQUIRY

HEALTH AND ENVIRONMENTAL PROTECTION
~ URANIUM MINING ~

PRESENTED: AUGUST l980

BY

E.R. YOUNG, B.Sc., M.D.
R.F. WOOLLARD, M.D.


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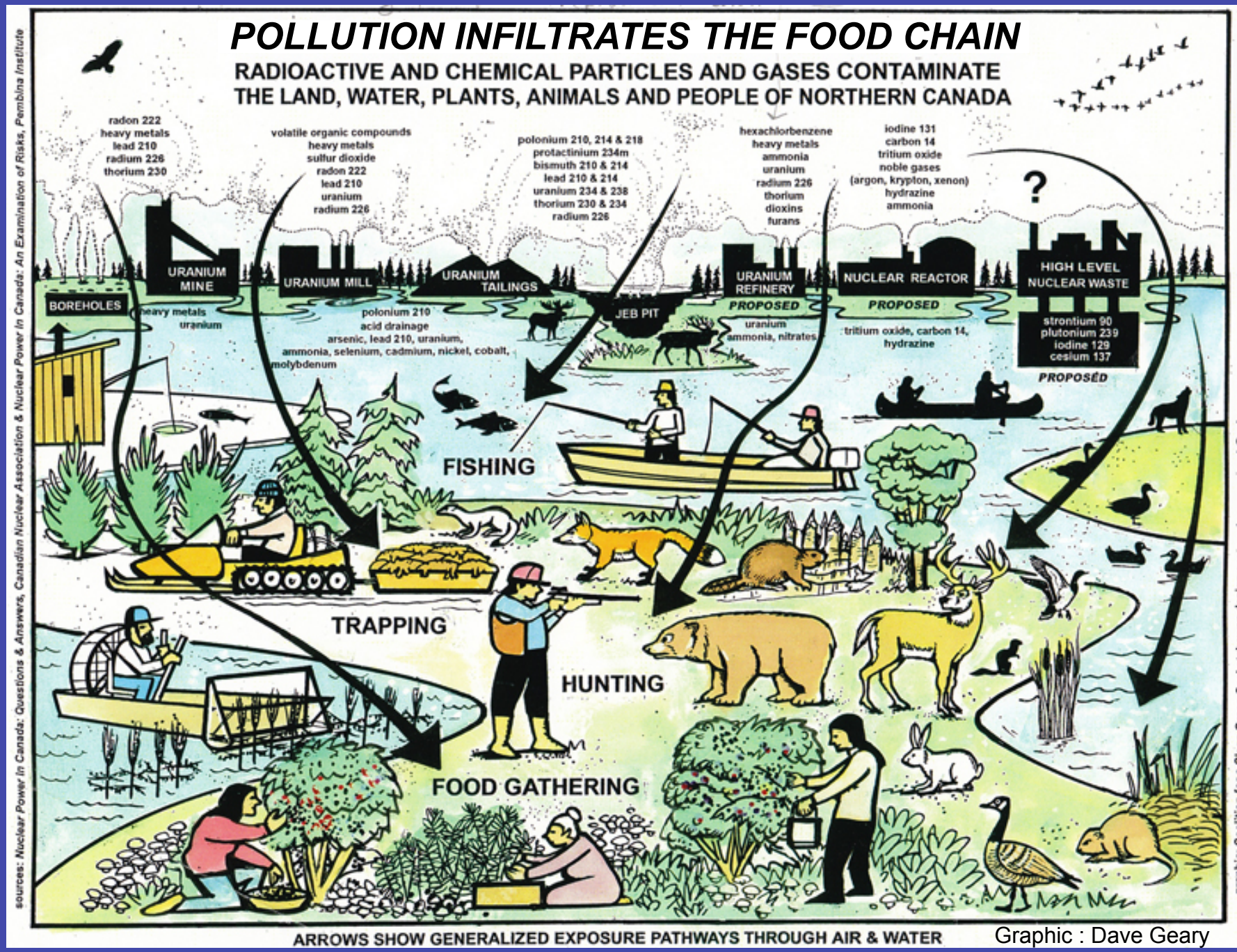
Uranium

is

Special

Uranium mining brings heavy metals and radioactive materials to the surface



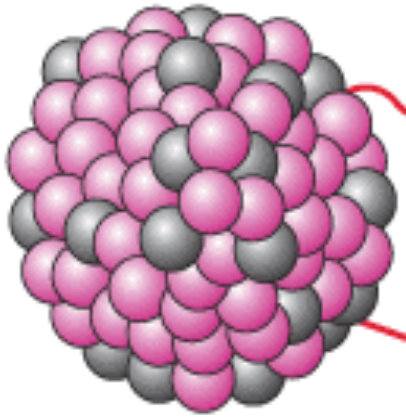
Graphic : Dave Geary

A Model of the Uranium Atom

Photo:
Robert Del Tredici

Radioactive Disintegration

Photon
of energy



Unstable atom disintegrates giving off 1 or 2 projectiles

"Atomic Radiation"

Radioactive Atom

subatomic Particle

A radioactive atom has an unstable nucleus. It will suddenly disintegrate, giving off a highly energetic particle and/or a photon of energy. These emissions are damaging to living cells.

A scientist with a radiation monitor found the rocks in this garden are dangerously radioactive

Bruno Chareyron is with the organization CRIIRAD

Dose rate measured :

**1 mS per hour on contact = 5 000 times above background level*

** 18,3 µS per hour at a distance of 1 m*

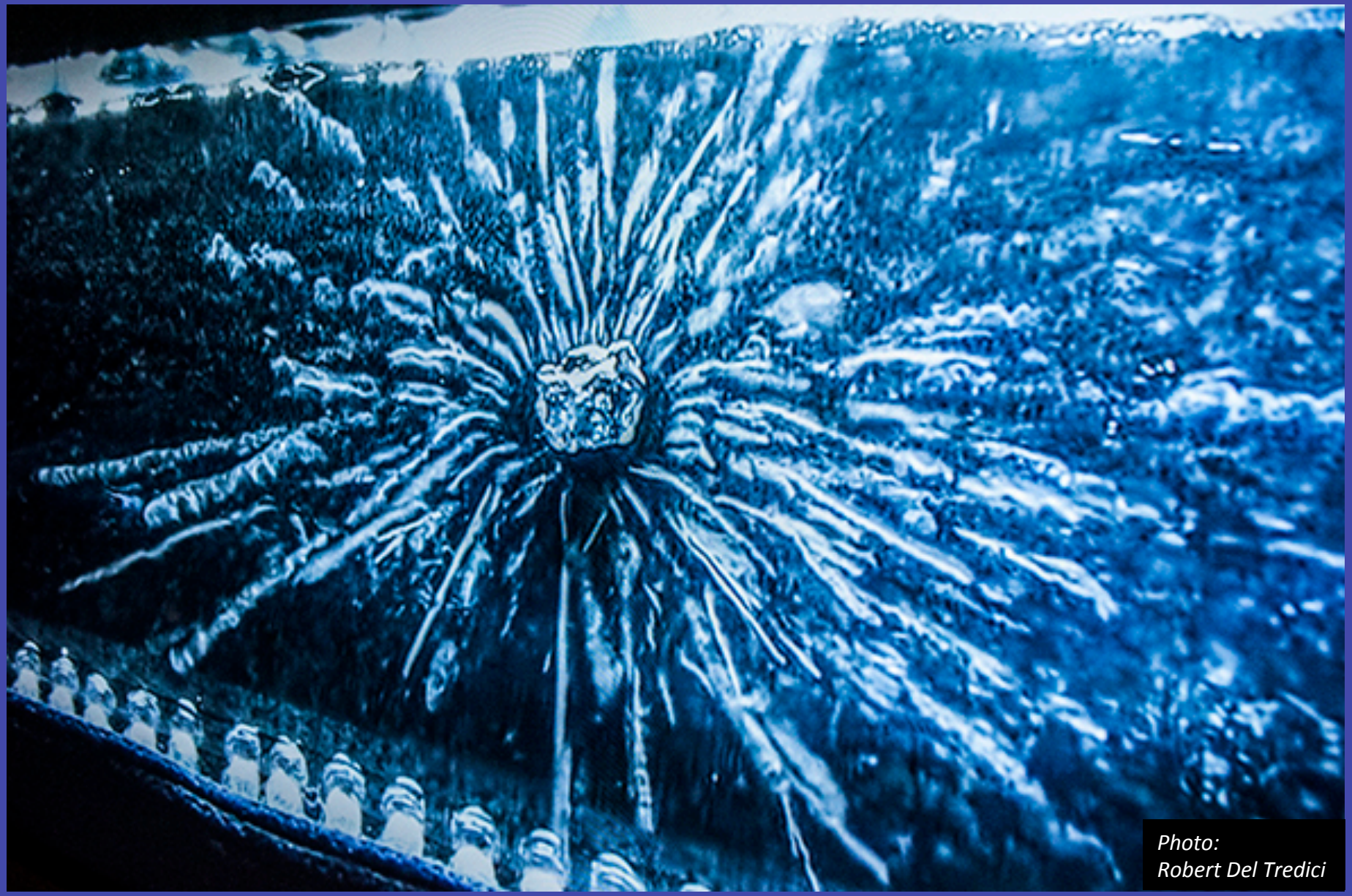
Comparison with EURATOM limits :

*Staying one hour at 1 meter : cancer risk is 'non negligible'

*Staying 10 minutes per day, each day of the year : cancer risk is 'unacceptable'.

CRIIRAD asked the mining company to remove the mineral

A woman in France kept these pretty rocks from the mine site in her garden (June 2002)



Invisible radioactive emissions leave visible tracks in a “cloud chamber”

A Model of the Uranium Atom

Photo:
Robert Del Tredici

Chemical energy is powerful.


Battlefield explosion


Forest fire

Nuclear energy comes directly from the nucleus – it is millions of times more powerful than chemical energy.


H-Bomb Blast

Radioactivity :
a form of Nuclear Energy . . .

Photo:
Robert Del Tredici

. . . that cannot be shut off

Chronic radioactive exposures at low doses increases the incidence of cancer, leukemia, genetic damage, strokes, heart attacks, other blood diseases and low intelligence in young children

Chronic radioactive exposures at low doses increases the incidence of cancer, leukemia, genetic damage, strokes, heart attacks, other blood diseases and low intelligence in young children

…but there is a "latency period"; the onset of disease will occur years or decades after exposure.

Dr. Alice Stewart (MD) showed embryos are very vulnerable to radiation damage.

Photo:
Robert Del Tredici

Dr. Karl Morgan (Ph.D.) found there is no safe level of radioactive exposure.

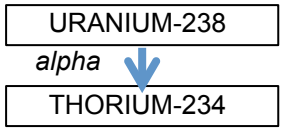
Uranium

is

Never Alone

Uranium-238 becomes Thorium-234.

URANIUM-238 DECAY CHAIN



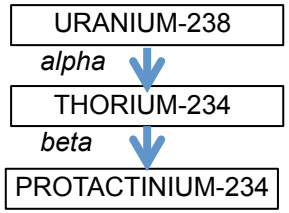
"THE URANIUM SERIES"

URANIUM-238 DECAY CHAIN

Thorium-234

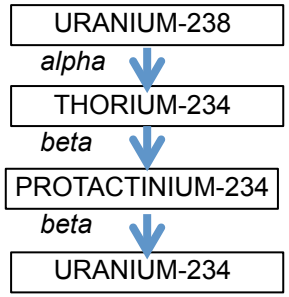
becomes

Protactinium-234



"THE URANIUM SERIES"

URANIUM-238 DECAY CHAIN



Protactinium-234

becomes

Uranium-234

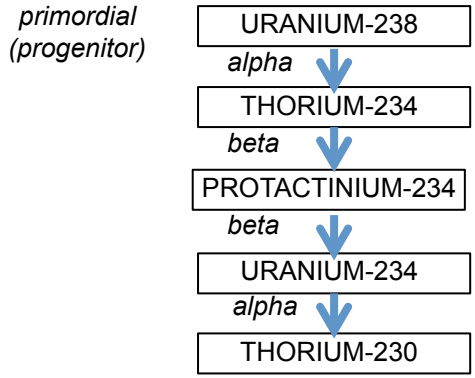
"THE URANIUM SERIES"

URANIUM-238 DECAY CHAIN

Uranium-234

becomes

Thorium-230

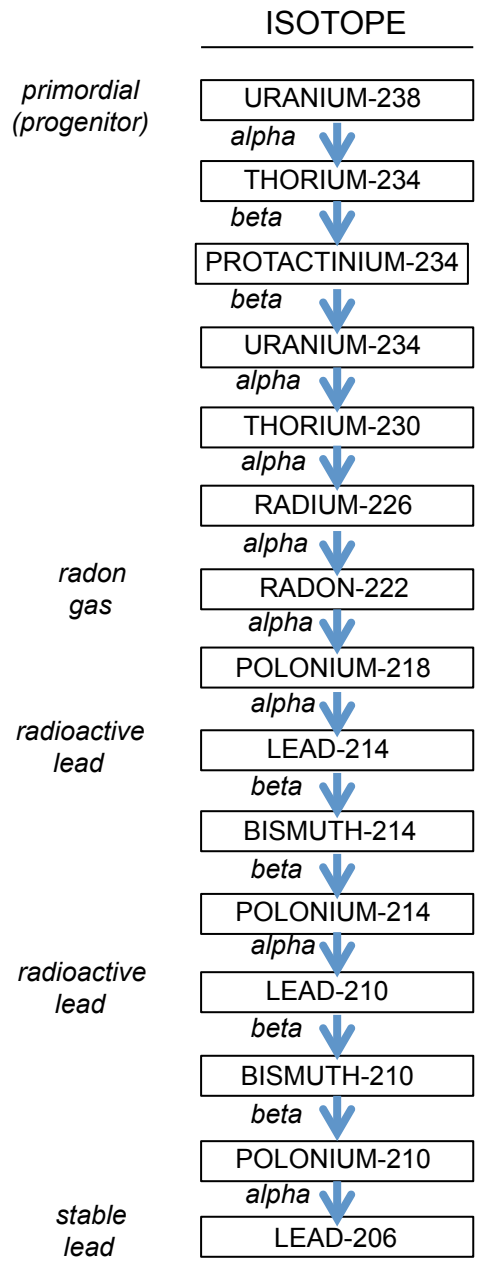


"THE URANIUM SERIES"

Here is the full decay chain of uranium-238

(It is the most common type of uranium found in nature)

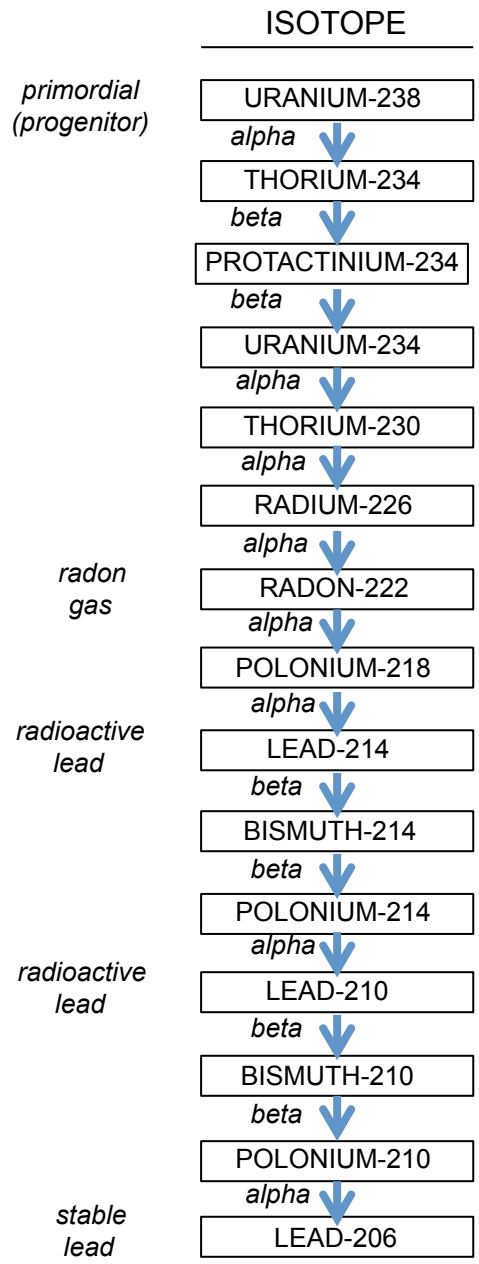
URANIUM-238 DECAY CHAIN



"THE URANIUM SERIES"

It´s like a family of radioactive elements – the great-great-great grandfather is uranium

URANIUM-238 DECAY CHAIN



"THE URANIUM SERIES"

The decay products are much more radioactive and much more dangerous than uranium itself.

The 3 types of polonium are most dangerous of all.

Henri Becquerel 1896

accidentally discovered that uranium ore is radioactive

Marie Curie 1898

discovered radium and polonium in uranium residues

Health Effects of

Radioactive Exposure

Radium Dial Painters 1920

radium-226

Girls hired to use radioactive paint to make numerals on watch dials glow in the dark …

… ingested minute amounts of radium when they licked the tips of their brushes to get a very fine point .

deaths from
Fatal anemia
Bone cancer
Head cancer

Deaths of Radium Dial Painters

from ingesting minute amounts of radium

Fatal anemias

Bone cancers

Head cancers

radium is a bone-seeker

radium (like calcium) – goes to **bones and teeth**

dial painters developed severe dental damage called "**radium jaw**"

radium also damaged **blood-forming organs** in their bone marrow

many **died of anemia** (as did Marie Curie and her daughter Irene) and others **of bone cancer**

radon gas (produced by radium) was **carried by blood to the head** and caused cancers there

Radium, like calcium, goes to bones & teeth.

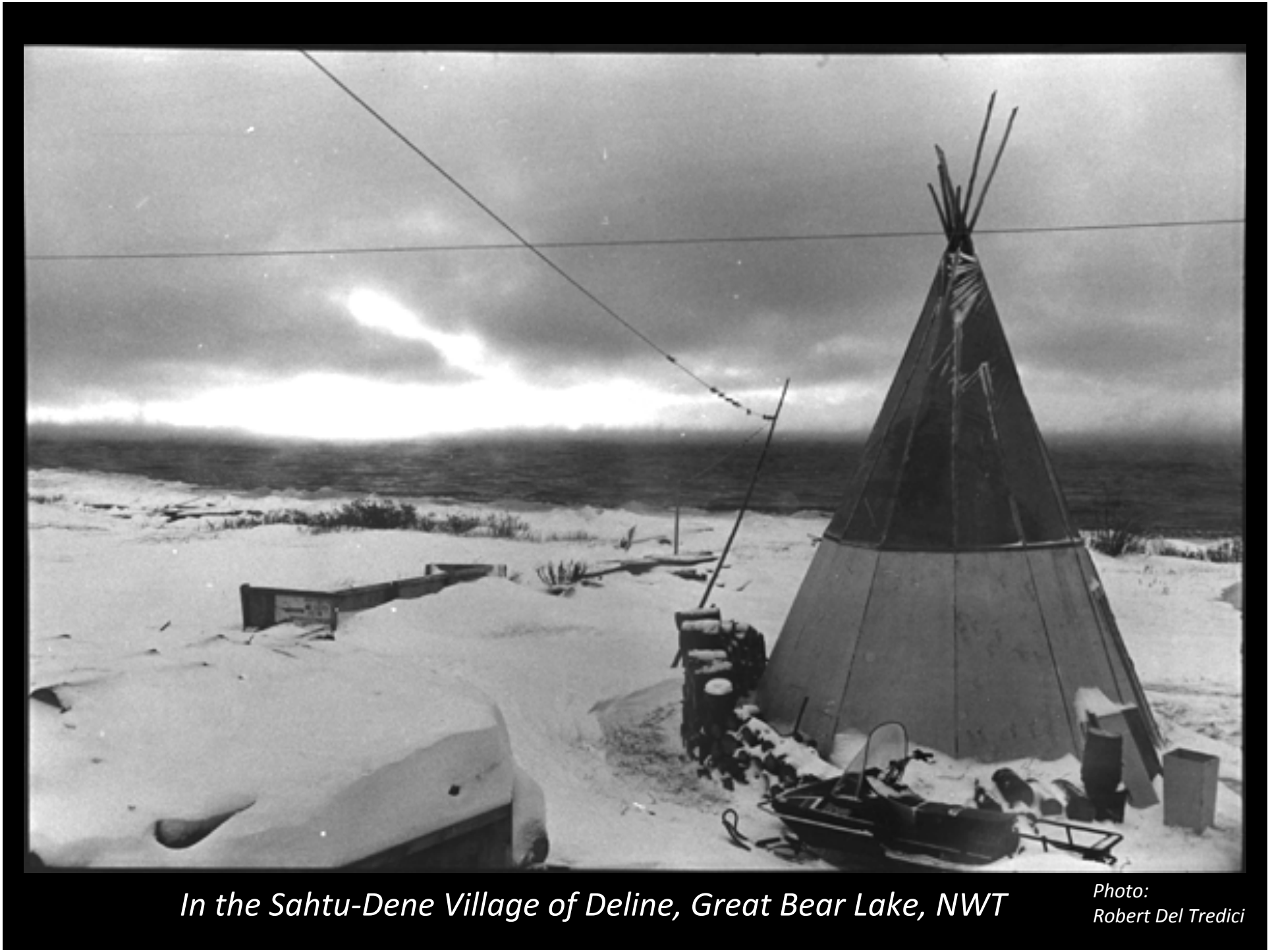
Dial painters suffered from

Phase 1: Fatal anemia (blood disease)
Phase 2: Bone cancers (skeletal damage)
Phase 3: Head cancers (sinuses and mastoid)

Phase 3 : radon gas is produced in the bones by radium disintegration -- then carried by the blood to the head where the radioactive gas builds up.

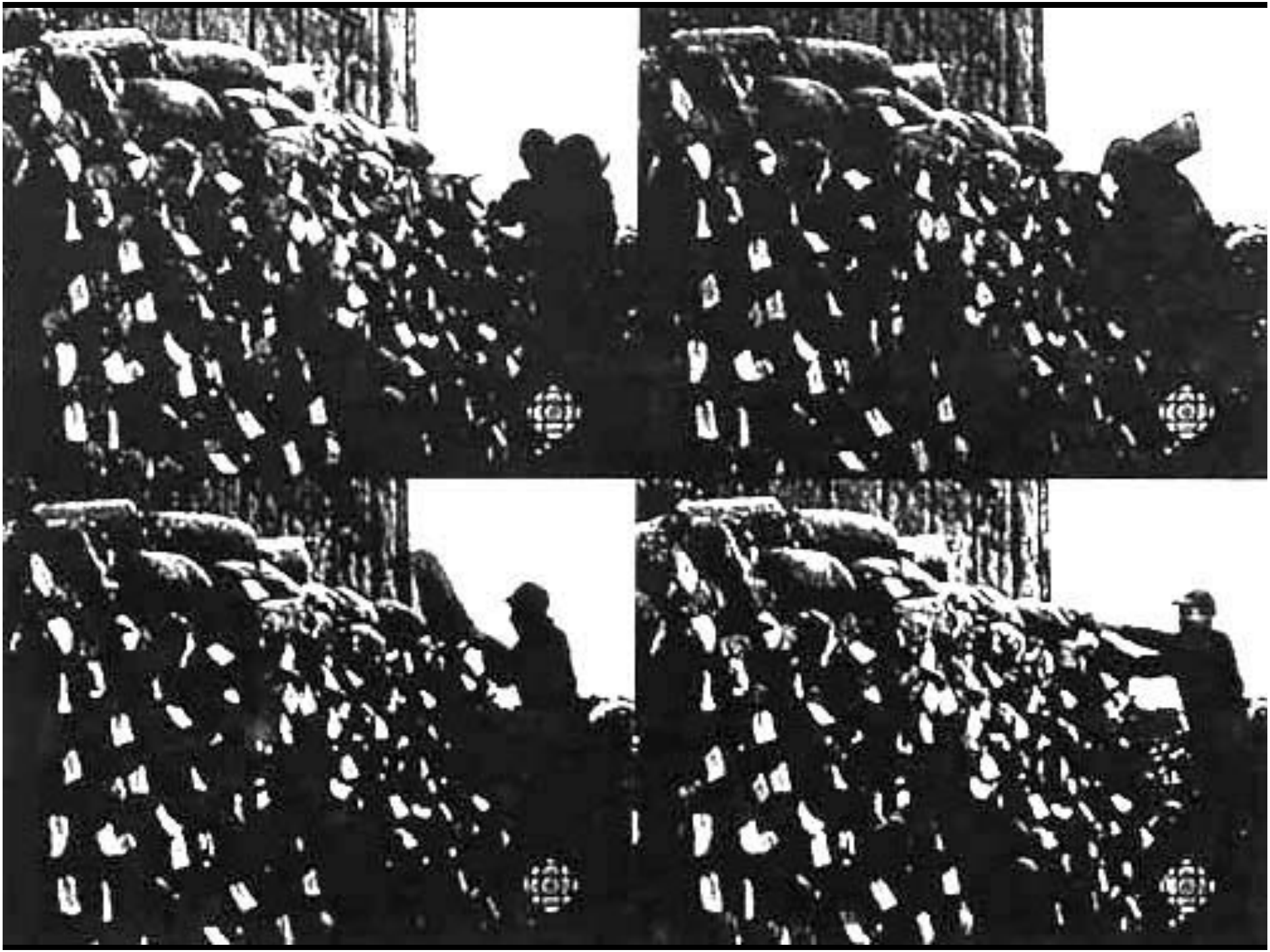
In 1920s, radium sold for $100 000 per gram.
Now it is discarded as a waste byproduct.

BCMA: "Radium is a superb carcinogen"



In the Sahtu-Dene Village of Deline, Great Bear Lake, NWT

Photo:
Robert Del Tredici



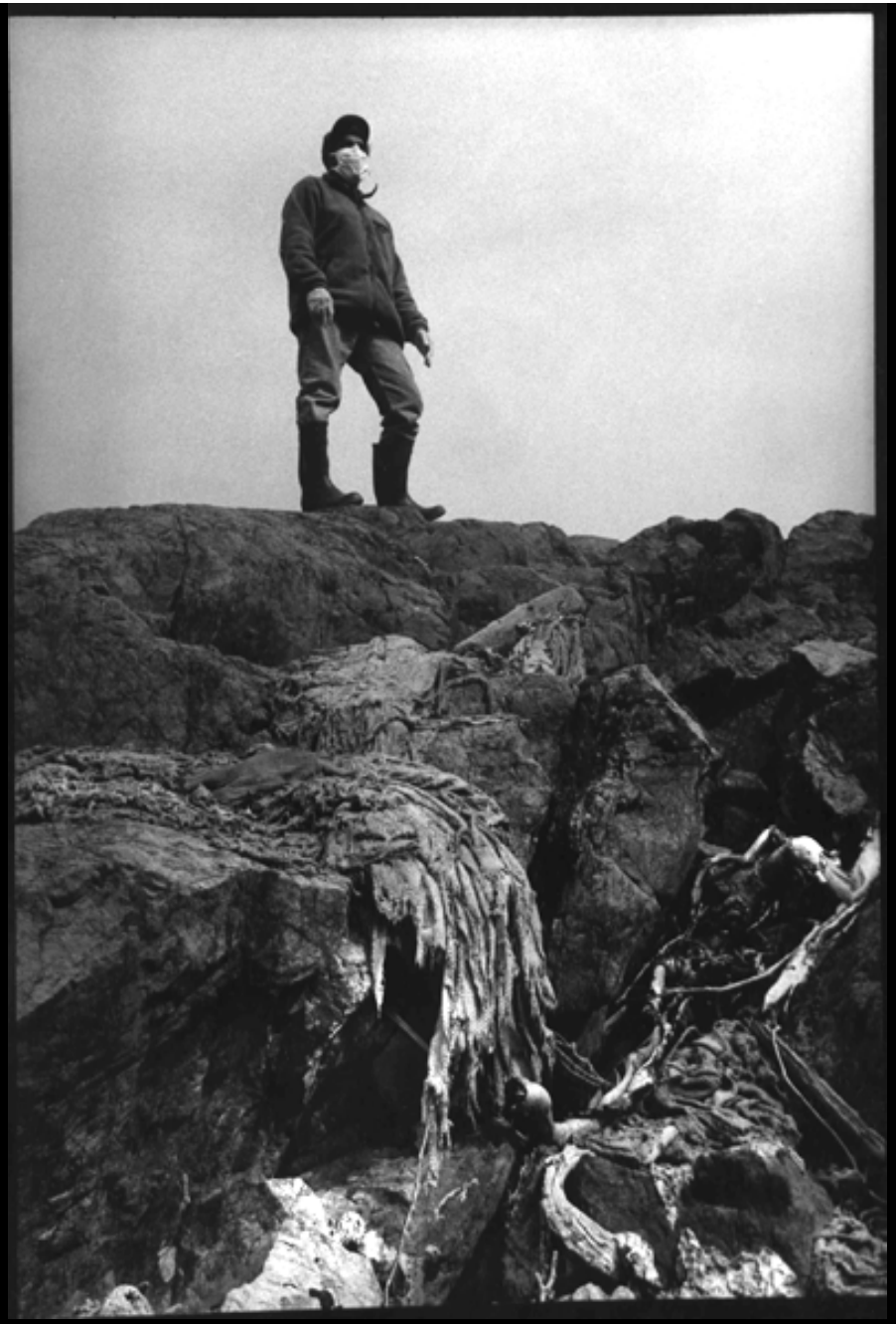


Photo:
Robert Del Tredici

Dene man standing over discarded uranium ore sacks at Port Radium, NWT

CANADA

DEPARTMENT OF MINES

INVESTIGATIONS IN ORE DRESSING AND METALLURGY

1931

OTTAWA

PRECAUTIONS FOR WORKERS IN THE TREATMENT OF RADIUM ORES

W. R. McClelland

Recent investigations in the field of radium poisoning have led to the conclusion that precautions are necessary even in the handling of substances of low radioactivity. The ingestion of small amounts of radioactive dust or emanation over a long period of time may have serious consequences: lung cancer, bone necrosis and rapid anemia are possible diseases due to deposition of radioactive substances in the cell tissue or bone structure of the body.

Alexander Litvinenko 2006

polonium-210

murdered by polonium poisoning in London England
(a tiny amount of polonium added to a cup of tea)

polonium is chemically similar to potassium – it attaches itself to the **red blood** corpuscles …

polonium travels throughout the body damaging **soft organs** …

polonium is 250 billion times **more toxic than hydrogen cyanide** …

polonium is the only material that can deliver a dose of **whole-body alpha radiation**…

polonium is produced by the **disintegration of radon** atoms …

Los Alamos National Laboratory's Chemistry Division

http://periodic.lanl.gov/elements/84.html

Polonium-210

Weight by weight

polonium-210 is about 250 billion times

as toxic as hydrogen cyanide.

American Health Physics Society

polonium-210

is probably the cause of

up to 90 percent of the deaths

attributed to tobacco

(lung cancers, heart attacks, strokes)

polonium is a blood-seeker

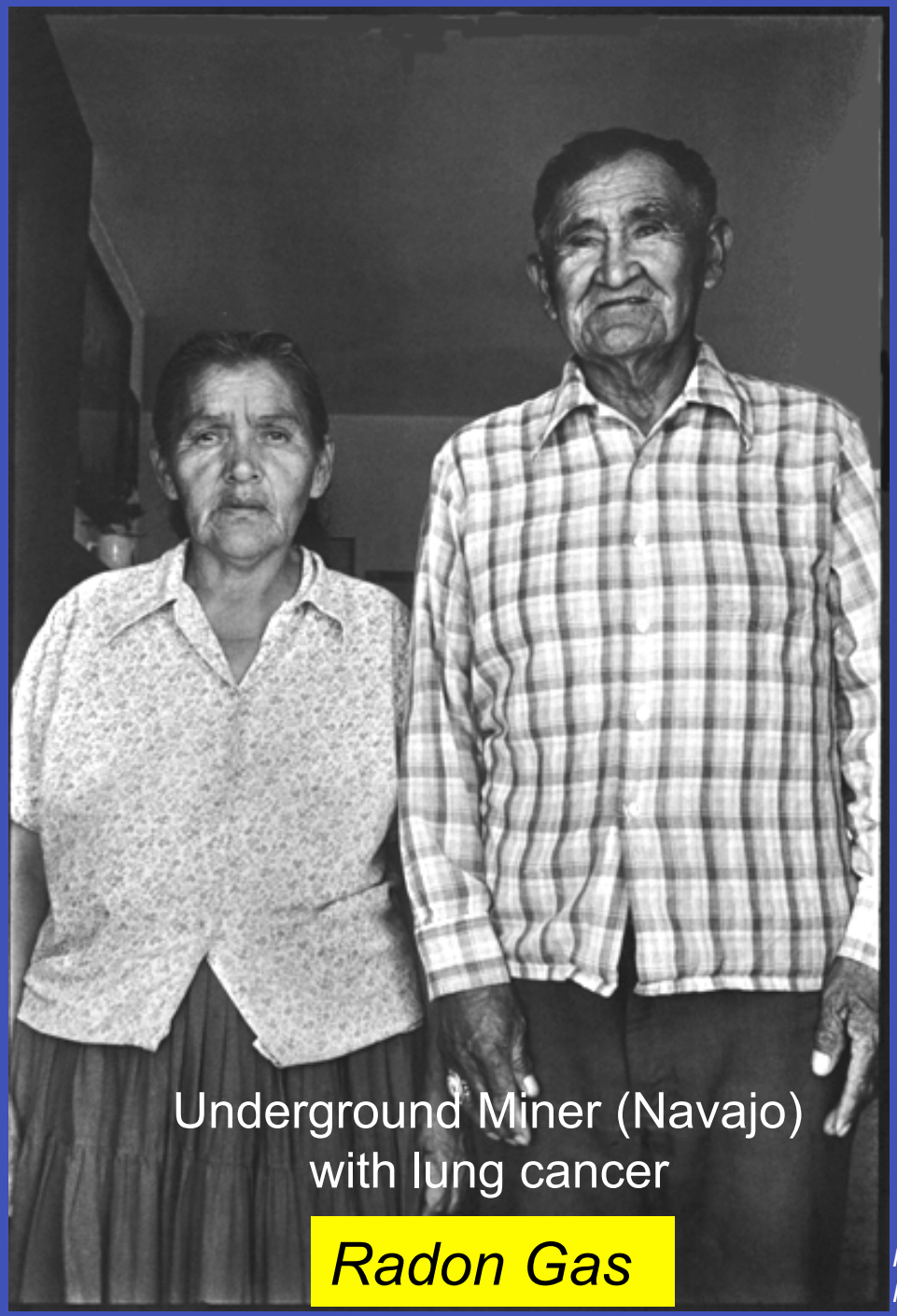
radon gas from soil and uranium-rich fertilizer builds up under a canopy of tobacco leaves …

radon disintegrates to form radioactive **lead-210 that sticks to the resinous hairs on tobacco leaves** …

harvested tobacco has very minute amounts of radioactive lead-210 …

lead-210 disintegrates to form polonium-210 that is inhaled by smoker …

polonium-210 **damages the lung** to cause cancer and **enters the blood** to cause strokes and heart attacks…



Underground Miner (Navajo)
with lung cancer

Radon Gas

Photo:
Robert Del Tredici

radioactive **radon gas** is produced when radium atoms disintegrate

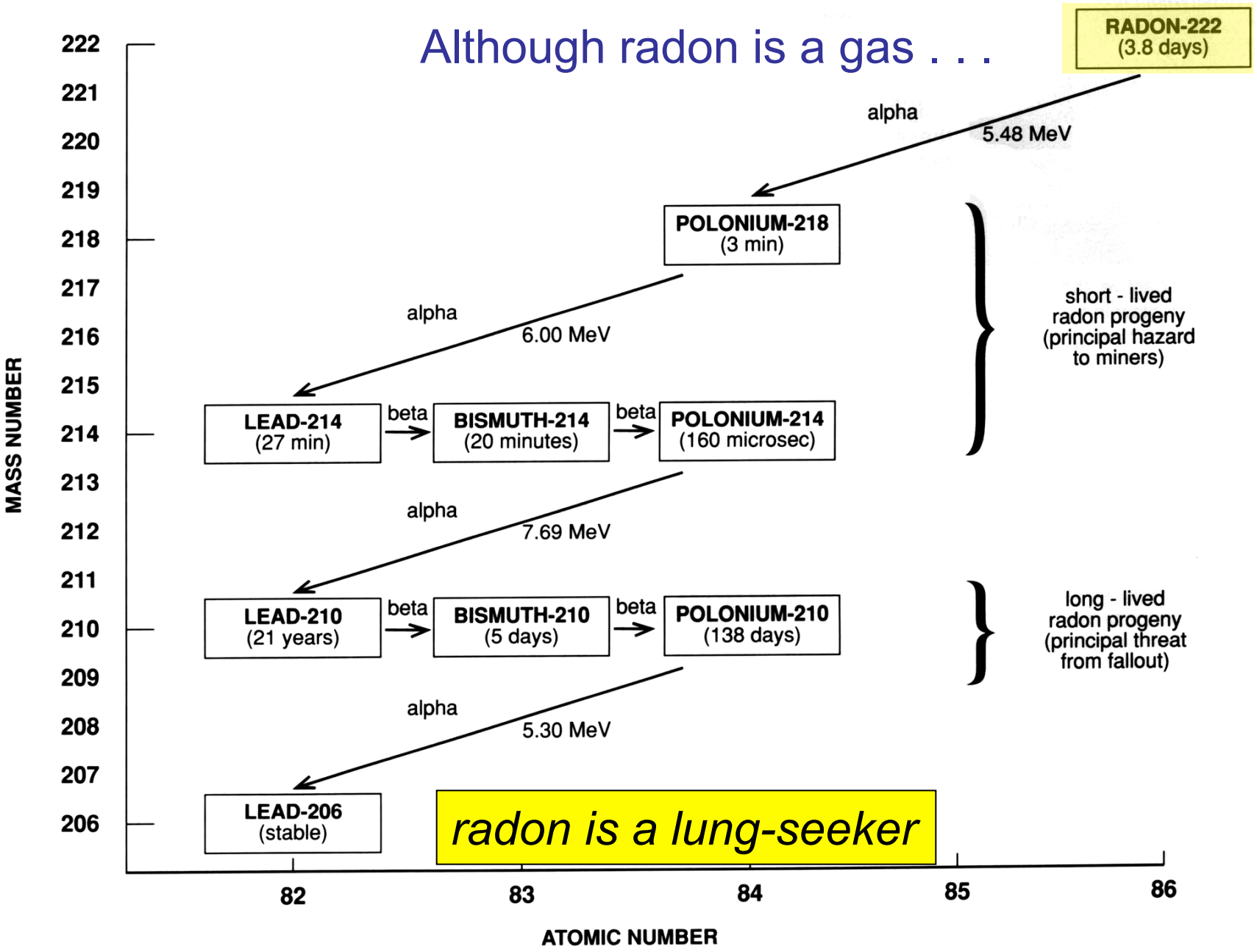
radon is the leading cause of **lung cancer** among non-smokers

radon causes lung cancers and other lung diseases in **uranium miners**

radon gas deposits solid **radioactive materials** in lung tissue

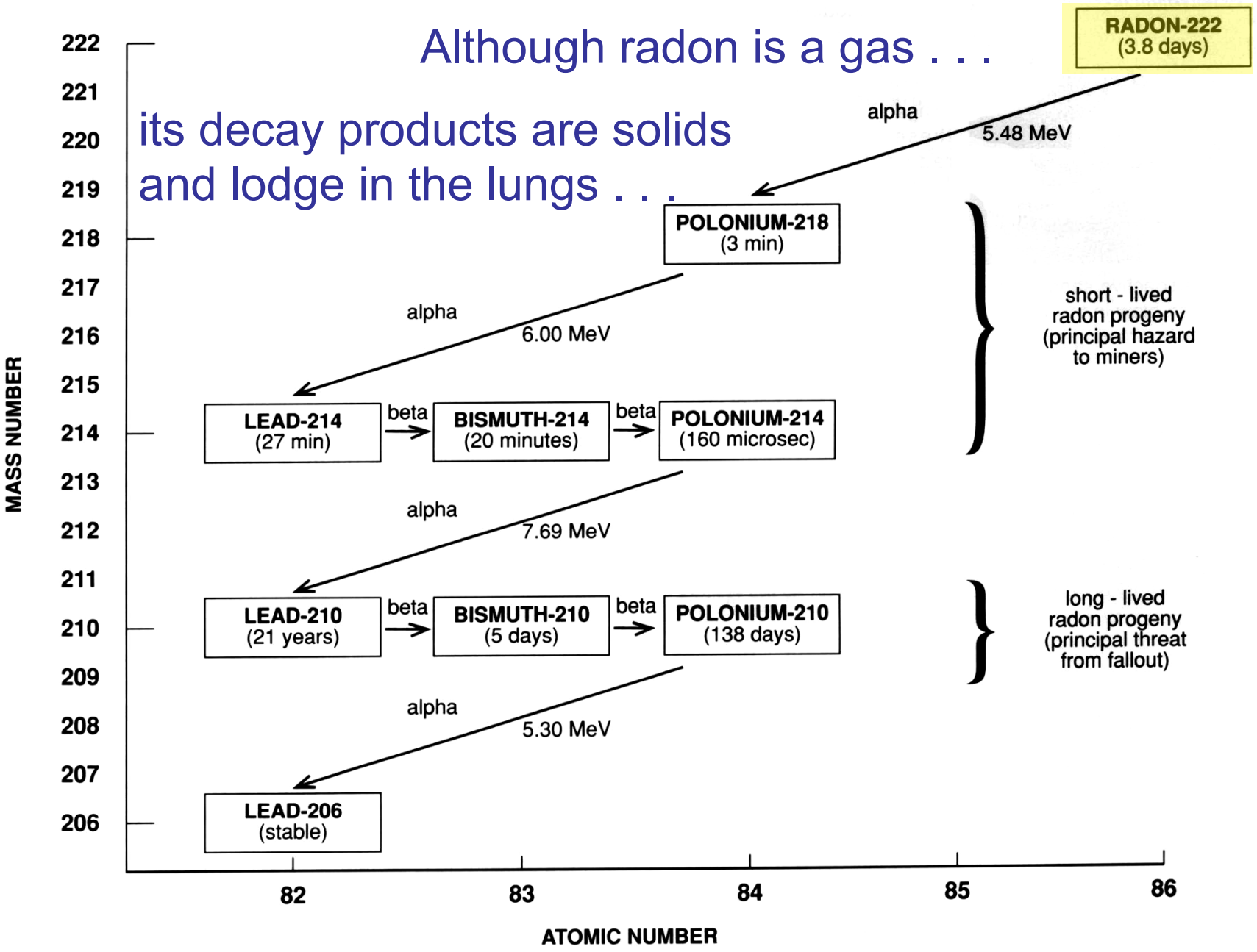
radon is eight times **heavier than air** and travels great distances …

Although radon is a gas . . .



Although radon is a gas . . .

its decay products are solids and lodge in the lungs . . .



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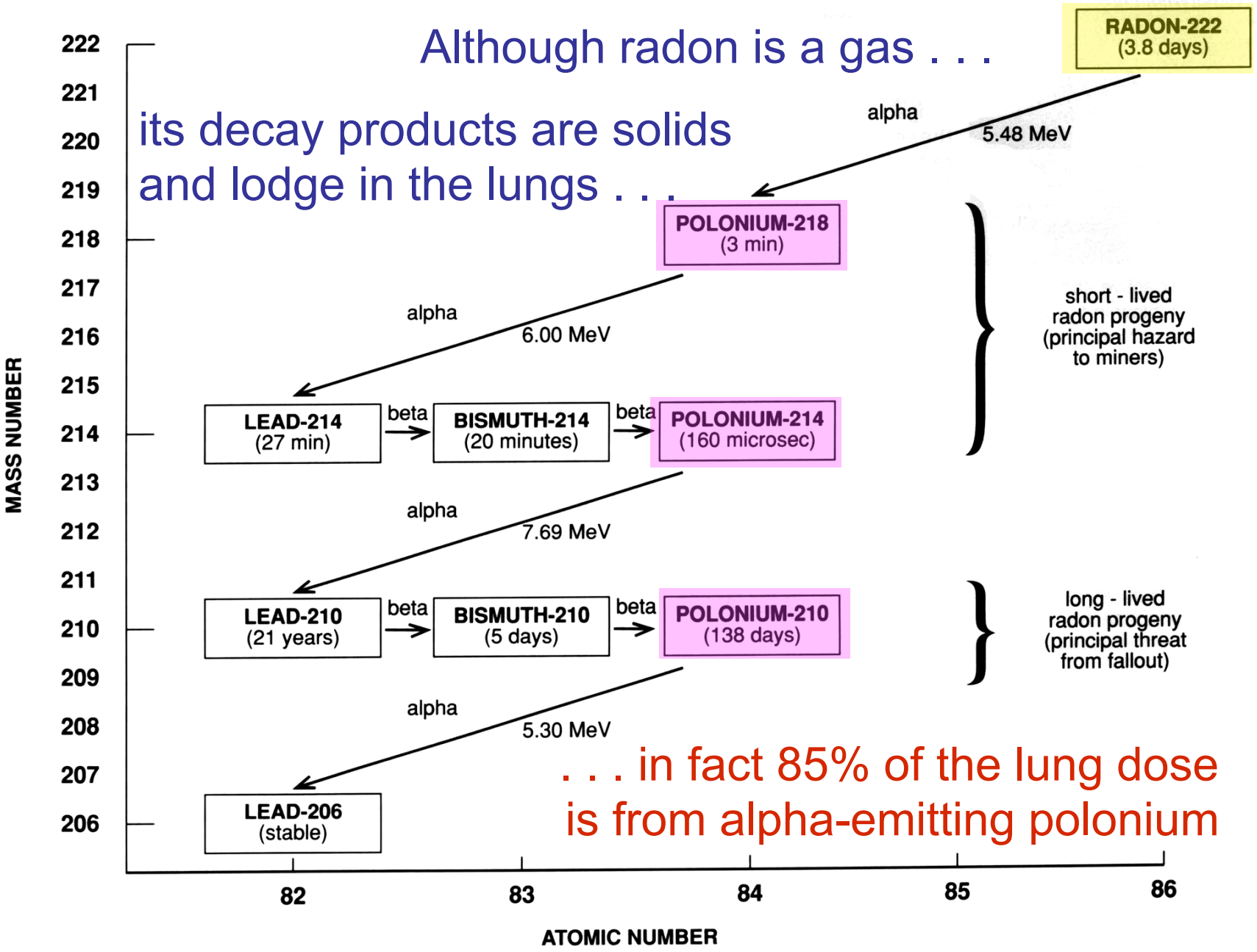
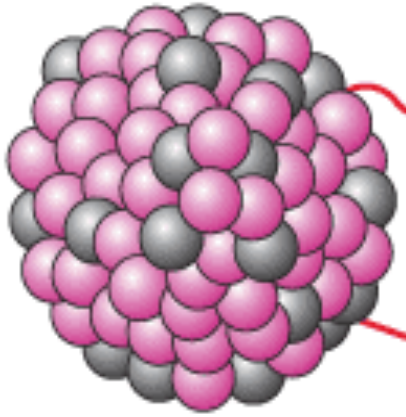


. . . in fact 85% of the lung dose is from alpha-emitting polonium

Non-Penetrating

Alpha Radiation

Three types of emissions: Alpha, Beta and Gamma



Radioactive Atom

(also called a radionuclide)

gamma

(sometimes)

Photon

alpha or beta

(always)

Particle

"Atomic Radiation"

Every radionuclide emits either an alpha or a beta particle.
Such particles are electrically charged and move very fast.
In some cases a powerful gamma ray is also given off.
All three forms of atomic radiation damage living cells.

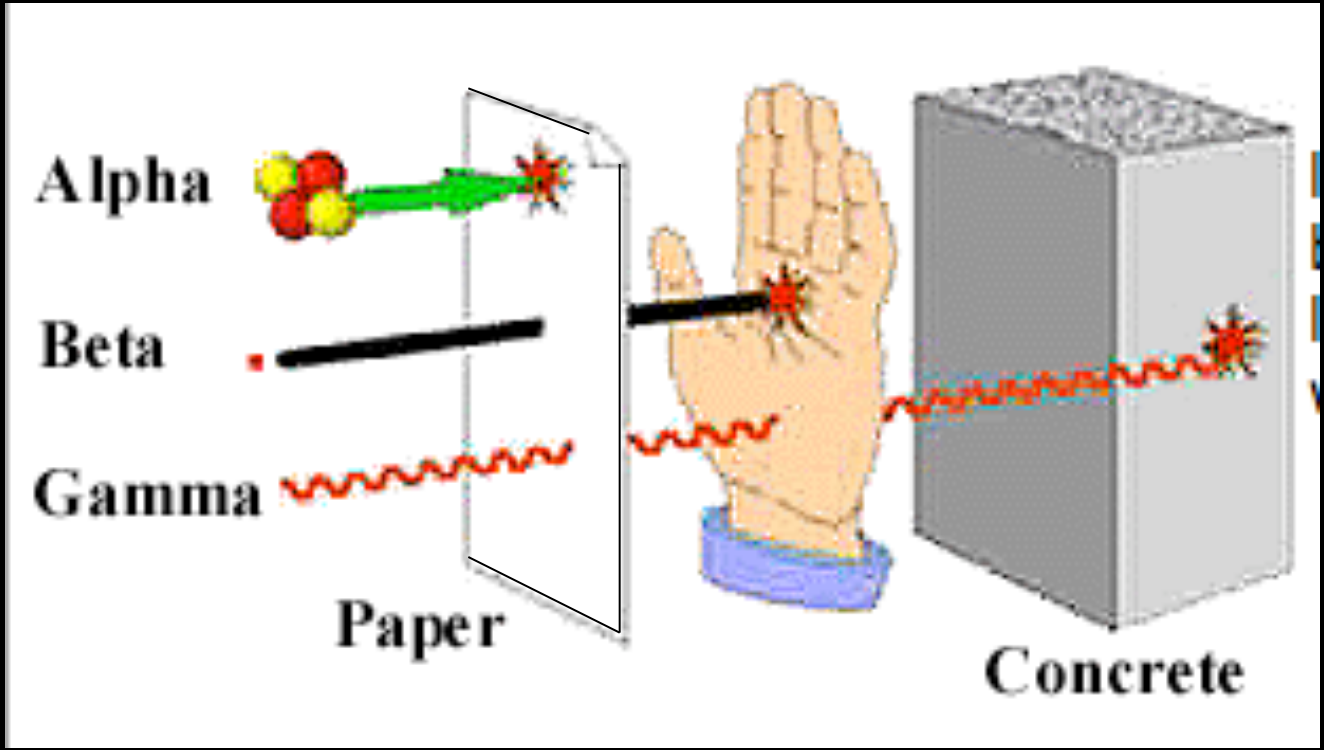
A gamma ray is like an x-ray, but more powerful.
highly penetrating ~ most easily detected

A beta particle is like a sub-atomic bullet.
moderately penetrating ~ harder to detect

An alpha particle is like a subatomic cannon ball.
least penetrating, but most damaging ~ often undetected

Alpha and Beta particles are INTERNAL hazards.
Gamma rays are both internal & external hazards..

Alpha particles can be stopped by a sheet of paper.
Alpha emitters are harmless outside the body, but
exceedingly dangerous when ingested or inhaled.



Beta particles penetrate only part-way.
They can damage eyes or skin externally.
But the main danger is internal exposure.

Gamma rays are highly penetrating.
They give "whole body" radiation.
Heavy shielding is often needed.

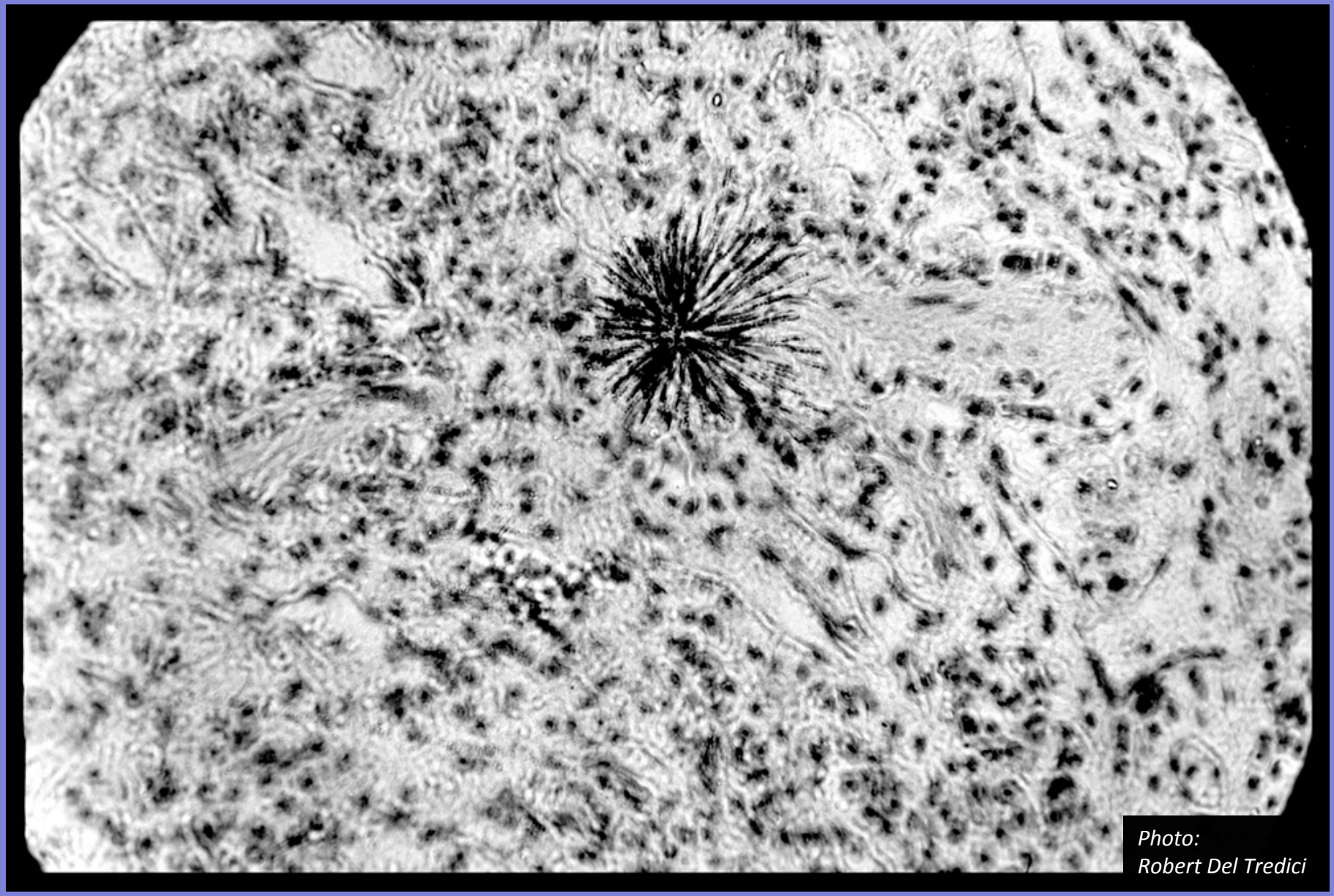
All of these deadly radionuclides

~ radium, radon, and polonium ~

are “alpha emitters”

Alpha radiation is
harmless outside the body,
but deadly inside

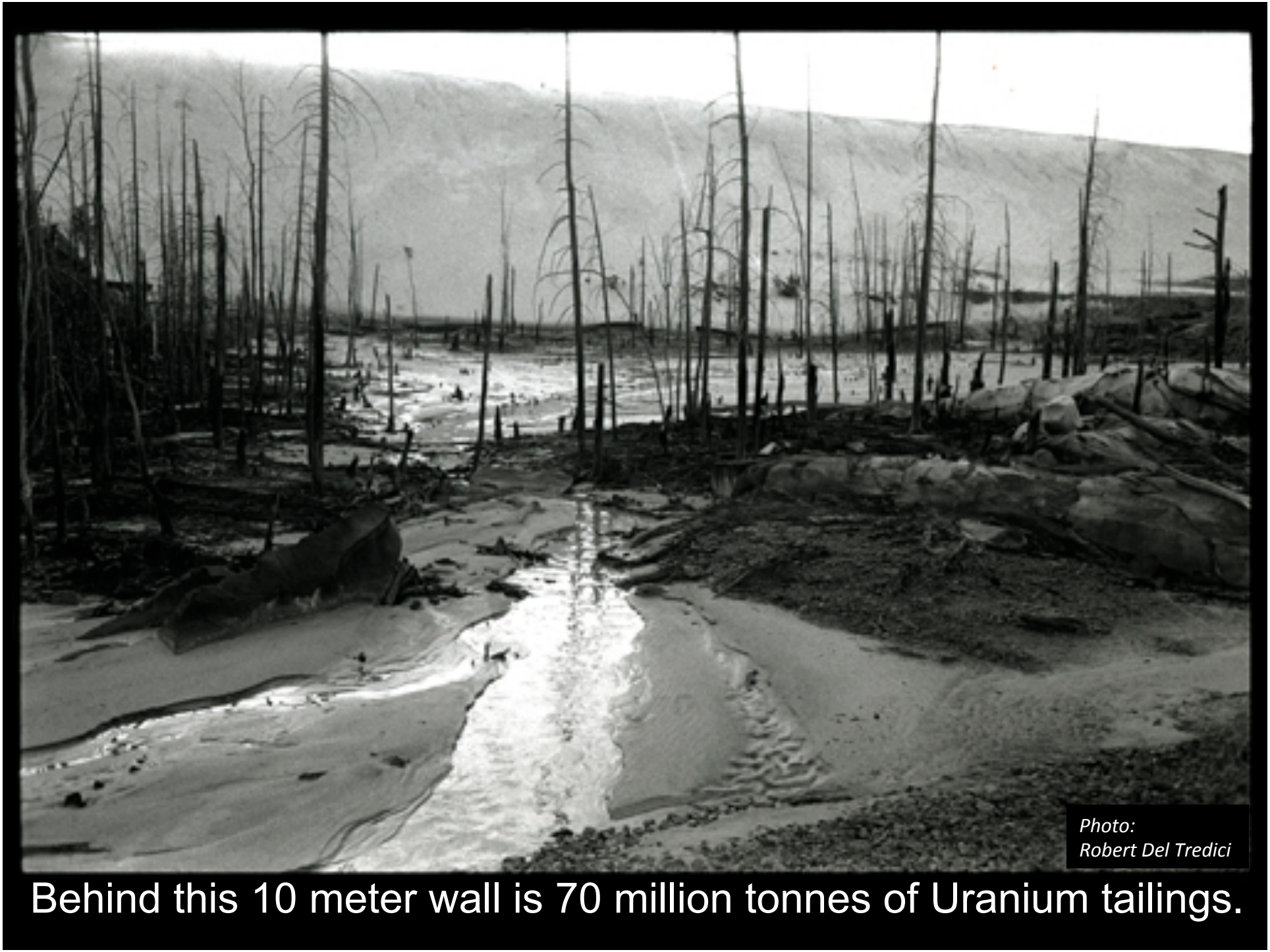
uranium, thorium and plutonium
are also alpha emitters



"Alpha Radiation" from a tiny radioactive particle in lung tissue

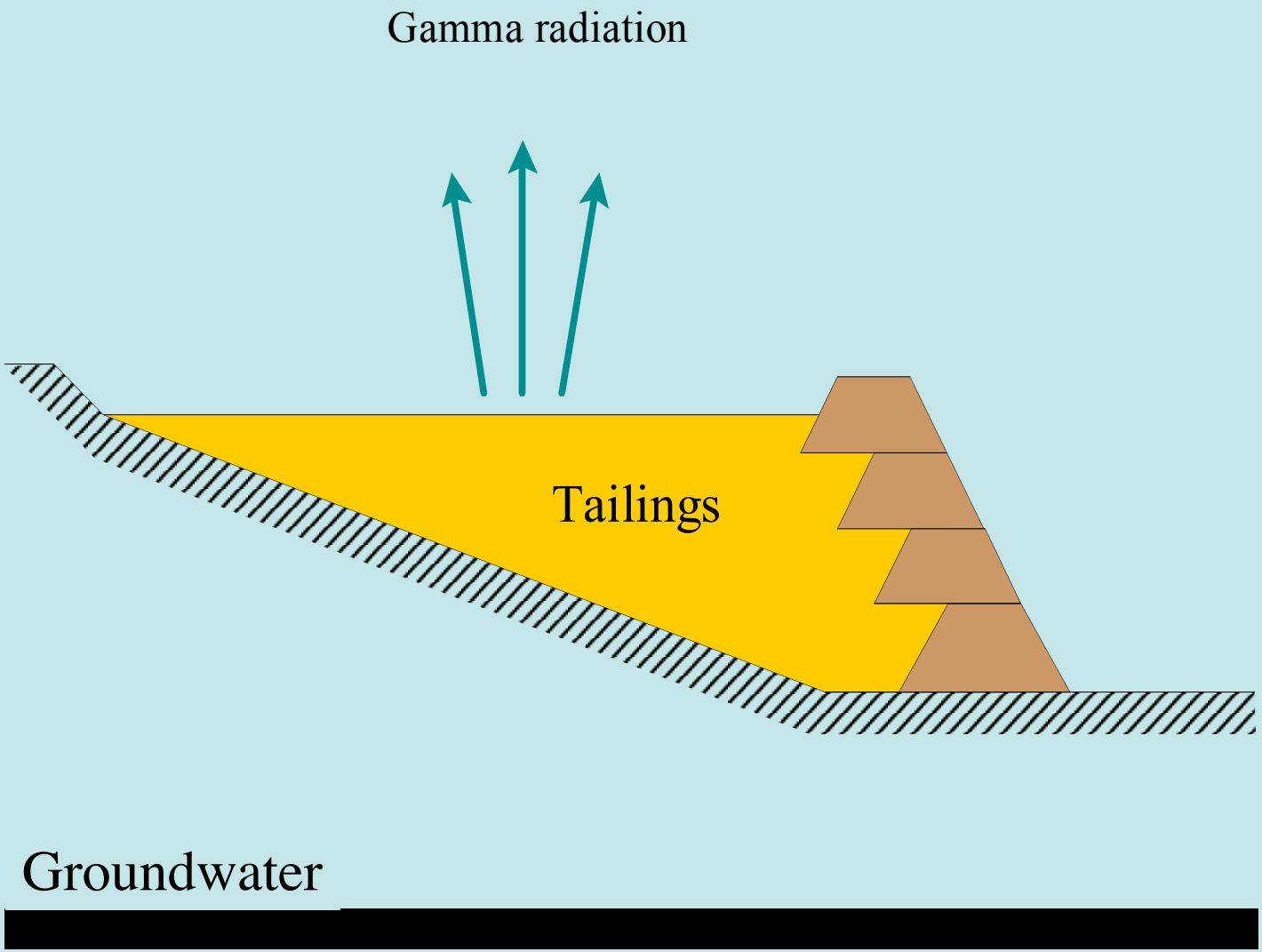
Radioactive

Tailings

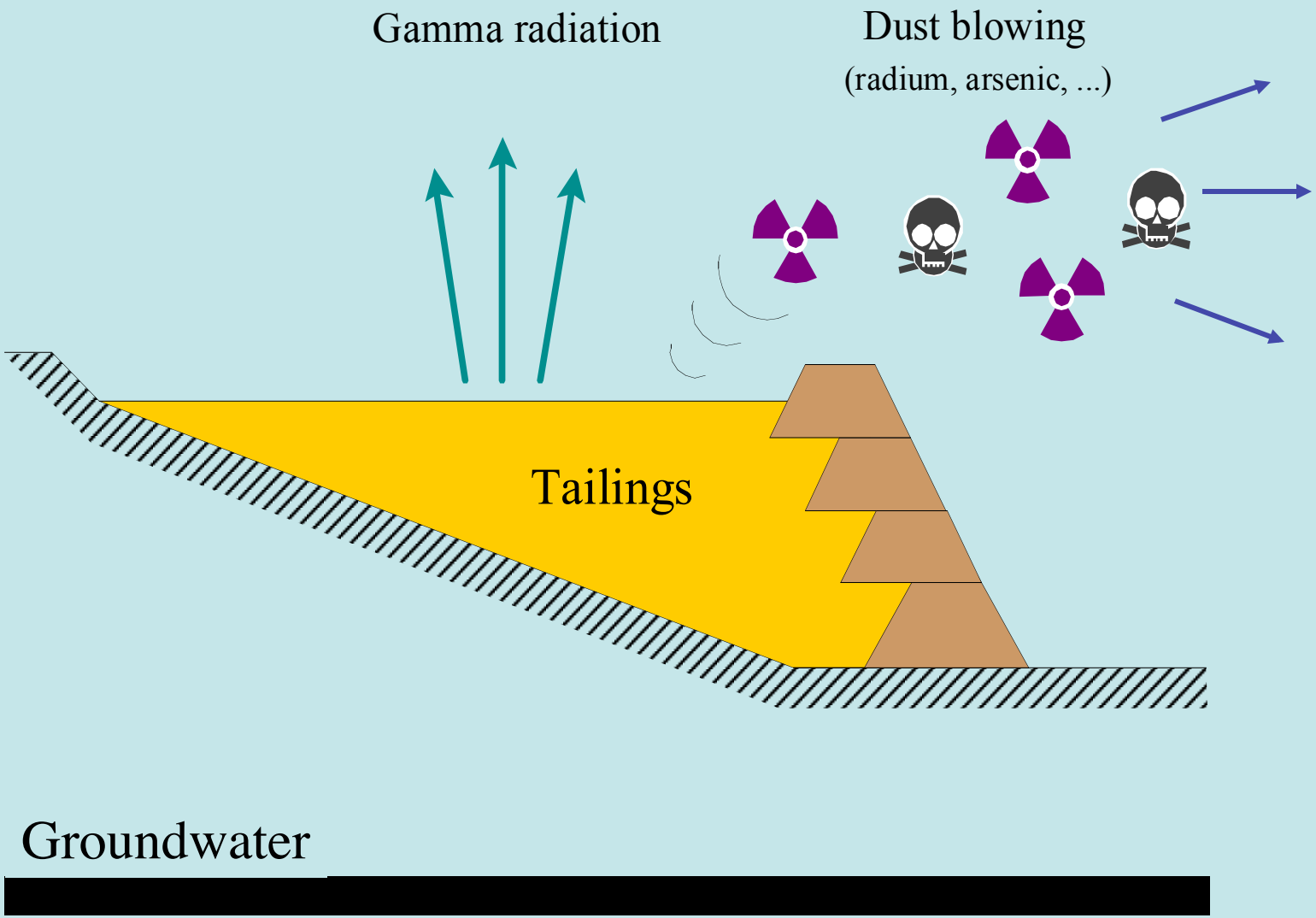


Behind this 10 meter wall is 70 million tonnes of Uranium tailings.

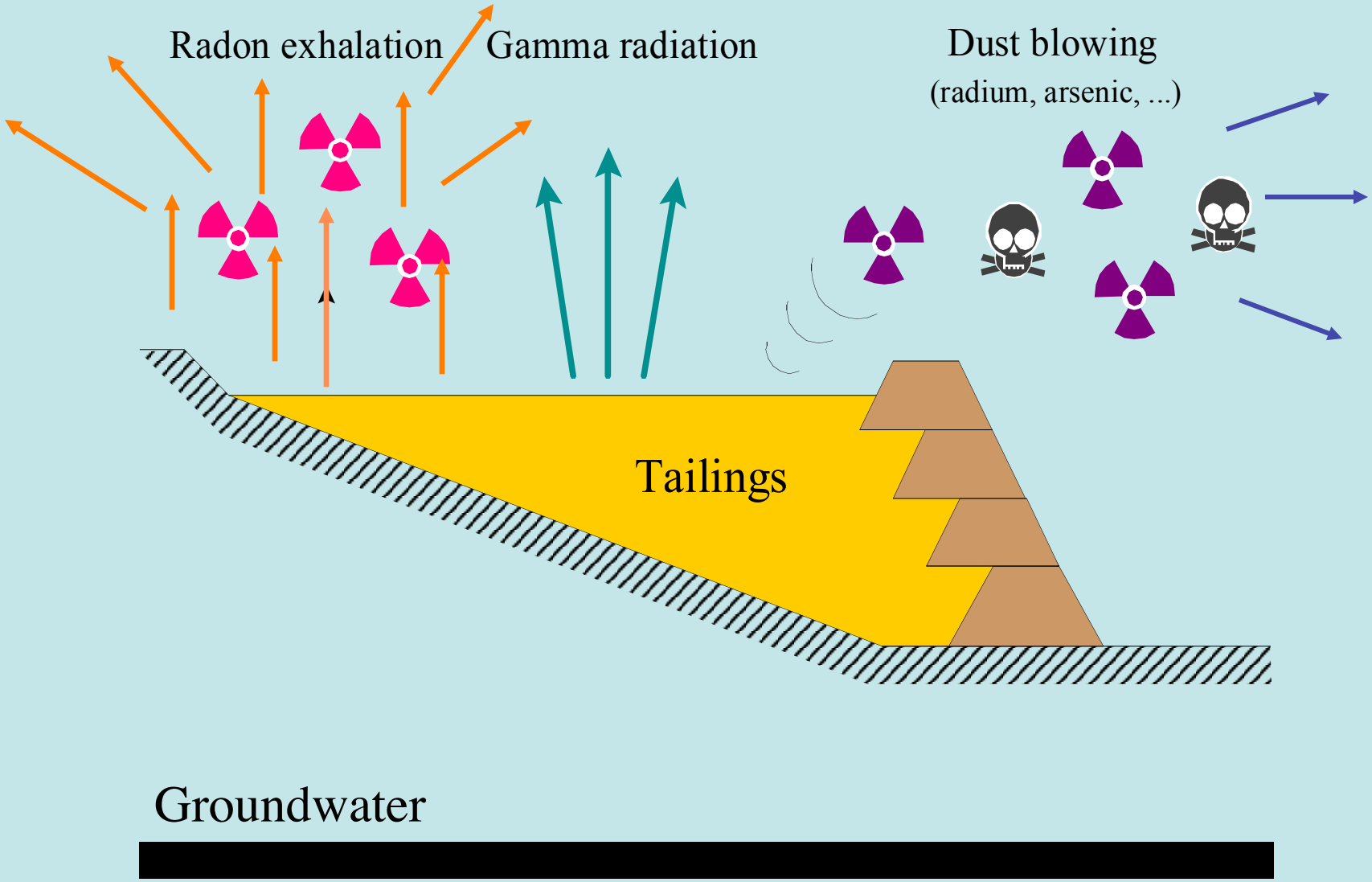
Mill Tailings Hazards



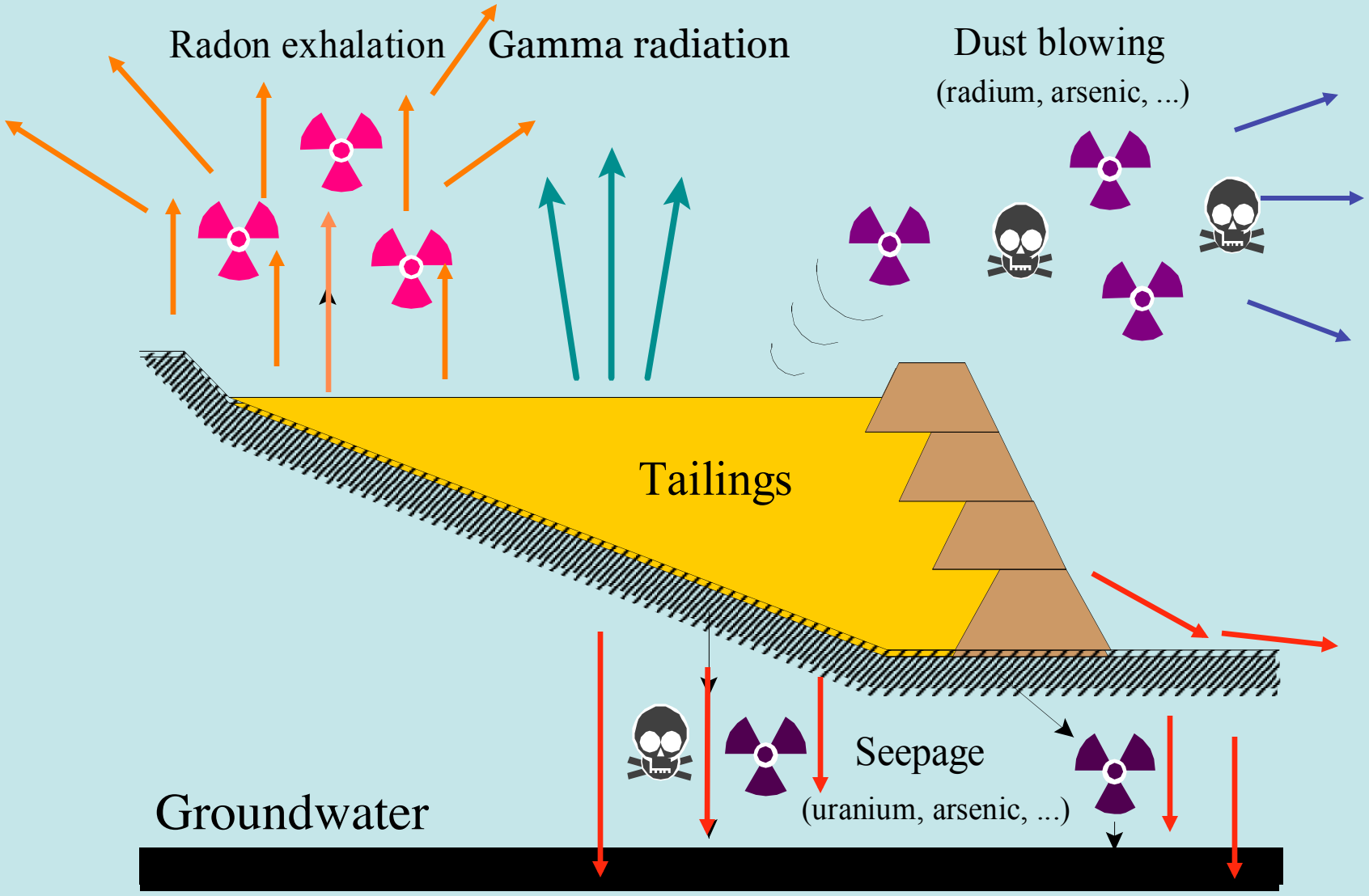
Mill Tailings Hazards



Mill Tailings Hazards



Mill Tailings Hazard



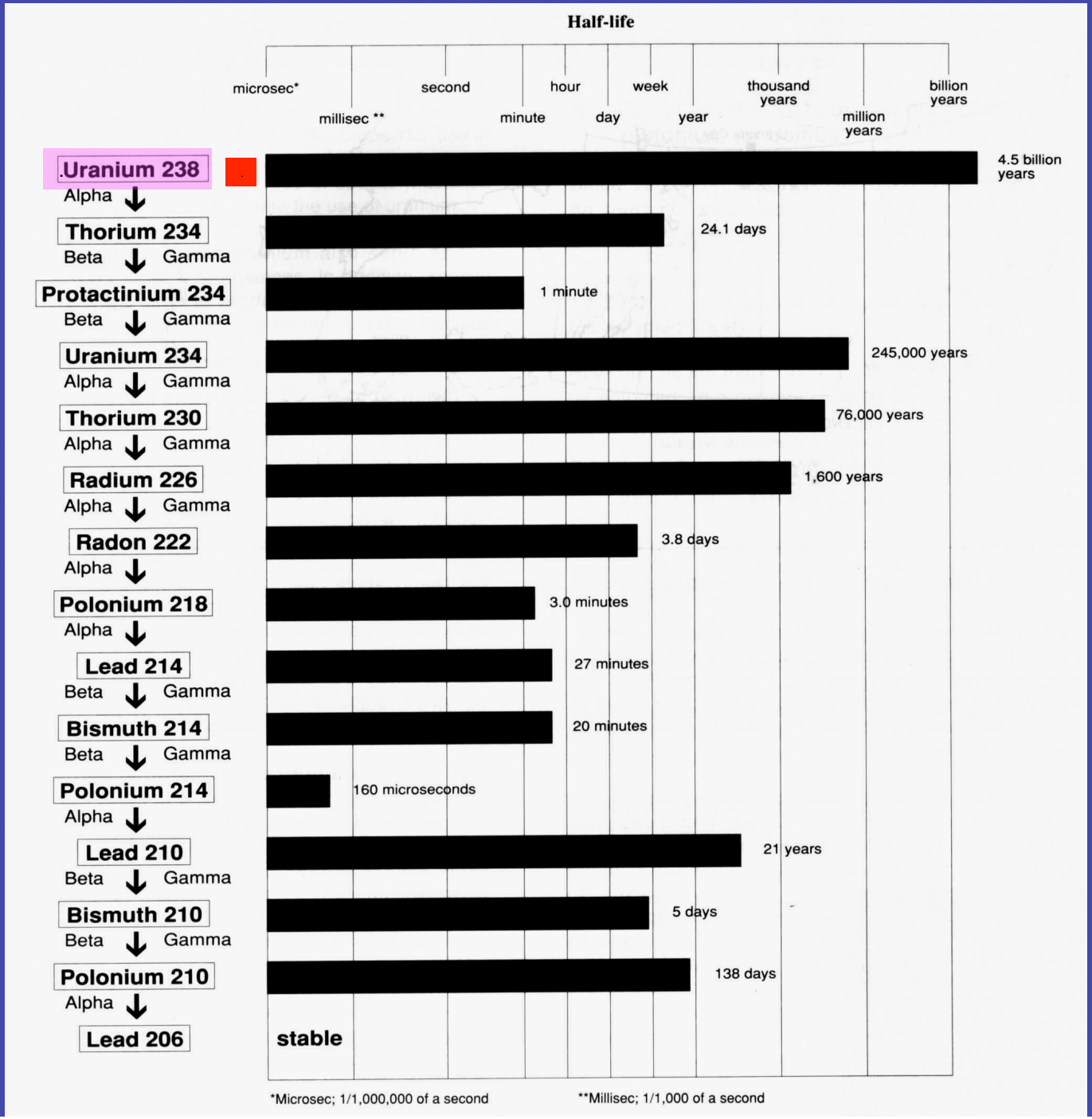
URANIUM-238 DECAY CHAIN

	ISOTOPE		HALF-LIFE
primordial (progenitor)	URANIUM-238		
		alpha	*4.5 billion yeas*
	THORIUM-234		
		beta	*24.1 days*
	PROTACTINIUM-234		
		beta	*1 minute*
	URANIUM-234		
		alpha	*245 thousand years*
	THORIUM-230		
		alpha	*76 thousand years*
	RADIUM-226		
		alpha	*1600 years*
radon gas	RADON-222		
		alpha	*3.8 days*
	POLONIUM-218		
		alpha	*3 minutes*
radioactive lead	LEAD-214		
		beta	*27 minutes*
	BISMUTH-214		
		beta	*20 minutes*
	POLONIUM-214		
		alpha	*160 microseconds*
radioactive lead	LEAD-210		
		beta	*22 years*
	BISMUTH-210		
		beta	*5 days*
	POLONIUM-210		
		alpha	*138 days*
stable lead	LEAD-206		*STABLE*

"THE URANIUM SERIES"

In the uranium decay chain each element has its own half-life indicated by the black bars.

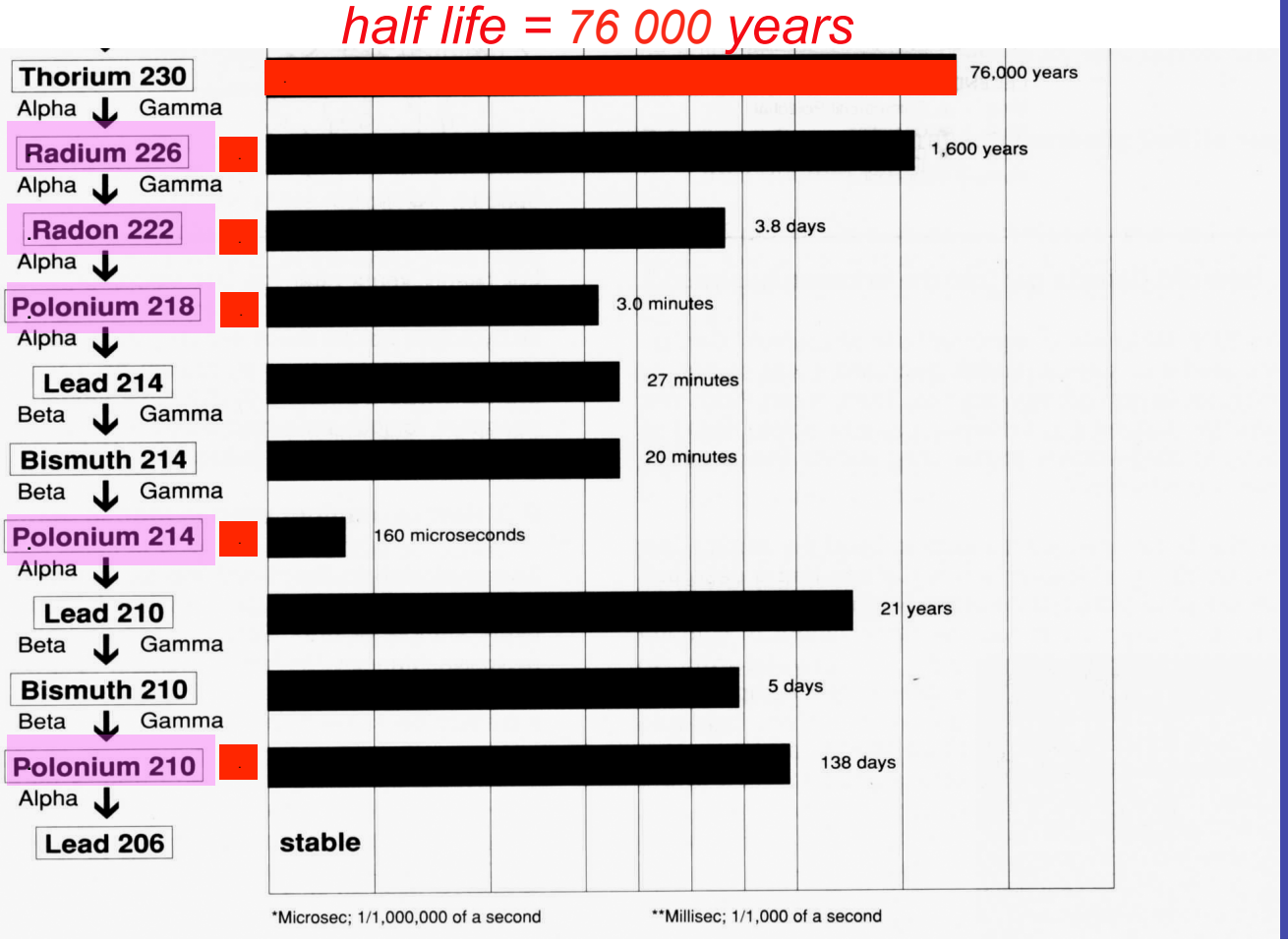
The half-life of Uranium-238 is about equal to the age of the Earth.



After uranium is taken away, 85 percent of all radioactive material is left behind as waste.

The half-life of these wastes is 76,000 years.

In the uranium residues (tailings) thorium-230 replenishes the inventory of radium, radon and polonium, for hundreds of thousands of years

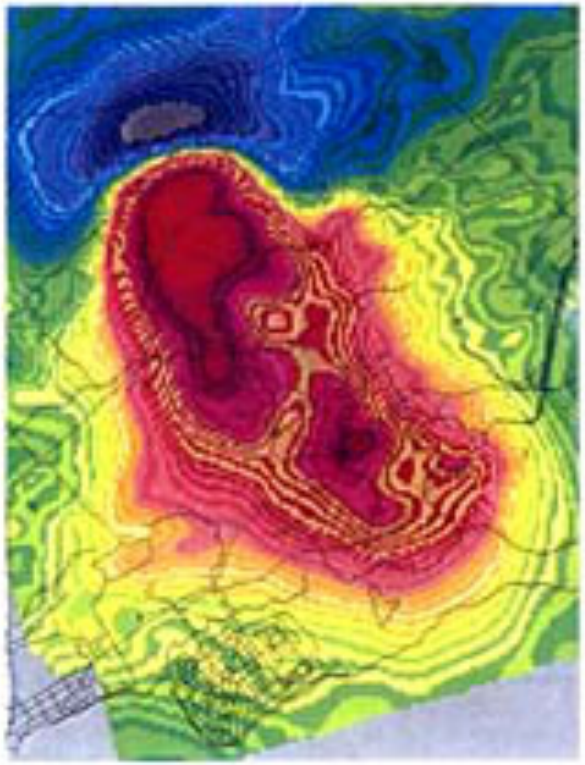


RÉGIE RÉGIONALE
DE LA SANTÉ ET DES
SERVICES SOCIAUX
DES LAURENTIDES

la santé *mieux* pensée

LE RADON À OKA

Rapport d'intervention de santé publique



1998

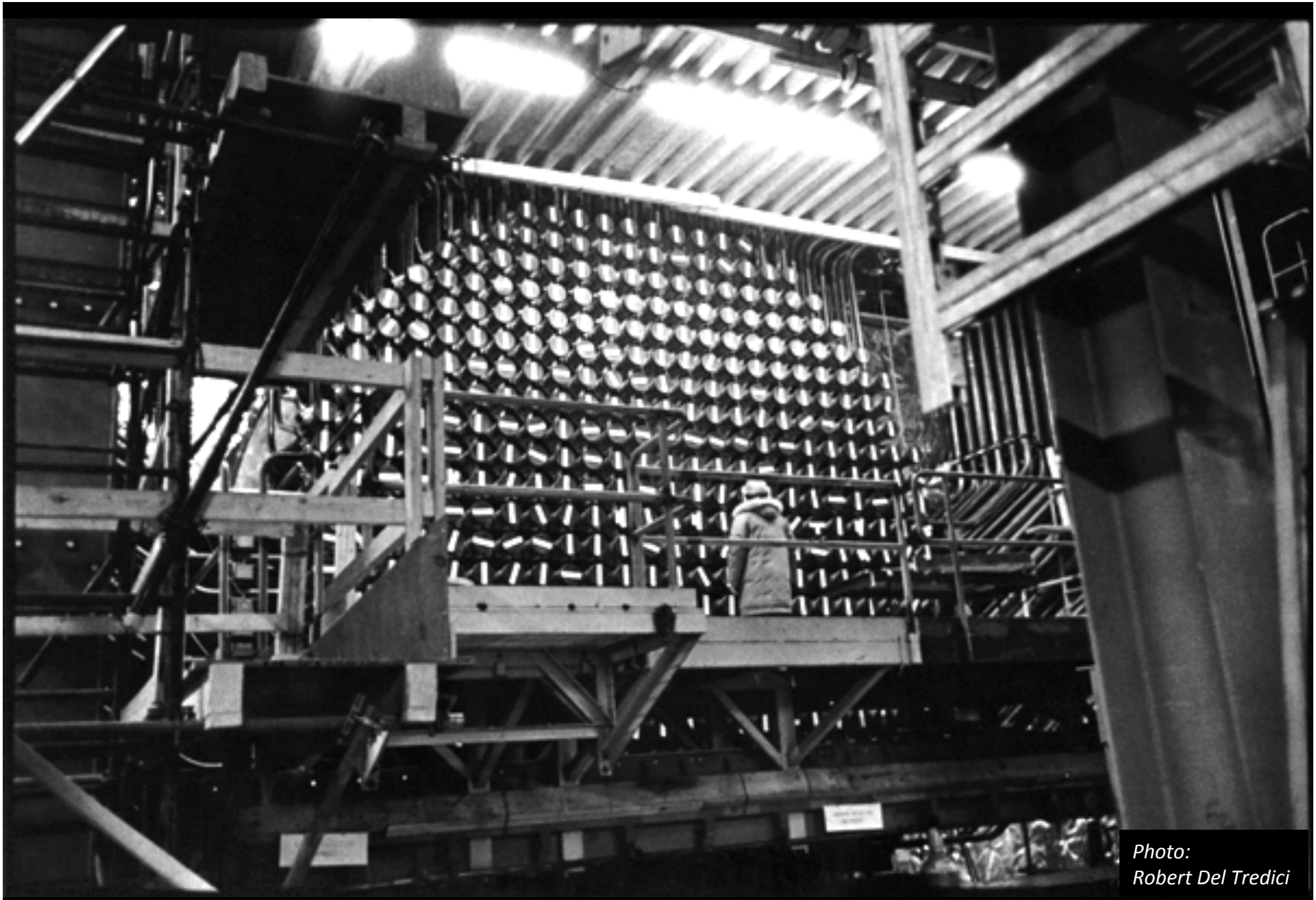
Direction régionale de la santé publique

Cameco uranium conversion plant on Port Hope harbor. *Photo: Robert Del Tredici*

Uranium

Boom

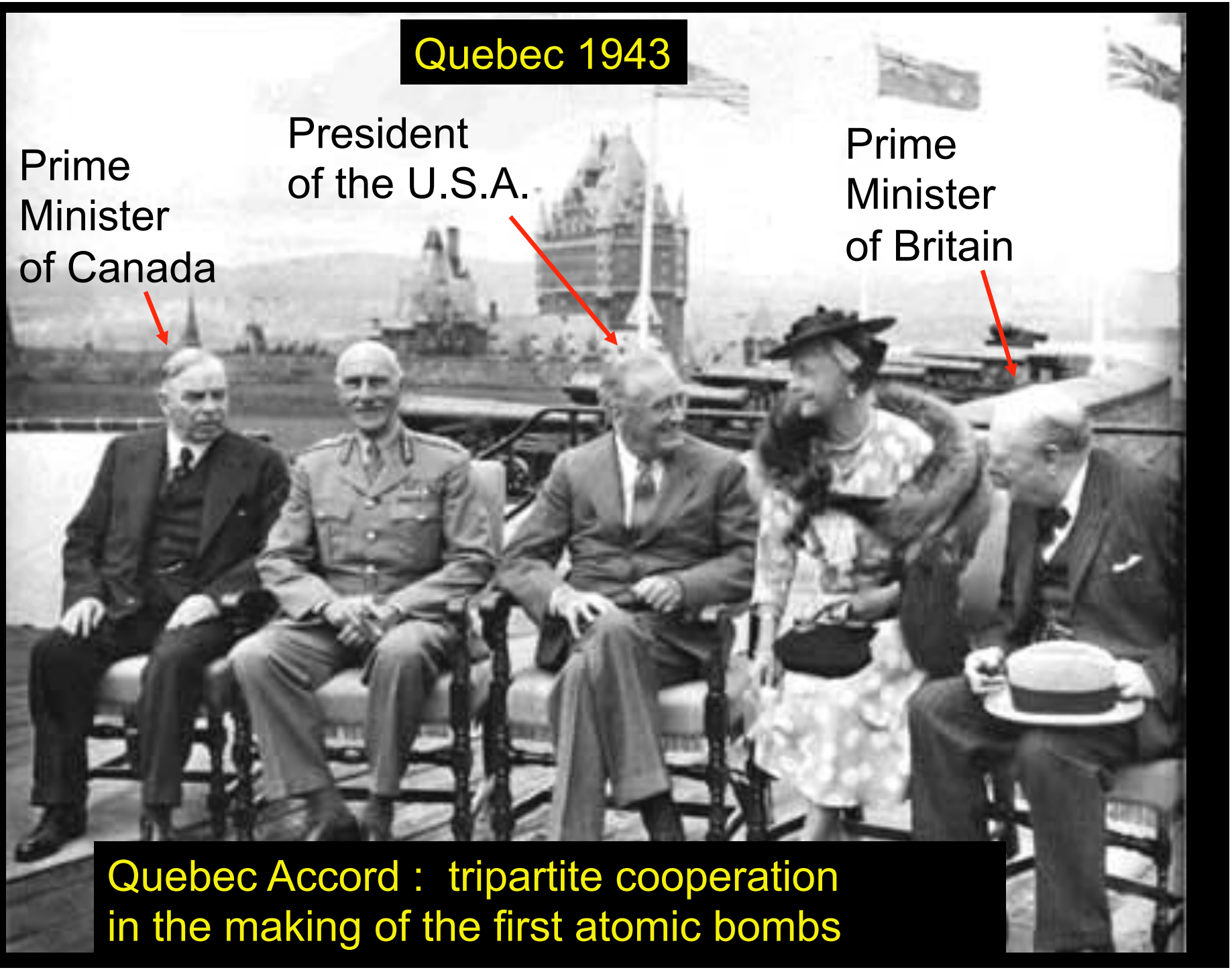
The first use of uranium is to build nuclear weapons.

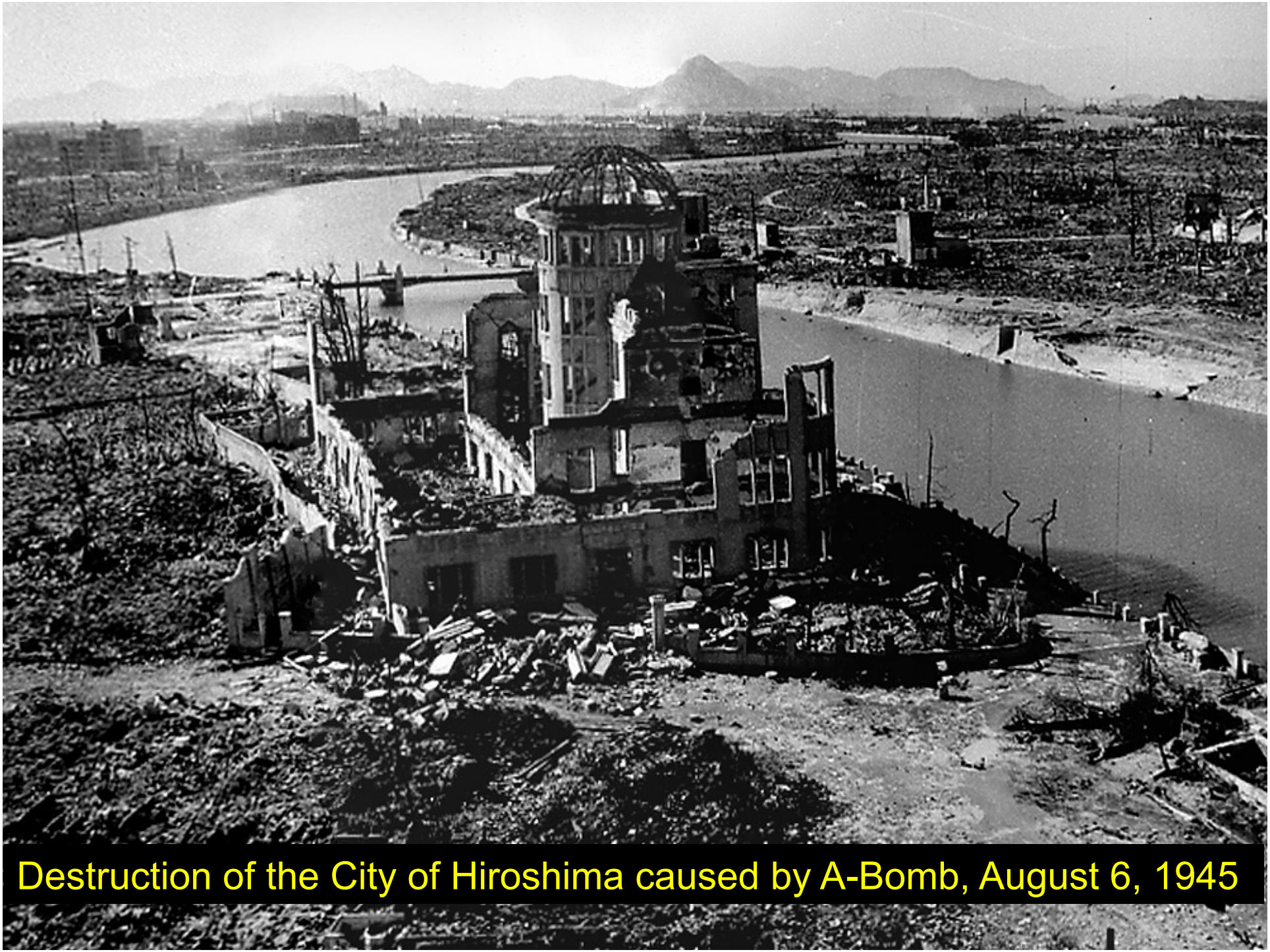


The second use of uranium is to fuel nuclear reactors.

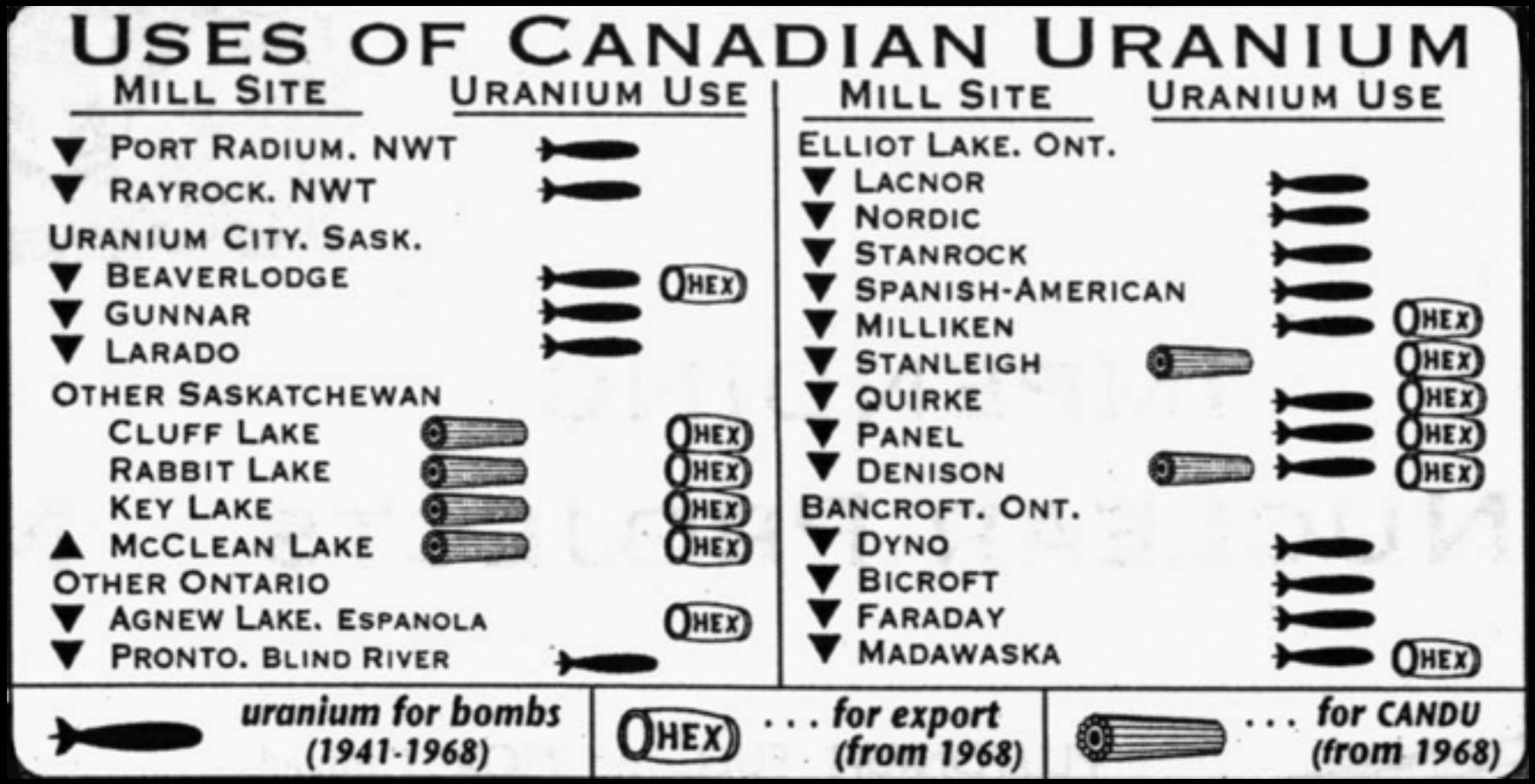
When the uranium nucleus is “split” enormous energy is released. Highly radioactive broken pieces of uranium atoms are left behind.

Photo: Robert Del Tredici


Quebec 1943
Prime Minister of Canada
President of the U.S.A.
Prime Minister of Britain
Quebec Accord : tripartite cooperation in the making of the first atomic bombs



Destruction of the City of Hiroshima caused by A-Bomb, August 6, 1945



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 sold to other countries.

Creation of plutonium in a nuclear reactor occurs…

…when an atom of uranium-238 absorbs a neutron

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

Doctors

on

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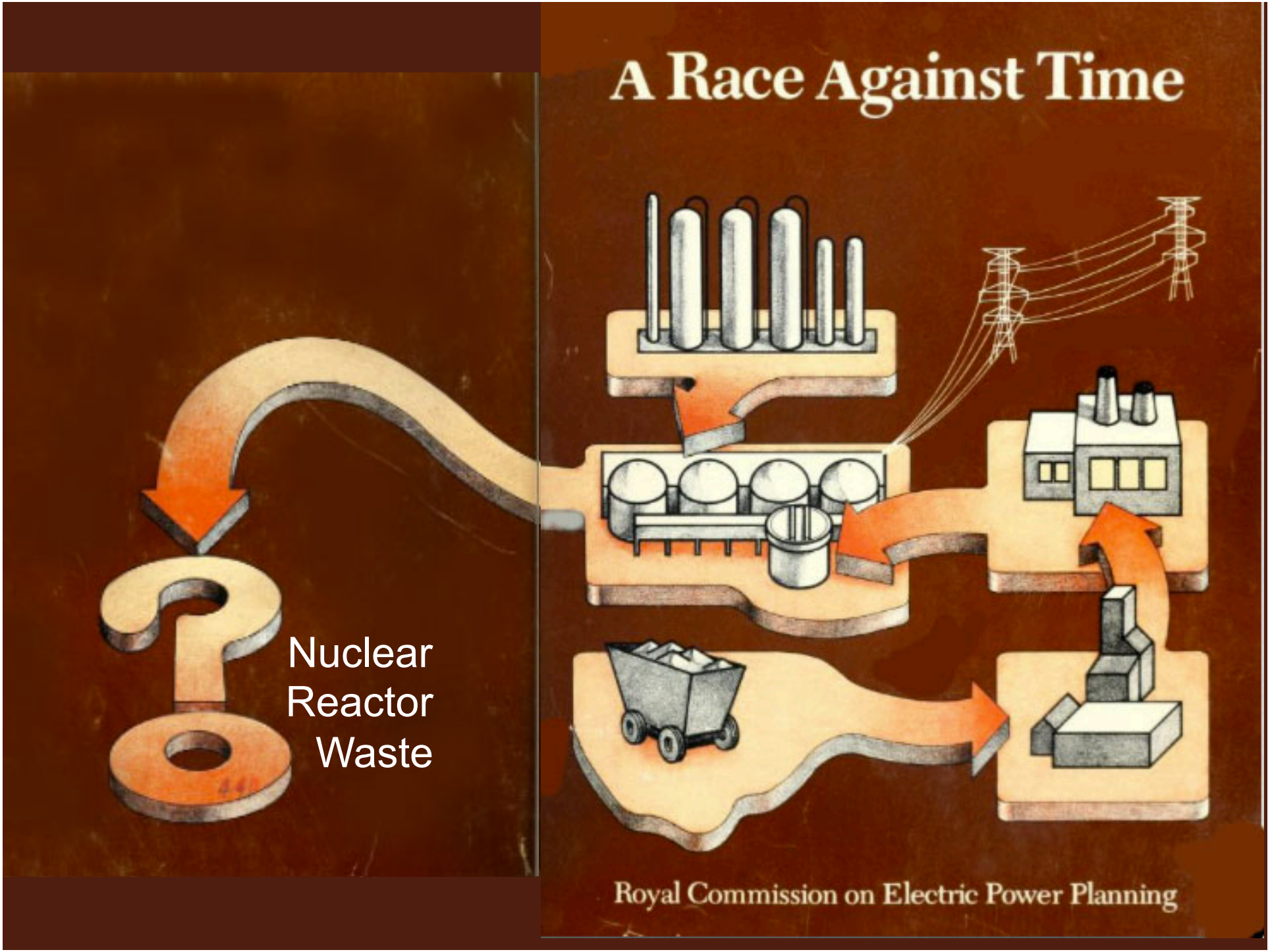
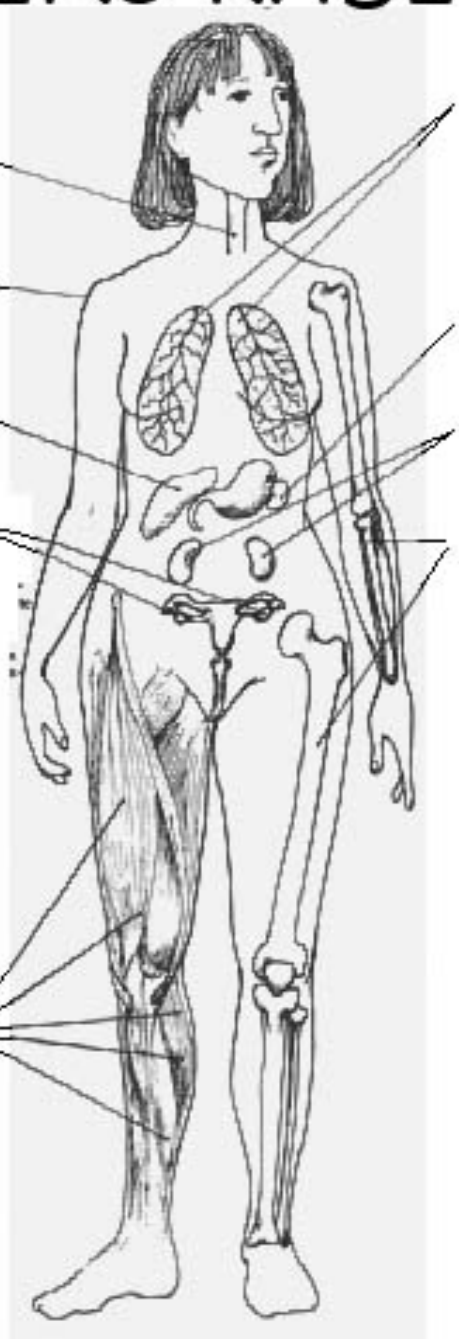
A model of all the nuclear weapons in the American nuclear arsenal


A Race Against Time
Nuclear
Reactor
Waste
Royal Commission on Electric Power Planning

Radionuclides are chemical substances which are also radioactive.

IONIZING RADIATION



THYROID
iodine–131
beta (gamma) ; 8 days

SKIN
sulphur–35
beta ; 87 days

LIVER
cobalt–60
beta (gamma) ; 5 years

OVARIES
iodine–131
beta (gamma) ; 8 days
cobalt–60
beta (gamma) ; 5 years
krypton-85
gamma ; 10 years
ruthenium–106
gamma ; 1 year
zinc–65
gamma ; 245 days
barium–140
gamma ; 13 days
potassium–42
gamma ; 12 hours
cesium–137
gamma ; 30 years
plutonium–239
alpha ; 24 000 years

MUSCLE
potassium–42
gamma ; 12 hours
cesium–137
gamma ; 30 years

LUNGS
radon–222 (and whole body)
alpha ; 3,8 days
uranium–233 (et os)
alpha ; 162 000 years
plutonium–239 (and bone)
alpha ; 24 000 years

SPLEEN
polonium–210 (and whole body)
alpha ; 138 days

KIDNEYS
uranium–238 (and bone)
alpha ; 4 500 000 years
ruthenium–106
gamma (beta) ; 1 year

BONE
radium–226
alpha ; 1 620 years
zinc–65
gamma ; 245 days
strontium–90
beta ; 28 years
yttrium–90
beta ; 64 hours
promethium–147
beta ; 2 years
barium–140
beta (gamma) ; 13 days
thorium–234
beta ; 24,1 days
phosphorus–32
beta ; 14 days
carbon–14 (and fat)
beta ; 5 600 years

Final

Word

World Uranium Symposium (Quebec 2015) calls for global halt to uranium mining

Matthew Coon-Come, Grand Chief of the Cree Nations of Quebec, at World Uranium Symposium

Photo by Robert Del Tredidi

U-BAN = International Campaign to Ban Uranium Mining Worldwide

The End

This backgrounder prepared by Dr. Gordon Edwards
on behalf of PGS, the Canadian chapter of IPPNW.

Narsaq June 11 2016

Canadian Coalition for Nuclear Responsibility

www.ccnr.org