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

Presentation

To the BAPE Panel
on Uranium Mining
In Quebec

Confessions of a Disappointed Educator

by Gordon Edwards, Ph.D.

Corrected Version Presented Orally on
November 17, 2014

NOTE TO BAPE COMMSSIONERS

THIS IS A CORRECTED VERSION
OF A PREVIOUSLY FILED WRITTEN SUBMISSION
(ALREADY CORRECTED DURING THE ORAL PRESENTATION)

– CONVERSION OF UNITS FROM 1978 to 2014 –

In 1978, the units used for measuring radon gas concentrations were different than they are today. Thus a conversion of units is required.

1978: Unit of radon concentration in air
1 working level = 1 WL

2014: Unit of radon concentration in air
1 becquerel per cubic metre = 1 Bq/ m3

[see next page]

NOTE TO BAPE COMMSSIONERS (continued)

According to Heath Canada, the proper conversion between Working Levels and Becquerels per cubic metre is:

1 WL = 7480 Bq/ m3 (becquerels per cubic centimetre).

Thus the 1978 standard for radon in NEW homes, 0.02 WL, is equivalent to 0.02 x 7480 = 149.6 Bq/m3 in 2014 units .

This is the correct conversion. It is used in this corrected submission, and in the oral presentation to the Panel on November 17.

In a previous written submission, I used an incorrect conversion: 1 WL = 3740 Bq/ m3 , (half the value given by Health Canada), and then made a typographical error by leaving out a decimal point in my conversion. I wrote 0.02 WL = 748 Bq/ m3 omitting the decimal point in the actual calculated result, 0.02 x 3740 = 74.8 Bq/ m3.

My incorrect conversion value was based on a conservative assumption that there would not likely be 100 percent equilibrium between radon gas and its progeny, but perhaps only 50 percent equilibrium, thus about half the concentration of radioactivity. Health Canada says this consideration is already accounted for in the conversion they give.

Confessions of a Disappointed Educator

Disappointment #1

The Cultivation of Ignorance

Radioactivity is invisible
. . . but do the facts have to hidden as well?

A critique of Strateco's EIS of october 2009

for the

Underground Exploration Program
of the Matoush property

Presented by Gordon Edwards, Ph.D.
in Mistissini, Québec

November 23, 2010

http://www.ccnr.org/GE_Critique_EIS.pdf

Le rayonnement est invisible
mais doit-on cacher aussi les faits?

une critique de l'ÉIE de Strateco (octobre 2009)

portant sur le

Projet d'exploration souterraine
de la propriété Matoush

présentée par Gordon Edwards, Ph.D.
à Mistissini, Québec

le 23 novembre 2010

http://www.ccnr.org/GE_Critique_EIS_f.pdf

Too Many Unanswered Questions

a violation of the EIS Guidelines

but nobody holds the proponent to account!

> ***"Special attention must be given to aspects of the project that are associated with radioactivity…***
>
> ***"Given the specific nature of the project, the impact statement must describe the radioactivity-related aspects that make this project different from other types of mining activities.***
>
> ***"Special attention should be given to the treatment of elements that may be associated with uranium based on the mineralogy and known history of uranium mining … "***
>
> ***Directives***

SOME UNANSWERED QUESTIONS

Question 1: What is atomic radiation? What is radioactivity?

Question 2: What is a Becquerel? What is a disintegration?

Question 3: What is the Half-Life of a Radioactive Material?

Question 4: What is a Decay Product? What is a Decay Series?

Question 5: What is a “radionuclide” or an “isotope”?

Question 6: What is “the Uranium Decay Chain (or Series)”?

The Uranium Series (U-238)
The Actinide Series (U-235)
The Thorium Series (Th-232)

Question 7: What is “Radioactive Equilibrium”?

Table 3.4 : “The U-238 Family”
Table 3.4 : “The U-235 Family”
Table 3.4 : “The Th-232 Family”

Question 8. How does one apply Quebec Directive 019?

Question 9. Are radioactive materials carcinogenic?

Question 10. Is radon gas responsible for the deaths of miners?

Question 11: Do mining regulations make radon exposures safe?

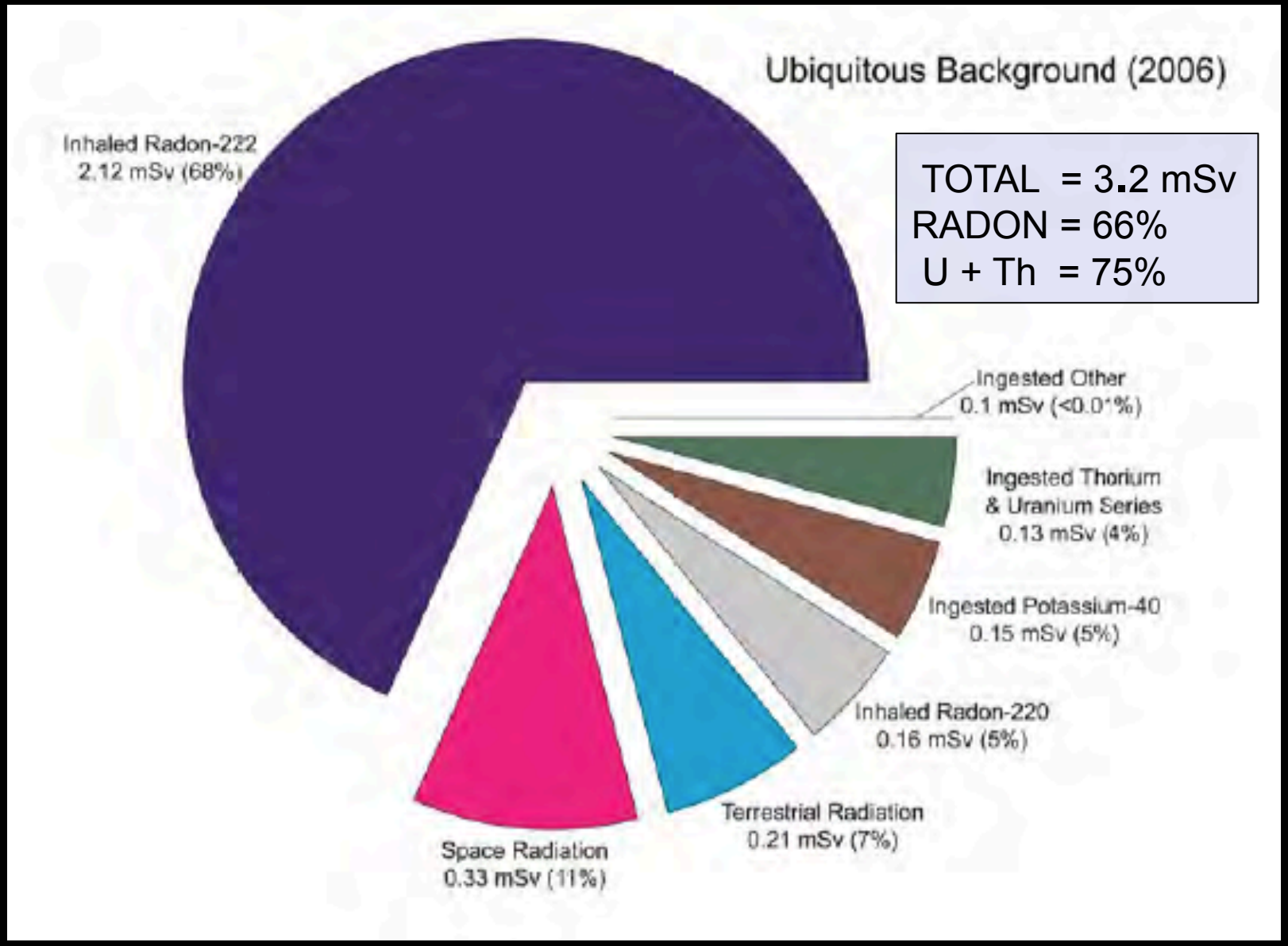
Question 12: Is there a safe level of exposure to atomic radiation?

Confessions of a Disappointed Educator

Disappointment #2

The Failure to Protect

Two thirds of radioactive exposures are from radon gas



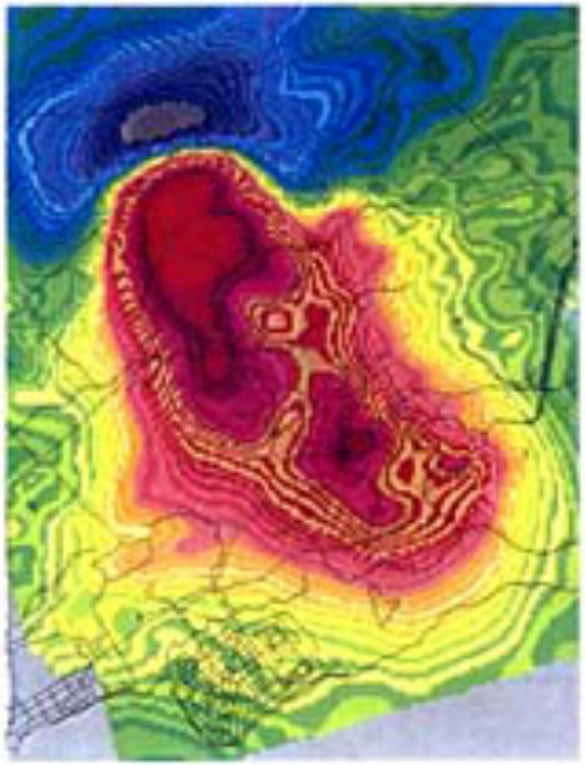
Three quarters of radioactive exposures are from radioactive ores

RÉGIE RÉGIONALE
DE LA SANTÉ ET DES
SERVICES SOCIAUX
DES LAURENTIDES

la santé *mieux* pensée

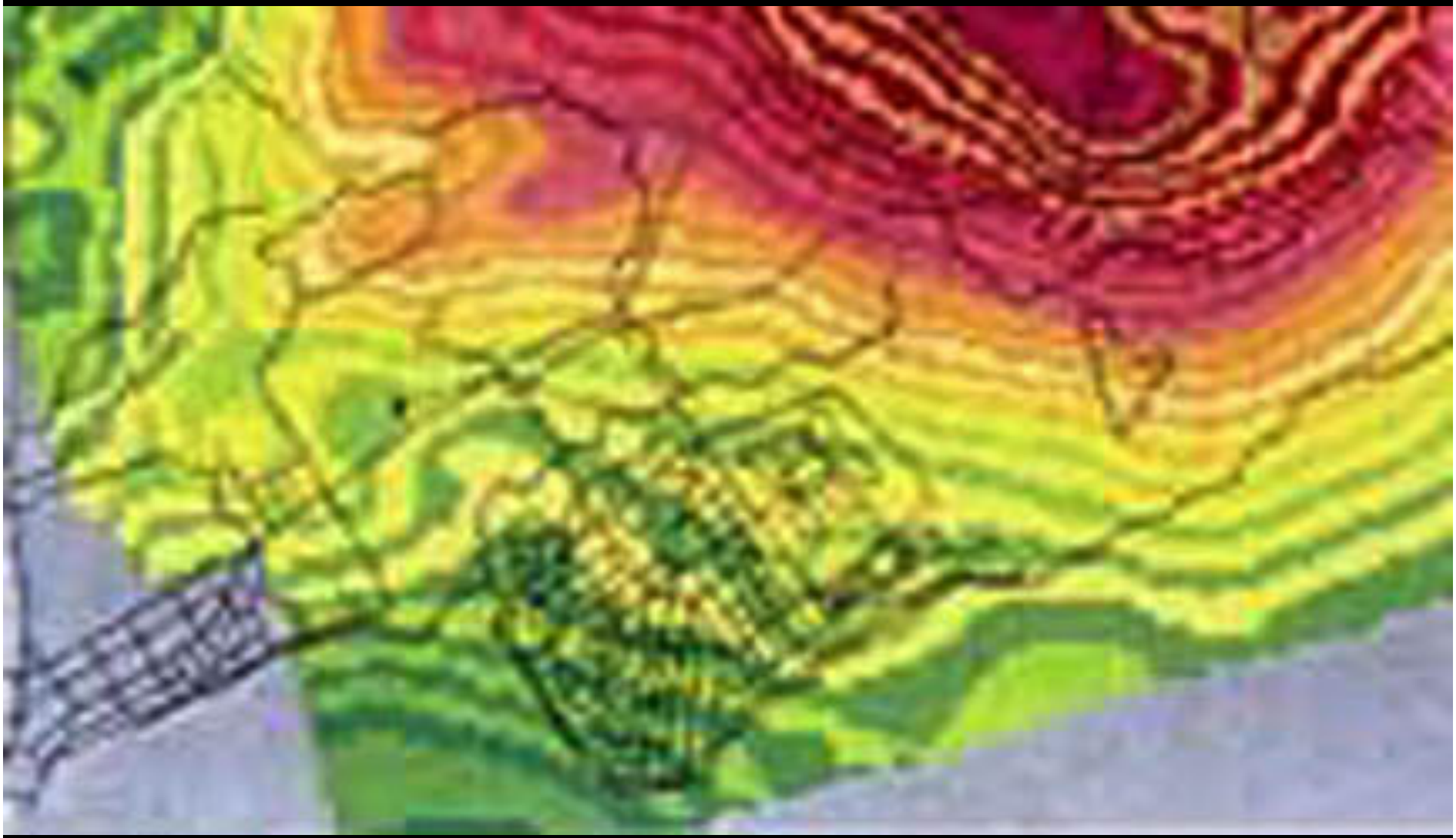
LE RADON À OKA

Rapport d'intervention de santé publique



1998

Direction régionale de la santé publique



Location of housing development close to radioactive formation

Medical Doctors at the Regional Health Centre

were shocked to discover the health implications of so-called "permissible" radon levels

800 becquerels of radon per litre of air (at that time)

Regie regionale de santé et des services sociaux des Laurentides – Le Radon à Oka (1998)

Estimation du risque relatif de développer un cancer du poumon pour une exposition à vie au radon domestique chez les fumeurs

Exposition	Modèle exposition - âge - concentration		Modèle exposition – âge - durée	
Bq/m^3	Hommes	Femmes	Hommes	Femmes
25	1,081	1,089	1,054	1,059
50	1,161	1,177	1,108	1,118
100	1,318	1,352	1,214	1,235
150	1,471	1,525	1,318	1,352
200	1,619	1,694	1,420	1,466
400	2,174	2,349	1,809	1,915
800	3,120 [11]	3,549	2,507	2,760

pouvons estimer, tout en étant conservateur, que *pour un fumeur* le risque de développer un cancer du poumon relié à des niveaux d'exposition résidentielle au radon de 800 Bq/ m^3 et plus pendant toute la durée de sa vie, prenant en considération une fréquentation normale d'un domicile, représente facilement un risque avec un ordre de grandeur 10^{-1}, c'est à dire 1 personne sur 10 et plus.

For smokers, exposed at the "permissible" limit

the number of individuals to get a radiation-induced lung cancer is about 1 in 10.

Normally, in our society, about 5 out of 100 smokers will get lung cancer

Regie regionale de santé et des services sociaux des Laurentides – Le Radon à Oka (1998)

Estimation du risque relatif de développer un cancer du poumon pour une exposition à vie au radon domestique chez les non-fumeurs

Exposition	Modèle exposition - âge - concentration		Modèle exposition - âge - durée	
Bqm^{-3}	Hommes	Femmes	Hommes	Femmes
25	1,194	1,206	1,130	1,137
50	1,388	1,411	1,259	1,274
100	1,775	1,821	1,518	1,547
150	2,159	2,229	1,776	1,819
200	2,542	2,637	2,033	2,091
400	4,057	4,255	3,053	3,174
800	7,008[14]	7,440	5,058	5,317

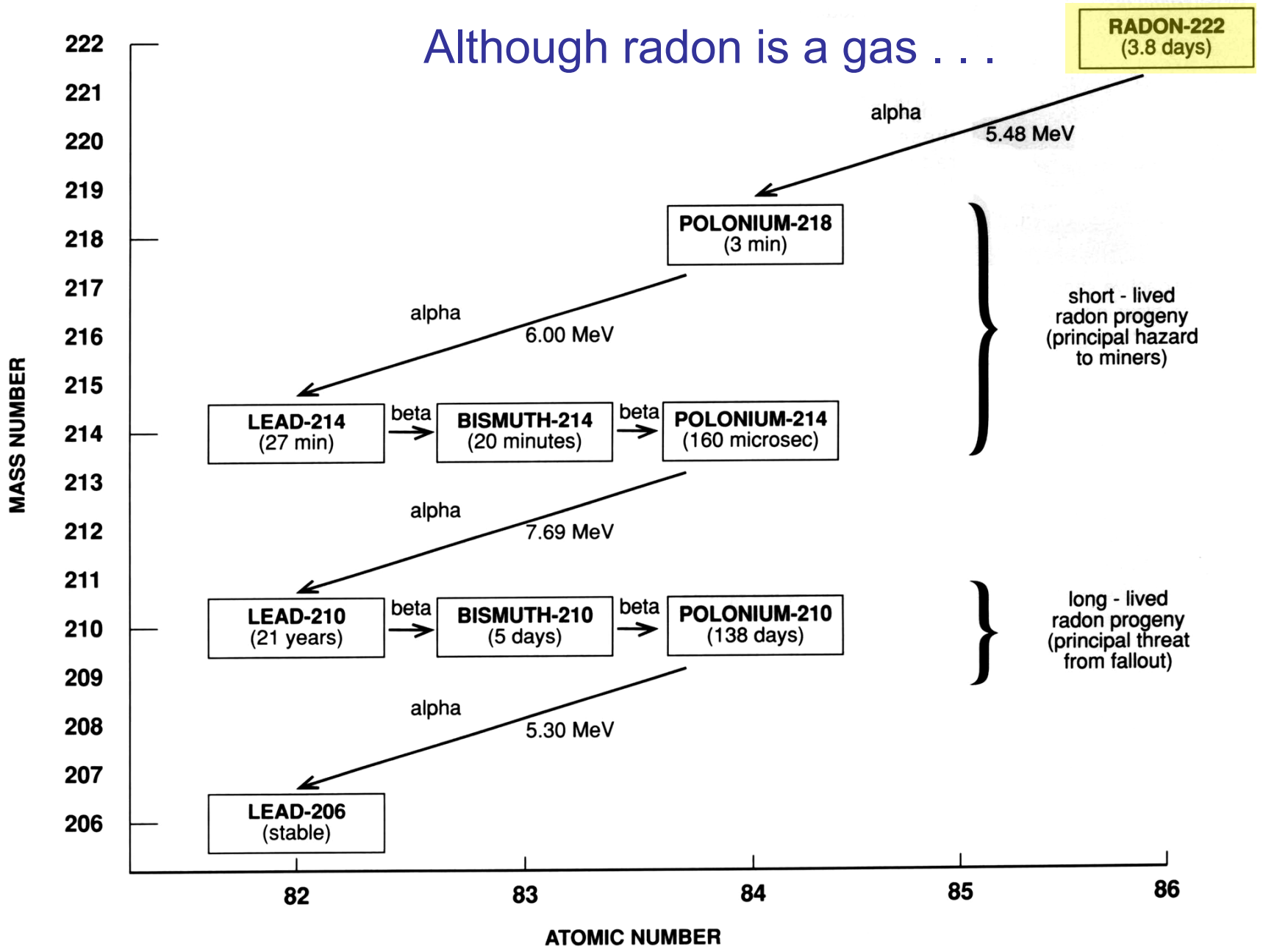
estimer, tout en étant conservateur, que *pour un non-fumeur* le risque de développer un cancer du poumon relié à des niveaux d'exposition résidentielle au radon de 800 Bq/m^3 et plus pendant toute la durée de sa vie, prenant en considération une fréquentation normale d'un domicile, représente facilement un risque avec un ordre de grandeur 10^{-2} c'est-à-dire 1 personne sur 100 et plus.

For non-smokers, exposed at the "permissible" limit

the number of individuals to get a radiation-induced lung cancer is about 1 in 100.

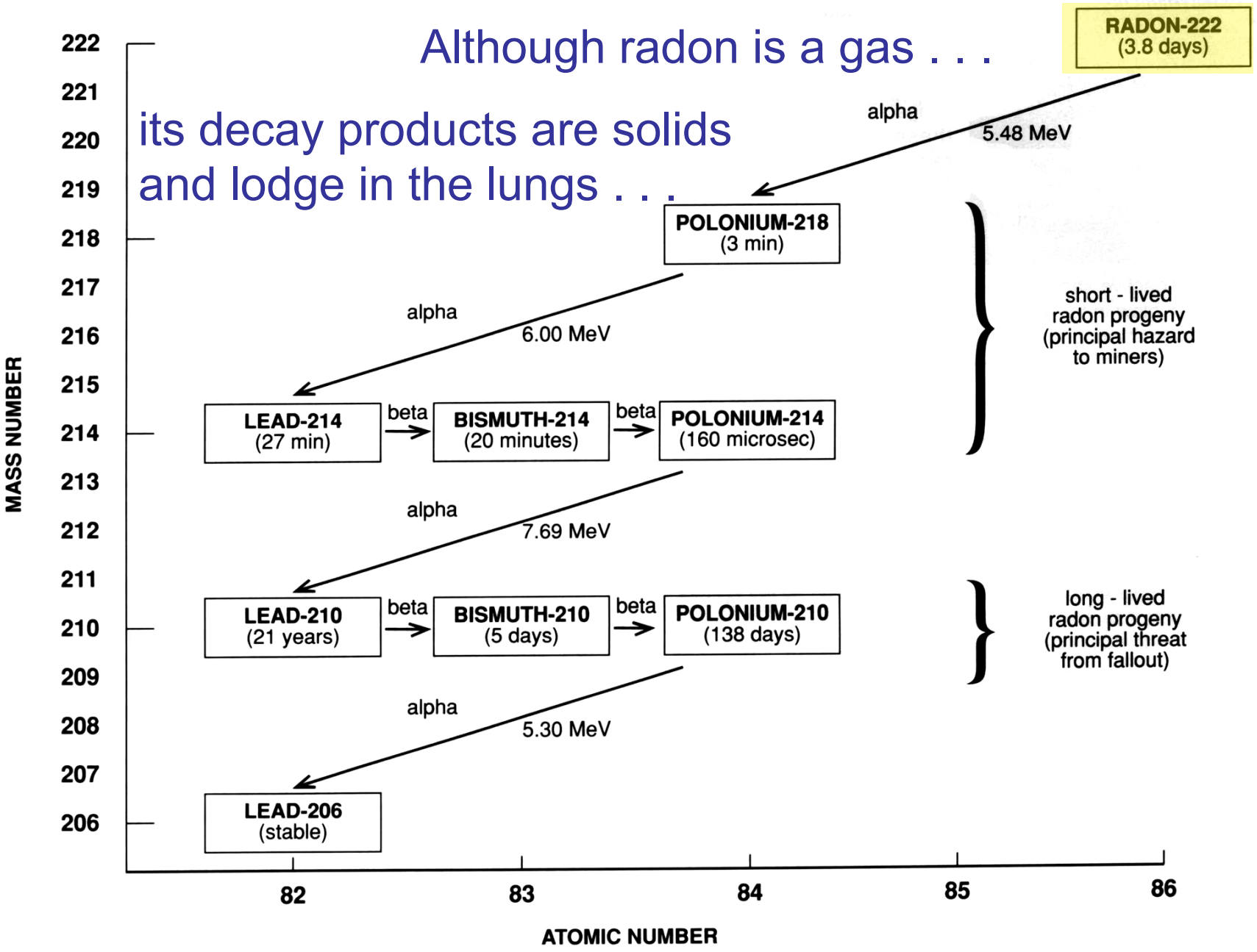
Normally, in our society, about 5 out of 1000 non-smokers will get lung cancer

Although radon is a gas . . .



Although radon is a gas . . .

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



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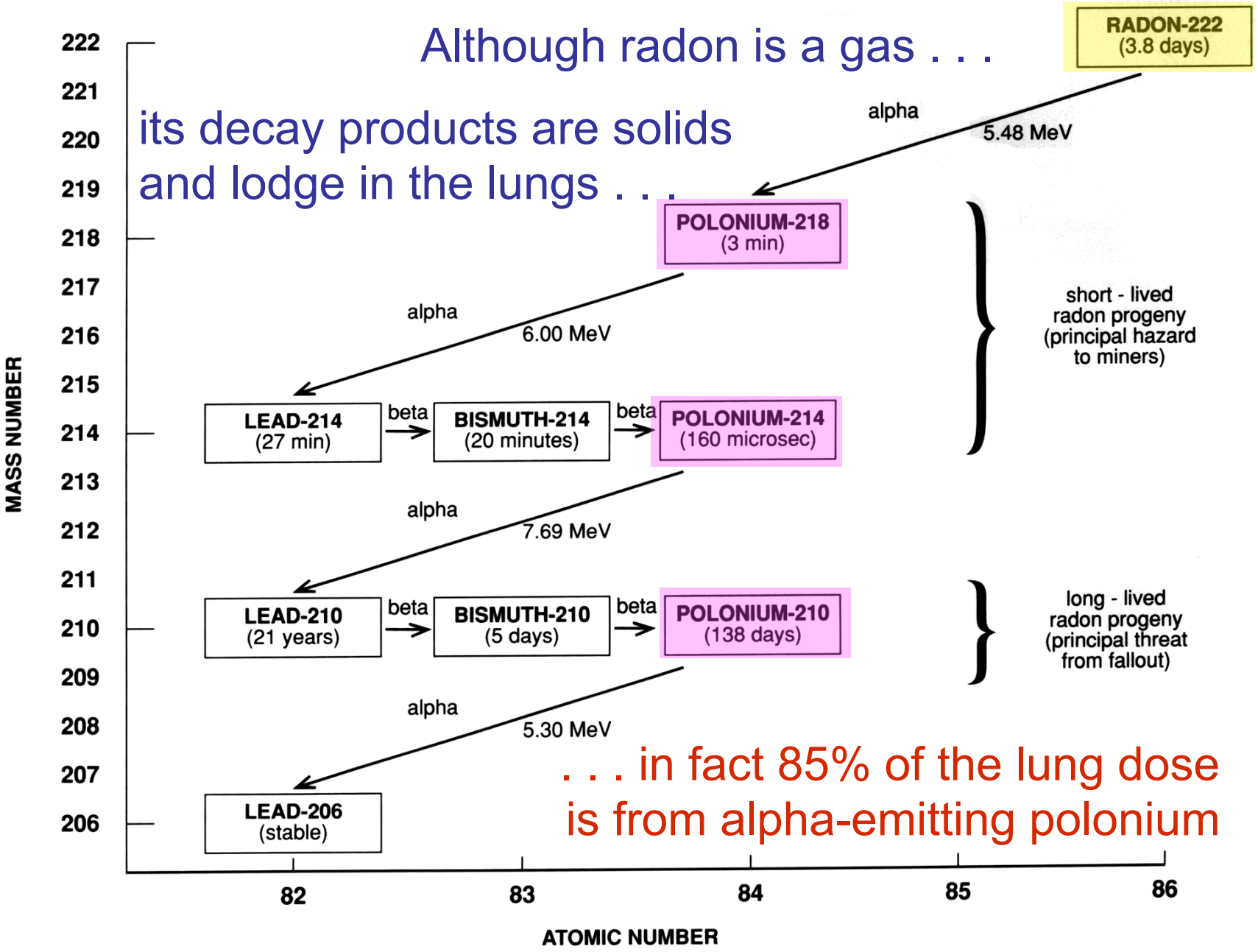


. . . in fact 85% of the lung dose is from alpha-emitting polonium

Health Canada

Q. Why did Health Canada announce in June 2007 a lowering of the guidelines for acceptable levels of radon in the house from 800 to 200 Bq/m³?

A. Recent scientific studies have conclusively linked the risk of developing lung cancer to levels of radon found in some houses.

These studies prompted the federal government to collaborate with provincial and territorial governments to review the federal radon guidelines in 2005.

Following a risk assessment and a public consultation, the revised guideline was approved by the Federal Provincial Territorial Radiation Protection Committee in October 2006.

http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/faq_fq-eng.php#announce

At the prompting of the provinces Ottawa tightened the limit for radon levels in homes by fourfold in 2007.

3 decades earlier

However in 1978 – almost thirty years earlier – it was documented that even the more stringent radon standard would be a public health disaster.

Estimating Lung Cancers
. . . or, It's Perfectly Safe,
But Don't Breathe Too Deeply

Estimating Lung Cancer Deaths
Caused by Permissible Radon Exposures
in New Homes in Elliot Lake, Ontario

by Dr. Gordon Edwards, 1978

a summary of testimony presented to
the Ontario Environmental Assessment Panel
on permissible levels of radon contamination
for new homes in the town of Elliot Lake

http://www.ccnr.org/lung_cancer_1.html

CNSC Regulatory Radon Standard

For Port Hope cleanup criterion : 0.02 WL

For New Homes in Elliot Lake : 0.02 WL

a working level is 1 WL = 7480 Bq/m^3

(thus 0.02 WL = 148 Bq/m^3**)**

Using official government data in evidence, I showed
this level of exposure over a 70 year lifetime
– with only 12 hours a day spent inside –
would cause a 31 % increase in lung cancer

That's an extra 17 lung cancers per 1000 added to the existing lung cancer incidence of 54 per 1000 (men).

Sequence of Events

Environmental Panel calls for review of radon standard

There is no review nor any change of the radon standard

British Columbia Medical Assn confirms Edwards' findings.

Regulatory Agency AECB commissions independent radon study

Thomas McNeill Report (pub. AECB) confirms Edwards' estimates

AECL publishes a 13-page document dismissing the T-M findings

BCMA says AECB "Unfit to Regulate" (Chapter 22)

BCMA excerpts http://www.ccnr.org/bcma.html
T-M excerpts http://www.ccnr.org/thomas_report.html

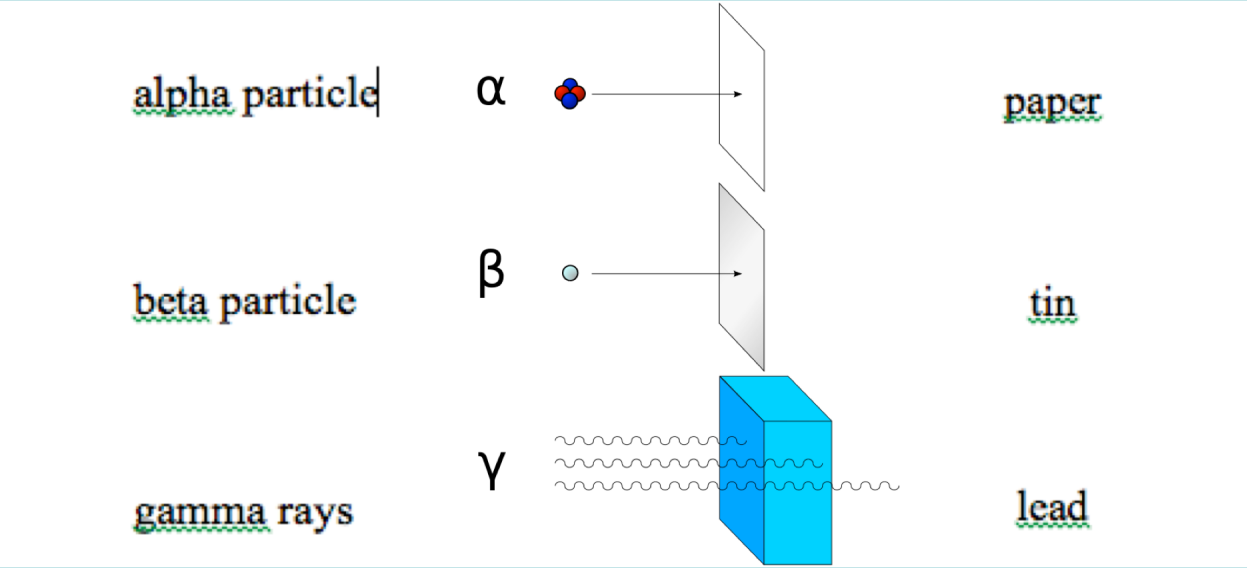
Confessions of a Disappointed Educator

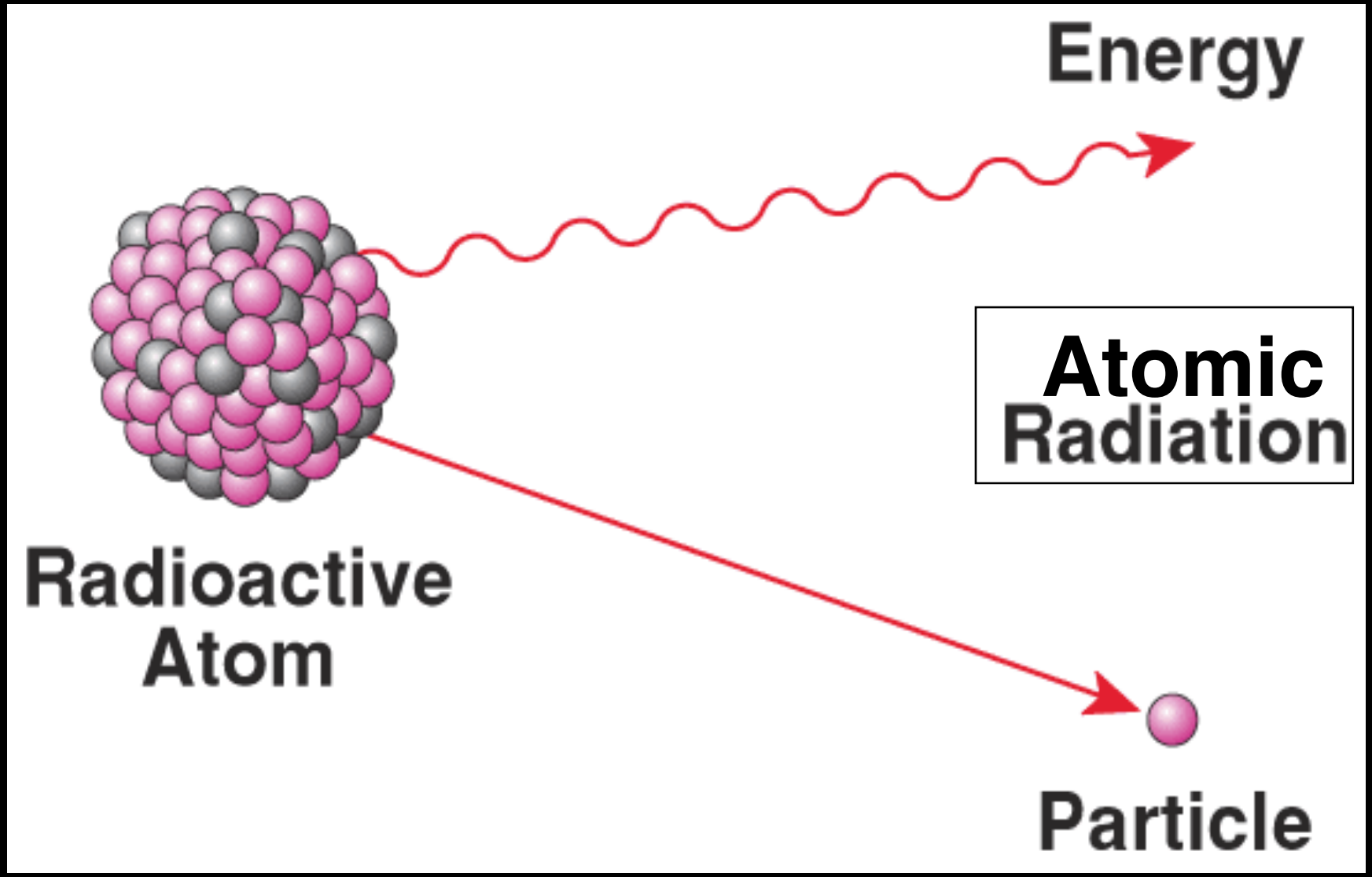
Disappointment #3

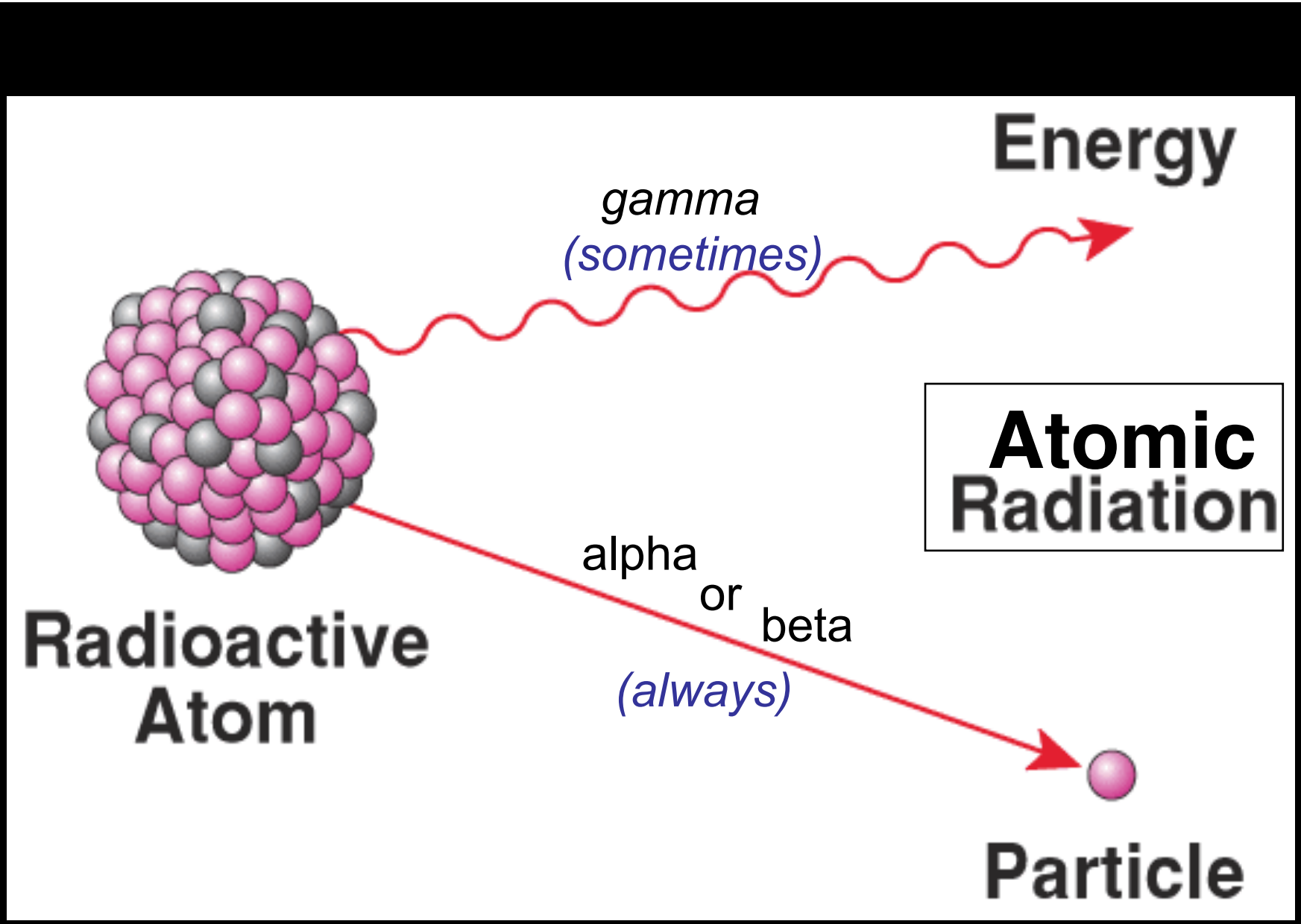
The Refusal to Demystify Alpha Radiation

What is Alpha Radiation?

In the context of uranium mining
the most damaging form of radiation is
non-penetrating but deadly alpha radiation.




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.

Canadian Centre for Occupational Health and Safety

Table 2 Recommended Radiation Weighting Factors	
Type and energy range	**Radiation weighting factor, WR**
Gamma rays and x rays	1
Beta particles	1
Neutrons, energy < 10 keV > 10 keV to 100 keV > 100 keV to 2 MeV > 2 MeV to 20 MeV > 20 MeV	 5 10 20 10 5
Alpha particles	20

http://www.ccohs.ca/oshanswers/phys_agents/ionizing.html

Alpha radiation ~ harmless outside the body, deadly inside.

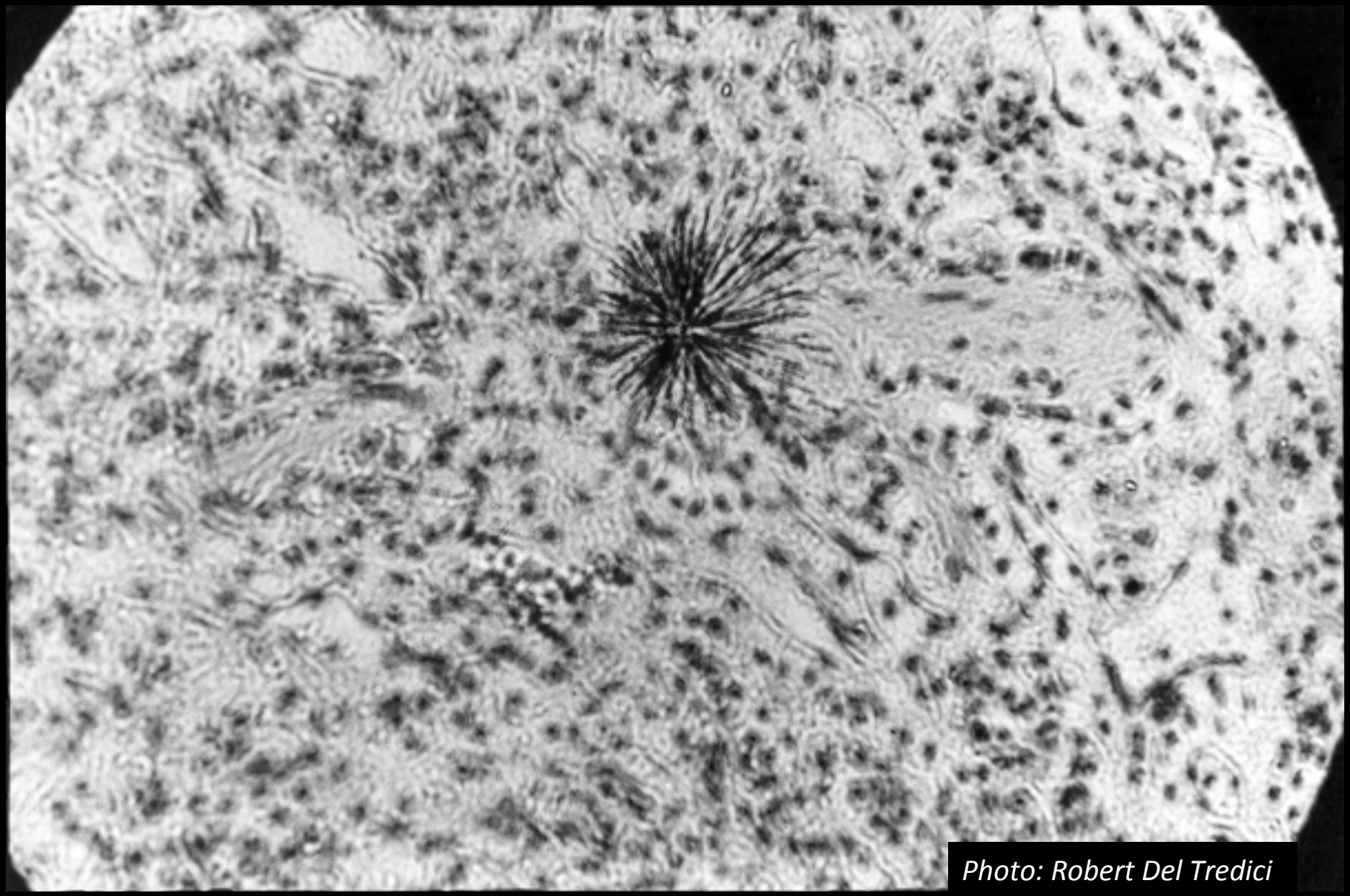


Photo: Robert Del Tredici

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

US EPA
Environmental Protection Agency

cigarette smoke . . . contains small amounts of radioactive materials which smokers bring into their lungs as they inhale.

The radioactive particles lodge in lung tissue and over time contribute a huge radiation dose. Radioactivity may be one of the key factors in lung cancer among smokers.

Smoking is the . . . cause of . . . 443,000 deaths, or 1 of every 5 deaths, in the United States each year [including] . . . 123,000 lung cancer deaths annually.

http://www.epa.gov/radiation/sources/tobacco.html

International Atomic Energy Agency

Investigations on alpha-emitting radionuclides, especially on ^{210}Po have gained significant importance as alpha interactions with chromosomes of cells may contribute to early arteriosclerosis developments in tobacco smokers.

https://inis.iaea.org/search/search.aspx?orig_q=RN:40008346

Medical News Today

September 18, 2014

When taken into the body via inhalation or ingestion, polonium can enter the blood stream and alpha particles can impact organs and vital tissues directly.

The polonium-210 dose that will kill 50 percent of persons who internalize it is about one 100,000th of a milligram, one-million times more toxic than cyanide.

http://www.medicalnewstoday.com/articles/58088.php

Recent developments (2014)

In Carlsbad, New Mexico, the US Waste Isolation Pilot Projects suffers an accidental release of plutonium.

22 workers >750 metres away are contaminated, CNSC cites a “degraded safety culture” in the US.

Edwards raises incident during Bruce refurbishment >500 workers are contaminated with plutonium (2009) over a period of >4 weeks – no one held accountable.

CNSC says there’s no degraded safety culture at Bruce.

Transcript: http://www.ccnr.org/GE_DGR_Transcript_Sept_9.pdf

Conclusions

Canada has a degraded nuclear safety culture.

CNSC does not provide objective information.

Alpha radiation is not properly dealt with in Canada.

No adequate worker or public education on alpha.

Quebec is urged not to allow uranium mining.