

308 P **NP** **MEM56**

Les enjeux de la filière uranifère au Québec

6211-08-012

Presentation

To the BAPE Panel
on Uranium Mining
In Quebec

by Gordon Edwards, Ph.D.

November 17, 2014

**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

Presemnted 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.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?

Ubiquitous Background (2006)

Inhaled Radon-222
2.12 mSv (68%)

TOTAL = 3.2 mSv
RADON = 66%
U + Th = 75%

Ingested Other
0.1 mSv (<0.01%)

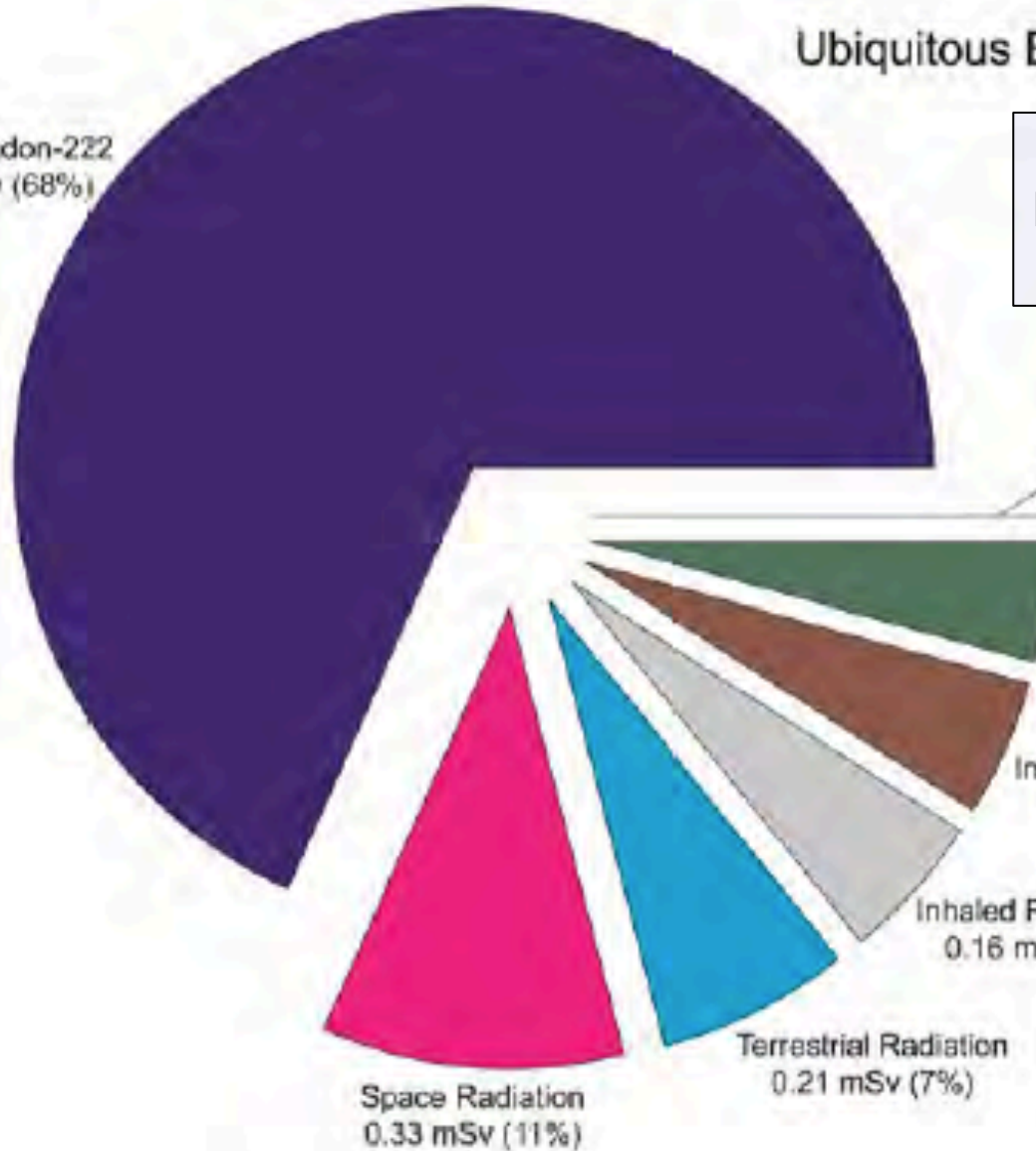
Ingested Thorium
& Uranium Series
0.13 mSv (4%)

Ingested Potassium-40
0.15 mSv (5%)

Inhaled Radon-220
0.16 mSv (5%)

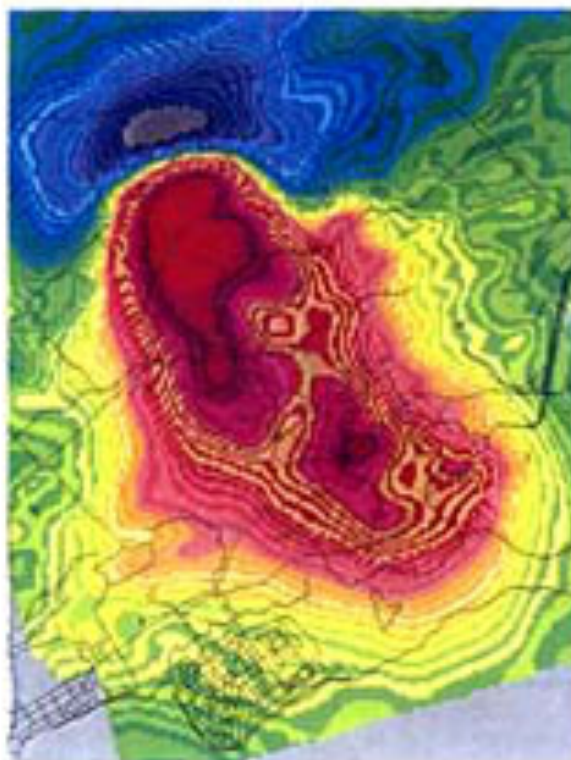
Terrestrial Radiation
0.21 mSv (7%)

Space Radiation
0.33 mSv (11%)



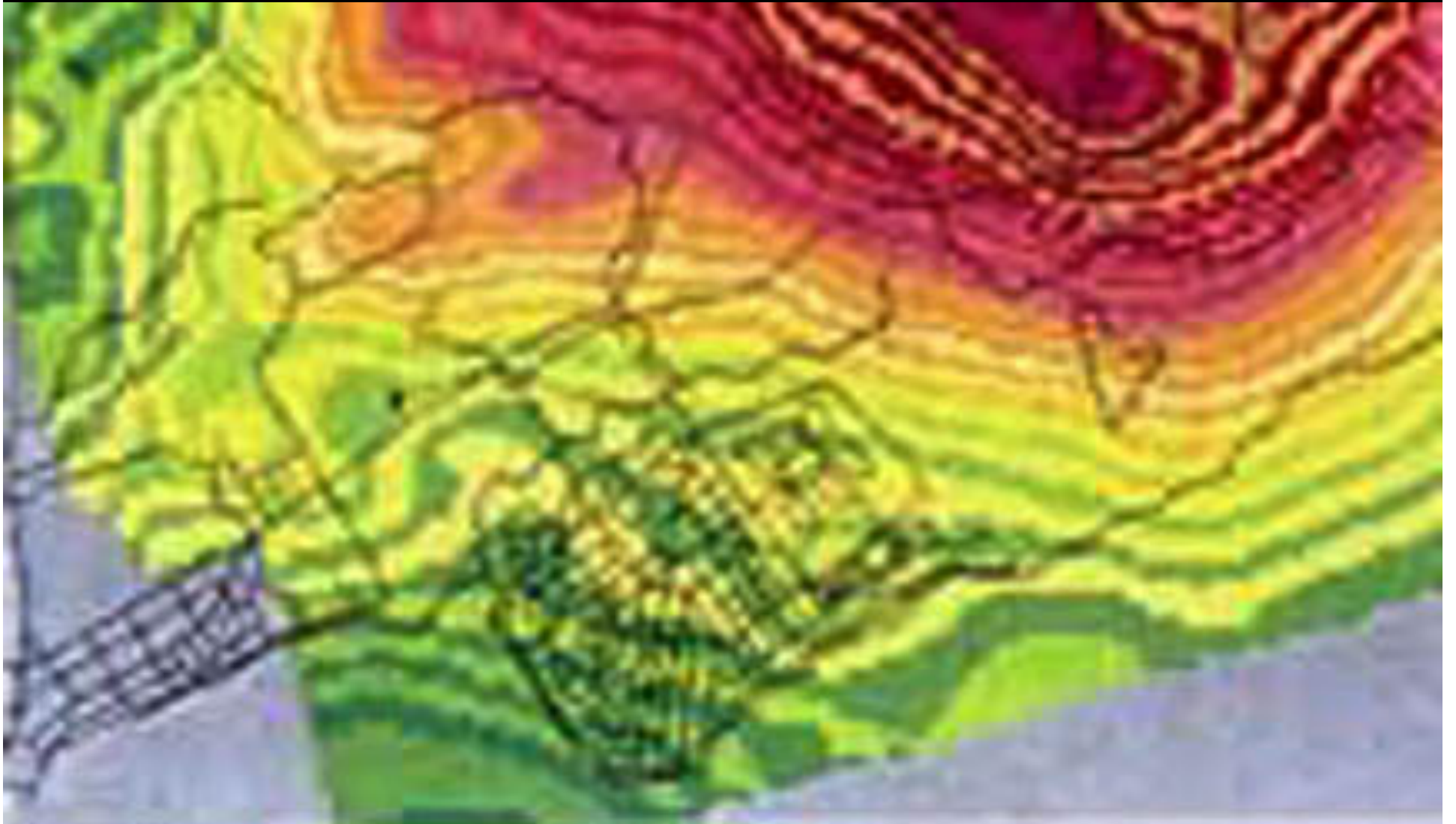
LE RADON À OKA

Rapport d'intervention de santé publique



1998

Direction régionale de la santé publique



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 Bq/m ³	Modèle exposition - âge - concentration		Modèle exposition - âge - durée	
	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/ m³ 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.

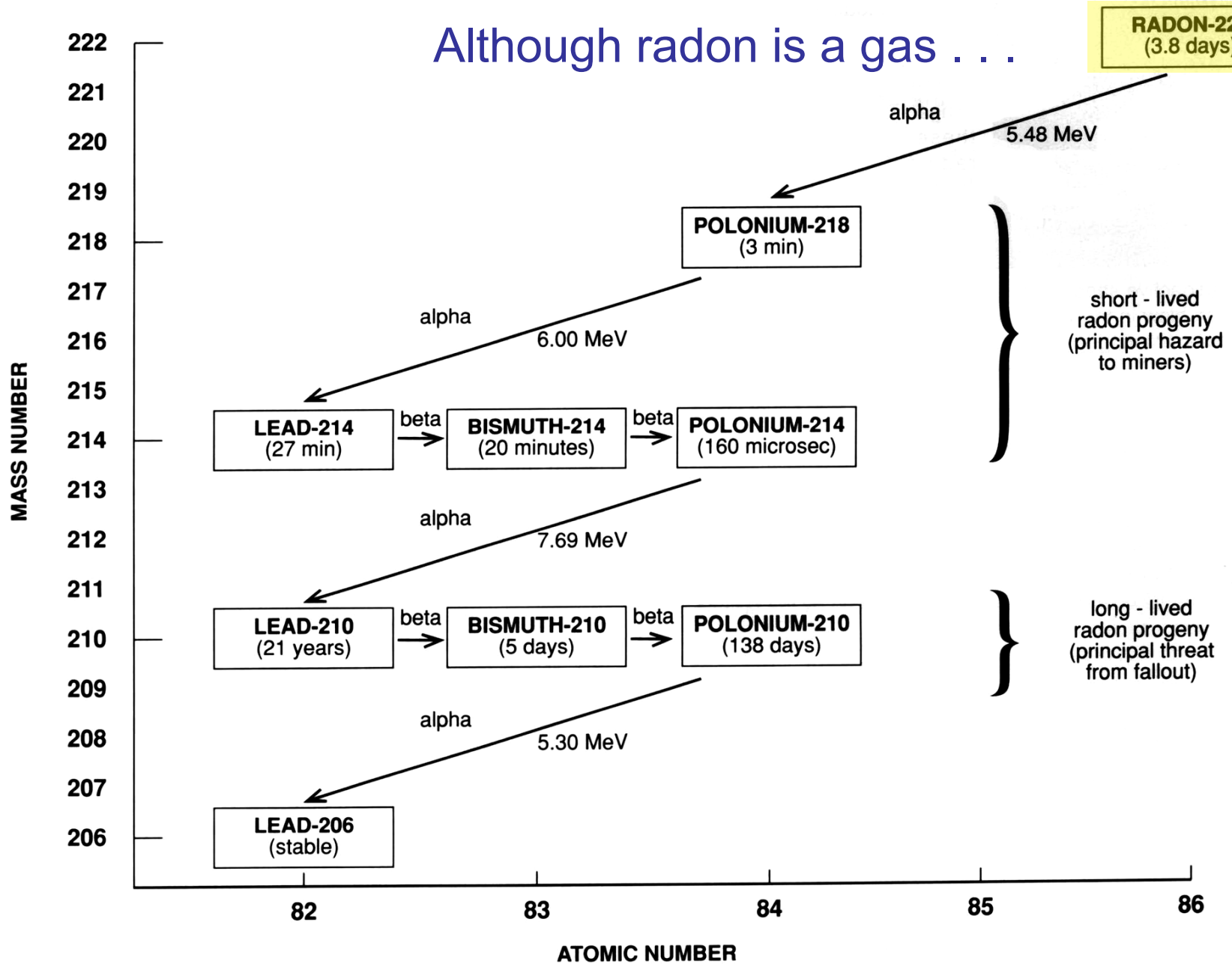
Regie regionale de santé et des services sociaux des Laurentides – Le Radon à Oka (1998)

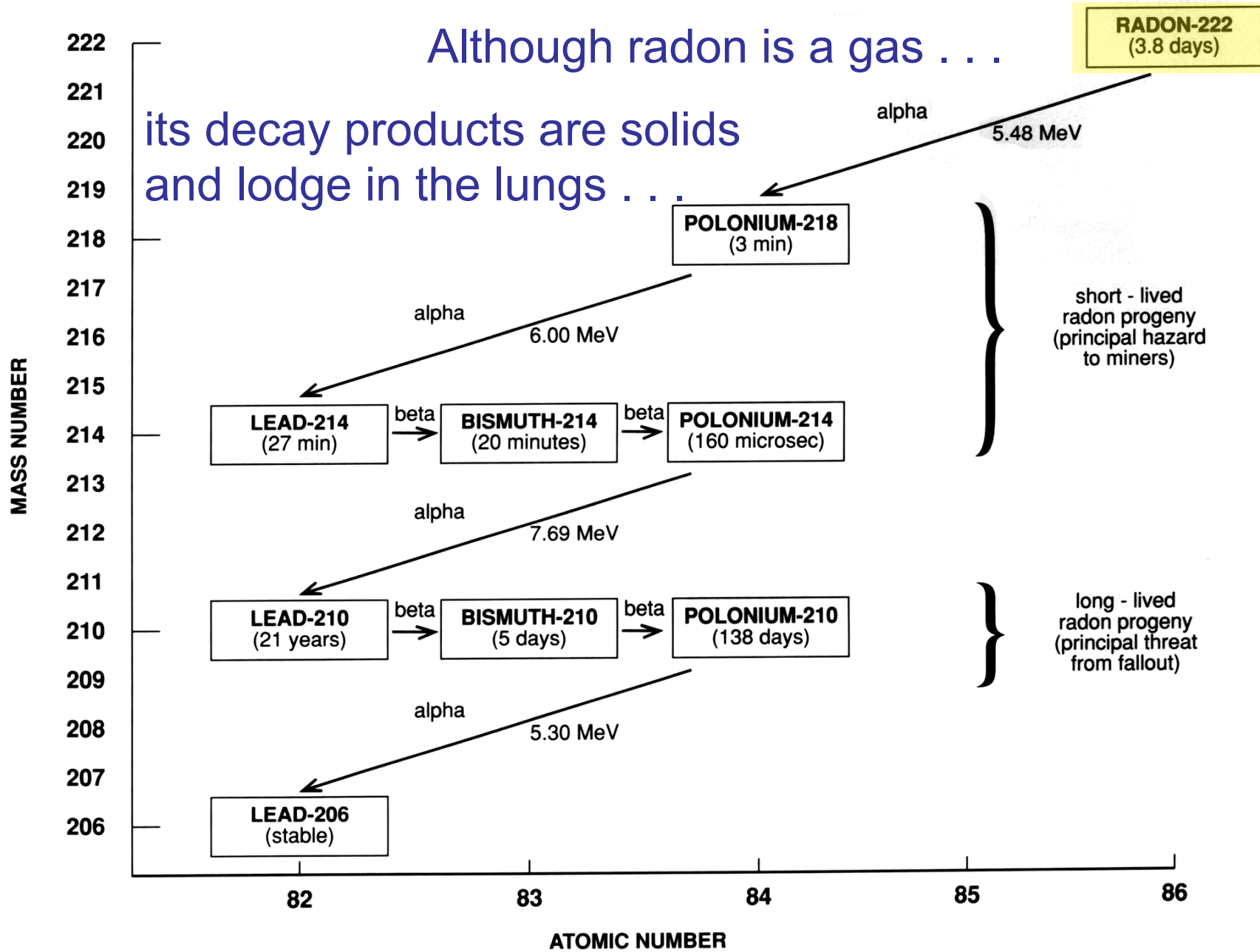
**Estimation du risque relatif de développer un cancer du poumon
pour une exposition à vie au radon domestique
chez les non-fumeurs**

Exposition Bqm ⁻³	Modèle exposition - âge - concentration		Modèle exposition - âge - durée	
	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

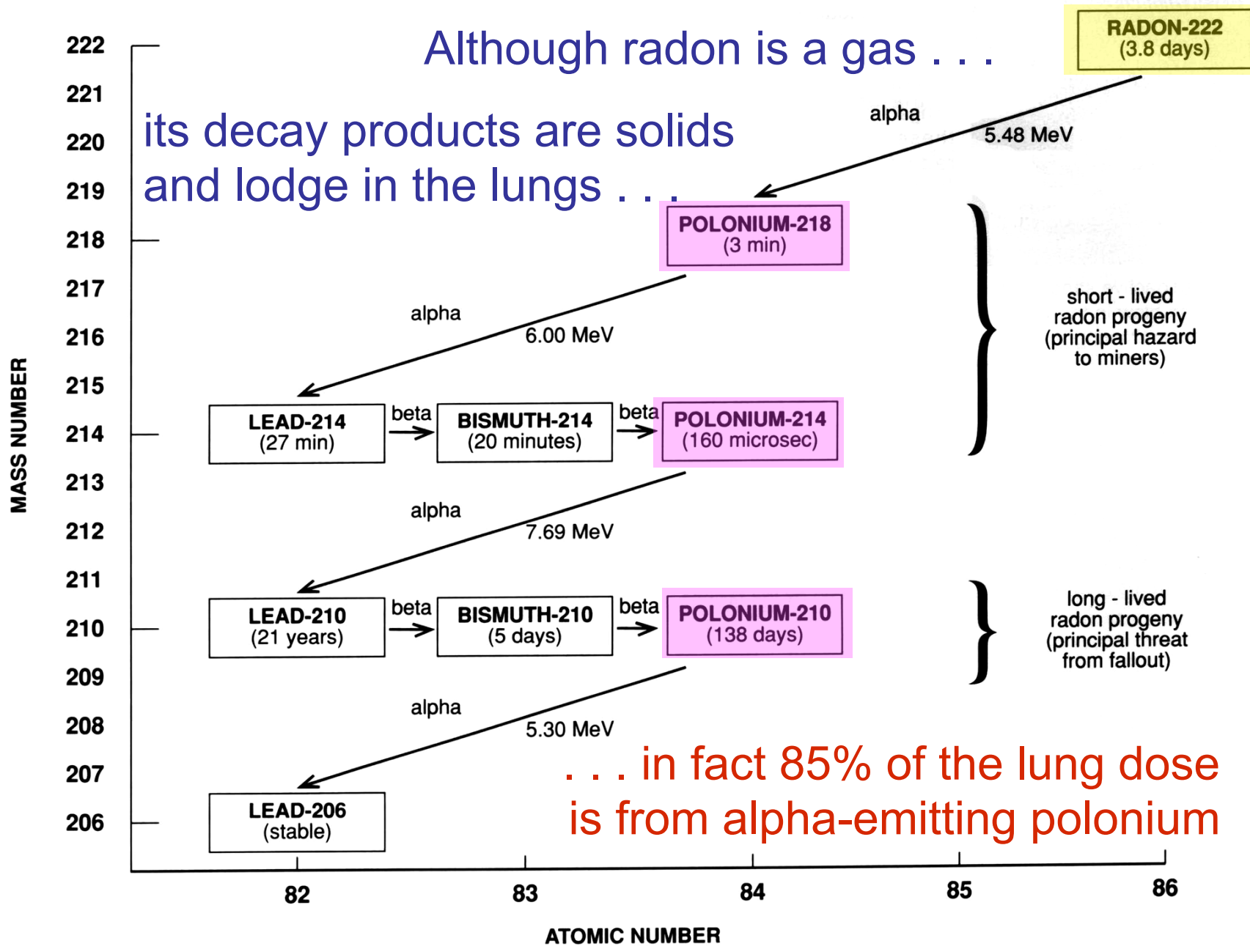
À la lumière du tableau qui suit portant sur les non-fumeurs, on constate qu'une personne *non-fumeuse* exposée à 800 Bq/m³ a un risque de développer le cancer du poumon environ 5 à 6 fois plus¹³ élevé que pour une personne *non-fumeuse* exposée à 25 ou 50 Bq/m³.

Although radon is a gas . . .





Although radon is a gas . . .
 its decay products are solids
 and lodge in the lungs . . .



... 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

**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

Canadian Regulatory Standard

Port Hope cleanup criterion : 0.02 WL

New Homes in Elliot Lake : 0.02 WL

**(a working level is 1 WL = 3740 Bq/m³
assuming 50% equilibrium with decay products)
(thus 0.02 WL = 748 Bq/m³)**

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

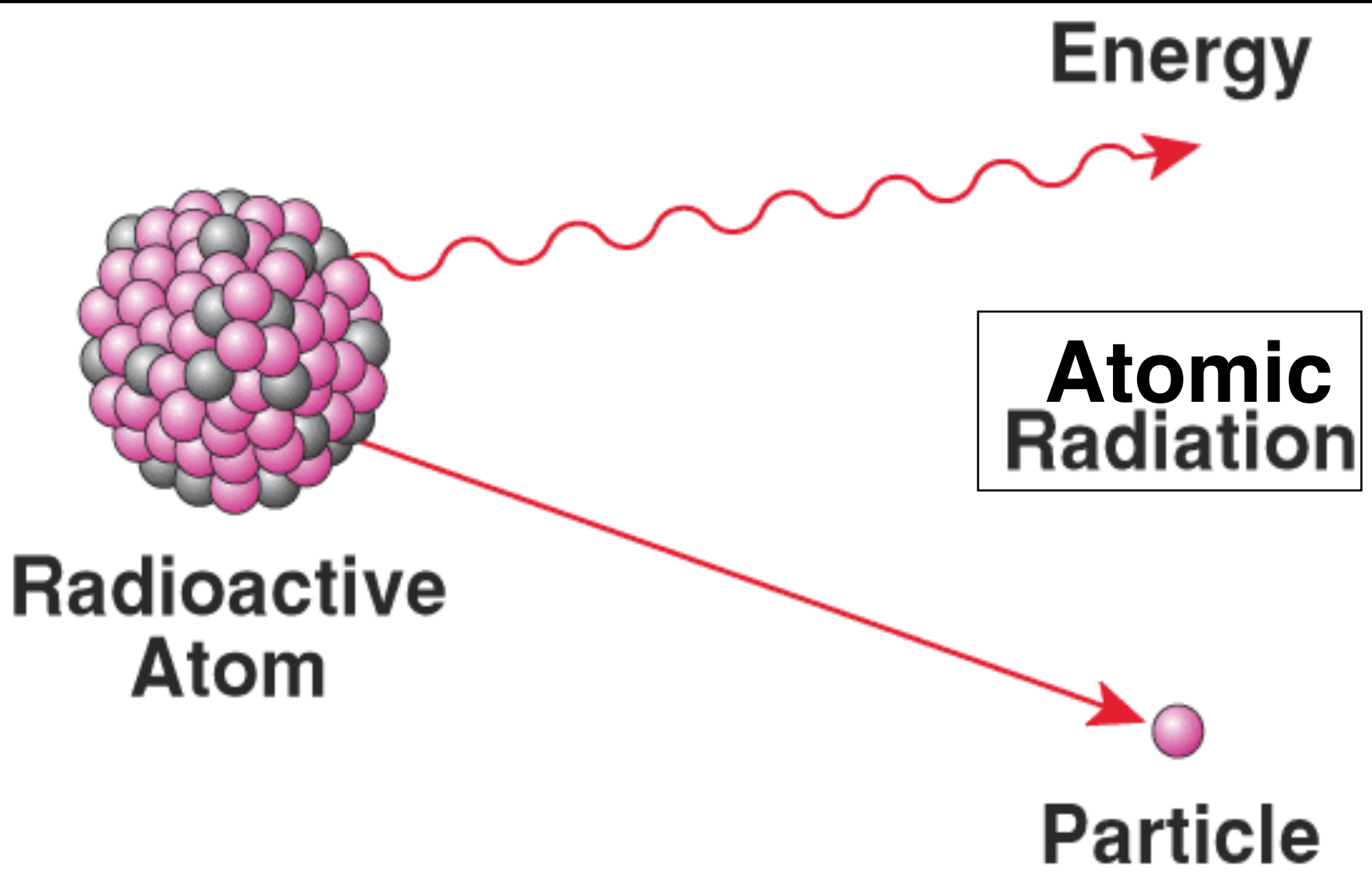
BCMA says AECB "Unfit to Regulate" (Chapter 22)

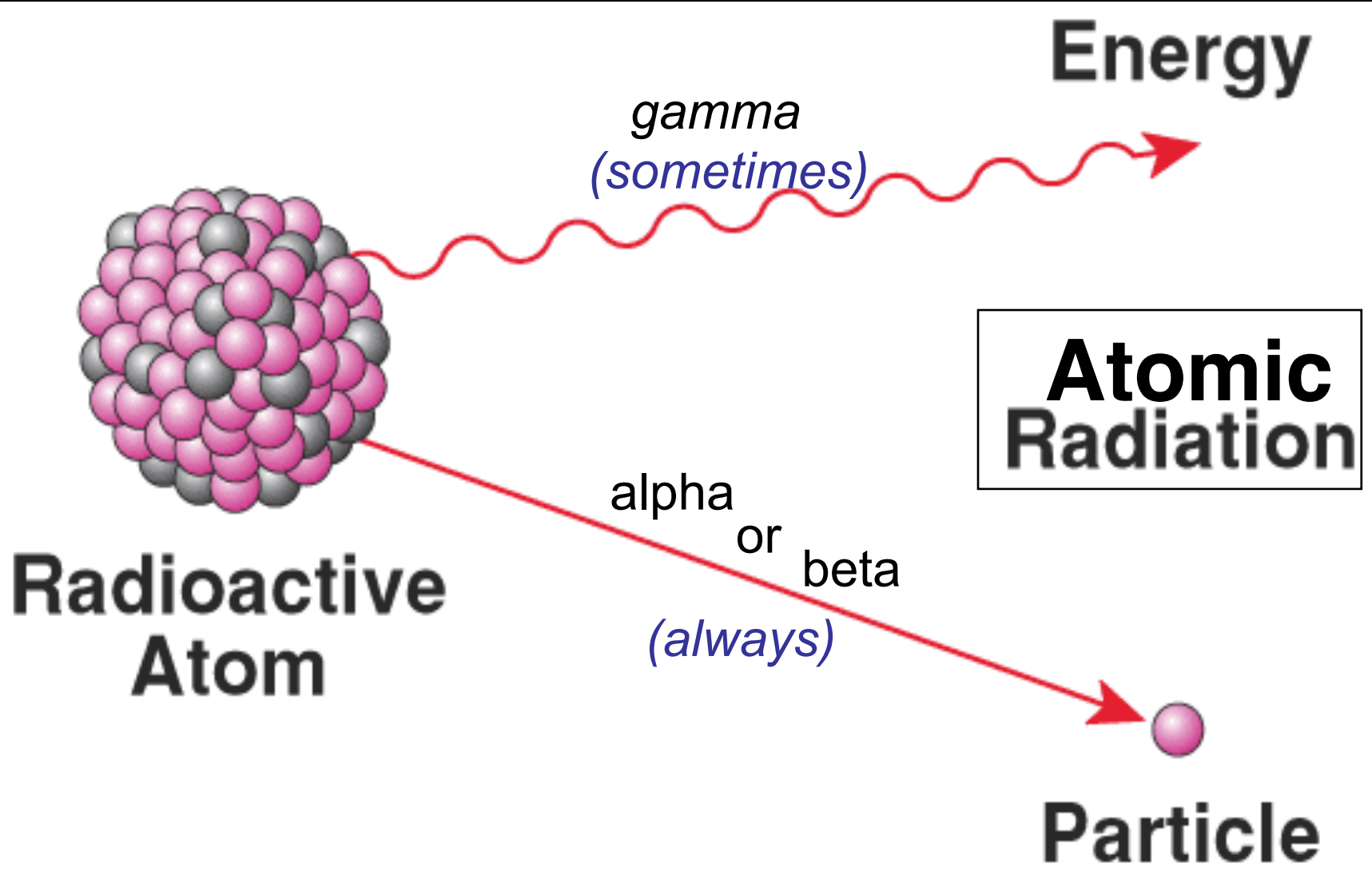
BCMA excerpts <http://www.ccnr.org/bcma.html>

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

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.





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	5
> 10 keV to 100 keV	10
> 100 keV to 2 MeV	20
> 2 MeV to 20 MeV	10
> 20 MeV	5
Alpha particles	20

Alpha radiation ~ harmless outside the body, deadly inside.

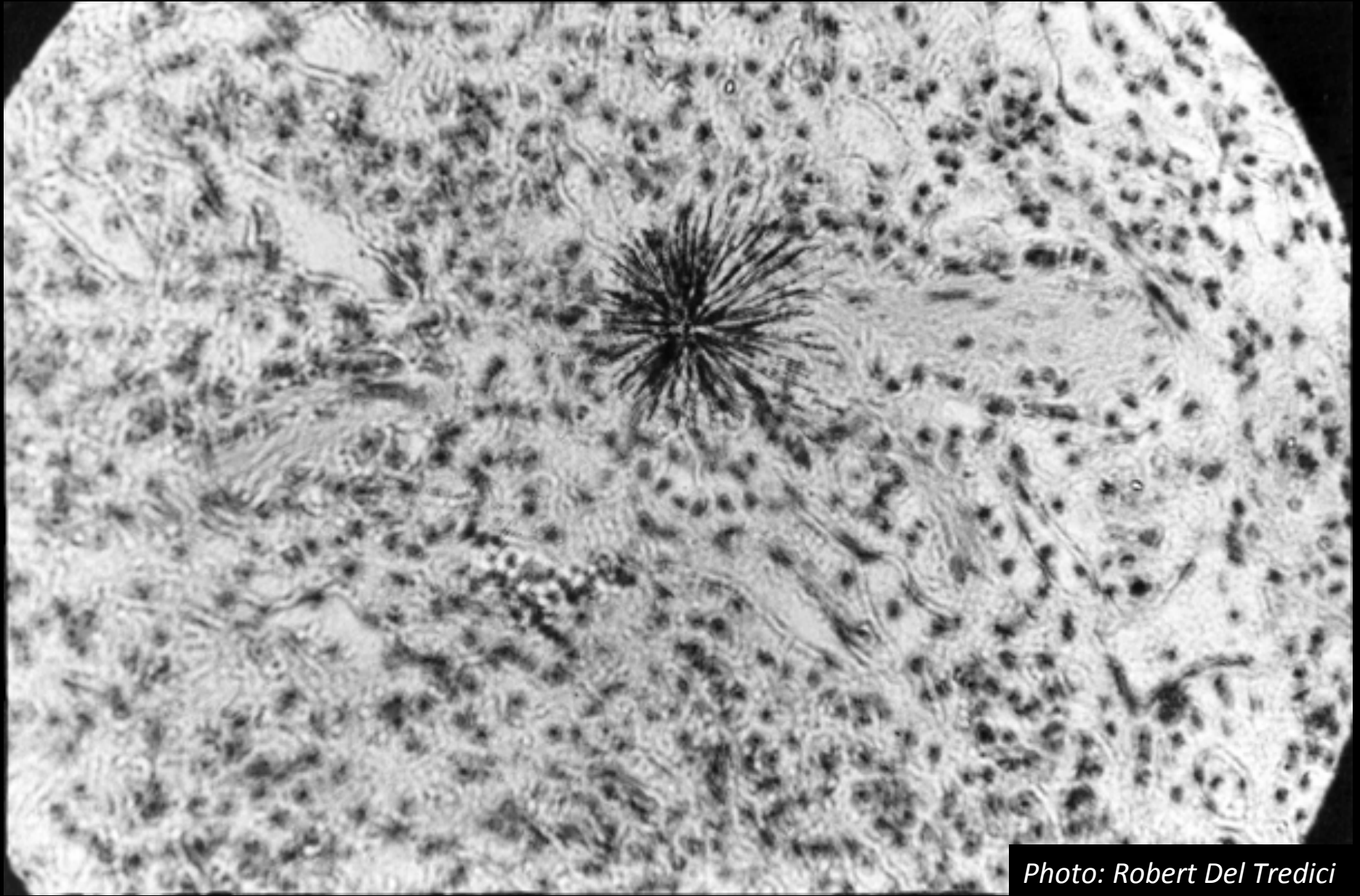


Photo: Robert Del Tredici

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

US EPA Environmental Protection Agency

While cigarette smoke is not an obvious source of radiation exposure, it 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 number one cause of preventable death in the U.S., with 443,000 deaths, or 1 of every 5 deaths, in the United States each year. And, there are 123,000 lung cancer deaths annually attributed to smoking cigarettes.

<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 Project suffers an accidental release of plutonium.

22 workers >750 metres away are contaminated, CNSN blames “degraded safety culture” in the US.

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

CNSC says there was no degraded safety culture.

Transcript: [/http://www.ccnr.org/GE_DGR_Transcript_Sept_9.pdf](http://www.ccnr.org/GE_DGR_Transcript_Sept_9.pdf)

Conclusion

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.

Alpha radiation is the principle hazard of uranium.

Quebec is urged not to allow uranium mining.