Canadian Coalition for Nuclear Responsibility

Regroupement pour la surveillance du nucléaire

BY E-MAIL

Michael Binder, President,
Canadian Nuclear Safety Commission (CNSC).

May l8 2016.

Dear Dr. Binder:

In a letter dated July 27, 2015, addressed to the Honourable David Heurtel, Quebec's Minister of Sustainable Development, the Environment, and the Fight Against Climate Change, you wrote : "It is very troubling to have the BAPE present your government with conclusions and recommendations that lack scientific basis and rigour." In the letters that you have subsequently sent to me, dated March 24 and April 27, 2016, you insist that CNSC relies on "solid science" and "rigour". The Canadian Coalition for Nuclear Responsibility (CCNR) strongly disagrees with your assessment. Consequently we have some questions for you.

1. The CNSC presentation of January 22 2016 to the Quebec Inter-Ministerial Committee on Uranium Mining asserted that "a recent epidemiological study of the Ontario uranium miners cohort (1965-2007) showed that their risk for lung cancer was no higher than for the Canadian population", which is simply untrue. The report shows no such thing, and the authors of the study stated no such conclusion. This has been called to your attention more than once.

In your letter dated April 27, 2016, you admit that the report is inconclusive. You say "modern miners could have lower, the same or slightly higher risks than the unexposed workers". This is not what was said in the CNSC presentation. Based on the results of the study itself, there is no scientific basis for the conclusion articulated by CNSC staff in its January 22 presentation..

Why have you not seen fit to apologize for this apparent misrepresentation of the findings of a scientific study that was commissioned and financed by CNSC ?

2. In paragraph (a) you take exception to our use of the phrase "mortality factor" to distinguish the Excess Relative Risk (ERR) for *lung cancer mortality*, from the Excess Relative Risk (ERR) for *lung cancer incidence*. This is nothing but a quibble. The ERR for lung cancer mortality is in fact an excess relative mortality factor, although not an absolute mortality factor. We made that distinction quite clear in our discussion and in our use of ERR in subsequent calculations.

In the same paragraph, you fail to mention that both ERR figures were incorrectly cited by CNSC staff in the Technical Response attached to your letter of March 24. The ERR figure for excess mortality was stated as 64% instead of 66%, and the ERR for excess incidence was stated as 63% instead of 64% – an evident lack of scientific rigour on the part of your staff. Both confidence intervals cited in the Technical Response attached to your letter of March 24 were also wrong – a total of six numerical errors in just two lines *[Technical Response, p.4]*.

You also fail to point out that in 2010 an absolute mortality factor for lung cancers caused by radon was published by the International Commission on Radiological Protection (**Lung Cancer Risk from Radon and Progeny and Statement on Radon,** ICRP Publication 115).

"Based on recent results from combined analyses of epidemiological studies of miners", the 2010 ICRP report indicates a risk of 5 lung cancer deaths per 10,000 persons per WLM of exposure, which is almost twice the value of 2.8 per 10,000 persons per WLM that was estimated by ICRP in 1993 (Publication 65). The ICRP refers to this number as "a fatality coefficient for radon-induced lung cancer" – in other words, it is indeed a mortality factor.

Why did CNSC choose not to communicate the latest scientific results from the International Commission on Radiologic Protection to the Quebec Interministerial Committee? Instead, CNSC chose to present the opinion of its own staff, as if that opinion had been confirmed by an Ontario epidemiological study whose data were clearly inconclusive on that very point. Not only is this not "solid science", not only is it not "rigorous", it is deceptive.

3. Article 9 of the Nuclear Safety and Control Act states that one of the obligations of the CNSC is "to disseminate objective scientific, technical and regulatory information to the public concerning … the effects, on the environment and on the health and safety of persons, of the development, production, possession and use" of nuclear energy or nuclear substances such as uranium.

Under this law, we at CCNR feel that the CNSC is legally required to provide scientific information that is accurate, reliable, unbiased, even-handed, and balanced, to assist citizens and decision-makers in understanding the potential dangers surrounding uranium mining, nuclear power and the use of radioactive materials. According to several dictionaries we consulted, the word "objective" means that the information should not be coloured by the personal opinions of staff. ***Is this your understanding of article 9(b) of the Nuclear Safety and Control Act?***

4. The CNSC bases its regulatory regime on the Linear No-Threshhold (LNT) Model of radiation-induced carcinogenesis. "Linear" means that the number of lung cancers in a given population is directly proportional to the total radon exposure (in WLM units) in that population. "No-Threshold" means that there is no level of exposure which can be regarded as perfectly safe, because of the linear relationship that exists between radon exposure and radiation-induced lung cancer deaths. These are clearly defined scientific terms that do not lend themselves to other interpretations. ***Are we correct in asserting that CNSC uses the LNT model as a scientific basis for its regulations? If not, please refer us to a document that states otherwise.***

In paragraph (c) you say that using the LNT model for large populations exposed to small exposures is "not grounded in science". On the contrary, for CNSC to abandon linearity, or to presume the existence of a threshold, is indeed "not grounded in science". It is not "solid science" nor is it evidence of good governance to deny the predictions of a well-established model that has been formally adopted as the basis for your regulatory regime. The cautions that have been expressed by various bodies in this context are based on socio-political concerns as well as the fact that such predictions have an unavoidable degree of uncertainty. However, this does not mean that such predictions are wrong or that they are "not grounded in science".

5. In paragraph (d) you say the "math is wrong" in our use of the LNT model to estimate 60 excess lung cancer deaths due to a average cumulative occupational radon exposure of 8.343 WLM in a population of 24,000 miners. In fact our math is simple, straightforward, and correct. Indeed, our estimate of 60 extra lung cancer deaths in such circumstances – an estimate that was

based on the incorrect ERR figure given by CNSC staff in the Technical Response attached to your March 24 letter – is probably an underestimate.

If, instead of using the incorrect ERR figure, we use the 2010 ICRP "fatality coefficient" mentioned above (5 lung cancer deaths per 10,000 persons exposed for each WLM of radon exposure) we obtain a total lung cancer mortality estimate of (24,000) x (8.343) x (5/10,000) = 100 deaths from occupational radon exposures among 24,000 miners. That is 70 percent greater than the 60 lung cancer deaths we estimated earlier. ***If these mathematical calculations are wrong, where precisely are the errors?***

6. In the second paragraph of your letter of April 27 you say that radon exposure levels among underground uranium miners in Canada were "0.1 WLM, or lower, for every year from 2001 to 2013". This assertion flatly contradicts CNSC Publication INFO-0813, which indicates that in 2006 the average radon exposure was about 80 percent higher than the figure that you give. Nevertheless, if we assume a radon exposure of 0.1 WLM for a working lifetime of 45 years, we obtain a cumulative exposure of 4.5 WLM. Such an average cumulative exposure in a population of 24,000 miners would result in an estimated (24,000) x (4.5) x (5/10,000) = 54 extra radiation-induced lung cancer deaths, using the 2010 ICRP absolute "fatality coefficient". ***But your staff calculates "less than one" lung cancer death in this population at current rates of exposure. May we please see the details of this calculation?***

7. In the second paragraph, you also state that 0.1 working level months (WLM) of radon exposure is equivalent to 0.5 millisieverts (mSv) of equivalent radiation exposure. This conversion is incorrect. It is based on an outdated estimate whereby one working level month of radon exposure was considered to be equivalent to five millisieverts of radiation dose. When ICRP updated its scientific database in 2010 and found that the risk of lung cancer deaths from radon exposure are actually much greater than previously thought, the conversion factor was altered so that 1 WLM of radon exposure is now considered to be equivalent to 12 millisieverts and not 5 millisieverts as was previously thought. (James W. Marsh, John D. Harrison, Dominique Laurier, et al: Dose conversion factors for radon: recent developments, in: Health Physics Vol. 99, No. 4, Oct. 2010, p. 511-516). ***Does CNSC have a reason for not accepting this updated scientific conversion factor, and if so, what is it?***

8. In our letter of April 11, 2016, we called attention to the 40-year-old regulatory limit on radon exposures for uranium miners, pointing out that lung cancer mortality would double or triple if workers were exposed to this limit throughout their working lifetime. In paragraph (b) of your response, you say "discussing continuously elevated exposure situations which do not occur under CNSC regulatory oversight is of little value." We, in turn, ask what value is there in describing a barbaric and antiquated radiation exposure limit, one that corresponds to totally unacceptable working conditions, as a "safety standard"? Patsy Thompson, Director General of the CNSC Directorate of Environmental and Radiation Protection and Assessment, referred to this 40-year-old limit as an "international safety standard" in her January 22 presentation to the Quebec Inter-Ministerial Committee, established to assess the 2015 BAPE report and recommendations regarding uranium mining and milling in Quebec.

Why has CNSC chosen not to tighten this regulatory limit on radon exposures for uranium miners on scientific grounds? Thirty-six years ago, in 1980, the British Columbia Medical Association urged that the radon exposure limit for uranium miners be reduced by a factor of

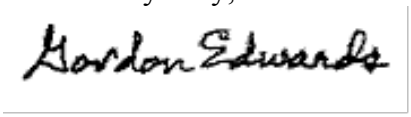
four, but nothing was done in that regard. (The Health Dangers of Uranium Mining, by R.F. Woolard M.D. and E. Young M.D., BCMA, 1980)

9. In the grand scheme of things, an increase of 50 or 100 lung cancer deaths may be deemed "statistically insignificant" by the CNSC – but such deaths are highly significant for the families of the workers who suffer and die from such illnesses. This is especially true when the burden of proof is unjustly placed on the shoulders of the grieving widows who must try to obtain compensation for their husband's occupationally-related deaths by "proving" that the illness was caused by occupational exposure to radon – a scientifically impossible task. ***Does CNSC feel that it has any responsibility toward those afflicted workers and their families?***

The US government is now paying sizable compensation packages to the families of many uranium workers who have suffered from any one of a long list of cancers and other illnesses, without the necessity of having to prove a causal relationship. This is the case for the Navajo miners of the Colorado Plateau and the workers at the Fernald uranium enrichment plant, for example. Here in Canada we have no such policy in place and it certainly does not help when the regulator denies that there is any excess illness at all, despite strong scientific evidence to the contrary.

We recognize that there have been improvements in reducing radiation exposures to miners, brought about in large part because of pressure from unionized workers, three separate Royal Commissions of Inquiry (in Saskatchewan, Ontario and British Columbia), numerous independent environmental assessment panel hearings, and the vigilance and whistle-blowing activities of non-governmental organizations such as the Canadian Coalition for Nuclear Responsibility, the Inter-Church Uranium Committee, and many others. However, to deny that there are still significant dangers needing to be confronted is irresponsible nonsense. To paraphrase the British Columbia Medical Association *(from their 1980 publication "Health Dangers of Uranium Mining")* it would be troubling to hear such attitudes coming from the uranium industry, let alone from the federal body that has been set up to regulate that industry.

Yours very truly,



Gordon Edwards, Ph.D., President,
Canadian Coalition for Nuclear Responsibility.

Attachments :

Letter from Dr. Michael Binder to the Honourable David Heurtel (July 27 2015).
Letter from Dr. Michael Binder to Dr. Gordon Edwards (April 27 2016).

cc. The Right Honourable Justin Trudeau, Prime Minister of Canada
The Honourable Catherine McKenna, Minister of Environment and Climate Change (Canada)
The Honourable Jim Carr, Minister of Natural Resources (Canada)
L'Honorable Philippe Couillard, Premier Ministre du Québec
L'Honorable Pierre Arcand, Ministre de l'Énergie et des Ressources naturelles (Québec)
L'Honorable David Heurtel, Ministre du Développement durable, de l'Environnement, et de la Lutte contre les changements climatiques (Québec)

JUL 2 7 2915

The Honourable David Heurtel, M.N.A.
Minister o f Sustainable Development, Environment and the Fight against Climate Change 675, boul. Rene-Levesque Est

30th Floor
Quebec, QC G1R 5V7

Dear Minister,

The recently published Bureau d'audiences publiques sur l'environnement (BAPE) report compels me to write to you. It is very troubling to have the BAPE present your government with conclusions and recommendations that lack scientific basis and rigour. Furthermore, to suggest that uranium mining is unsafe is to imply that the Canadian Nuclear Safety Commission (CNSC) and the Government of Saskatchewan have been irresponsible in their approval and oversight of the uranium mines of Canada for the last 30 years.

The CNSC welcomed the Government of Quebec's decision to hold hearings to study the impacts of uranium exploration and mining in the province. Our experts fully participated in the BAPE's public process to inform and educate the BAPE on how we regulate the industry and ensure that the public, workers and the environment are protected. The BAPE's decision to continue to question the long-standing science and proven safe track record of modern uranium mining is misleading Quebecers and all Canadians.

It is our mandate to promote and enforce nuclear safety, and the CNSC takes exception to the BAPE's assertions that uranium mining is not safe.

At the BAPE's request, our staff- who are recognized internationally as scientific and regulatory experts provided numerous submissions on how the CNSC oversees and monitors all aspects of a uranium operation to ensure safety, including environmental and radiation protection, worker health and safety, tailings and waste rock management, emergency preparedness and safe uranium transport. Our experts were available to the BAPE and appeared on the many days ofhearings to support the panel's work. Solid, factual evidence was given on how Canadian nuclear activities are among the safest and most secure in the world due to stringent CNSC regulatory requirements.

We are also fully transparent in our regulatory oversight of uranium mines and mills, with a public hearing based licensing process and annual reporting of operational safety and environmental performance.

This represents a level of transparency and oversight practiced by no other industry in Canada.

While certain individuals or groups may have their diverse reasons to call for a permanent moratorium on uranium mining, their assertions regarding the health impacts on the public and environment are fundamentally flawed, as they ignore factual scientific research that has been conducted in these areas.

We have carried out and validated several peer-reviewed studies over the past several decades. These studies have repeatedly provided sound evidence that workers and residents near these facilities are as healthy as the rest of the general population. The same is true of people who live near nuclear power plants.

The BAPE's report raised concerns that uranium is radioactive and that uranium tailings are dangerous for thousands of years. The reality is that every type of mining or industrial activity produces waste that needs to be effectively managed well into the future. All mines, including uranium mines, generate waste that contains both radiological and non-radiological contaminants of varying concentrations. All modern uranium tailings management facilities operating in Canada employ underground, in-pit tailings disposal that eliminates any risk of tailings dam accidents such as the one recently experienced at the Mount Polley copper and gold mine in British Columbia. Uranium mines have been the top environmental performers in the mining sector since the federal Metal Mining Effluent Regulations came into force in 2004.

We would never compromise safety by issuing a licence or allowing a uranium mine or mill to operate if it were not safe to do so. Furthermore, Canada is fully committed to international agreements on the peaceful use of nuclear energy to ensure that no uranium from Canada is used to produce nuclear weapons.

It is clear that the BAPE's recommendation not to proceed is based on the perceived lack of social acceptance and not on proven science. I would like to remind the Minister of CNSC's decision in 2013 involving a uranium project in northern Quebec (Strateco) where a panel of the Commission, which included a former BAPE president, determined that it was safe to proceed.

Minister, I understand that you will be reviewing the BAPE report's conclusions through an interdepartmental committee. I would like to offer CNSC experts once again to assist in that process, as the BAPE did not accurately synthesize and fully consider the information previously provided. As your government moves forward on this important matter, it must not ignore years of evidence-based scientific research on this industry. It is one of the most understood types of mining in Canada and has been safely undertaken in Saskatchewan for over 30 years.

Yours sincerely,

Michael Binder

c.c.: Pierre Baril, President of the BAPE

Canadian Nuclear Safety Commission

President

Commission canadienne de sûreté nucléaire

Président

e-Doc: 4976844
ccm: 2016-000135

APR 2 7 2016

Dr. Gordon Edwards
Canadian Coalition for Nuclear Responsibility
53 Dufferin Street
Hampstead QC H3X 2X8

Dear Dr. Edwards,

Thank you for your letter dated April 11, 2016 (enclosed). Your comments and questions provide us with another opportunity to explain the scientific basis on which the Canadian Nuclear Safety Commission's (CNSC) position rests. This letter will provide clarity and closure regarding the risks to uranium miners from exposure to radon decay products (RDP).

For many years, radon has indeed been recognized as a hazard to underground miners. Radon was identified as a human lung carcinogen in 1988 by the International Agency for Research on Cancer, which is part of the World Health Organization. Epidemiological studies of historic uranium mine workers showing increased risk of lung cancer are the scientific basis for the current requirements for strong radiation protection measures in modern uranium mines. The CNSC's strict enforcement of radiation protection requirements is the reason the levels of RDP exposure of modern miners are so low. For example, RDP levels were 0.1 working level months (WLM) (equivalent to 0.5 millisieverts (mSv)) or lower for every year between 2001 and 2013. Current doses are almost 1,000 times lower than they were in the 1940s and 1950s.

As mentioned in your letter, the recent Cancer Care Ontario (CCO) report titled *Ontario Uranium Miners Cohort Study* stated that the cohort of uranium miners as a whole had a significantly increased risk of lung cancer mortality and incidence when compared to the general Canadian population. Taken in isolation, this finding does not tell the complete story. The report goes on to state that a subset of modern miners (starting employment after 1970) had similar risks to the entire cohort for the same dose categories. In other words, lower doses yielded lower risks, which were generally not statistically significant. The CNSC staff presentation in question correctly concluded that the true risk to modern miners is in line with what is expected for the general Canadian population. We stand behind our conclusions.

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The CNSC could have elaborated on the scientific evidence supporting our conclusions regarding the CCO report with the following:

- The statistically significant increased risk conclusions were based on external comparisons (section 5.1) of the entire cohort with the general Canadian population, with no consideration of the worker doses. After a critical review of the report, CNSC staff found the internal analyses (section 5.2) of radon exposure and lung cancer mortality and incidence diminished the statistical significance when the dose-response relationship was taken into account.

- In reference to table 56 (section 5.5), modern miners have similar risk levels as that of the entire cohort for the same dose categories. In the lower dose region, the risks are low. The confidence intervals for every relative risk value in table 56 spans 1; this means that these modern miners could have lower, the same or slightly higher risks than the unexposed workers (those who received 0 WLM).

- The limitations of this study should be considered when interpreting the results. The study did not include data on potential cofounders and co-exposures of radon decay products including: smoking status or exposures to crystalline silica, diesel exhaust, arsenic, and nickel. The lack of data on lung carcinogens warrants further investigation to determine their contribution to risk.

There are several issues regarding the challenging comments (a-d) made on page 2 of your letter:

a) Excess relative risk (ERR) is an epidemiological risk measure that quantifies the additional risk of exposed persons, over and above the risk level of non-exposed persons that can be attributed directly to a given exposure, such as radiation. As stated in the CCO report [10]: the ERR for lung cancer mortality per 100 WLM was 0.66 (95% CI: 0.44-0.87) and the excess relative risk for lung cancer incidence per 100 WLM was 0.64 (95% CI: 0.43-0.85). ERR values are not, and should not, be called mortality factors; that is a grossly inappropriate representation of risk.

b) In Canada, nuclear energy workers are limited to 50 mSv in a one-year dosimetry period and 100 mSv over a five-year dosimetry period. Regulatory dose limits apply to a worker's total effective dose and are not limited to radon progeny. By law, as required by the *Radiation Protection Regulations,* the application of the ALARA principle keeps doses as low as reasonably achievable, with social and economic factors taken into account. Strict controls (both engineered and administrative) are in place in uranium mines and mills which ensure that those uranium miners' exposures to RDP are very low and in line with the ALARA principle. For this reason, discussing continuously elevated exposure situations which do not occur under CNSC regulatory oversight is of little value.

c) It is not appropriate to multiply small dose values by large groups of people to obtain a number of deaths or cancer cases. This is not grounded in science; it is in fact discouraged by all international scientific bodies.

d) Given the inappropriateness of statement (c), CNSC staff conclude that the manipulation of the values in statement (d) are incorrect and misleading. Your math is incorrect. The CNSC regulatory framework establishes appropriate dose limits and ALARA requirements to maintain the health and safety of workers and members of the public. We do not regulate based on inflated risk projections grounded in overestimated doses.

There is sound and current evidence that the risk of lung cancer to uranium miners is no higher than for the general Canadian population. While the CCO study does assign an excess relative risk to RDP exposure, the impact of that risk on health outcomes is small. Given the low exposure levels of modern miners, their risk of lung cancer is indistinguishable from the risks to the general Canadian population. The CNSC will continue to ensure that doses and therefore risks to all workers and members of the public remain low.

As always, we encourage you to visit our website at nuclearsafety.gc.ca to get the facts about uranium mining, and to access the vast amount of health-related research published in peer-reviewed scientific journals.

Yours sincerely,

M. Binder

Michael Binder

Enclosure: (1)

c.c.: The Right Honourable Justin Trudeau, Prime Minister of Canada
The Honourable Catherine McKenna, Minister of Environment and Climate Change (Canada)
The Honourable Jim Carr, Minister of Natural Resources (Canada)
The Honourable Philippe Couillard, Premier of Quebec
The Honourable Pierre Arcand, Minister of Energy and Natural Resources
The Honourable David Heurtel, Minister of Sustainable Development, the Environment and the Fight Against Climate Change

Canadian Coalition for Nuclear Responsibility

Regroupement pour la surveillance du nucléaire

PAR COURRIEL

Michael Binder, President,
Canadian Nuclear Safety Commission.

April 11 2016.

Dear Dr. Binder:

I have received your e-mail of March 29, 2016, replying to my recent critique of the January CNSC presentation to the Quebec Interministerial Committee. You say in your response, "*Our presentation is based on solid science, research and decades of regulatory experience."*

But you fail to retract a false assertion in the CNSC presentation concerning the findings of a 2015 scientific report on lung cancers in Ontario's uranium miners. The report in question, "Ontario Uranium Miners Cohort Study Report", was funded by CNSC and carried out by the Occupational Cancer Research Centre. [www.nuclearsafety.gc.ca/eng/pdfs/RSP-0308.pdf].

The CNSC presentation states "a recent epidemiological study of the Ontario uranium miners cohort (1965–2007) ***showed that their risk for lung cancer was no higher than for the Canadian population***". [CNSC, p.20] This statement is completely false. The OCRC report ***found that the mortality rate from lung cancer among the cohort of Ontario uranium miners is 34 percent greater than for the Canadian population, and the incidence of lung cancer in the same cohort is 30 percent higher than for the Canadian population.*** [OCRC, p.iii]

The OCRC report also states that "***miners who started employment after 1970 had similar risks of lung cancer mortality to the full cohort for the same categories***," [OCRC, p.75[and that ***"lung cancer mortality and incidence rates were persistently elevated overall and across sub-cohorts***" [OCRC, p.84]. How does the phrase "persistently elevated" become translated by CNSC staff into the phrase "no higher than for the Canadian population" ?

The OCRC report concludes: ***"This study confirms what is known about underground uranium miners, which is that they have an increased risk of lung cancer."*** [OCRC, p.82] That concluding statement is not subject to any qualifications or reservations of any kind. It is strikingly different from the statement made to the committee by the CNSC, which implies that the study reached the exact opposite conclusion. In the view of CCNR, this misrepresentation of the results of a scientific study is inconsistent with the CNSC's obligation to disseminate objective scientific information (Nuclear Safety and Control Act, Article 9b).

To say OCRC found no increase in lung cancer in uranium miners could not be farther from the truth. The OCRC web site states: ***"Over 30,000 men were employed to extract uranium from deep underground mines in Ontario from 1954 through 1996. Despite economic benefits, mining uranium is a dangerous occupation with potentially fatal long-term consequences. One example is the excess of lung cancer mortality associated with radon decay products that has been well demonstrated in uranium miners worldwide."*** [http://tinyurl.com/z6b5gpc]

Nevertheless, CNSC staff argues that less than one lung cancer death would occur in a population of 24,000 miners, based on risk factors in the OCRC Report, and concludes :

> *"while the [OCRC] study does assign an excess relative risk to [radon] exposure, the impact of that risk on health outcomes is so small, given the low exposure levels of modern miners, that lung cancer risks to current uranium miners are indistinguishable from the risks to the general Canadian population."* [E-mail from M Binder, March 29 2016]

CCNR challenges this conclusion, and the appropriateness of your endorsing such a conclusion.

(a) The OCRC study reported a 66 % increase in lung cancer mortality per 100 WLM of radon exposure, compared with those unexposed. *Note: the WLM (Working Level Month) is a unit of human exposure to radon.* CNSC staff chooses to use a lower mortality factor – 64% instead of 66%– taken from a different study. We will use CNSC's chosen number.

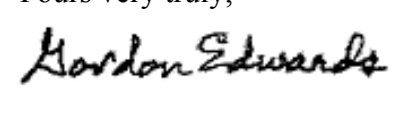
(b) The current regulatory limit for radon exposure of miners is 4 WLM per year, the same as it was 40 years ago. CNSC's presentation to the Quebec Interministerial Committee [p.20] describes this limit as an "international safety standard". But a miner exposed at this level during a 45-year working lifetime would accumulate 180 WLM of radon exposure, and ***according to the CNSC risk figures cited above, 180 WLM gives an increase in lung cancer mortality of 64 x 1.8 = 115 percent – more than double the expected number of lung cancer deaths.*** Nevertheless, CNSC has kept this "safety standard" for 40 years.

(c) Actual radon exposures are less than the regulatory limit. CNSC publication INFO-0813 shows that the average 2006 radon exposure for Canadian workers in underground uranium mines was 0.1854 WLM (per year). That rate of exposure gives an accumulated lifetime radon exposure of 8.343 WLM.* *[see Technical Note]* ***Using CNSC's mortality factor, this exposure would cause a 5.3% increase in lung cancer mortality.*** Most oncologists would regard a 5 % increase in lung cancer mortality as a matter of concern. In a population of 24,000 miners it represents about ***60 additional radiation-induced lung cancer death*s**.

(d) CNSC says the excess relative risk for lung cancer mortality could range from 42% to 86% per 100 WLM ; 64 % is just the midpoint of the interval, and is of uncertain validity. Using the upper end-point of the interval, and repeating the same calculations as before, we get ***a projected 7.1 percent increase of lung cancer mortality***. In a population of 24,000 underground miners, that would correspond to ***about 80 extra lung cancer deaths***

As a federal agency charged with protecting the health and safety of workers and the public, we feel that CNSC should be overestimating rather than underestimating potential harm to workers – especially when that harm is a matter of life and death.

Yours very truly,



Gordon Edwards, Ph.D., President,
Canadian Coalition for Nuclear Responsibility.

cc. The Right Honourable Justin Trudeau, Prime Minister of Canada
The Honourable Catherine McKenna, Minister of Environment and Climate Change (Canada)
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L'Honorable David Heurtel, Ministre du Développement durable, de l'Environnement, et de la Lutte contre les changements climatiques (Québec)

See Technical Note, next page →

*** Technical Note :**

According to CNSC publication INFO-0813, the average radiation exposure for Canadian workers in underground uranium mines in the year 2006 was 1.74 millisieverts (mSv) and 53.3 percent of that exposure was due to radon and its decay products ; thus 1.74 x .533 = 0.927 mSv radiation equivalent exposure from radon.

According to the Canadian Centre for Occupational Safety and Health (CCOSH), one WLM of radon exposure is equal to five millisieverts of radiation equivalent. [www.ccohs.ca/oshanswers/phys_agents/ionizing.html]

So the average 2006 radon exposure for underground uranium miners, as reported by CNSC, was about 0.927 / 5 = 0.1854 WLM.

G. Edwards.

References :

Regulation des mines et usines de concentration d'uraniums, 22 janvier 2016, P. Thompson, powerpoint presentation to Quebec Interministerial Committee on Uranium in Quebec, www.ccnr.org/CNSC_BAPE_Jan22_2016.pdf

Truth and Consequences, Feb 22/16, G. Edwards, a critique of CNSC's presentation to the Quebec Interministerial Committee on Uranium in Quebec. www.ccnr.org/CCNR_CNSC_Feb22_2016.pdf

Reply from Michael Binder to Gordon Edwards, March 29, 2016. www.ccnr.org/Binder_reply_March29_2016.pdf

Ontario Uranium Miners Cohort Study Report, Feb 2015, OCRC. www.ccnr.org/OCRC.pdf

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