# HEALTH DANGERS OF URANIUM MINING AND JURISDICTIONAL 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 1980**

**BY**

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

**ON BEHALF OF**

**THE ENVIRONMENTAL HEALTH COMMITTEE OF THE BRITISH COLUMBIA MEDICAL ASSOCIATION**

**ACADEMY OF MEDICINE BUILDING**
**1807 WEST 10TH AVENUE**
**VANCOUVER BC**

**Telephone (604) 736-5551**

---

Brief Summary of Major Points:

- Uranium Industry: Occupational Exposures
- Uranium Industry: Public Exposures
- Regulatory Framework: Setting Standards

Verbatim Excerpts from the 470 page report:

Clarification from the BCMA President



---

# BCMA REPORT: SUMMARY OF MAJOR POINTS

## URANIUM INDUSTRY: OCCUPATIONAL EXPOSURES

**Delay of hazard recognition and consequent worker non-protection is an unfortunate but recurring theme in the Canadian regulatory and uranium industry history:**

- **Radon daughter radiation is a health hazard to workers in advanced stages of exploration, such as in tunnels and shafts, where very high levels of 1.6 working levels (WL) have been recorded in low grade deposits (1600 times normal background levels).**
- **Average radon daughter levels in underground mines range from 0.1 WL to about 1 WL (that is, 100 to 1000 times normal background levels).**
- **In open-pit mines. the high density of radon (7.8 times heavier than air) and atmospheric inversion conditions can cause levels of from 2 to 10 WL in moderate to high grade ore bodies.**
- **Workers in open pits with low to moderate grade ore receive 2 to 4 times the normal lifetime dose of radon daughter radiation during their employment life, under conditions where there are no inversions.**
- **In a uranium mill, with low to moderate grade ore, the millers receive from 5 to 14 times the normal background lifetime dose of radon daughter radiation during their 30-year working lives.**
- **Uranium millers may receive doses of gamma radiation 1000 times background from high grade ores.**
- **Although the AECB assumes workers are receiving only a small fraction of the annual limits, this is not borne out by the facts.**
- **Despite AECB claims to the contrary, the risks from radiation in uranium mining far exceed those of a "safe" industry.**
- **The 4 WLM annual maximum permissible exposure to radon and thoron**

daughters should be lowered to less than 1 WLM per year immediately, and serious consideration should be given to lowering it to 0.4 WLM per year [ a factor of 10 lower than present permissible levels ]. This would still exceed risks for a safe industry using AECB criteria.

- The AECB is unfit to regulate uranium mining.
- Canada has lagged many years behind other countries in its collection of cancer death statistics among uranium miners. It is most unfortunate that there has been such a long delay in publication of the follow-up study of the Elliot Lake miners.
- Nuclear industry proponents have tended to minimize risk through lack of knowledge, generalizations, quoting outdated studies, dilution of risk estimates, unsubstantiated arguments, personal bias, basing conclusions on inadequate studies, doublethink, and assuming workers cannot absorb the full truth.
- The new ICRP weighting system [ based on the concept of an "effective dose equivalent" ], if accepted, will permit much larger doses of radiation at a time when reports indicate that cancer risk is many times what it was considered to be 22 years ago.
- AECB reliance on the ICRP as a basis for standards is unwise. That body has become a political and social arbiter rather than a scientific advisory group.

## URANIUM INDUSTRY: PUBLIC EXPOSURES

Uranium tailings will remain radioactive for hundreds of thousands of years, and will require such expensive long-term surveillance and maintenance by government and the local citizenry as to make statements about uranium mining providing revenue very misleading:

- Misuse of uranium tailings has led to internal lung doses calculated to be 100 rems per year to the public.
- Conservative calculations show that the public near uranium tailings will receive a 25 percent increase in lifetime radon daughter radiation.
- Uranium tailings will have appreciable radioactivity for more than 100,000 years.
- In Canada we now have approximately 100 million tons of radioactive tailings; this will eventually increase to about one billion tons by the year 2000.
- There have been many uranium tailings disasters in Australia, Canada and the United States. even with the most modern "state of the art" tailings dams.
- The present average allowable exposure to the public [ of 0.02 WL of radon exposure ] could result in 200-300 extra cases of lung cancer per 10,000 people per lifetime. In light of current knowledge, this might be considered tantamount to allowing an industrially induced and publicly sanctioned epidemic of cancer.
- This present guideline of 0.02 WL must be immediately withdrawn and

replaced with "no exposure (above ambient levels) of any carcinogen permitted to the local public".

- Radon contamination of ground water may be a health risk in pincushion drilling typical of advanced exploration, yet under present AECB regulations, a couple of hundred drill holes can be made without obtaining a license. AECB admitted to having no scientific data to show this is safe; the regulation was based on an arbitrary administrative decision.

- Radium-226 [ released from uranium tailings ] is a superb producer of osteosarcoma [ bone cancer ] .

- In 1959 the ICRP recommended a maximum exposure of 3 picocuries per liter (pCi/l) of [ dissolved ] radium-226 to the public.

- In 1968 Canada allowed a maximum permissible concentration of 100 picocuries per liter, with an objective of 10 picocuries per liter [ of dissolved radium-226 ] .

- Ontario has retained a maximum permissible concentration of 3 picocuries per liter [ of dissolved radium-226 ] .

- New "recalculations" of the ICRP recommend relaxing the radium-226 standard to 27 picocuries per liter (9 times the Ontario limit of 3 picocuries per liter).

  **[ NOTE: Canada has since authorized this increase in permissible radium levels in drinking water. ]**

- Certain uranium mining companies in Ontario are discharging radium-contaminated effluents which exceed the standard of 3 picocuries per liter. With the relaxation of the standard to 27 this will no longer be [ considered as ] a technical or regulatory problem.

- American standards are as usual more stringent than Canada's; in the U.S.A., [ dissolved ] radium-226 plus radium-228 cannot exceed 5 picocuries per liter.

- A U.S. Public Health Service study shows increased bone cancer in communities with 4.2 picocuries per liter of [ dissolved ] radium-226 in drinking water, as compared with communities having only 1 picocurie per liter.

- The concept that a radium-226 limit for the public can be set ten times too high because the usual radium-226 levels will only be one-tenth of that, is as inane as setting a speed limit of 200 kilometers per hour in a school zone because most caring people will only drive at 20 km/hr anyway.

- There are no standards for total radium-226 (dissolved and particulate); one wonders if that is because total radium-226 effluents range as high as 168 picocuries per liter.

## REGULATORY FRAMEWORK: SETTING STANDARDS

The BCMA calls for an Emergency Task Force into tightening the present radiation standards. Review by the AECB or by its Committees is unacceptable; the Task Force should be under the Advisory Council on Occupational Health and Safety or

the Science Council of Canada:

- Industry and regulatory officials are overly eager to select conversion factors for dose calculations that are at the lower end of the spectrum of values proposed. This consequently leads to lower risk estimates of radiation effects. The fact that the calculations are subject to "large unquantifiable uncertainty" leaves one with little confidence in the conclusions of health risks made by nuclear physicists and former employees of Atomic Energy of Canada Limited, now associated with the Atomic Energy Control Board.

- Canadian regulations lag far behind countries which are more conscious and concerned about occupational and public health and safety.

- Canadians cannot continue to allow vested interest Ministries and regulatory bodies to promulgate maximum permissible exposure levels [ of radiation ].

- The BCMA is on record as calling for a national enquiry into nuclear energy in Canada, [ including ] a total reassessment of the structure and function of the AECB; this resolution arose out of our investigations of nuclear waste management and uranium mining.

- That the AECB consistently and seriously neglected its statutory responsibility for the regulation of uranium mines is obvious to the most casual observer.

- We believe that the continued use of the ALARA principle, [ unenforced ] guidelines, and the encouragement of industrial self-regulation is a combination of objectives that will [ continue to ] compromise the effectiveness of the AECB as a regulator of uranium mining.

---

## EXCERPTS FROM THE TEXT OF THE BCMA REPORT

### LUNG CANCER AMONG UNDERGROUND MINERS

Dr. Wagoner well described the discovery of the relationship between lung cancer and radon daughters:

> "The real nature of this pulmonary disorder among miners of the Schneeberg (Germany) area was not identified until 1879 when Harting and Hesse first diagnosed it.
>
> "In 1913, Ainstein reported that of 665 Schneeberg miners dying during 1875-1912, 40 percent (or 276) died of lung cancer.
>
> "Pircham and Sikl, in 1932, reported that of 17 deaths observed during 1929-1930 among miners of uranium-bearing ores in Joachimsthal (Czechoslovakia), 53 percent (or 9) were due to cancer of the lung.
>
> "These same investigators ... concluded that the most probable cause of these tumors was radiation in the air of the mines. These investigators also made note 'the miners themselves state that discovery of a rich uranium vein is always followed some years later by a strongly increased mortality among them'."

Hollywood, in his article on "The Epidemiology of Lung Cancer Among Workers Exposed to Radon and Radon Daughters" in May, 1979, noted:

> "By 1940, then, excess deaths from lung cancer among two groups of European miners had been associated with relatively high concentrations of radon in the mine atmosphere. In that same year ... conclusions were drawn that prolonged breathing of air containing a high concentration of radon, may have caused what was estimated at that time to be a 30-fold increase in the incidence of lung cancer.
>
> "The percentage of miners developing carcinoma of the lungs in Schneeberg was 63 percent, in Joachimsthal 42 percent, and in St. Lawrence [Newfoundland] 36 percent."

Studies in the U.S. were undertaken in the 1950's on uranium miners in the Colorado Plateau area. These results began to appear in the early 60's, and they showed an increase in lung cancer with an increase in exposure to radon daughters. Dr. Wagoner noted that these studies had to be extended and refined to rule out any possible other agent:

> "First there was a basic denial that there was such a problem. Then there was a position that it had to be due to smoking. Then it was on the basis -- well, it had to be due to hard rock mining. There were sequential analyses undertaken to address all of these, what in statistical terms I would call confounding factors, but in public health terms I would call delaying [factors] .
>
> "In 1967, Lunden demonstrated that during the period 1950 through June 1965, white underground uranium miners experienced 37 deaths due to lung cancer whereas only 7.3 would have been expected [and] through September 1967, 62 deaths due to lung cancer as contrasted to only 10.02 expected."

[As noted by Dr. Wagoner, referring to the Colorado data] , observed versus expected carcinoma of the lung cases in 1978 was 205 versus 40, with an attributable risk of 164 men

> "who have died due to lung cancer over and above what I would expect in that population if they had not been subjected to those exposures. I would consider that as epidemic."

With the long latent period of carcinoma induction by low level radiation, these numbers will increase further over the next 20 years.

The submission of Dr. Wigle relating to the St. Lawrence (Newfoundland) fluorspar miners who were exposed to elevated levels of radon daughters demonstrated an observed incidence of lung cancer of 65 versus an expected 6.41, with an average ratio of observed to expected of 10.1 . Dr. Radford noted that the ongoing studies, such as the one of the Newfoundland fluorspar miners,

> "clearly indicate the seriousness of this problem, still with us fifty years after the risk was originally identified in the Bohemian miners of central Europe."

The collection of the Canadian [uranium mining] data began in 1974. The Royal Commission on Health and Safety in Mines in Ontario [the Ham Commission] commissioned an epidemiological study of the uranium miners in the Elliot Lake area; this was conducted from 1975 to 1976. Dr. Muller noted that

> "The Ontario uranium mining population is characterized by relatively low exposures and relatively short periods of exposure. There is, therefore, less extrapolation involved from high to low doses and dose rates, ... relatively short periods of exposure in most men, ... and nearly 20 years of observation time."

The Ham Commission analyzed the data [81 observed lung cancer deaths versus 45.08 expected] in order to determine whether radon daughters were the agent:

> "The lung cancer cases tended to accumulate more in the higher exposure groups, which indicates that lung cancer risk was greater in the higher exposure groups than in the lower ones."

In his analysis of the Ontario data, Ellett stated:

> "From the occupational health point of view, it is certain that exposure to radon daughters leads to an increased risk of lung cancer for the working force as a whole, and that this risk extends to levels of exposure that are below current occupational guidelines."

According to the United Steelworkers of America, the number of lung cancer cases should now read well in excess of 100 at Elliot Lake and are "climbing steadily".

---

## MORE EVIDENCE ON LUNG CANCER AND RADON GAS

Dr. Axelson, in his submission on Swedish Miner Lung Carcinoma, stated:

> "Several studies have shown an increased lung cancer mortality among Swedish metal [zinc-lead-iron] miners as probably caused by the exposure to radon and radon daughters in the mine atmosphere. In a nation-wide survey, as yet unpublished, the average lung cancer mortality among Swedish miners was found to be about fivefold the normal.
>
> "These Swedish studies deal with a life-time follow-up of miners, whereas most other mining populations have been studied by means of cohorts with a follow-up time of not less than about 2S-30 years or more."

Wagoner noted that

> "In 1942, Campbell reported the induction of lung tumors in 20.3 percent of mice exposed by inhaling dust from the Joachimsthal mines, whereas only 2.1 percent was found in the unexposed controls."

**The most detailed and conclusive evidence showing the carcinogenic effect of radon daughters has been done by Dr. Lafuma of the Radiation Protection Department of the Atomic Energy Commission of France:**

> "Studies have been carried out by two teams from the Commission of Atomic Energy in France.... Throughout the ten years of research, close to **10,000 rats were used of which 3,000 were used for radon studies. In these 3,000 rats, more than 600 pulmonary cancers were observed."**

Dr. Lafuma's research indicates a higher risk [per unit of exposure] at lower cumulative working level months (WLM).

---

**It seems that the controversy over low level radiation which is now taking place is following a similar pattern to that of the health hazards of cigarettes that began 30 years ago when epidemiological studies were met with flat denials that cigarettes could possibly cause cancer of the lung.**

**One of the serious consequences of down-playing the effects of low-level radiation will be to deny those who have developed various carcinomas adequate compensation which may be their due. With the abundant information on the effects of low-level ionizing radiation, the humane course of action would be to give the worker, or in most cases the deceased worker's family, the benefit of the doubt as to whether his or her particular carcinoma was a product of radiation, and compensate accordingly.**

**Society and industry must be willing to shoulder this burden if we wish to continue with the production of nuclear power and nuclear weapons.**

---

## RADON RISK ESTIMATES: COMPARISON WITH A SAFE INDUSTRY

Mr. Bush, Manager of the Radiation Protection Division of the AECB, described mining as an industry with high risk:

> "one [accidental] death per year for every thousand workers"

According to Mr. Bush,

> "Workers in the safest occupations -- manufacturing, for example -- are subject to an annual risk of accidental death of about one in ten thousand."

When asked whether the mining industry in Canada was an industry with a high standard of safety, Mr. Bush replied: "No". [In particular] he knew of no industry that exceeds the combined risk of uranium mining.

According to the AECB,

> "The risk of lung cancer associated with an exposure of 4 WLM per year over a normal working life is considered to be acceptably small, compared to the risk of [accidental] death associated with other ["safe"] industries."

Mr. Bush re-iterated this in cross-examination:

> "The risk of working with the present dose limits is no greater than the occupational risk of the safer industries."

Of course, what he clearly means is that the risk [from uranium mining] is no greater than adding the occupational risk of a safer industry on top of the occupational risk of an industry [mining] which does not have a high standard of safety.

[In any event] , the risk of accidental death in a "safe industry" can be approximated at 100 deaths per million workers per year. Several authors have produced estimates of lung cancer cases per million people exposed to one working level month (WLM). According to Mr. Bush,

> "Dr. Gordon Stuart, formerly of Chalk River, reviewed the American and Czechoslovakian data and he concluded that ... you get about 14 to 20 lung cancer cases per million people exposed to one WLM.
>
> "A year or two ago, the [European] Nuclear Energy Agency concluded that a reasonable risk estimate, for purposes of radiation protection, would be about 100 cases of lung cancer per million people per WLM."

Sevc, in his calculations of the [Czechoslovakian] data in 1970, found

> "0.23 ± 0.04 lung cancer cases per thousand workers per WLM [that is, 230 ± 40 lung cancer cases per million workers per WLM] as an estimate of average radiation risk for the total group."

**As can be seen, even using the Nuclear Energy Agency's calculations, the [ cancer ] risk to miners would be four times as great at present radiation standards [4 WLM per year] than the accident risk in safe industries.**

**Using Sevc's calculations, [the cancer risk] would be 9.2 times as great** -- approximately 10 times as great -- which would then be in a category of industries with a high degree of risk [one accidental death per thousand workers per year] .

Moreover, there is a very important flaw in the AECB's comparison of accidental risks per year with lung carcinomas, which makes direct comparison meaningless:

- Risk of accidental occupational death is a relatively instantaneous risk, which exists (by definition)

only during the period of employment and ends upon termination of employment.

- Risk of lung cancer from radiation, although beginning after several years of employment, continues many years past termination of employment; thus a gradually flowering crop of cancers grows larger each year.

[Indeed] Archer & Linden in 1967 concluded that an exposure of 120 WLM

> "appears to double the lung cancer incidence characteristic of the general [unexposed] population."

---

**Summary of doubling dose estimates for lung cancer in uranium miners:**

| | | | |
|---|---|---|---|
| Archer | (1967) | 120 | WLM |
| Hewitt | (1980) - Ontario | 40-50 | WLM |
| | - Newfoundland | 50 | WLM |
| Sevc | (1976) | ~50 | WLM |
| US EPA | (1980) | ~40 | WLM |
| Ellett | (1980) | 40 | WLM |
| BEIR-II | (1972) | 34 | WLM |
| BCMA | (1980) - NIOSH & Sevc | 19-20 | WLM |
| BEIR-III | (1980) | 12-17 | WLM |
| Axelson | (1980) | 2 | WLM |

---

The lifetime incidence of lung cancer in males can be calculated to equal 52.5 per thousand, equivalent to approximately a five percent lifetime risk for lung cancer development in males. It would appear that the doubling dose from exposure to radon daughters would be 40 WLM or less, in the exposure ranges experienced by today's miners.

**Thus, at a lifetime dose of 40 WLM, a miner would have approximately a 10 percent rather than a 5 percent risk of developing carcinoma of the lung; that is a risk of 1250 lung cancer cases per million workers per WLM. The risk [per million workers] would be four times as high at today's maximum permissible exposure of 4 WLM per year. Compare this value with the risk of accidental death in safe industries of 100 accidental deaths per million workers per year!**

Because of the long latent period of lung cancer, and its variability with age and smoking, Archer has calculated the attributable cancer for lifetime per million [workers] per WLM, which is certainly the value most significant to the mining population. Using the exposure rates present in today's mines and mills, the attributable cancer per lifetime per WLM is approximately 1000 [per million workers] .

---

## ATOMIC ENERGY CONTROL BOARD: UNFIT TO REGULATE

The AECB [Atomic Energy Control Board] policy regarding a lifetime exposure limit for uranium miners [February 1978] is based on one study [published in 1969] , which is not only 11 years out of date, but which has been revised several times by the authors. The AECB notes in passing that in Ontario,

> "only 20 of the 81 lung cancer victims who had worked in uranium mines had accumulated as much as 120 WLM (the exposures of the other 61 victims being 0 to 99 WLM, or 35 WLM on average)."

Ignoring this and using the 1969 study (which seems to be the extent of their literature review as no other references are cited) AECB states:

"If one had to choose a WLM value that had some special significance 840 WLM would be a more logical choice [than 120 WLM] because it marks the level above which lung cancer incidence appears to increase with increasing exposure; (i.e. although an excess of lung cancer is evident in each of the exposure categories, the excess appears to be independent of exposure below 840 WLM.)"

**Such a policy statement, based on antiquated data and inadequate literature review, would be irresponsible coming from the nuclear industry, let alone the regulatory agency of that industry. However, as will become clear, it is difficult to ascertain where one ends and the other begins.**

The Manager of the Radiation Protection Division of the AECB is Mr. Bush, who has a degree in Chemical Engineering (1955). He worked for Atomic Energy of Canada Limited (AECL) in Chalk River from 1957 to 1969, and subsequently with the AECB from 1969 to the present. One notes that Mr. Bush is responsible for developing radiation protection guidelines and regulations. Mr. Bush admitted,

"I'm not a medical doctor. I'm not an epidemiologist."

(This is evident as well from the Board's paltry data analysis upon which their statements of risk are made.) The AECB

"is currently considering how the latest recommendations [on permissible radiation exposures for workers and the public, put forward by the International Commission on Radiological Protection ~ ICRP 1977] might be incorporated into AECB regulations. AECB is being assisted in its review of the ICRP recommendations by its Advisory Committee on Radiologic Protection [ACRP] , which it established early in 1979. The Advisory Committee was set up to provide the Board with independent advice ... no Board staff member is [on it] ."

Mr. Bush pointed out the difficulty the U.S. Nuclear Regulatory Commission may have in adopting these new ICRP higher dose limits:

"they would be difficult to implement under the climate of nuclear controversy currently existing in the U.S.A. For example, the new ICRP system of dose limitation implies higher dose limits for irradiation of some individual organs ..."

**The Chairman of the new Advisory Committee, Dr. G. C. Butler, listed members of this Committee.**

- **It includes himself, who has been an employee of AECL at Chalk River from 1957 to 1965,** a member of the ICRP Committee from 1963 to 1973 and again from 1973 to 1977, and worked from 1945 to 1947 with the National Research Council (Ottawa) in the Atomic Energy Project; he has been with the National Research Council since 1965.

- **It also includes Dr. Marko of AECL [Director of Health Physics at Chalk River] and Dr. Hollywood from Newfoundland, who wrote a section in the AECB Elliot Lake Uranium Mine Inspector's Training Course Manual.**

  The [1979 Elliot Lake] manual contains the following:

  - "The AECB has seen no convincing evidence for a limitation on cumulative lifetime exposure, provided the average exposure received during a working life does not exceed 4 WLM per year...."

  - "Radiation damage is observed only at doses higher than about 100 rads; and although effects have generally not been observed at lower doses, it is assumed for radiation protection purposes that the effect is proportional to the dose right down to zero exposure."

  Not only is the last sentence grossly in error, any trainee inspector who is using the graph

[showing "observed" cancers at low doses to be less than "expected" cancers obtained by linear extrapolation] would be led to the incorrect conclusion that for all radiation, the linear hypothesis will over-estimate the effects.

- Other members [of ACRP] include **Dr. Jan Muller** from the Department of Labour, Ontario, [who is of the opinion] that there is no serious risk at current standards of 4 WLM per year of radon exposure, despite mounting evidence to the contrary. No follow-up study on the Ontario uranium miners has been completed because the information is still being processed by Dr. Muller. It is unfortunate, because of the crucial nature of the Ontario studies, that there has been such a long delay since 1976. It is hoped that this data will be available to the scientific community soon.

- Dr. Butler also noted that his Committee did have Dr. Stuart from AECL, but that he had now retired. [ACRP now includes both **Dr. Myers and Dr. Newcombe, both of AECL.**]

Dr. Butler agreed that his Committee had not asked any independent bodies, such as the Canadian Medical Association, the Royal College of Physicians and Surgeons, or the Royal Society, to place a member of its own choice on the Committee.

**The "independence" of this Committee must be seriously questioned. This lack of "independence" is characteristic of the AECB.**

As Dr. Bates [David Bates, M.D., Chairman of the B.C. Royal Commission on Uranium Mining] noted about the previous [AECB] Standing Committee on Safety,

> "There appeared to be only one M.D. on it, and he had worked at Chalk River for all of his life before that."

---

## RADON GAS IN HOMES: AN INDUSTRIALLY-INDUCED EPIDEMIC?

The Atomic Energy Control Board has announced adoption of radiation criteria for use in the investigation and cleanup of communities contaminated by radiation.

**The Government of British Columbia has adopted the AECB exposure limits [for public exposure to radon daughters] :**

> **"The WLM unit is not appropriate for exposures in the home or in other non-occupational situations. In such situations the maximum permissible annual average concentration of radon daughters (attributable to the operation of a nuclear facility) shall be 0.02 WL."**

[Outdoor] levels higher than 0.02 WL may be produced locally by uranium mines. Higher outdoor concentrations would obviously produce higher indoor concentrations of radon. [According to Dr. Wagoner:]

> "On the basis of additional data, the EPA [U.S. Environmental Protection Agency] has estimated that 110 to 230 extra lung cancer deaths would occur among 100,000 population with a lifetime residency at ambient levels of radon daughter exposure (i.e. 0.004 WL).
>
> "In contrast, **2000 to 3000 extra lung cancer deaths per 100,000 population were estimated to occur over a lifetime indoor radon daughter exposure to 0.02 WL ."**

**In light of the present state of knowledge, one could well view the allowable exposure to the public from nuclear facilities as tantamount to allowing an industrially-induced epidemic of cancer.**

Dr. Radford in his submission to the Commission stated that

> "epidemiological and experimental evidence indicates that alpha radiation [from radon] is more effective (per unit dose) in producing cancer when exposure is at low dose rates over long periods of time, than when the equivalent dose is given at a high rate for short periods of time."

Dr. Archer observed that

> "Alpha radiation [from radon] appears to be approximately eight times as efficient at 100 WLM as at 1000 WLM. This data makes it highly likely that radon daughter levels in residences are responsible for some lung cancers."

In 1971, the joint monograph by NIOSH [U.S. National Institute for Occupational Safety and Health] and NIEHS [U.S. National Institute for Environmental Health Studies] also noted:

> "The risk of respiratory cancer per unit of exposure appeared to be greater in the lower cumulative radiation groups than in the higher ones -- i.e. an assumption of linearity appears not to be conservative [it may well under-estimate the actual risks] ."

Nevertheless, the AECB assumes that this [linear hypothesis]

> "is a cautious assumption; i.e. the number of cancer cases will probably be overestimated."

---

**AN OPEN LETTER FROM THE PRESIDENT OF THE**

# British Columbia Medical Association

**13 January 1984**

**TO WHOM IT MAY CONCERN:**

As there appears to be some confusion among representatives of industry and government with respect to the British Columbia Medical Association's efforts as a major participant in the British Columbia Royal Commission of Inquiry, Health and Environmental Protection Uranium Mining, we wish to make the following comments:

1. Dr Eric R Young and Dr Robert F Woollard participated as interveners at the Inquiry as representatives of this Association.

2. Dr Young is presently the chairman of the environmental health committee of the BCMA and Dr Woollard is past-chairman.

3. During the Inquiry the BCMA was privileged to present statements of evidence of internationally-recognized authorities on various aspects of this issue.

4. The report entitled "The Health Dangers of Uranium Mining and Jurisdictional Questions" authored by Drs Young and Woollard is the summary argument of the BCMA presented in 1980 to the Royal Commission in response to its call for final arguments from participants in the inquiry. As such it has been supported by the BCMA Executive and Board of Directors.

5. This report has had significant peer review and there has been ample opportunity for public comment.

6. The substance of the report is reflective of BCMA policies in the area of environmental health as established over several years by consideration and debate at the general assembly and Board of Directors and, as confirmation of this, the BCMA holds copyright on both printings of this BCMA publication.

Extensive feedback has confirmed the report's value as an aid in promoting public participation in this important area of environmental health and has vindicated the medical association's expressed interest to raise the level of debate on this issue.

Yours sincerely

G D McPherson, MD
BCMA President

---

[ Uranium Sub-Directory ] [ COMPLETE DIRECTORY ]

ccnr@web.net