Canadian Nuclear Society
Sheridan Park Branch
Mississauga, May 25, 2022

Distributing iodine pills links nuclear plants to cancer

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Dr. Jerry M. Cuttler biography

Completed Engineering Physics at University of Toronto 1964. M.Sc. in Nuclear Engineering 1968, D.Sc. Nuclear Sciences 1971 at Israel Institute of Technology.

From 1974, Atomic Energy of Canada Limited to design, procure equipment and provide support for 25 nuclear reactors.

From mid-2000, consulting services through Cuttler & Associates.

From 1995, collaborating with renowned medical scientists in studies on applications of low doses of radiation in therapies for cancer, infections, inflammations, and neurodegenerative diseases.

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Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

UNPROTECTED/NON PROTÉGÉ

ORIGINAL/ORIGINAL

CMD: 22-M6

Date signed/Signé le : 10 JANUARY 2022

Technical Briefing

Exposé technique

Potassium Iodide Pill Working Group – Phase I Report

Groupe de travail sur la pilule d'iodure de potassium – Rapport de phase I

Public Meeting

Réunion publique

Scheduled for:
January 26, 2022

Prévue pour :
26 janvier 2022

Submitted by:
CNSC Staff

Soumise par :
Le personnel de la CCSN

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada

https://www.nuclearsafety.gc.ca/eng/the-commission/meetings/cmd/pdf/CMD22/CMD22-M6-A.pdf

CMD 22-M6.A
Potassium Iodide (KI) Pill Working Group – Phase I Report

CNSC Staff Presentation

January 26 – 27, 2022

e-Doc 6696665 (PPT)
e-Doc 6720713 (PDF)

Radiation has been used in medicine for over 120 years; it's a great benefit

From 1896, physicians used X-rays and radium to

- **treat cancer**
- **stop infections: sinus, inner ear, pneumonia, etc.**
- **relieve inflammations: arthritis, asthma, nasal adenoids in kids**

Recently: cancer, non-malignant disorders (inflammation), benign diseases, Alzheimer's, Parkinson's, autoimmune diseases, etc.

Studies of X-rays for inflammatory diseases

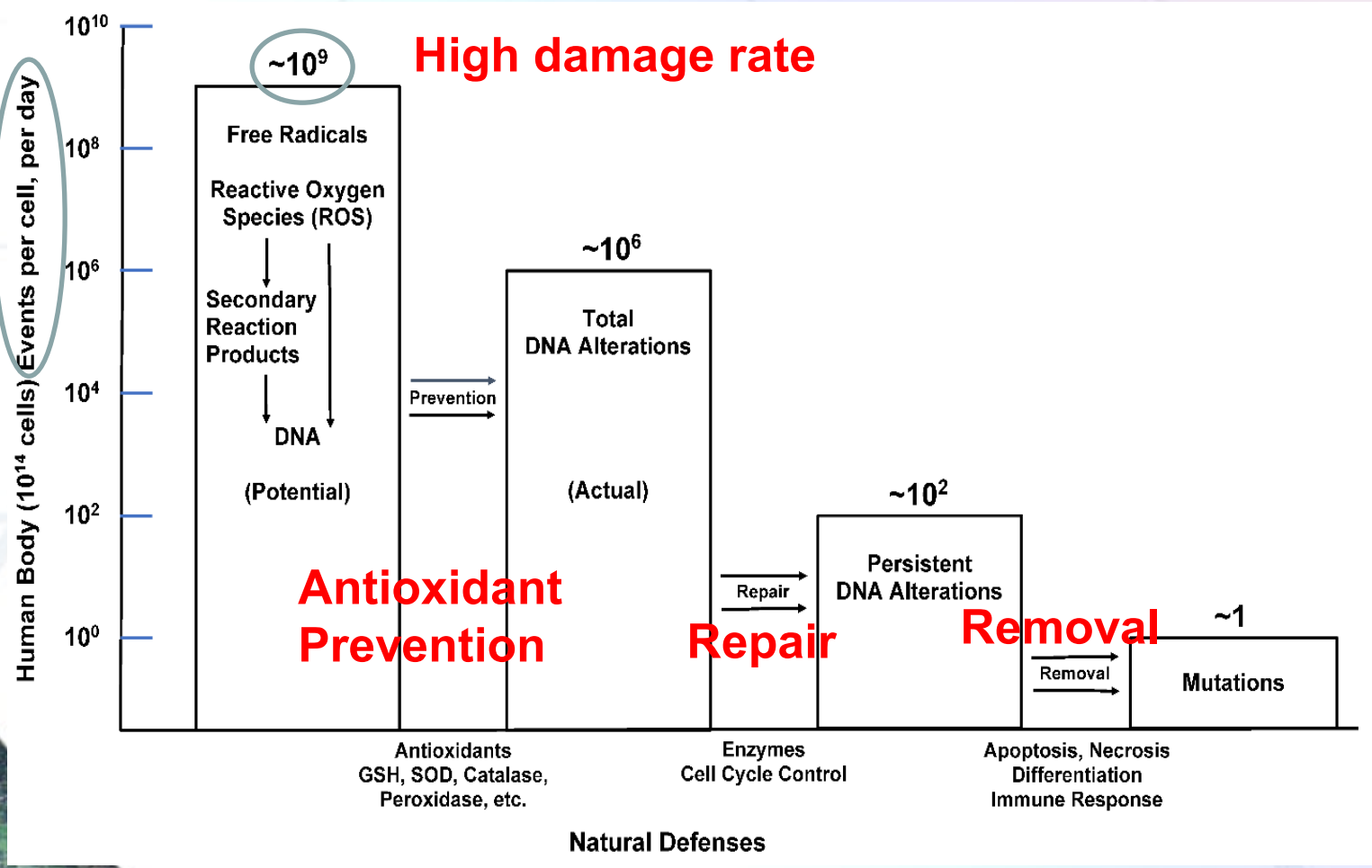
	Number of subjects	Successful treatment (%)	Studies (*N*)	References
Arthritis	>5000	~85	Cumulative experience	Kahlmeter[14] and Kuhns and Morrison[15]
Bronchial asthma	~4000	75–80	57	Calabrese et al.[12]
Carbuncles	187	60–90	5	Calabrese[6]
Cervical adenitis	893	75–90	11	Calabrese and Dhawan[10]
Deafness	15,000	>95%; performed prior to age 15	Cumulative experience	Crowe and Baylor[22]
Furuncles	420	75–95	5	Calabrese[6]
Gas gangrene	365	Mortality rate decreased from 40% to 10%	13	Calabrese and Dhawan[7]
Otitis media/ mastoides	564	~90	16	Calabrese and Dhawan[10]
Pertussis	~2400	~80	22	Calabrese et al.[13]
Pneumonia	863	80–85	18	Calabrese and Dhawan[8]
Sinus infection	4492	75–90	16	Calabrese and Dhawan[9]
Tendonitis/bursitis	3333	70–90	31	Calabrese and Dhawan[10]
	37,517			

Calabrese et al 2019: https://doi.org/10.1177/0960327119846925

Protection systems bring recovery to health

- We need agents for redox cell-signaling: O_2^-, H_2O_2 , others
- These signaling agents are reactive oxygen species (ROS); they are made in our cell mitochondria, and elsewhere
- ROS cause oxidative damage to DNA. Damage rate is very high
- Our powerful protection systems act against ROS damage, and we recover from internal damage and external causes of harm
- The protection systems get weaker with age

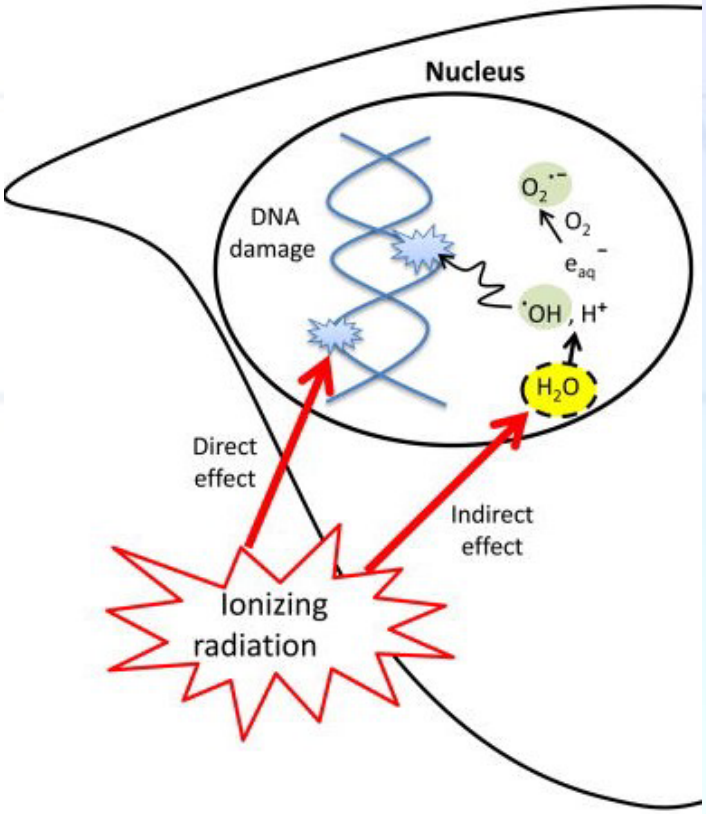
See very high DNA damage rate caused by ROS
Protection systems decrease damage enormously



http://het.sagepub.com/content/22/6/290

Burst of radiation also causes DNA damage

Direct hits damage DNA
Radiolysis of water (> 70%) makes ROS



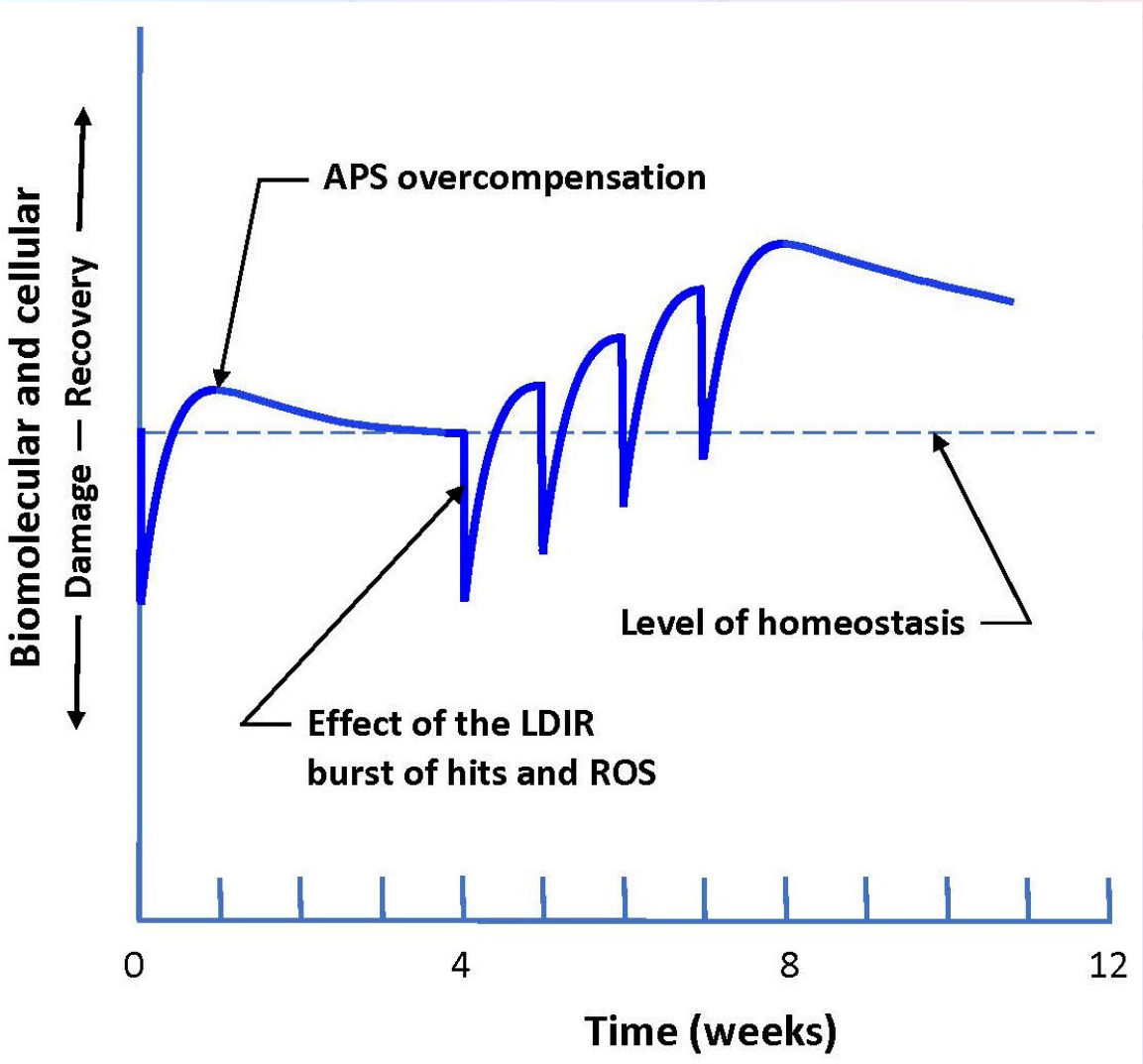
But radiation is beneficial
It stimulates the protection systems!

- The protection systems over-respond to each burst of radiation. So, the recovery is stronger and faster
- *Low* radiation doses stimulate an over-response against all damage; a dose gives a better recovery from diseases:
  - internal oxidative damage and all internal illnesses
  - external diseases: infections, toxins, injuries, etc.
- But high doses *inhibit or damage* protection systems

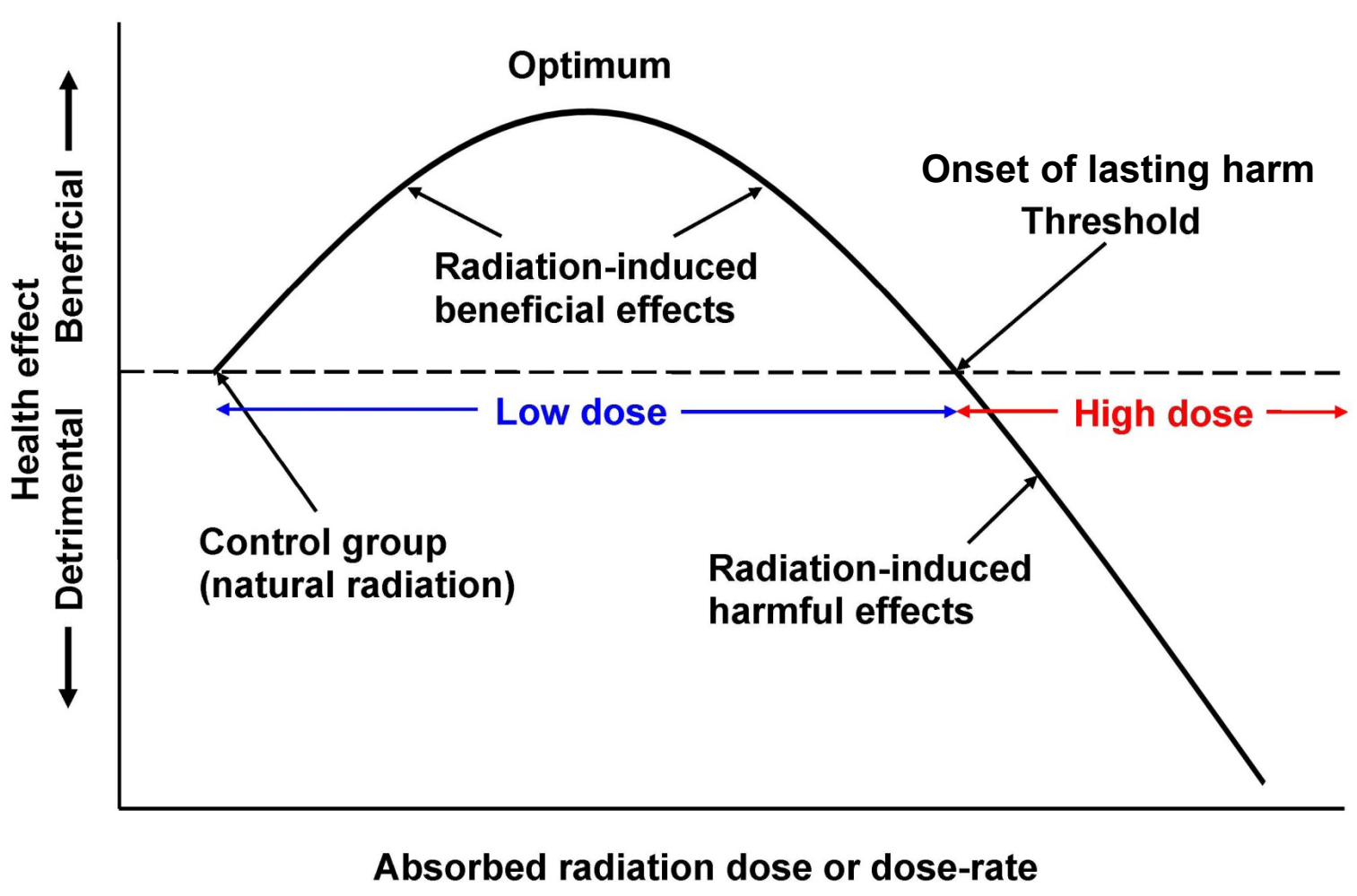
Single and repeated X-ray treatments

See over-recovery from a quick low dose

Repeat doses give larger and long-lasting recovery for diseases and injuries

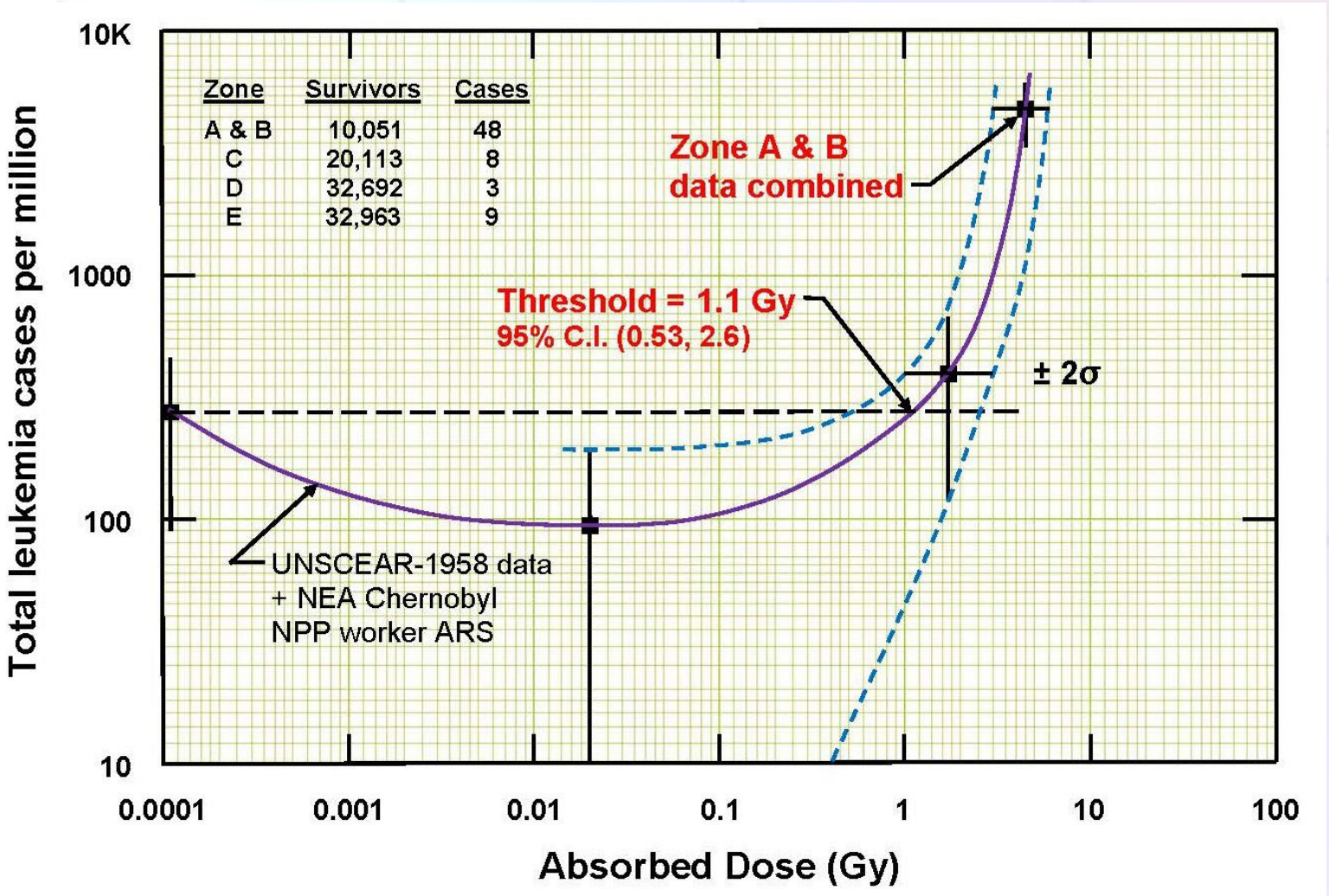


What is a low dose?



Dose-response model

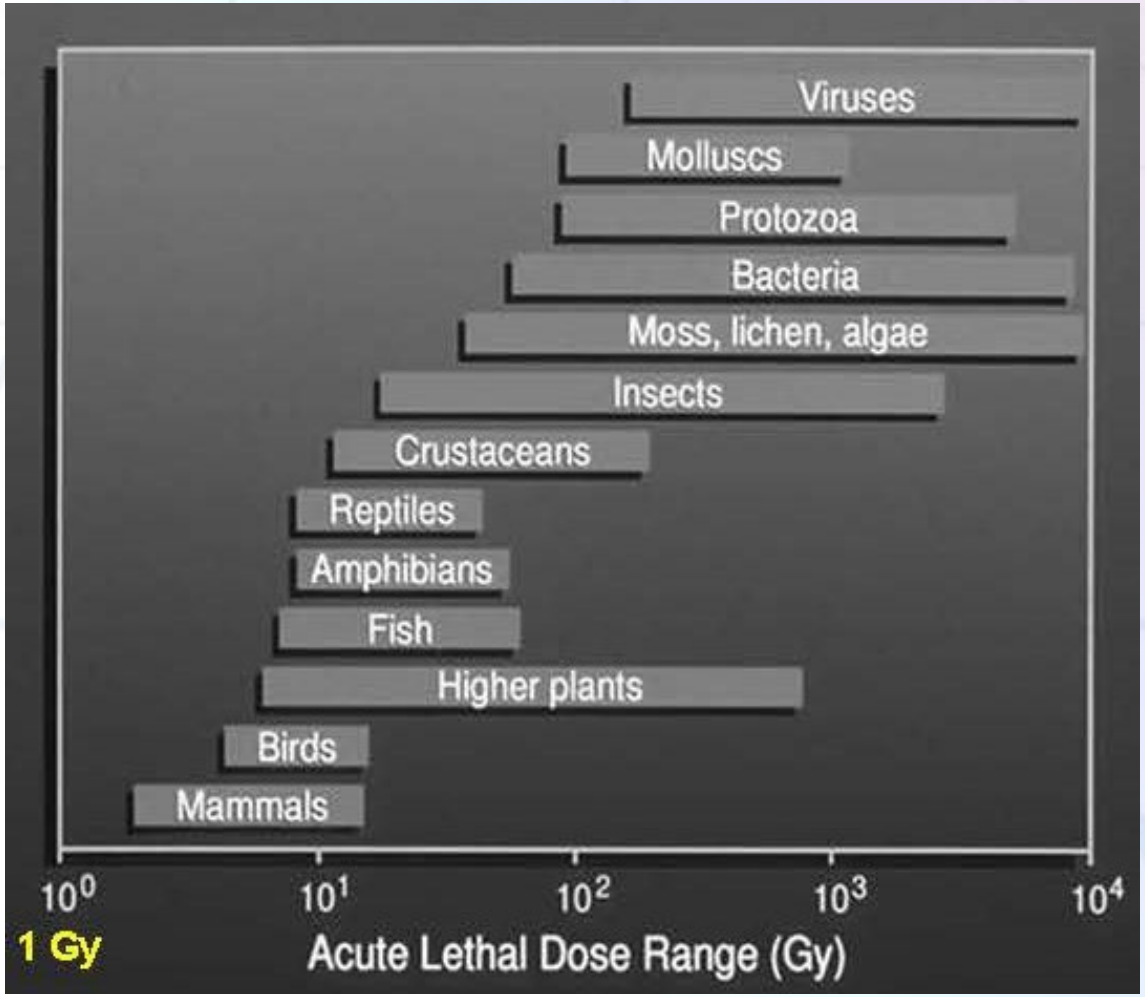
Threshold for radiation-induced leukemia after Hiroshima atomic bomb Aug 1945



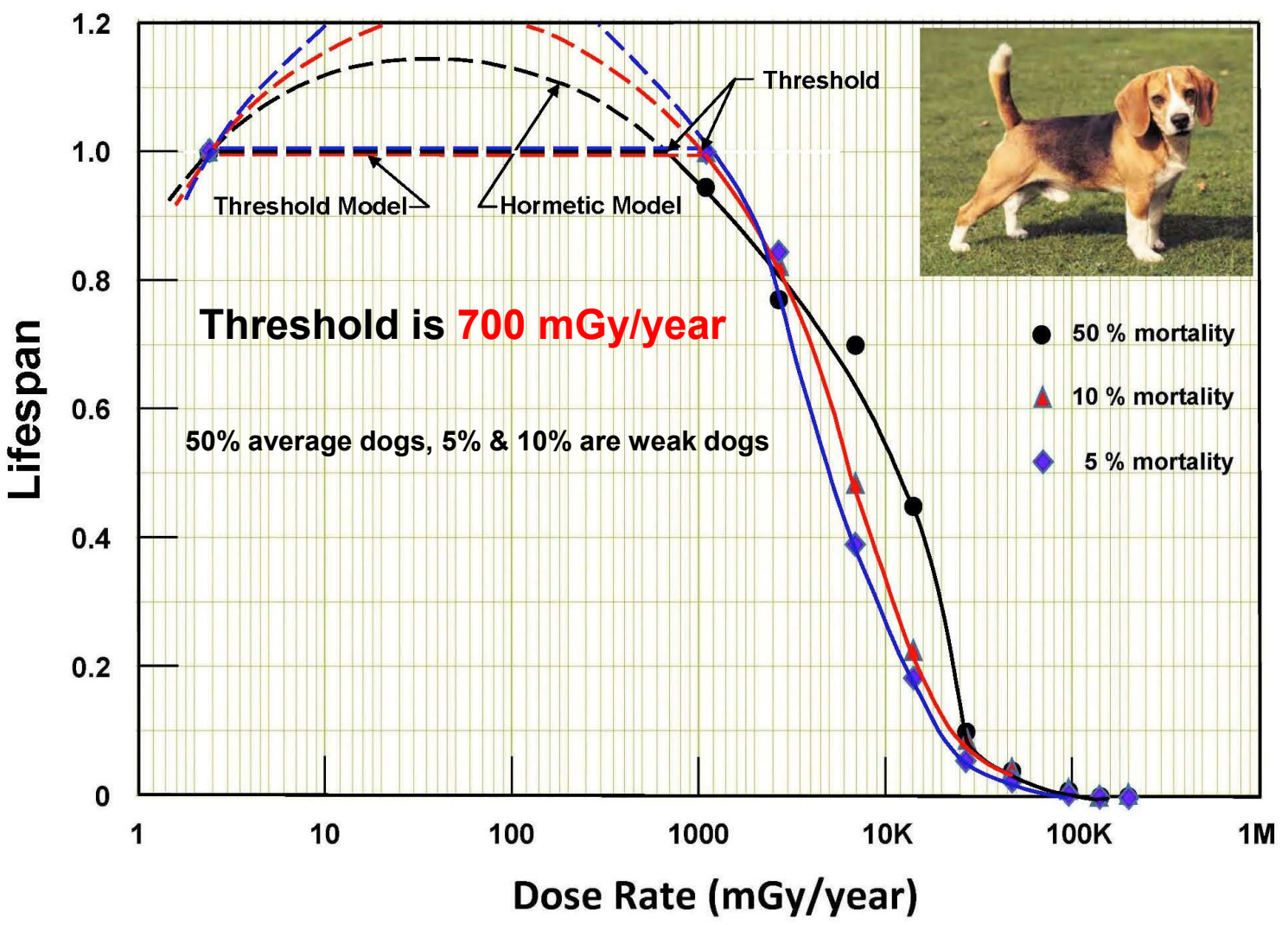
Is radiation a major cause of cancer?

- Blood-forming stem cells in bone marrow are very radiation sensitive. Leukemia threshold is 1.1 Gy
- What about cancer in cells that are less radiation sensitive? Threshold dose should be higher than 1.1 Gy
- And latencies should be longer than 5 to 12 years
- Leukemia caused in only 48 cases in 10,051 survivors located in the high radiation 3 to 6 Gy zones, A and B
- Radiation is not a major cause of cancer

Organisms tolerate a high dose of radiation



Continuous cobalt-60 exposure affects life span



Why are all people afraid of radiation?

- Fear started after Japan 1945 atomic bombs, testing, and *arms race*. Heat and blast caused most deaths, not radiation
- President Eisenhower's Atoms for Peace Speech to UN in Dec 1953 proposed nuclear energy to make electricity, power ships, etc. that use oil, coal, natural gas. Rockefeller reacted.
- Rockefeller Foundation (funded by oil) directed U.S. National Academy of Sciences to recommend LNT hypothesis in 1956
- U.S. National Committee on Radiation Protection In 1960 led world to adopt "*precautionary principle"* policy and ALARA
- Caused much fear. 60 years scientific evidence was ignored
- United States and the whole world accepted the changes
- These changes link any radiation dose to risk of mutations and cancer. This is false information. It is wrong to accept.

NAS-ATOM RAD

THE ROCKEFELLER FOUNDATION
49 West 49th Street
New York 20, N. Y.

Rockefeller Foundation asked Eisenhower for permission to study genetic effects of radiation on organisms.

February 23, 1955

Dear Mr. President:

At the most recent meeting of the Board of Trustees of The Rockefeller Foundation there was an extended and sober discussion of a matter of deep concern to you and to all thoughtful men and women, namely, the effects of atomic radiation on living organisms.

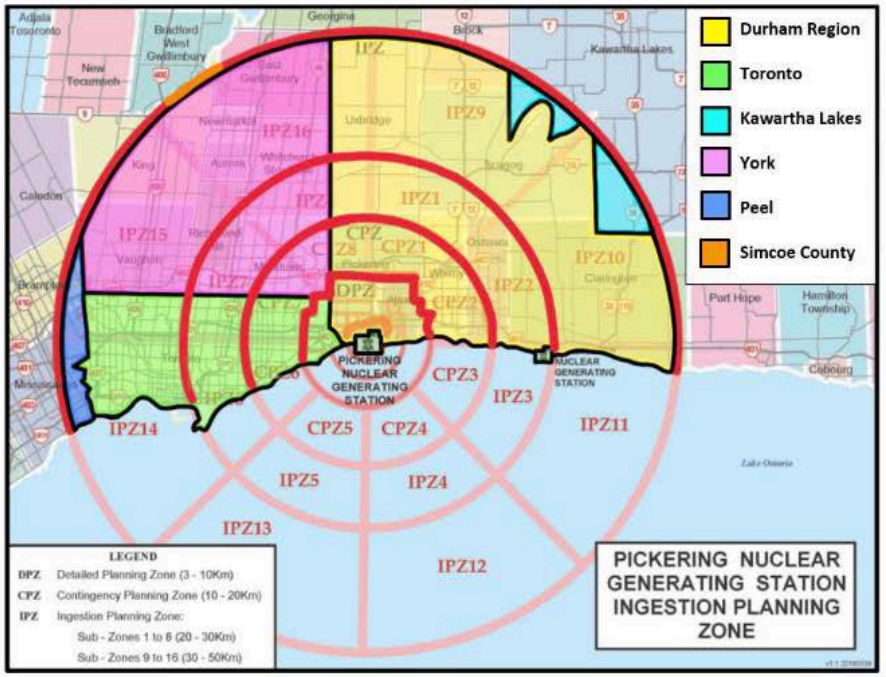
Our Emergencies Measures organizations plan to distribute iodine: Mississauga to Port Hope

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire | Canada

Commission Meeting, January 2022
CMD 22-M6.A

Ingestion Planning Zone

Ingestion Planning Zone (IPZ) for Pickering Nuclear Generating Station, and associated municipalities



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But radioiodine is not dangerous!

Study in Sweden 1988

Avg. thyroid dose 1.1 Gy

No evidence I-131 caused any cancers

Thyroid Cancer After Diagnostic Doses of Iodine-131: A Retrospective Cohort Study[1,2]

Lars-Erik Holm,[3] Kerstin E. Wiklund,[3] Göran E. Lundell,[3] N. Åke Bergman,[4] Göran Bjelkengren,[5] Ebbe S. Cederquist,[6] Ulla-Britt C. Ericsson,[5] Lars-Gunnar Larsson,[4] Monika E. Lidberg,[7] R. Sture Lindberg,[8] Harriet V. Wicklund,[9] John D. Boice, Jr.[10,11]

The incidence of thyroid cancer was evaluated in 35,074 patients examined for suspected thyroid disorders between 1951 and 1969 with an average of 1.92 megabecquerel [(MBq) 52 μCi] of ^{131}I. The radiation dose to the thyroid gland was, on the average, approximately 0.5 Gy. The mean age at the time of examination was 44 years; 5% were under age 20. Patients were followed for an average of 20 years. Record linkage with the Swedish Cancer Register identified 50 thyroid cancers occurring 5 years or more after the initial ^{131}I examination, in contrast to 39.4 expected based on general population rates [standardized incidence ratio (SIR)=1.27, 95% confidence interval = 0.94–1.67]. Risk was highest among males (SIR = 2.70, *n* = 10), patients followed 5–9 years (SIR = 2.22, *n* = 23), and patients receiving more than 74 μCi or 2.74 MBq of ^{131}I (SIR = 2.04, *n* = 17). However, these observations were confounded by the fact that patients examined for a suspected thyroid tumor received the highest ^{131}I exposures and were at highest overall risk (SIR= 2.77, *n*=34). Patients given ^{131}I for reasons other than a suspected tumor were not at increased risk (SIR = 0.62, *n* = 16). Patients anticipated to be at highest risk, i.e., women (SIR= 1.12, *n*=40) and those observed for 10 years or more (SIR= 0.93, *n*=27), showed no evidence of a dose response. Overall, these data provide little proof that ^{131}I is carcinogenic in humans and support the notion that the carcinogenic potential of internal ^{131}I beta particles might be as low as four times less than external x rays or γ rays. [J Natl Cancer Inst 1988;80:1132–1138]

persed over large areas (*1*). Iodine-131 is still used extensively in nuclear medicine, and its potential carcinogenic properties are therefore a matter of concern to both scientists and the general public.

Animal experiments indicate that internal exposures to ^{131}I beta particles are less carcinogenic than exposures to external photon radiation at high dose rates when compared rad by rad. The biological effectiveness of ^{131}I compared to x-rays may be lower at high doses but similar at low doses and low dose rates (*2*). Iodine-131 also appears to be less effective in inducing thyroidal stochastic and nonstochastic damage than the short-lived radioiodines ^{132}I, ^{133}I, and ^{135}I, which

[1]Received March 28, 1988; revised May 20, 1988; accepted June 1, 1988.
[2]Supported by Public Health Service contract CP-51034 from the National Cancer Institute, National Institutes of Health, Department of Health and Human Services; and by a grant from the National Institute of Radiation Protection, Stockholm, Sweden.
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[8]Nuclear Medicine Section, Department of General Oncology, Sahlgren's

Study in England 1999

Avg. thyroid dose 300 Gy

“Decrease in overall cancer is reassuring.”

Cancer incidence and mortality after radioiodine treatment for hyperthyroidism: a population-based cohort study

Jayne A Franklyn, Patrick Maisonneuve, Michael Sheppard, Joan Betteridge, Peter Boyle

Summary

Background Radioiodine is used increasingly as first-line treatment for hyperthyroidism, but concerns remain about subsequent risk of cancer, especially in those treated at a young age. We investigated cancer incidence and mortality in patients treated with radioiodine for hyperthyroidism.

Methods We did a population-based study in 7417 patients treated in Birmingham, UK, between 1950 and 1991. We compared details of all cancer diagnoses and deaths in 1971–91 from the UK Office for National Statistics with data on cancer incidence and mortality for England and Wales specific for age, sex, and period.

Findings During 72 073 person-years of follow-up, 634 cancer diagnoses were made, compared with an expected number of 761 (standardised incidence ratio [SIR] 0·83 [95% CI 0·77–0·90]). The relative risk of cancer mortality was also decreased (observed cancer deaths 448, expected 499; standardised mortality ratio [SMR] 0·90 [0·82–0·98]). Incidence of cancers of the pancreas, bronchus, trachea, bladder, and lymphatic and haemopoietic systems was lowered. Mortality from cancers at all these sites was also reduced but findings were significant only for bronchus and trachea. There were significant increases in incidence and mortality for cancers of the small bowel (SIR 4·81 [2·16–10·72], SMR 7·03 [3·16–15·66]) and thyroid (SIR 3·25 [1·69–6·25], SMR 2·78 [1·16–6·67]), although absolute risk of these cancers was small.

Interpretation The decrease in overall cancer incidence and mortality in those treated for hyperthyroidism with radioiodine is reassuring. The absolute risk of cancers of the small bowel and thyroid remain low, but the increased relative risk shows the need for long-term vigilance in those receiving radioiodine.

Introduction

Radioiodine is used increasingly as first-line therapy for hyperthyroidism.[1] Even though it has been used for this purpose for more than 50 years, concerns among patients and doctors remain about the subsequent risk of malignant disorders, especially among those treated at a young age.[2] These concerns have been heightened by reports of increased incidence of cancers after the Chernobyl nuclear accident, especially for thyroid cancer among children exposed at younger than 10 years to the main contaminating isotope iodine-131.[3,4]

Although there have been several studies of cancer risk in patients treated with radioiodine for hyperthyroidism, results have been conflicting. Hall and colleagues[5] studied the incidence of leukaemia in a large population of Swedish patients exposed to iodine-131 during diagnostic scanning or treatment of hyperthyroidism or thyroid cancer. No significant excess risk of leukaemia was seen, but the risk of stomach cancer increased with time and increasing dose of radioactivity.[6] Other studies that compared cancer risk in those treated by surgery and with radioiodine for hyperthyroidism[7–9] showed no difference in cancer incidence or mortality at these or other specific sites.

The small size of most studies and the low incidence of thyroid cancer has meant that an increase in thyroid-cancer incidence after radioiodine therapy has not been convincingly confirmed. By contrast, a small increase of thyroid-cancer deaths was reported in a Swedish cohort treated for hyperthyroidism,[10] and an analysis of patients treated with radioiodine in centres throughout the USA in 1946–64 also reported an increase in thyroid-cancer mortality.[11]

We investigated cancer incidence and mortality in patients treated with radioiodine for hyperthyroidism.

Patients and methods

UK study, lung cancer incidence down 40%

Site of cancer	Number of diagnoses		SIR (95% CI)	p	Number of deaths		SMR (95% CI)	p
	Observed	Expected			Observed	Expected		
Lip, oral cavity, and pharynx	5	9·0	0·55 (0·23–1·33)	0·19	2	5·4	0·37 (0·09–1·48)	0·16
Digestive organs and peritoneum								
Total	169	188	0·90 (0·77–1·04)	0·16	151	157	0·96 (0·82–1·12)	0·64
Stomach	38	39	0·97 (0·71–1·34)	0·86	39	37	1·05 (0·77–1·44)	0·76
Pancreas	11	23	0·47 (0·26–0·85)	0·01	17	24	0·72 (0·45–1·16)	0·18
Small bowel	6	1·2	4·81 (2·16–10·72)	0·0001	6	0·8	7·03 (3·16–15·66)	0·0001
Respiratory and intrathoracic organs								
Total	68	112	0·60 (0·48–0·77)	0·01	79	104	0·76 (0·61–0·95)	0·01
Bronchus and trachea	65	106	0·61 (0·48–0·78)	0·0001	78	100	0·78 (0·62–0·97)	0·03
Bone, connective tissue, skin, and breast								
Total	222	226	0·98 (0·86–1·12)	0·77	74	81	0·92 (0·73–1·15)	0·46
Breast	132	124	1·07 (0·90–1·27)	0·45	69	74	0·93 (0·74–1·18)	0·58
Genitourinary organs								
Total	97	128	0·76 (0·62–0·92)	0·006	62	78	0·80 (0·62–1·02)	0·07
Bladder	18	28	0·63 (0·40–1·00)	0·05	7	14	0·49 (0·23–1·03)	0·06
Other sites*								
Total	15	12	1·28 (0·77–2·13)	0·33	14	8·7	1·61 (0·89–2·55)	0·12
Brain	4	7·4	0·54 (0·20–1·44)	0·22	8	6·7	1·20 (0·60–2·40)	0·60
Thyroid	9	2·8	3·25 (1·69–6·25)	0·0004	5	1·8	2·78 (1·16–6·67)	0·02
Lymphatic and haemopoietic								
Total	24	39	0·61 (0·41–0·91)	0·02	25	30	0·84 (0·57–1·24)	0·38
Lymphoma	12	16	0·73 (0·41–1·28)	0·27	7	11	0·64 (0·31–1·34)	0·23
Leukaemia	10	13	0·75 (0·40–1·39)	0·36	13	11	1·17 (0·68–2·01)	0·58
All sites	634	761	0·83 (0·77–0·90)	0·0001	448	499	0·90 (0·82–0·98)	0·02

*International Classification of Diseases (ninth revision) codes 190–194, excluding 195–199 (secondary cancers).

Table 2: **Cancer diagnoses and deaths**

Thyroid is near windpipe and bronchial tubes

What about long-term health effects on the Chernobyl emergency workers?

Number of patients	Estimated dose (Gy)	Deaths during the first weeks
21	6 - 16	20
21	4 - 6	7
55	2 - 4	1
140	less than 2	0
Total 237		28

*** Used accurate biological dosimetry**

- **Of the 237 who were hospitalized, 134 were heavily irradiated, 28 died, and 106 recovered from doses in range from 1 to 6 Gy.**
- **After 19 years, 22 of 106 had died; so, mortality rate 1.09%/year, which is lower than 1.4%/year for normal Russian workers**
- **After 30 years, the deaths increased to 26. So, the mortality rate was 0.82% per year---lower still**
- **Of 26 who died, only 7 died of cancer. It is normal cancer incidence.**

Distributing iodine pills is a cancer scare

- Emergency Measures follow the 'precautionary principle' policy. The iodine pills are to stop intake of radioiodine when a severe accident happens. But I-131 does not cause cancer.
- The pills cause residents to fear reactors because of cancer risk
- Canada should inform everyone that our reactors are safe, and that radioiodine does not cause cancer. No need for iodine pills.
- Canada should inform public about study on 35,074 patients in Sweden and the study on 7414 patients in England.
- No increased cancer from I-131; actually, saw decrease in cancer
- Thyroid screening at Chernobyl detected *natural*, self-limiting "occult thyroid cancer" nodules, which are harmless.

Conclusions #1

- Emergency Measures organizations, acting by the 'precautionary principle' policy, ALARA. They are now planning to distribute iodine pills about Pickering NGS, from Mississauga to Port Hope.
- Iodine pills will start a cancer scare that will block initiatives to refurbish or replace Pickering NGS, after 50 years safe operation.
- Use of radiation in medicine has been beneficial for > 120 years. However, Rockefeller Foundation created a radiation scare from 1955-1960 to stop nuclear energy competing with oil-fired energy.
- A scare replaced safe dose threshold by linear no-threshold myth False to say radiation dose increases risk of mutation and cancer.
- Fear is supported by international consensus opinion on radiation effects on health, which is contradicted by 120 years of science.

Conclusions #2

- It's wrong to distribute iodine pills; it causes false fear of cancer
- Canada should inform public about the study on 35,074 patients in Sweden and the study on 7,414 patients in England.
- Canada should inform everyone that our reactors are safe, and that radioiodine does not cause cancer. Therefore, distribution of iodine pills is not needed; it is harmful.