8 Radiophobia

Fission is in Fashion

Fear sells

Fission power safest

Metabolism

DNA, cellular repair

Evidence, ignored by authorities

Deadly evacuations unnecessary

Radiophobia policy, NRC, EPA

Educational video, book

Confounders, controls, p-hunting


Unfounded radiation fear is the ignored elephant in the room.
https://www.2lo.co.uk/Elephant-in-the-room/

New York Times prints radiation scares.

We Are Giving Ourselves Cancer

By RITA F. REDBERG and REBECCA SMITH-BINDMAN JAN. 30, 2014

"a 2009 study from the National Cancer Institute estimates that CT scans conducted in 2007 will cause a projected 29,000 excess cancer cases and **14,500 excess deaths** over the lifetime of those exposed."

https://www.nytimes.com/2014/01/31/opinion/we-are-giving-ourselves-cancer.html

New York Times *ignores the evidence.*

Nghi Phan 2011 PhD thesis
BIOLOGICAL EFFECTS AND CANCER RISK OF COMPUTED TOMOGRAPHY

Results from this research found that low-dose diagnostic CT scans **do not increase risk and can, in fact, induce protective effects**. …

…**CT scans can increase longevity** and reduce cancer risk

https://www.researchgate.net/publication/241814041_UNDERSTANDING_THE_BIOLOGICAL_EFFECTS_AND_CANCER_RISK_OF_MEDICAL_DIAGNOSTIC_COMPUTED_TOMOGRAPHY

Radiation dose is the energy transferred to body tissue.

Example dose
X-ray mammography
2 mSv (millisievert)

= 0.002 Sievert

= 0.002 Gray (for X-rays)

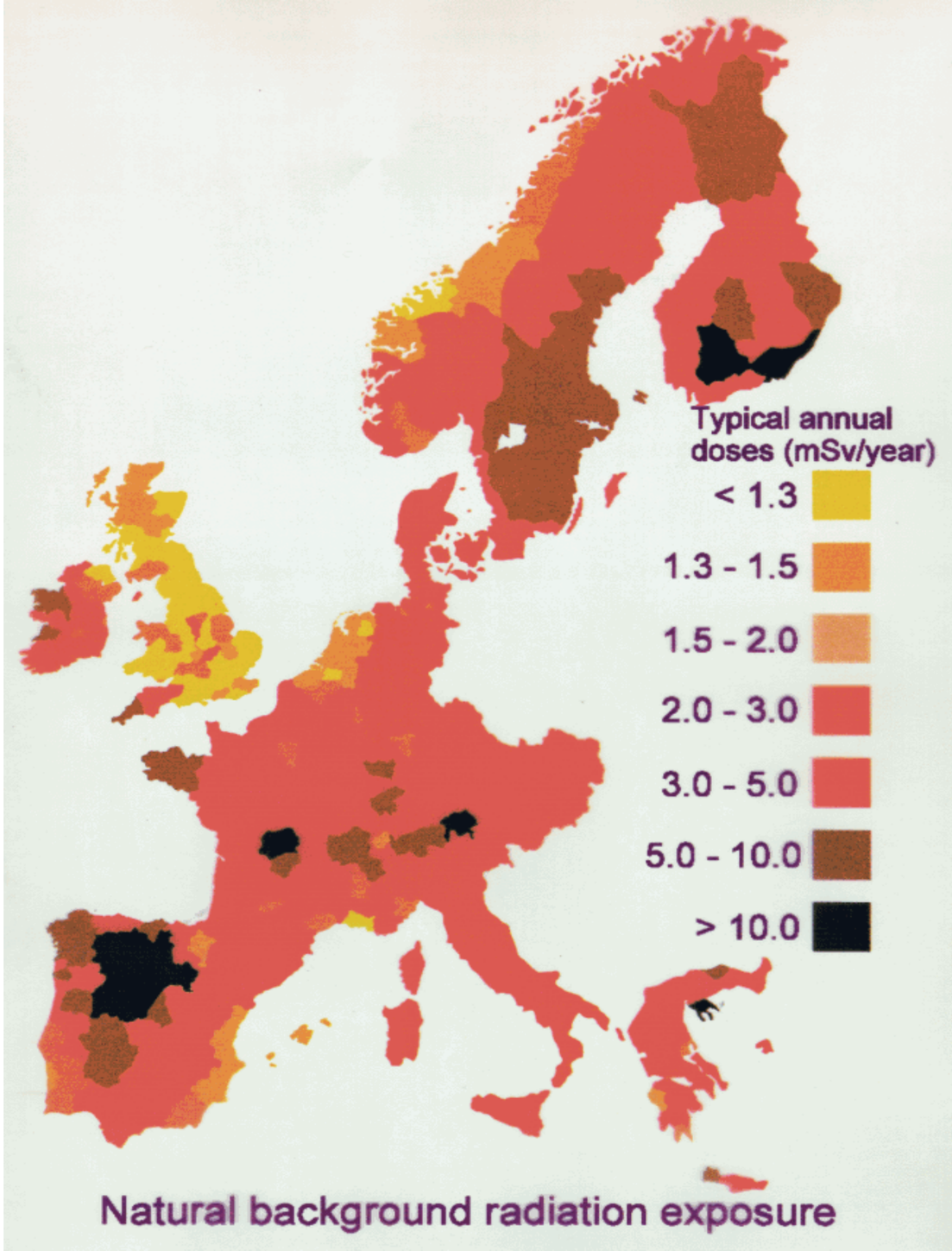
= 0.002 joule per kilogram

= 0.002 watt-second per kg

<u>Natural</u> background radiation dose rates are 1-10 mSv/year.

Sources
Radon
Cosmic rays
Food
Granite

Places	**Ave dose rate**
US	3 mSv/y
Denver	4
Finland	7



Natural background radiation exposure

Guarapari, Brazil

Radiation 45-175 mSv/a

Known locally as "Health City"

Tourists visit for "medicinal sands"

Ramsar, Iran

Radiation 250-260 mSv/a

Hot springs known as "health spas"

Low rates of lung cancer

Yangjiang, China

Radiation 5-6 mSv/a

City of 2,500,000

Lower than average rates of cancer

Cornwall, England

Radiation 6-8 mSv/a

Hotspot for holidays and surfing

Known for pasties and clotted cream

Kollam, India

Radiation 20-35 mSv/a

Occupied since ancient times

Population 45,000

Chernobyl, Ukraine

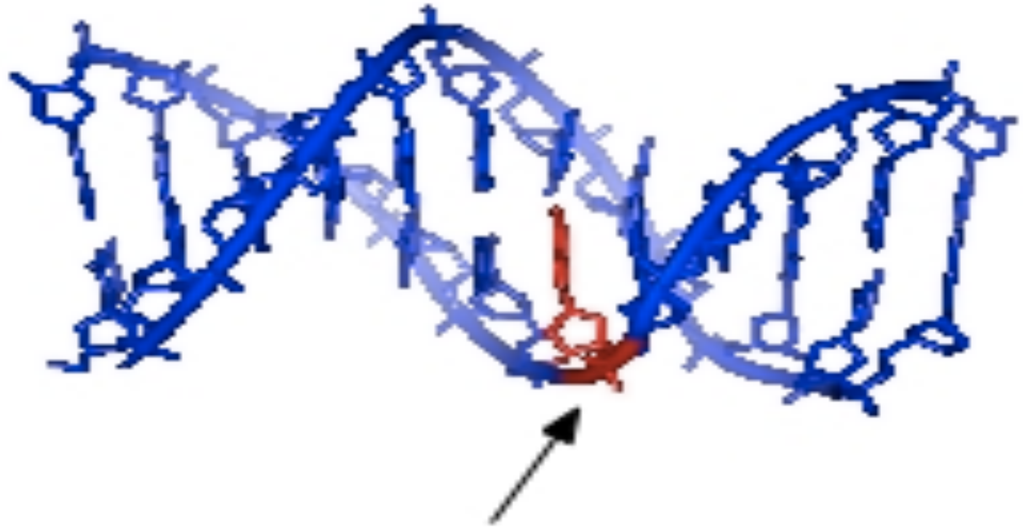
Radiation 2-8 mSv/a

"Dangerous and toxic wasteland"

"Uninhabitable for centuries"

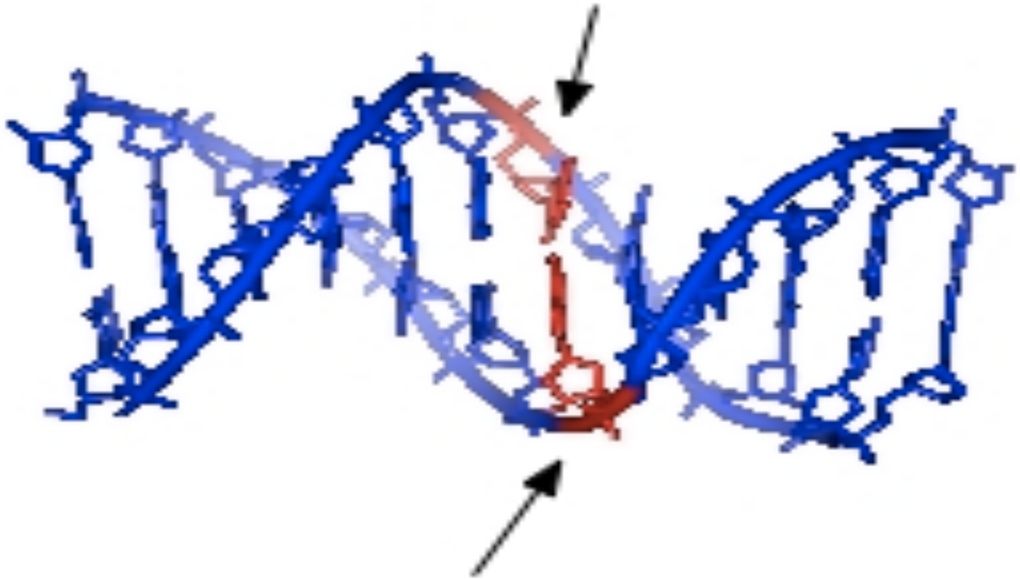
Population 500

DNA strand breaks occur frequently, by ionized oxygen molecules from metabolism.



Single strand breaks occur **10,000 times per day per cell**.

100 mSv/y radiation adds 12 per day.

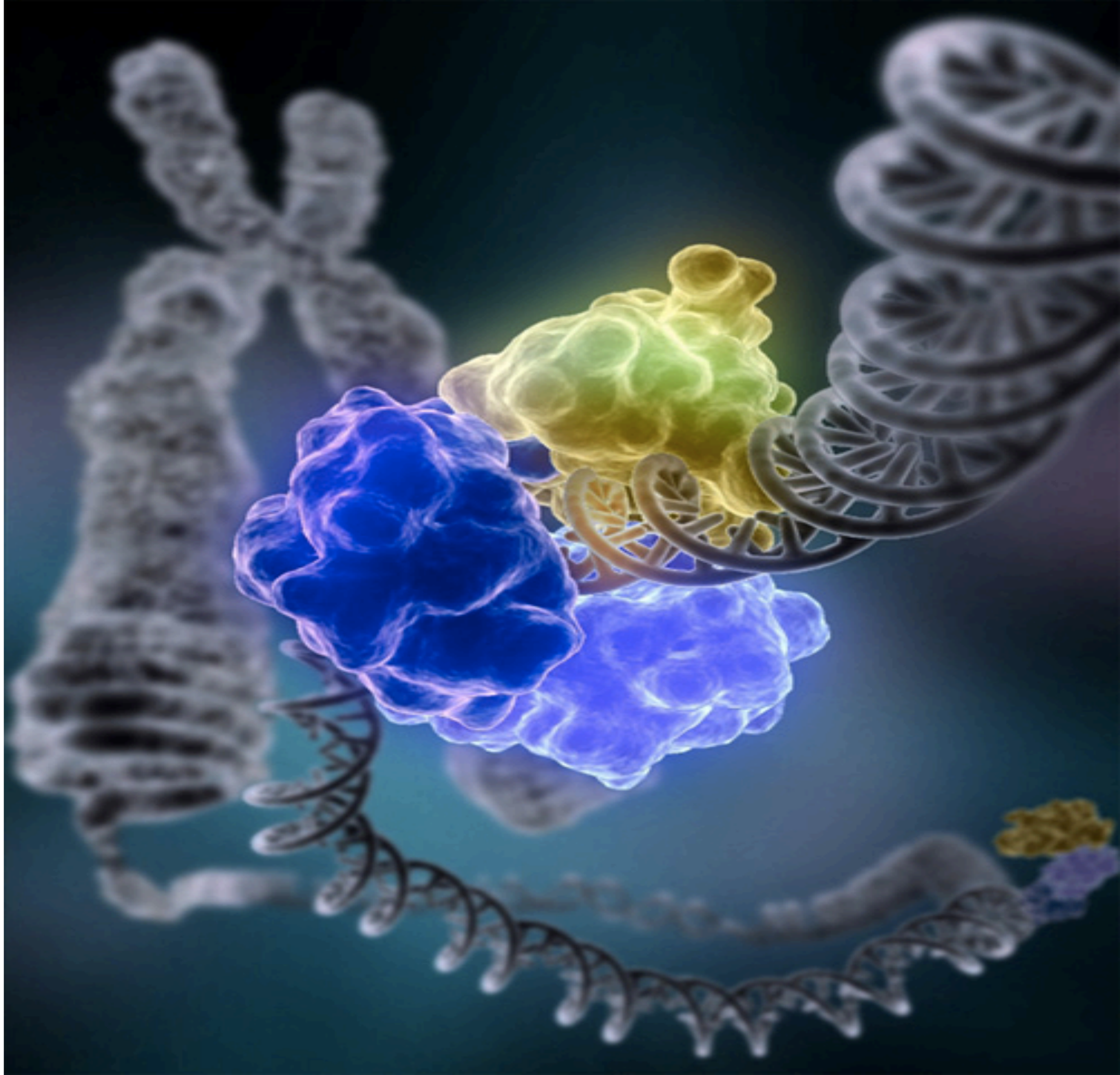


Double strand breaks occur **10 times per day per cell**.

100 mSv/y radiation adds 1 per year.

DNA is repaired.

Special enzyme DNA ligase encircles the double helix to repair a broken strand of DNA.



2015 Nobel Prize: How DNA is repaired.

Lindahl: excision ***repair*** — the cellular mechanism that repairs damaged DNA during the cell cycle.

Modrich: how cells ***correct errors*** that occur when DNA is replicated during cell division.

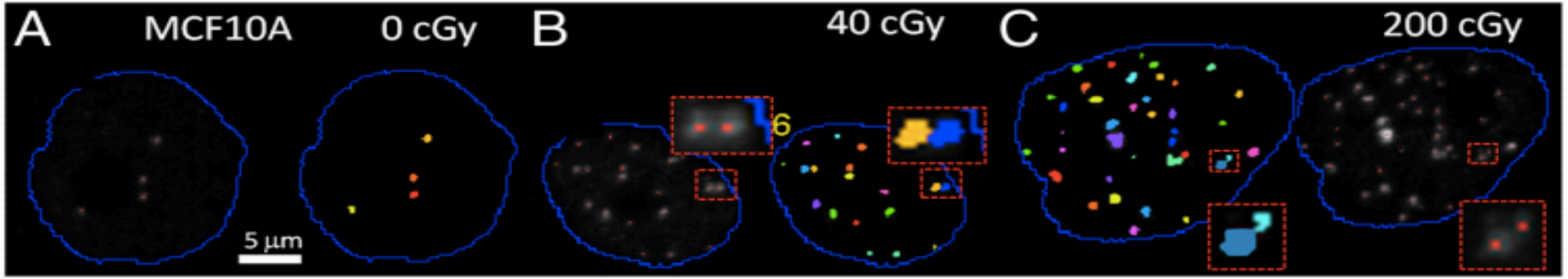
Sancar: mapping the mechanism cells use to ***repair*** ultraviolet damage to DNA.

http://www.nytimes.com/2015/10/08/science/tomas-lindahl-paul-modrich-aziz-sancarn-nobel-chemistry.html

DNA repair times are ~ 1 hour.

Evidence for formation of DNA repair centers and dose-response nonlinearity in human cells

Teresa Neumaier[a], Joel Swenson[b,c], Christopher Pham[d], Aris Polyzos[d], Alvin T. Lo[d], PoAn Yang[d], Jane Dyball[d], Aroumougame Asaithamby[e], David J. Chen[e], Mina J. Bissell[d,1], Stefan Thalhammer[a], and Sylvain V. Costes[d,1]

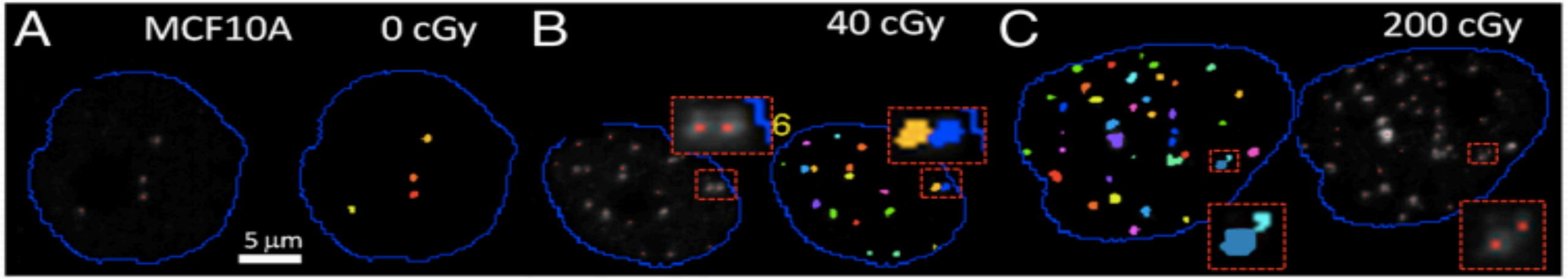


UC Berkeley pictures of DSB repair process

https://www.pnas.org/doi/10.1073/pnas.1117849108

- Bright spots are RIF's, Radiation Induced Foci, clusters of damage sensing/repair proteins.
- RIFs are repair centers for Double Strand Breaks (DSBs).

Each RIF can accurately repair ~ 1 DSB.



Observe/expect ~ 25-40 DSBs per Gy.
Study reveals RIF/Gy, repairability, decreases with radiation exposure:
100 mGy: 73 RIF/Gy
1000 mGy: 28 RIF/Gy

@ 100 mGy, get 7.3/4 RIF/Gy, >1, so repairability OK.
@1000 mGy, get 28/40 RIF/Gy, <1, so repair system overwhelmed.

Repairs are nonlinear with dose rate.

Fukushima evacuation killed 2,000 citizens.

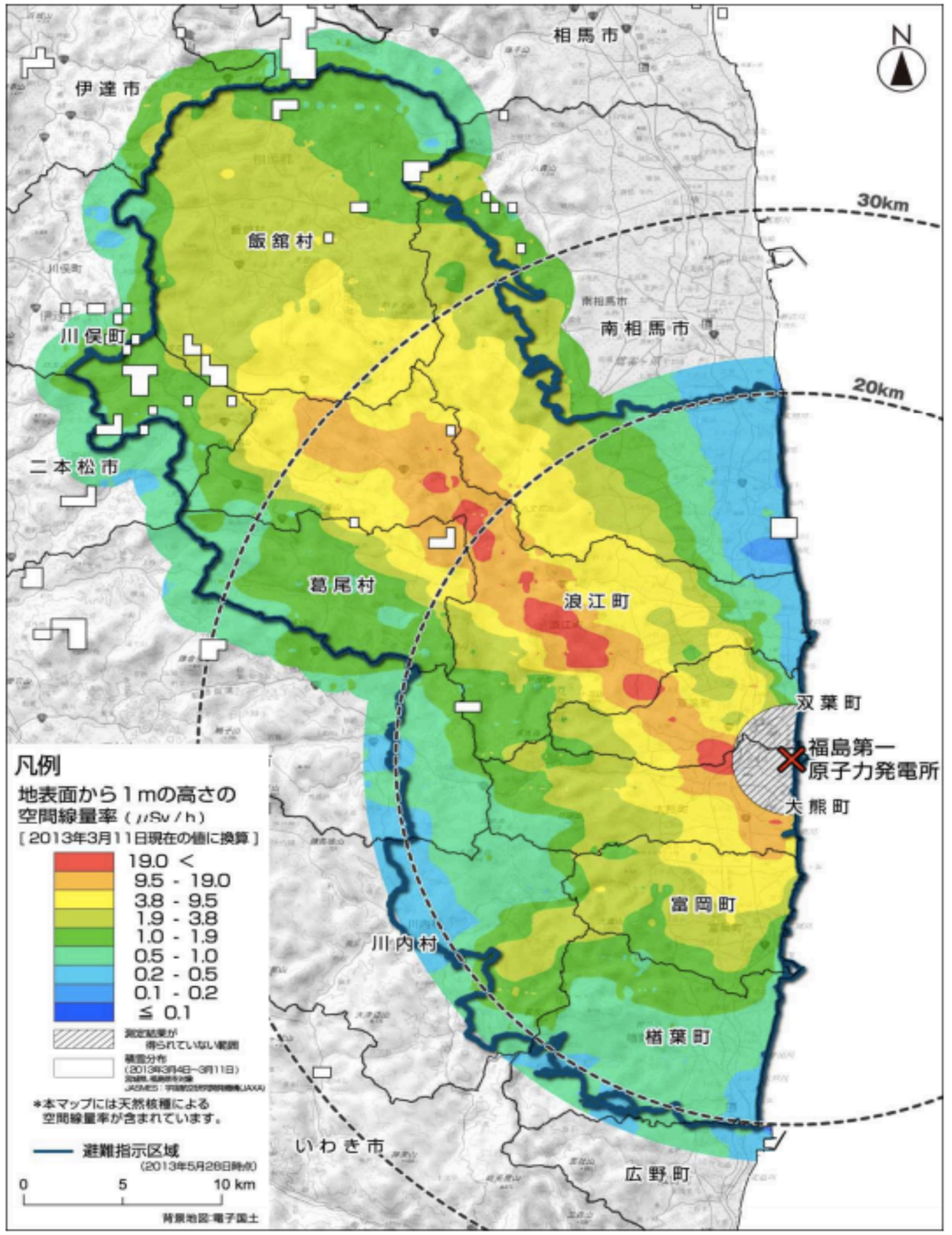
Japan evacuated the black-lined area.

IAEA published recommendation: evacuate the red area.

Evacuation was unnecessary anywhere.

No one died from radiation.

20,000 died from the tsunami.



Tritium in Fukushima water release is harmless.

1. Tritium is hydrogen with 2 neutrons.
2. Decays to He-3, releasing electron.
3. Each electron releases: **6,000 eV,** average**.**
4. Decay half-life: **12 years**.
5. Biological excretion half-life: **10 days**.
6. Cosmic rays make **15e16 Bq** per year.
7. Fukushima water: **1,000,000 Bq/L x 1e9 L**
8. Lethal dose: **8e15 Bq/kg** (in ~35g mouse).
9. Safe continuous ingestion: **4,000,000 Bq/L.**
10. US drinking water limit: **740 Bq/kg**

Tanks storing treated groundwater flowing through destroyed fission power plants at Fukushima

https://www.forbes.com/sites/jamesconca/2017/11/29/japan-should-release-tritium-contaminated-water-to-the-ocean

https://www.jstor.org/stable/3570515

‘No One Died From Radiation At Fukushima’: IAEA Boss Met With Laughter At COP26

“No one died from radiation at Fukushima,” Grossi said, **provoking laughter from the audience**.

“I don’t know why you’re laughing, it’s a fact. Thousands of people died because of the tsunami but there were no deaths attributable to exposure to radiation. People died also because of the evacuation, it was very traumatic,” he continued.

IPCC scientists’ ignorance is appalling.

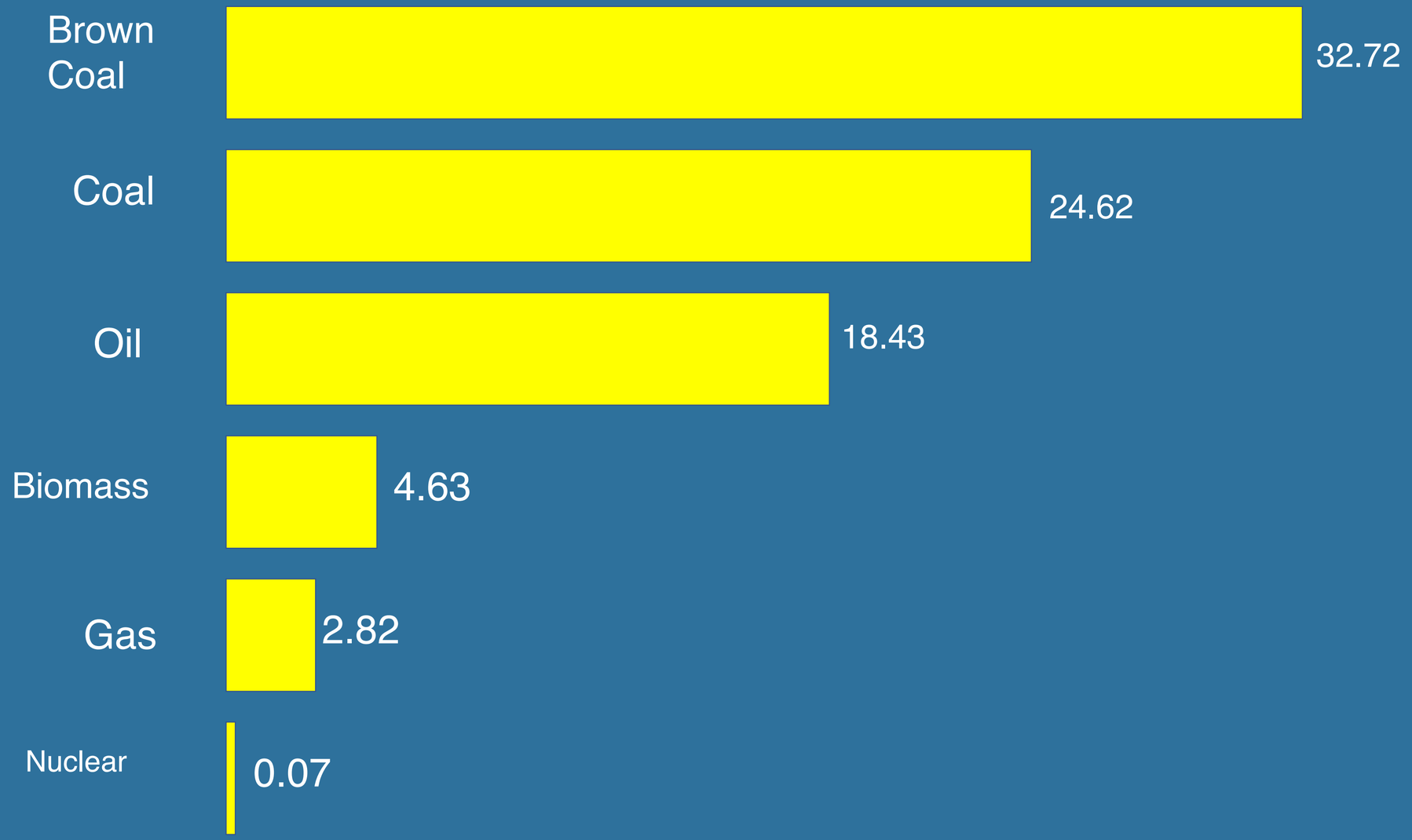
https://www.forbes.com/sites/sofialottopersio/2021/11/04/no-one-died-from-radiation-at-fukushima-iaea-boss-statement-met-with-laughter-at-cop26/?sh=697b8ba27a47

How Much Radiation Is Too Much?

Regulators have set exposure limits far too low, inspiring irrational fear of a cheap, clean energy source.

> …The Dirty Harry atomic bomb test in 1953 dropped **two to three times as much radioactive fallout** on the residents of St. George, Utah, than people near Fukushima were exposed to. There was no evacuation in Utah. People were asked to stay indoors that day; there was **no increase in cancer** rates. …

Fission power is the safest energy source.



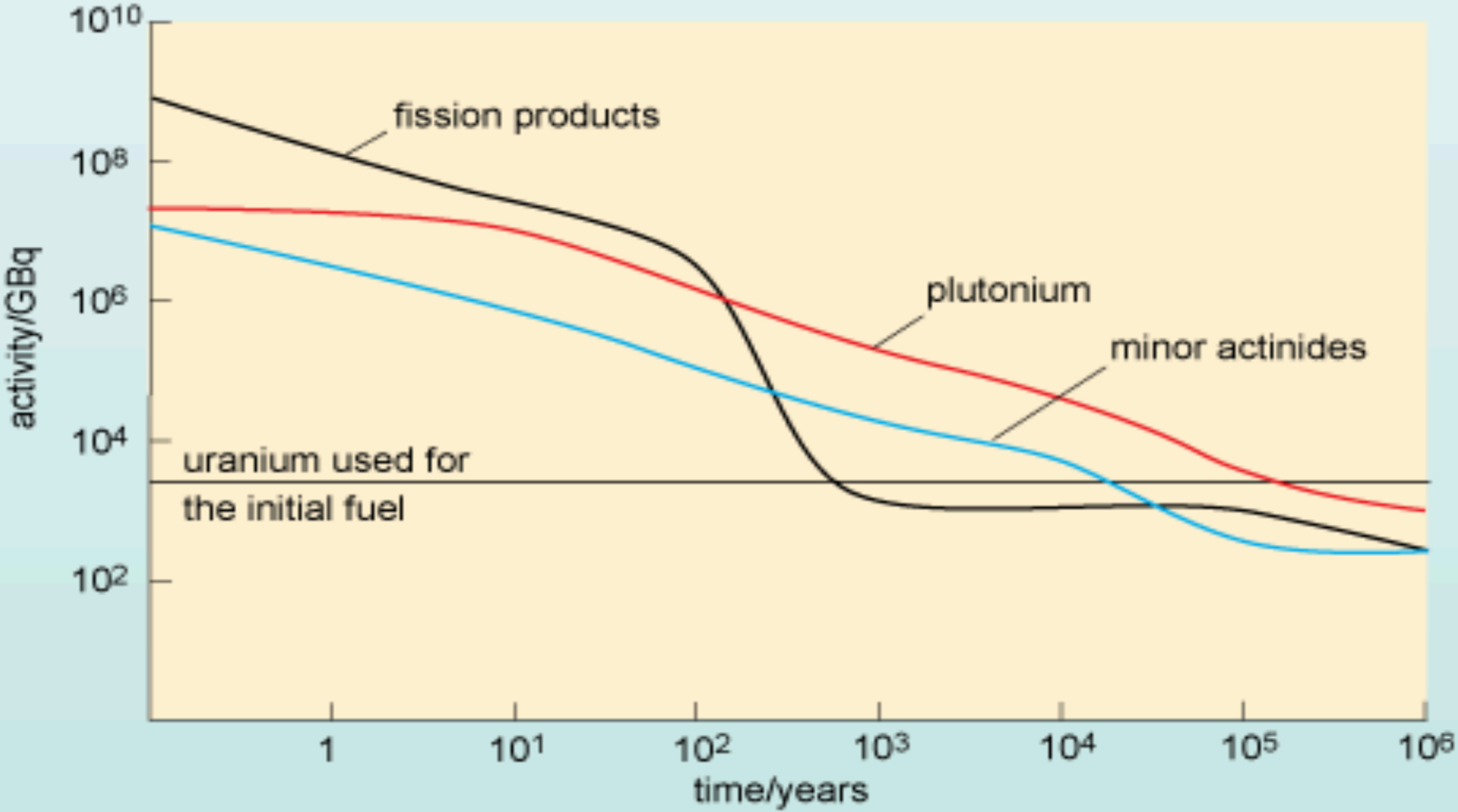
Deaths per thousand gigawatt hours

https://ourworldindata.org/energy#what-are-the-safest-sources-of-energy

Small amount of waste is easily stored.

- Dry cask storage for 28 years of 620 MW Connecticut Yankee.
- 80 GW-yrs may be stored in casks on pad for ThorCon fission energy.
- 80 GW-yrs of coal ash on that pad would reach one mile high.
- 80 GW-yrs of end-of-life solar panels on that pad would reach one mile high.

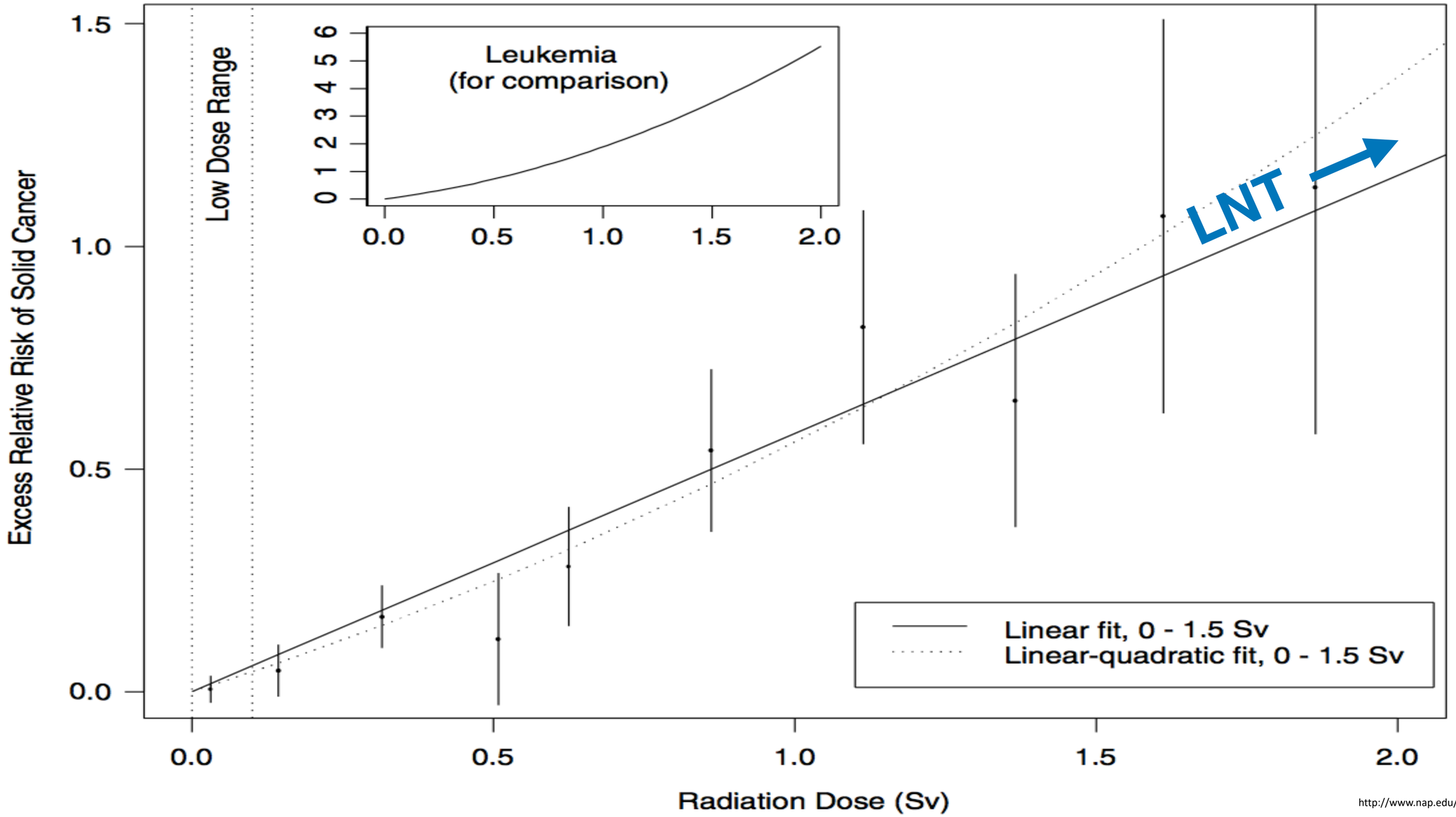
Used fuel radioactivity drops 10,000X in a few hundred years.



Jim Conca: CalTech, NASA, PNNL, WSU, LANL, ANS, Forbes…

https://www.youtube.com/watch?v=0JfJEK3R1k0

National Academy report said cancer risk is proportional to radiation dose (Linear No Threshold).

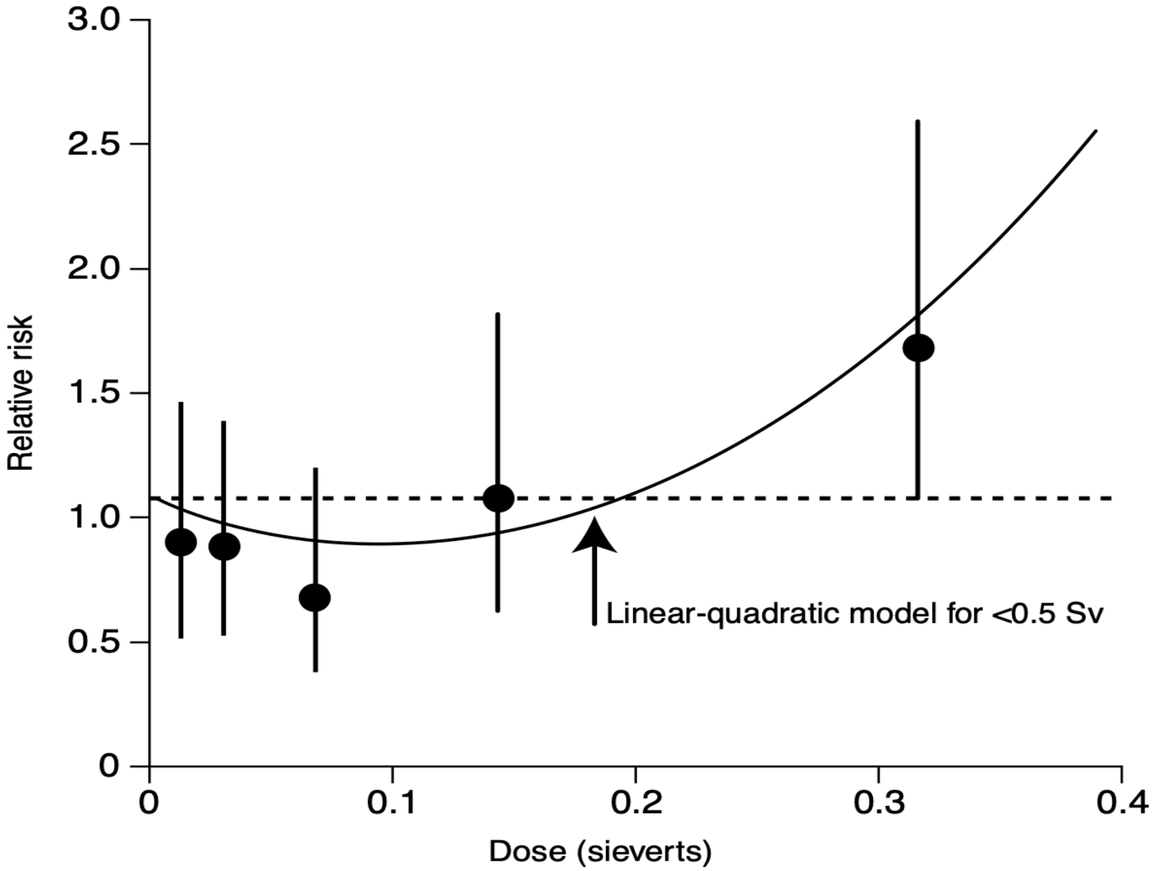


http://www.nap.edu/catalog.php?record_id=11340

National Council on Radiation Protection hides data.

FIGURE 1a

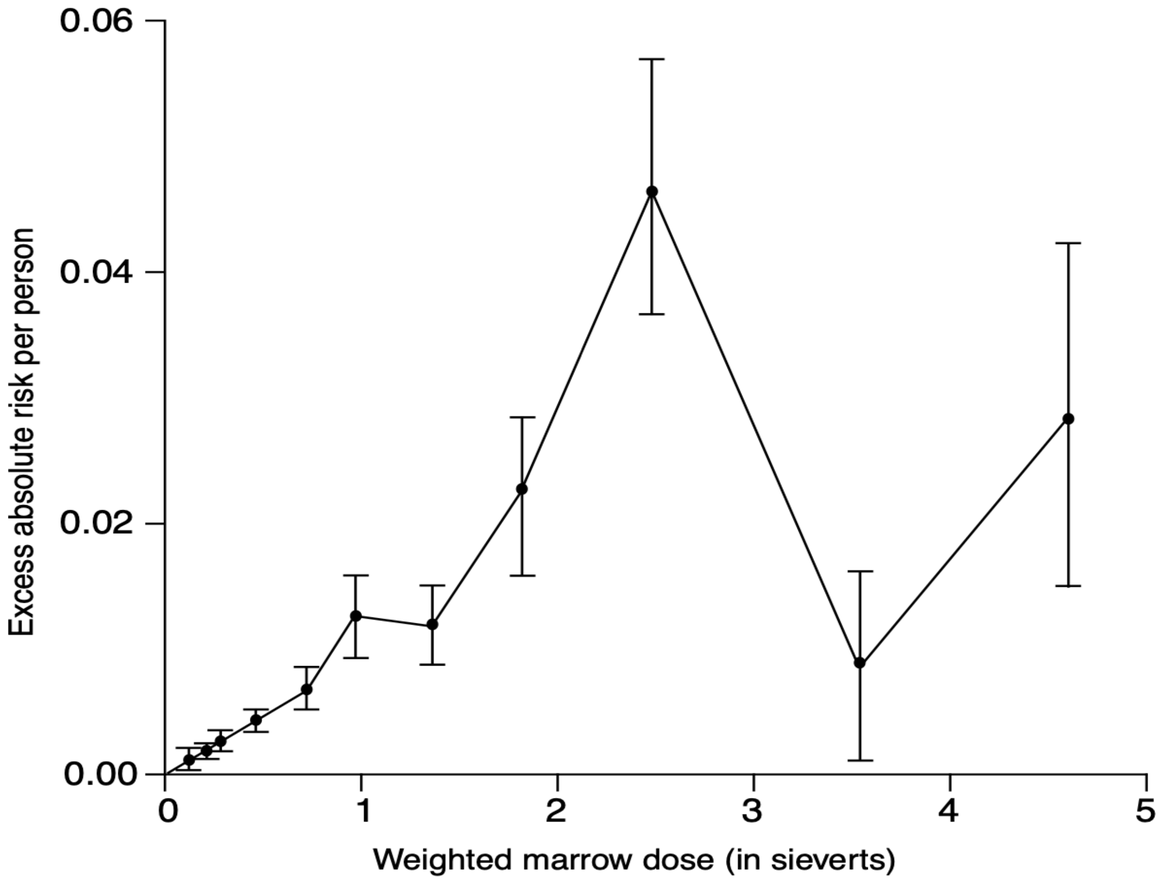
Mortality from Leukemia in Hiroshima and Nagasaki—Data as Presented by UNSCEAR



Source: UNSCEAR 1994, p. 257.

FIGURE 1b

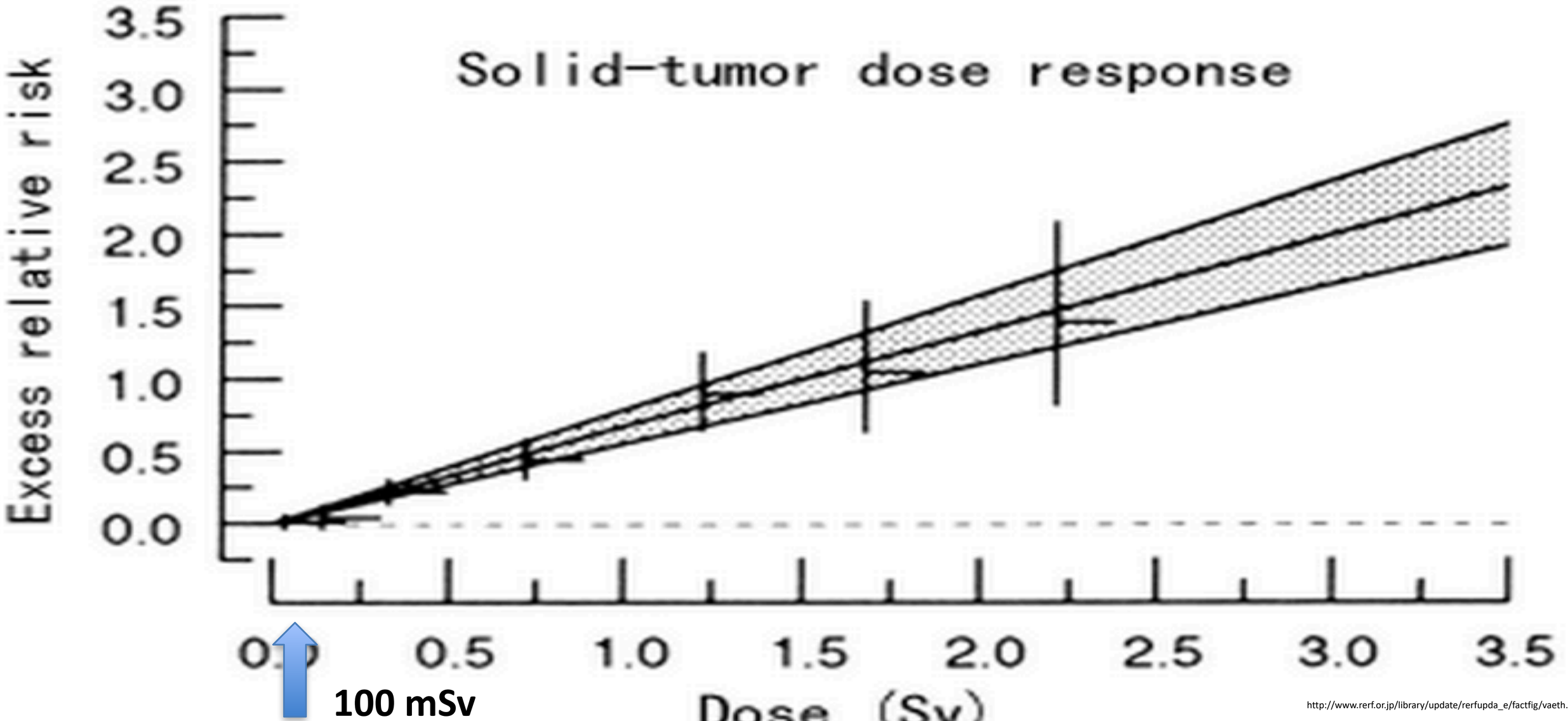
Mortality from Leukemia in Hiroshima and Nagasaki—NCRP Version of the Same Data



Source: NCRP Report No. 136, p. 146.

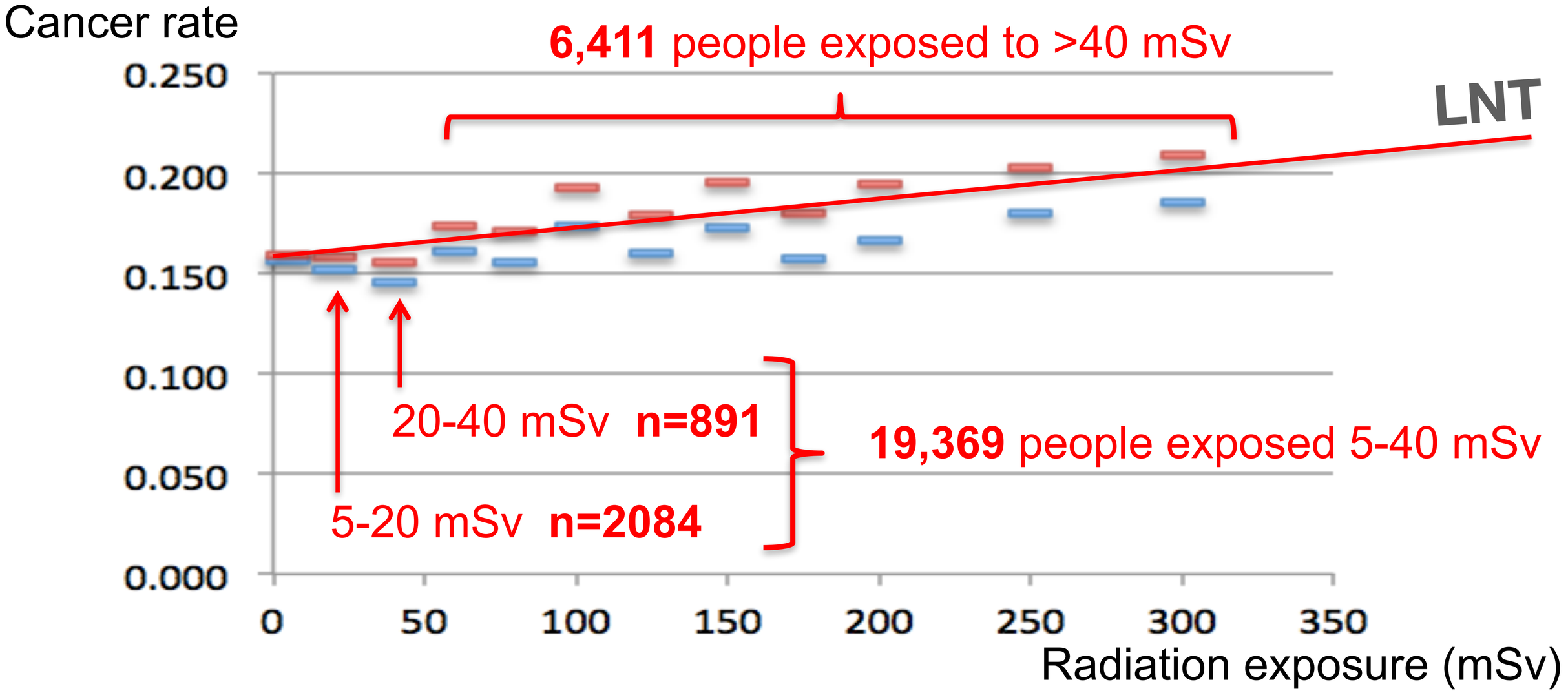
https://larouchepub.com/eiw/public/2003/eirv30n19-20030516/eirv30n19-20030516_018-problems_of_us_policy_on_radiati.pdf

Atomic bomb survivor publications do not show the details of doses < 100 mSv.

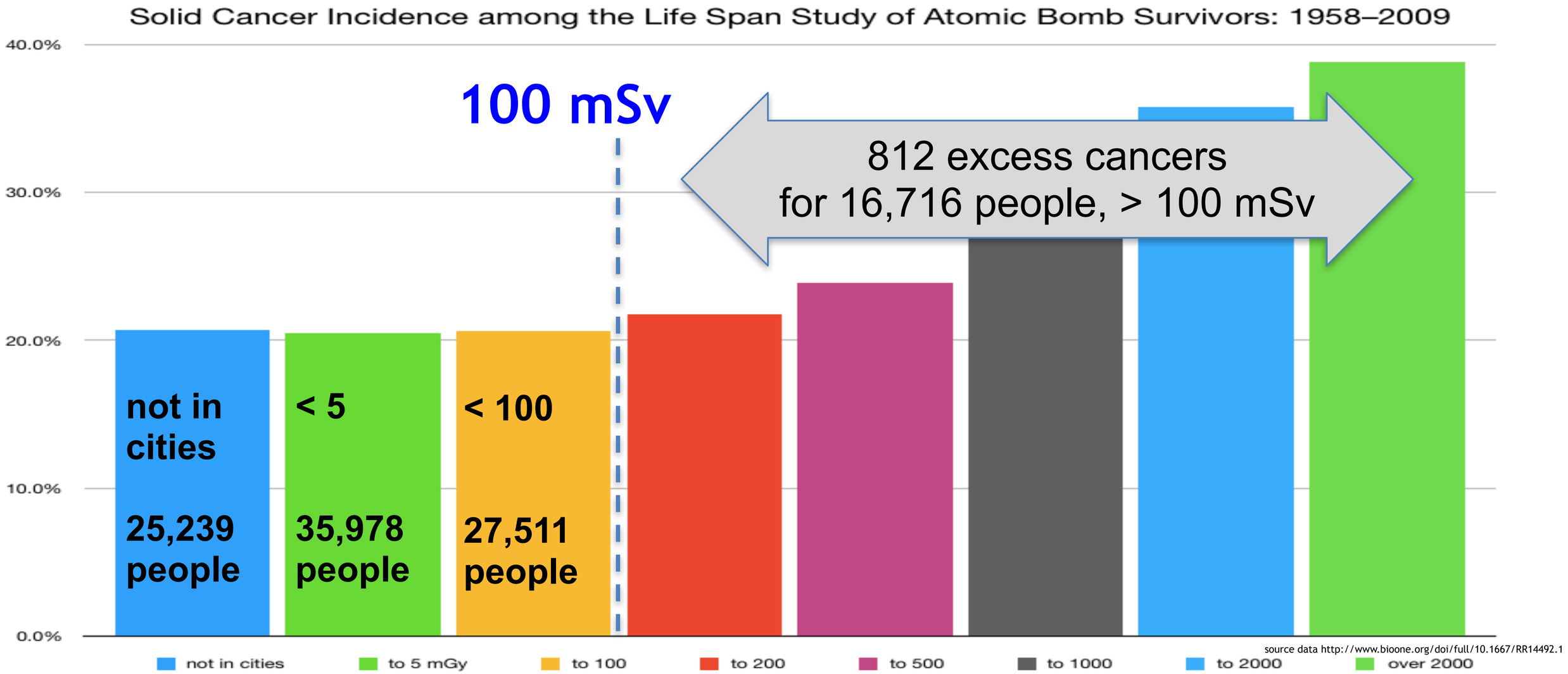


http://www.rerf.or.jp/library/update/rerfupda_e/factfig/vaeth.html

Yet the *decrease* in cancers below 40 mSv dose is significant.

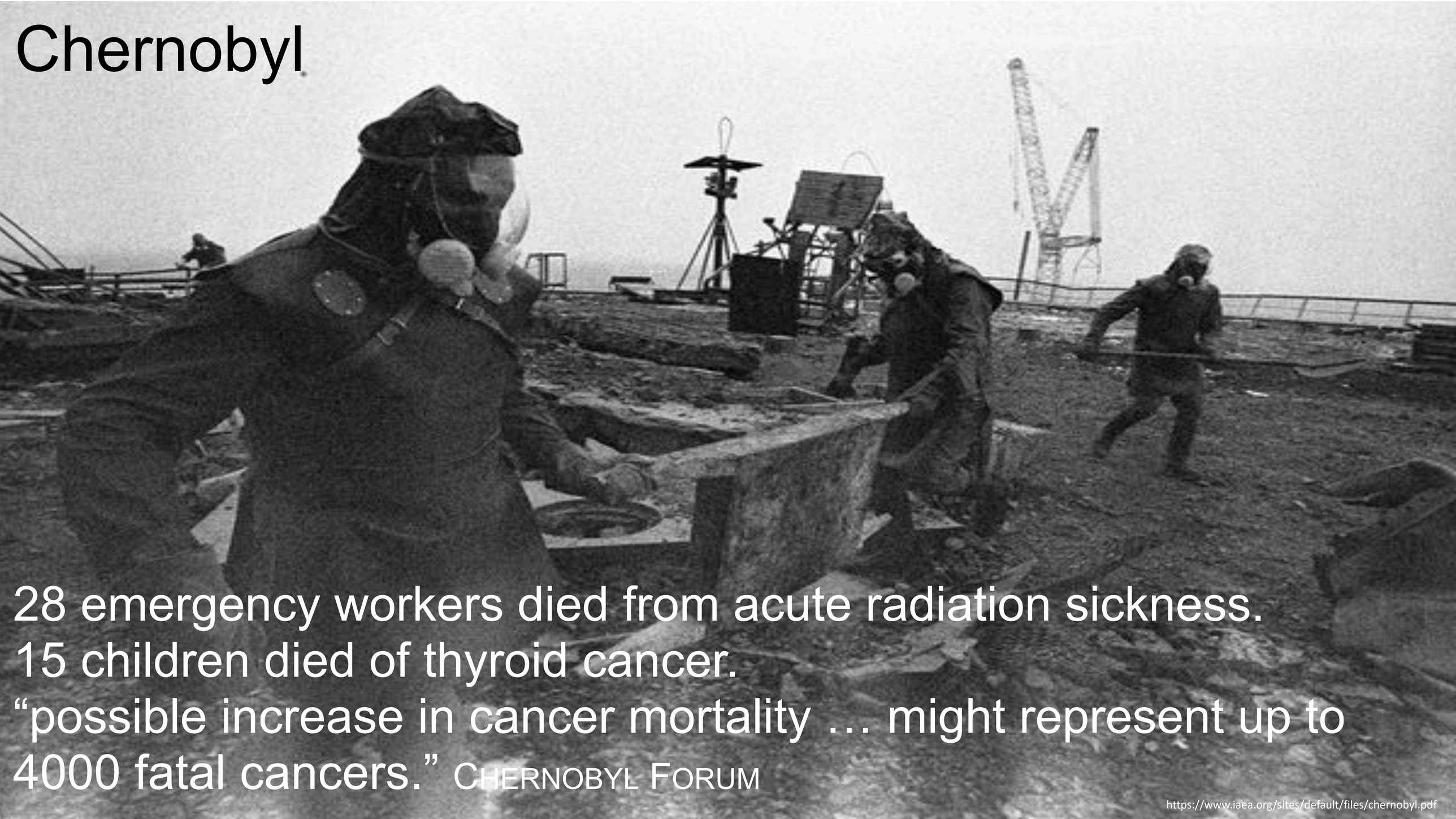


Atom bomb survivors exposures < 100 mSv caused no observed excess cancers.



source data http://www.bioone.org/doi/full/10.1667/RR14492.1

Chernobyl



28 emergency workers died from acute radiation sickness.
15 children died of thyroid cancer.
“possible increase in cancer mortality … might represent up to 4000 fatal cancers.” CHERNOBYL FORUM

https://www.iaea.org/sites/default/files/chernobyl.pdf

A rotating X-ray beam focused on cancer tissue delivers up to 80,000 mSv.

To minimize the small risk of causing cancer in nearby tissue

- radiologists divide the radiation dose into fractions
- administered daily rather than all at once

giving healthy tissue time to recover. (3 million therapies/yr)

If LNT were true, fractionated radiation therapy wouldn't work.

28,000 nuclear shipyard workers exposed to ~8 mSv had a 24% lower death rate.

- Controls - age-matched
  - job-matched

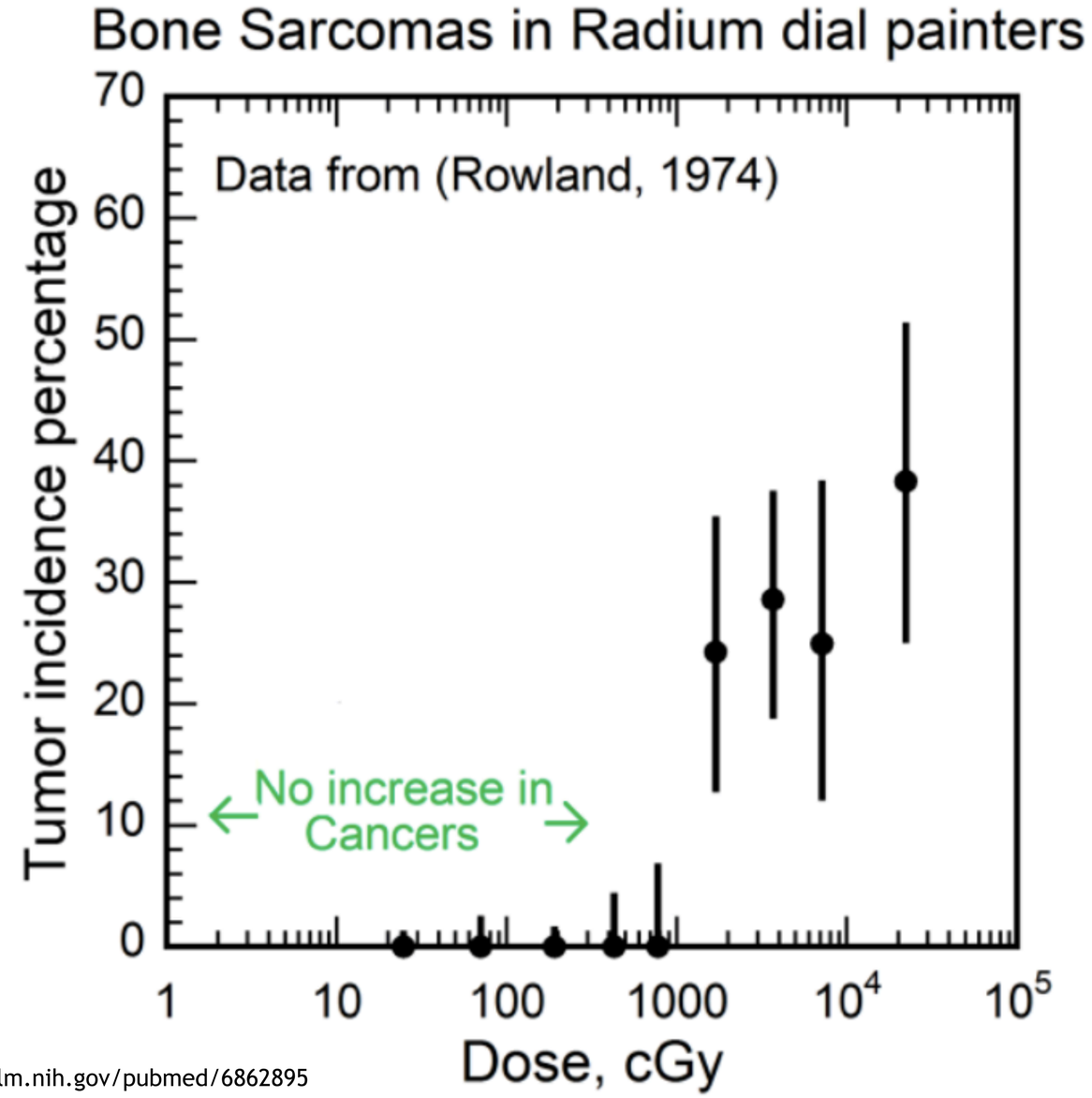
.ecolo.org/documents/documents_in_english/low-dose-NSWS-shipyard.pdf

7,271 Taiwan apartment dwellers exposed to ~48 mSv had 55 fewer cancers than 150 predicted by LNT.

http://www.ncbi.nlm.nih.gov/pubmed/17178625
http://taiwan-apt-cancer-data-analysis.blogspot.com/
http://www.ncbi.nlm.nih.gov/pubmed/18666807

Cancer site	Men			Women			All		
	Cases			Cases			Cases		
	Observed	Expected	SIR (95% CI)	Observed	Expected	SIR (95% CI)	Observed	Expected	SIR (95% CI)
All cancers	42	53.8	0.8 (0.5, 1.0)	53	60.9	0.9 (0.7, 1.1)	95	114.9	$0.8^{\dagger}$ (0.7, 1.0)
All cancers except Leukemia	36	52.0	$0.7^{\ddagger}$ (0.5, 0.9)	52	59.3	0.9 (0.7, 1.2)	88	111.6	$0.8^{\ddagger}$ (0.6, 0.9)
Solid cancers	32	50.9	$0.6^{\ddagger}$ (0.4, 0.8)	50	58.5	0.9 (0.6, 1.1)	82	109.5	$0.7^{\ddagger}$ (0.6, 0.9)

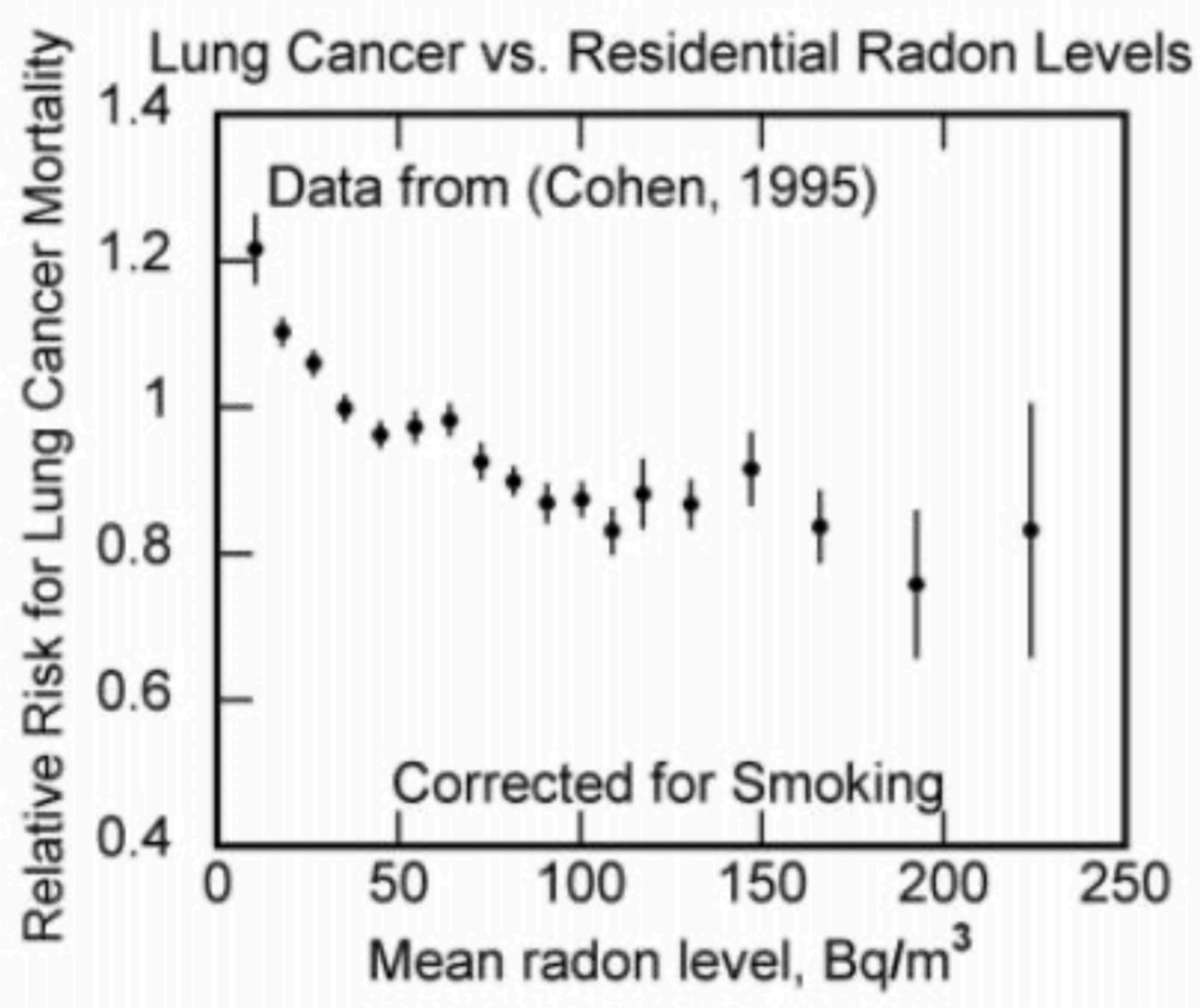
56 radium dial painters' bone sarcomas occurred at a threshold over ~ 10,000 mGy. (1412 unharmed)

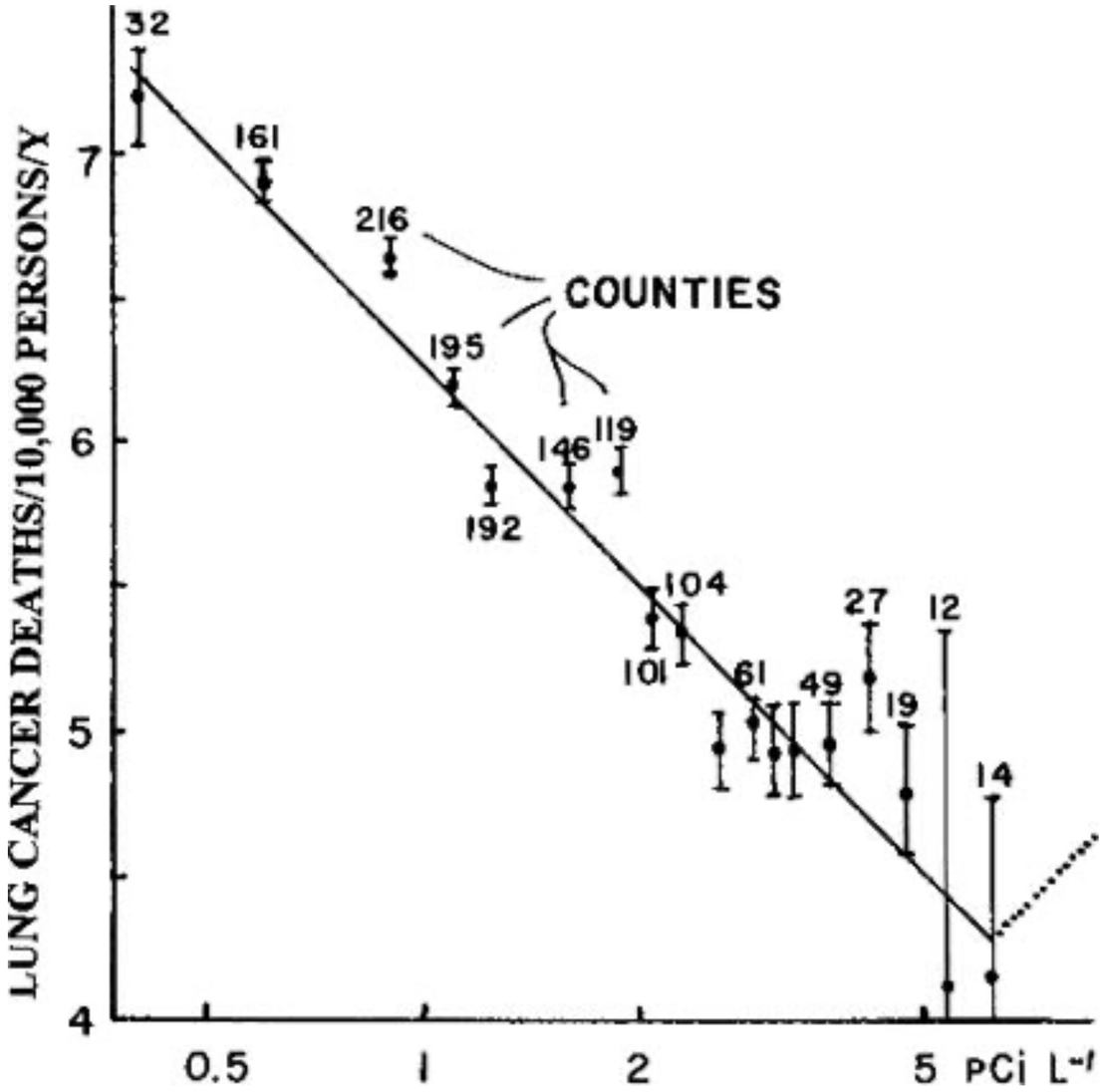


http://journals.lww.com/health-physics/Abstract/1974/11000/Radium_in_Man_.10.aspx

http://www.ncbi.nlm.nih.gov/pubmed/6862895

Lung cancer rates decrease with increasing residential radon levels.

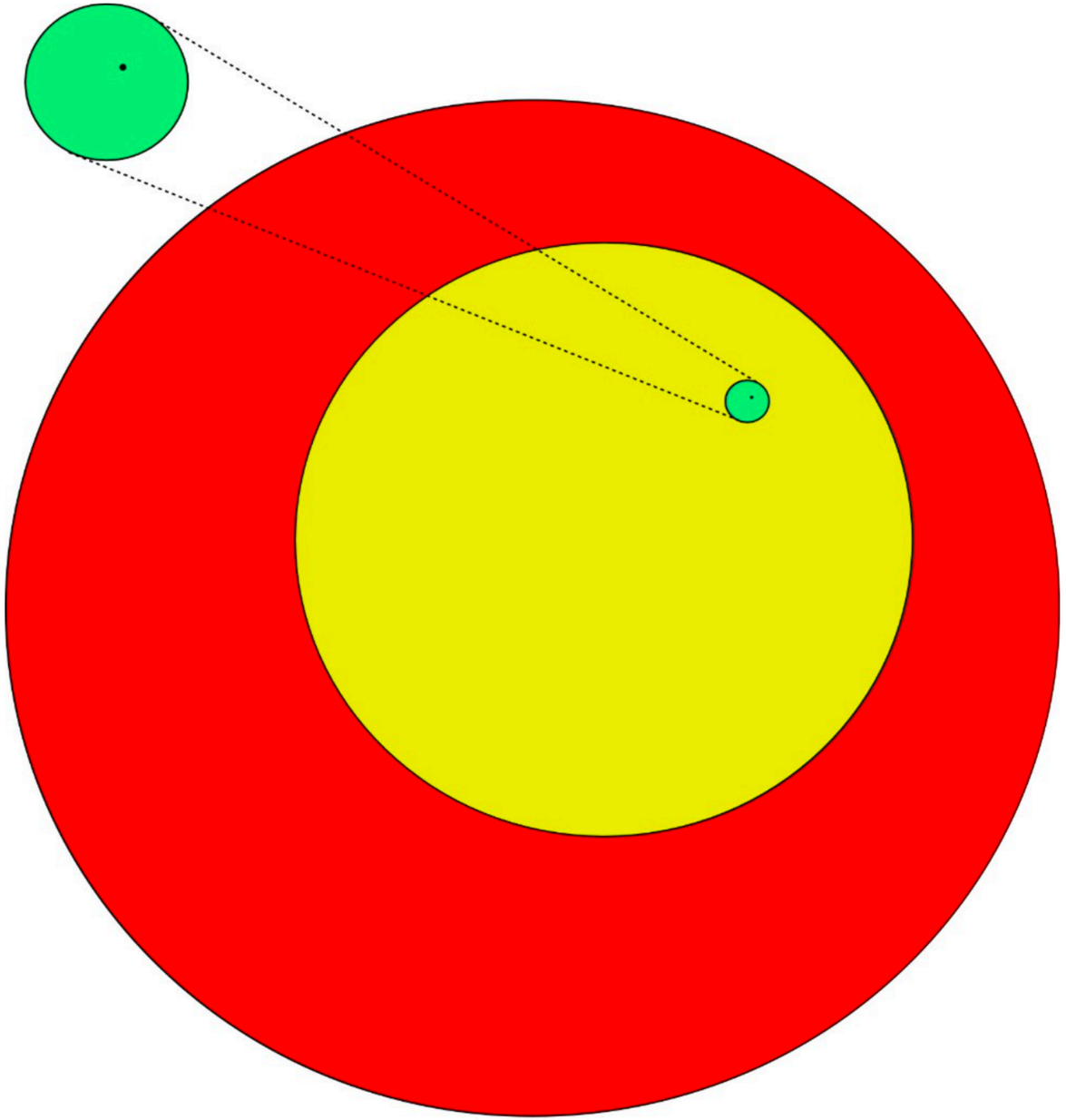




https://www.x-lnt.org/debate-announcement

https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC2477686/

What radiation exposure is safe? 100 mGy per month



Red: 80,000 mGy/mo
- deadly to cancer tumors

Yellow: 30,000 mGy/mo
- healthy tissue recovers, rarely causing second cancer

Green: 100 mGy/mo
- harmless

Black dot: < 0.08 mGy/mo
- ICRP, EPA, NRC public limit

https://www.researchgate.net/publication/311175620_Nuclear_energy_and_society_radiation_and_life_-_the_evidence_1 Wade Allison

French Academy of Sciences accepts safe threshold.

At US NRC, policy trumps science. No threshold! ALARA!

SUBJECT: REPORT OF THE FRENCH ACADEMY OF SCIENCES, "THE DOSE-EFFECT RELATIONSHIP AND ESTIMATING THE CARCINOGENIC EFFECTS OF LOW DOSES OF IONIZING RADIATION"

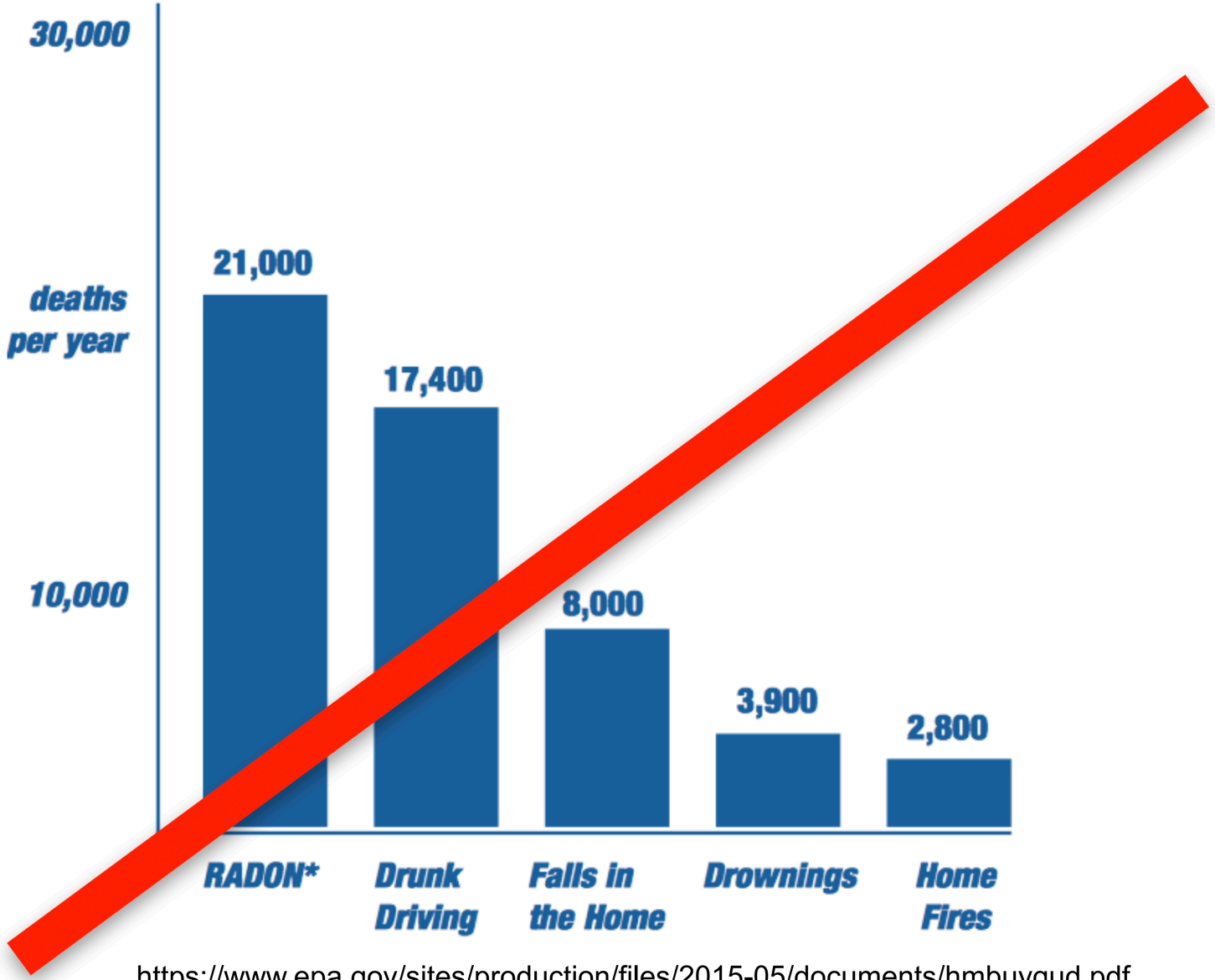
1. The French Academy of Sciences report focuses on the radiobiological science and does not try to interpret these results in a policy context. In contrast, the BEIR VII report

3. The French Academy report, based on current data, raises doubts about the validity of using the LNT theory to estimate carcinogenic risks at doses less than 10 rem (< 100 mSv) and is even more skeptical of such estimates at doses less than 1 rem (< 10 mSv).

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, DC 20555 - 0001

https://www.nrc.gov/docs/ML0701/ML070160572.pdf

Ignoring science, with no observed evidence, EPA claims radon deaths exceed those from drunk driving.



EPA recommends radon testing and remediation if radioactivity exceeds 4 pico-curies per liter of air.
= 0.15 Bq/liter, 20 mSv/yr
1 Bq = 1 decay/sec

Note: humans are naturally slightly radioactive at about 2,700 pico-curies per liter.
= 100 Bq/liter

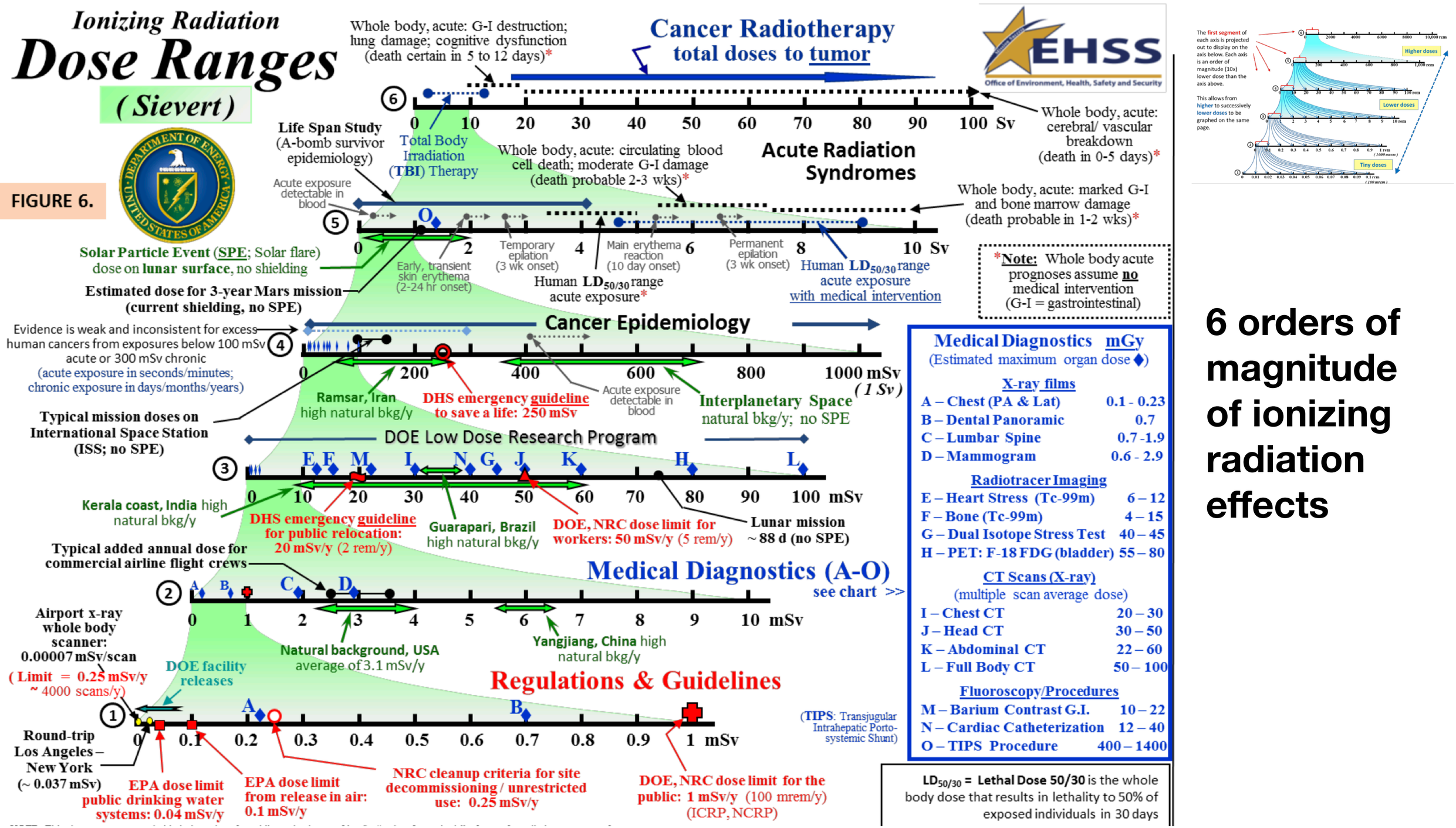
https://www.epa.gov/sites/production/files/2015-05/documents/hmbuygud.pdf

https://hps.org/publicinformation/ate/q11963.html

Ionizing Radiation Dose Ranges

(Sievert)

FIGURE 6.



6 orders of magnitude of ionizing radiation effects

https://www.energy.gov/sites/prod/files/2018/01/f46/doe-ionizing-radiation-dose-ranges-jan-2018.pdf

Excerpts from 2015 petition to end LNT *2022: denied!*

There has **never been scientifically valid support for this LNT hypothesis** since its use was recommended by the U.S. National Academy of Sciences Committee on Biological Effects of Atomic Radiation (BEAR I)/Genetics Panel in 1956. The **costs of complying with these LNT- based regulations are enormous.** Prof. Dr. Gunnar Walinder has summed it up: "**The LNT is the greatest scientific scandal of the 20th century.**"

Regulators use the LNT assumption because nationally and internationally respected bodies recommend and advocate it. NCRP, ICRP, IAEA, and NAS-NRC's BEIR Committee come to mind. However, they appear to have lost their sheen of expertise and appear mostly committed to maintaining the status quo. **An army of regulators at NRC, EPA, FDA, as well as DOE, would be unbudgeted if the LNT disappeared.** In addition, there are politicians whose anti-nuclear stand gets them votes.

I am not talking about a few **scientific papers that show that the LNT model is in error. We are talking about thousands**. There are a couple of textbooks in this field, and journals that publish scientific findings that refute the LNT model. This is a **whole field of science that regulators pretend does not exist.** The attitude of today's regulators is reminiscent of the Catholic Church at the time of Galileo.

https://issuu.com/johna.shanahan/docs/150209_nrc_petition_to_end_lnt_and_

Consequence: US NRC certification of an advanced reactor design costs $1 billion.

"It is a multi-decade process, with costs up to $1 billion to $2 billion, to design and certify or license the reactor design, … "

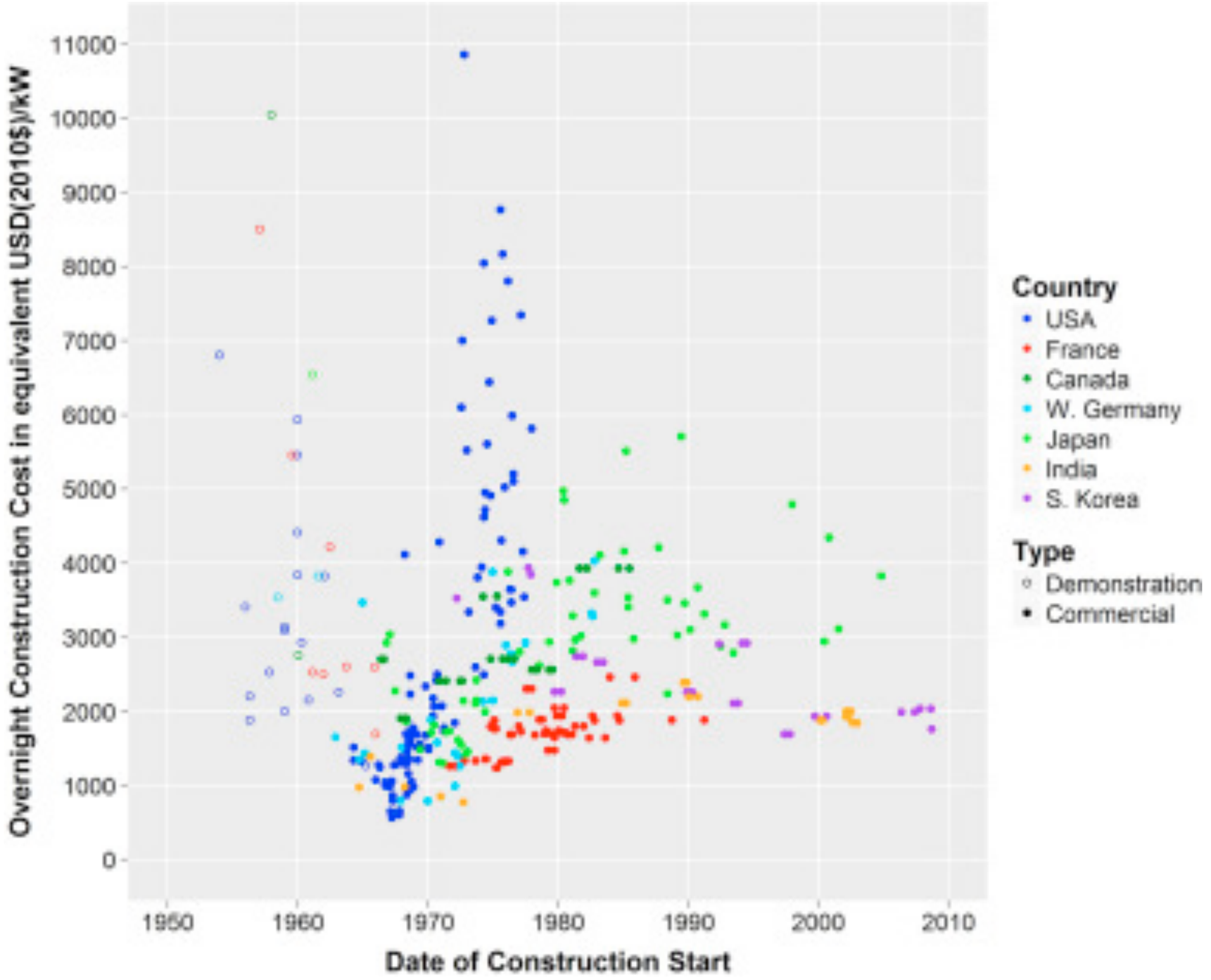
GAO, July 2015

…and then you may be allowed to build and test it.

<u>Consequence</u>: Fission power plants became too expensive in the US.

$2/W --> $11/W

- regulation
- inexperience
- delays



https://www.sciencedirect.com/science/article/pii/S0301421516300106

Bad science is decried by editors.

"The case against science is straightforward: **much of the scientific literature, perhaps half, may simply be untrue**. Afflicted by studies with small sample sizes, tiny effects, invalid exploratory analyses, and flagrant conflicts of interest, together with an obsession for pursuing fashionable trends of dubious importance, science has taken a turn towards darkness."

Richard Horton, Lancet editor

"It is simply **no longer possible to believe much of the clinical research that is published**, or to rely on the judgment of trusted physicians or authoritative medical guidelines. I take no pleasure in this conclusion, which I reached slowly and reluctantly over my two decades as an editor of the New England Journal of Medicine"

Marcia Angell, New England Journal of Medicine editor

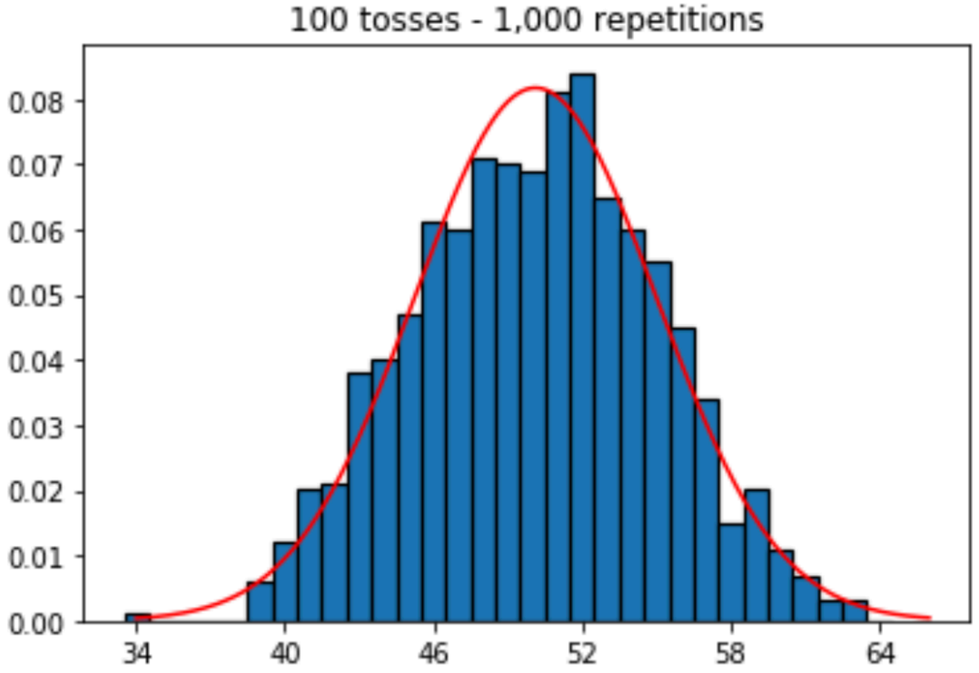
For the **great enemy of the truth** is very often not the lie—deliberate, contrived, and dishonest—but the myth—persistent, persuasive, and unrealistic. Too often we hold fast to the clichés of our forebears. We subject all facts to a prefabricated set of interpretations. We enjoy the comfort of opinion without the discomfort of thought. (1966)

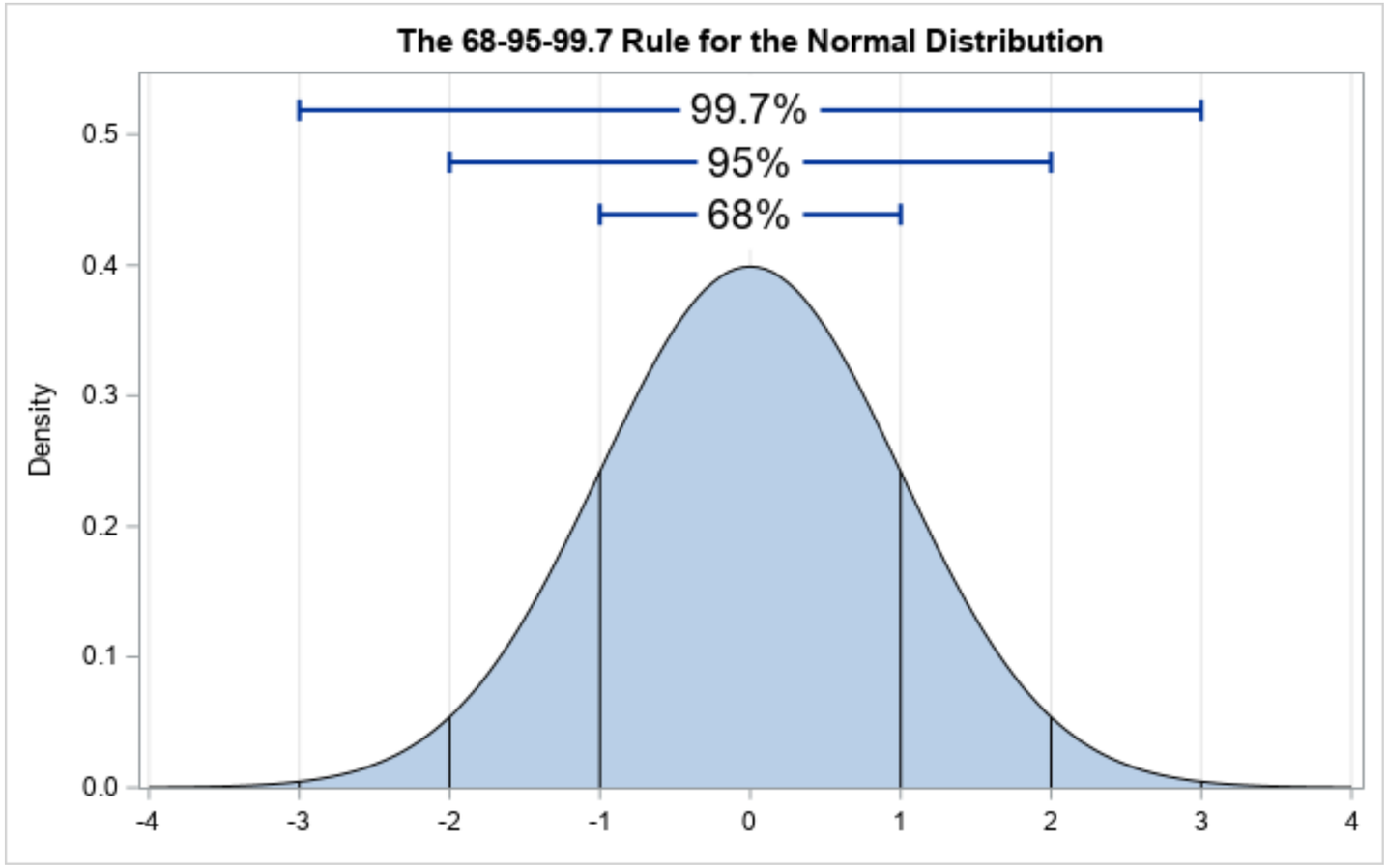
What's a p-value?

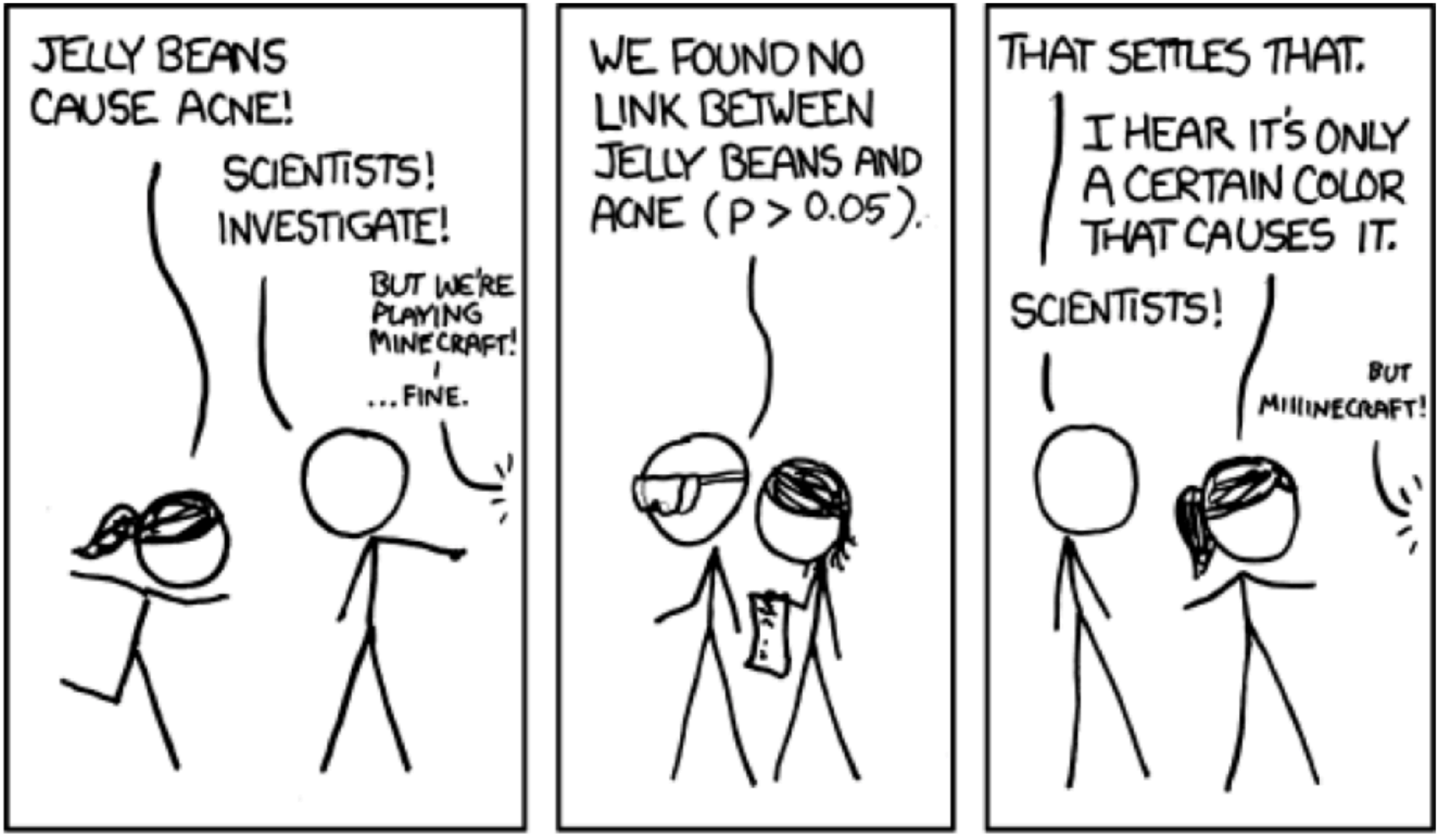
Null hypothesis: Every day is equally lucky.
My Hypothesis: Friday-the-13ths are lucky days.
I observed 66 heads on Friday the 13th! I'm right!

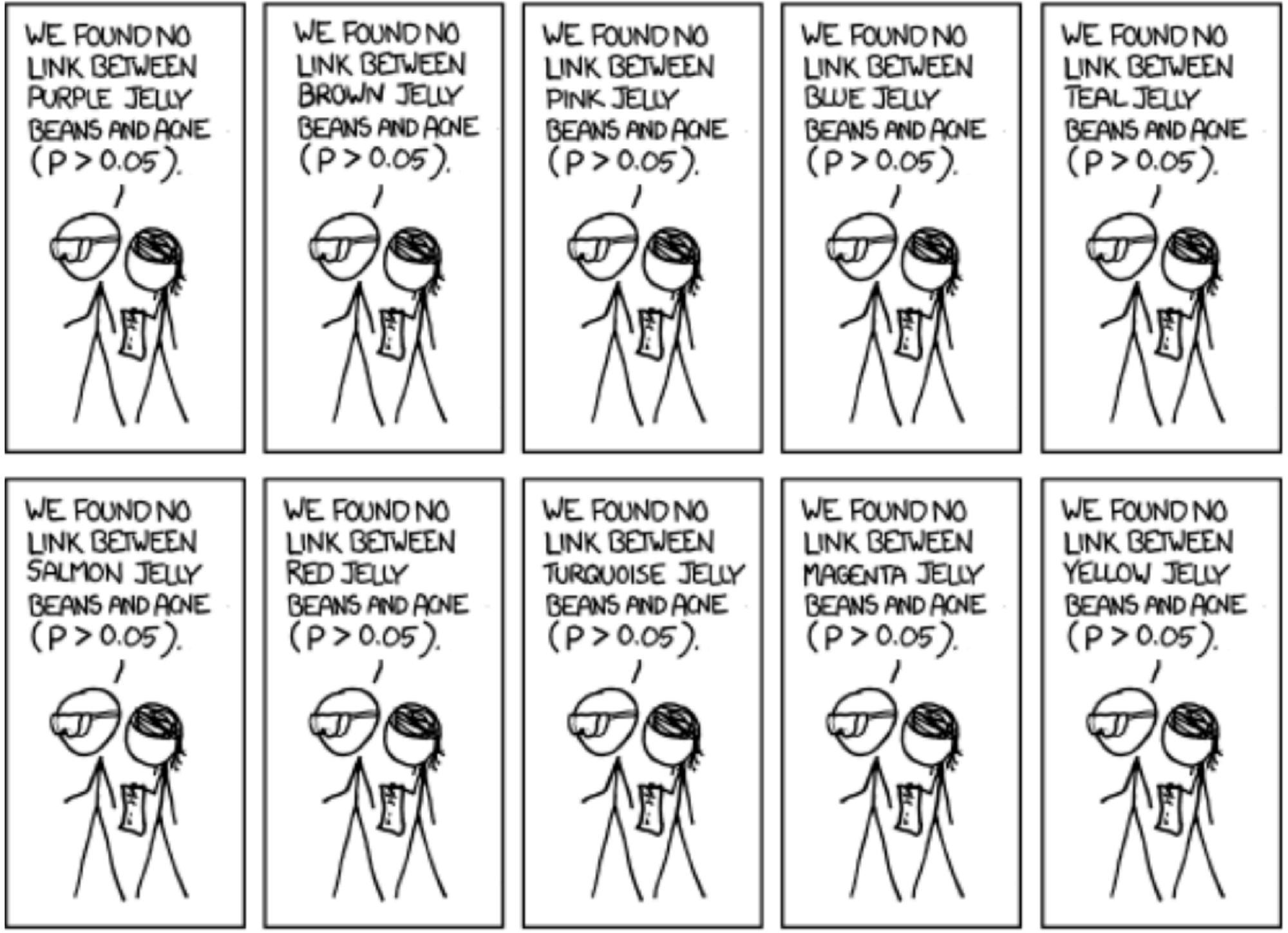
p-value = 0.05 is the probability such an extreme result would be observed under the null hypothesis.

Toss a coin 100 times. Repeat.

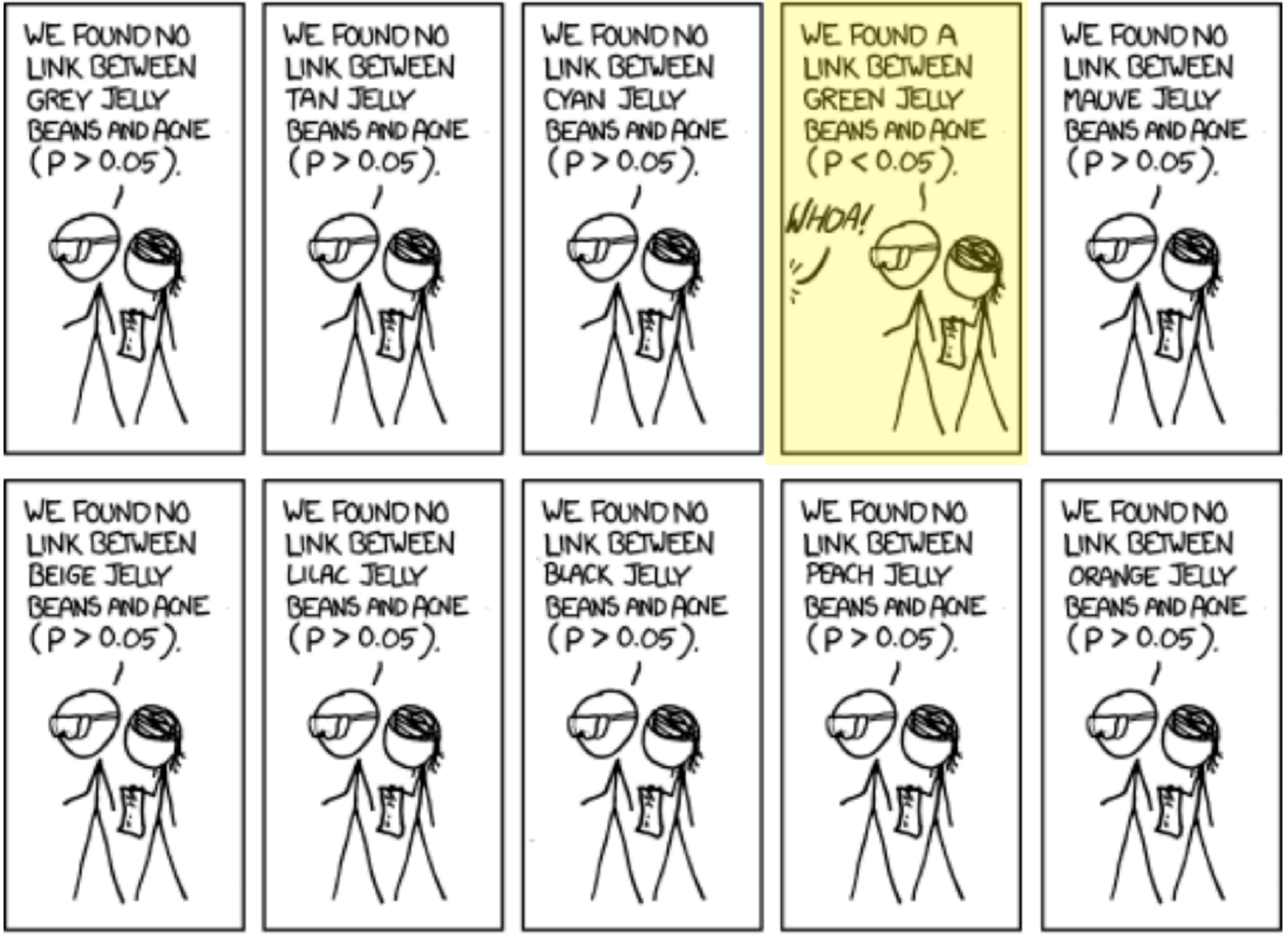




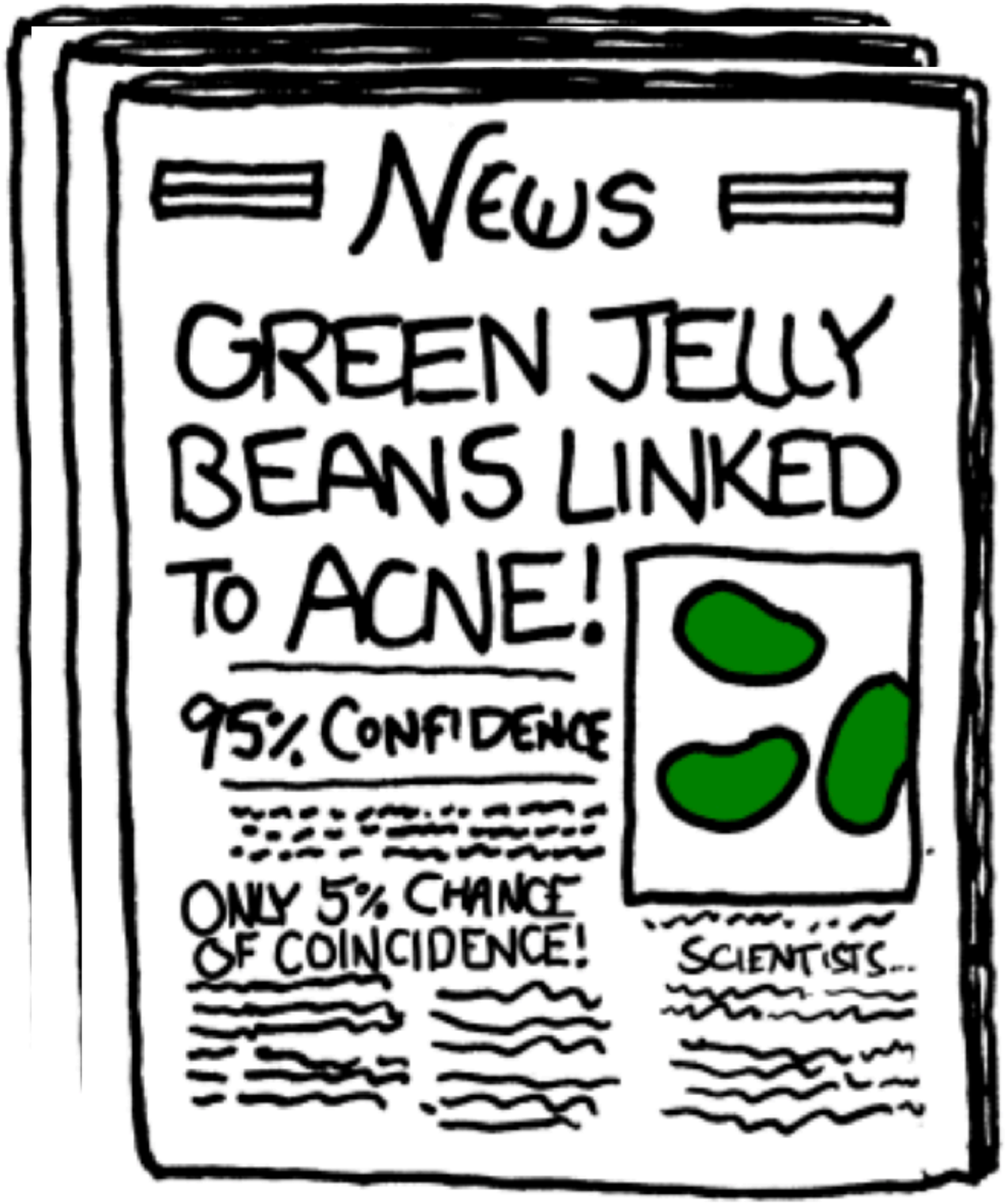

JELLY BEANS CAUSE ACNE!
SCIENTISTS! INVESTIGATE!
BUT WE'RE PLAYING MINECRAFT!
... FINE.
WE FOUND NO LINK BETWEEN JELLY BEANS AND ACNE (P > 0.05).
THAT SETTLES THAT.
I HEAR IT'S ONLY A CERTAIN COLOR THAT CAUSES IT.
SCIENTISTS!
BUT MIIINECRAFT!

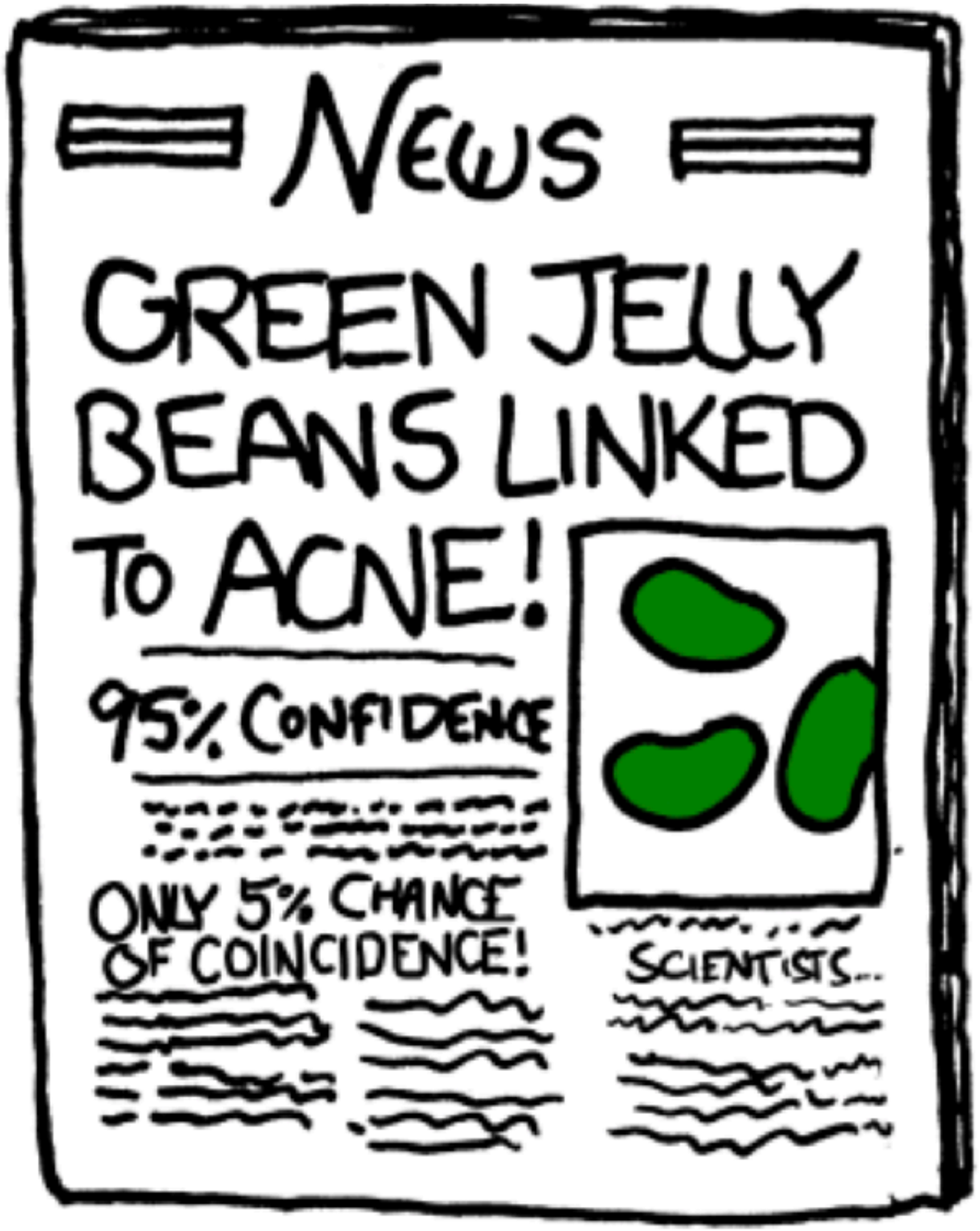

WE FOUND NO LINK BETWEEN PURPLE JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN BROWN JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN PINK JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN BLUE JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN TEAL JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN SALMON JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN RED JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN TURQUOISE JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN MAGENTA JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN YELLOW JELLY BEANS AND ACNE (P > 0.05).

xkcd.com/882


WE FOUND NO LINK BETWEEN GREY JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN TAN JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN CYAN JELLY BEANS AND ACNE (P > 0.05).
WE FOUND A LINK BETWEEN GREEN JELLY BEANS AND ACNE (P < 0.05).
WHOA!
WE FOUND NO LINK BETWEEN MAUVE JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN BEIGE JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN LILAC JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN BLACK JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN PEACH JELLY BEANS AND ACNE (P > 0.05).
WE FOUND NO LINK BETWEEN ORANGE JELLY BEANS AND ACNE (P > 0.05).

xkcd.com/882/


NEWS
GREEN JELLY BEANS LINKED TO ACNE!
95% CONFIDENCE
ONLY 5% CHANCE OF COINCIDENCE!
SCIENTISTS...


NEWS
GREEN JELLY BEANS LINKED TO ACNE!
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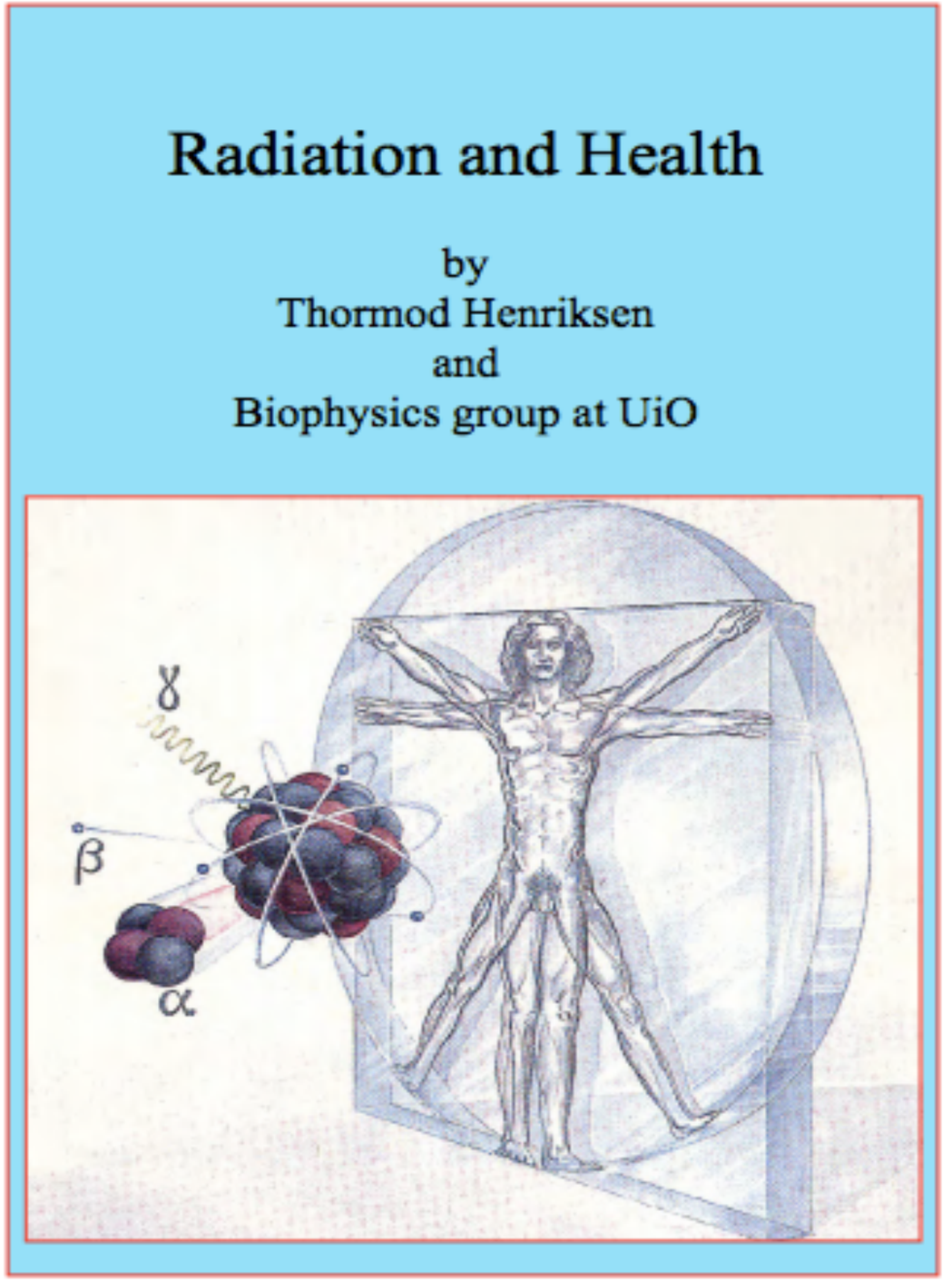
SCIENTISTS...

Dose of sanity and science:

Radiation and Health, Thormod Henriksen

Free to download at
http://www.mn.uio.no/fysikk/tjenester/kunnskap/straling/radiation-and-health-2015.pdf

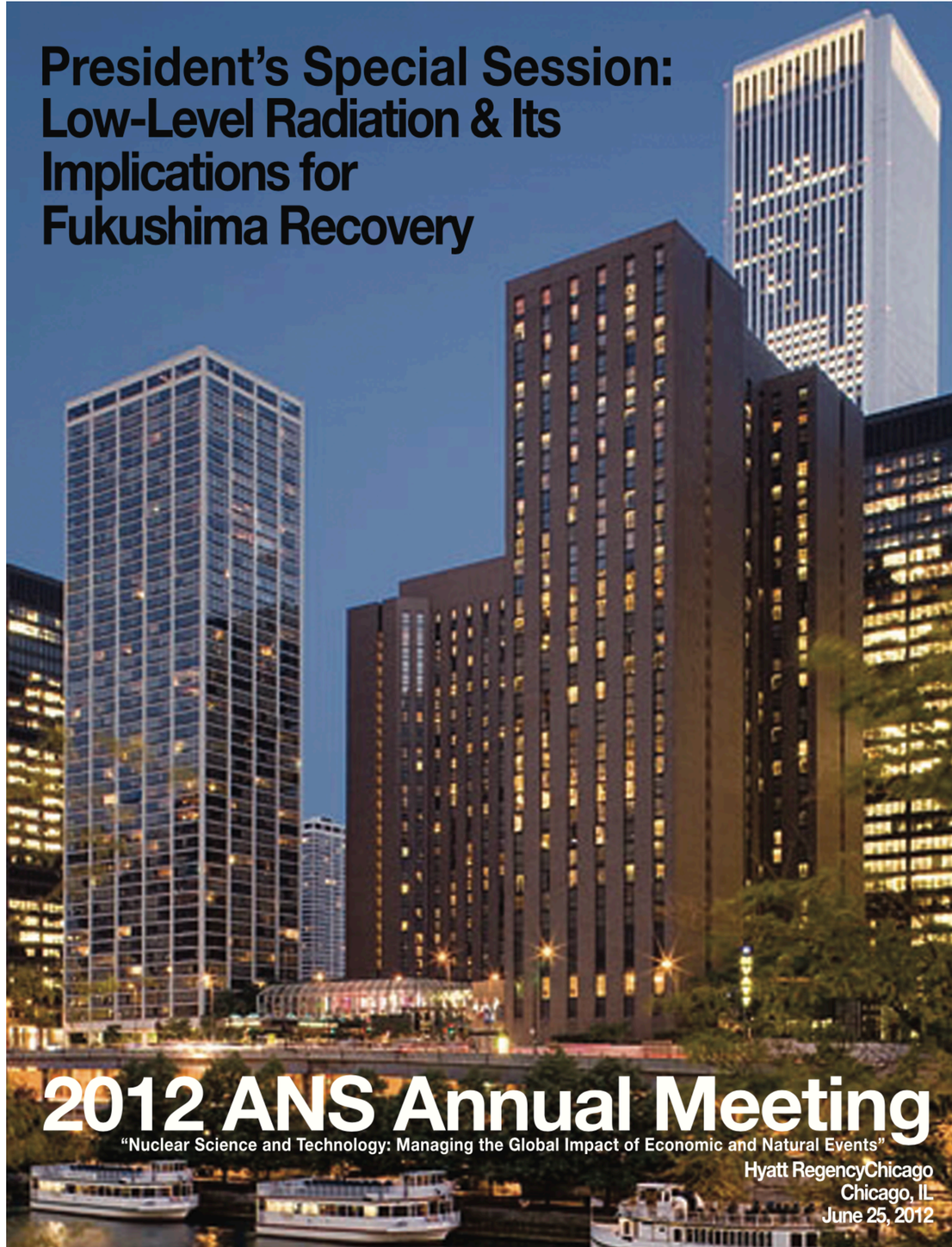
With his OK, I published paperback version on Amazon at cost.
https://www.amazon.com/dp/1499104073



American Nuclear Society

reprinted two dozen scientific studies showing low level radiation is benign.

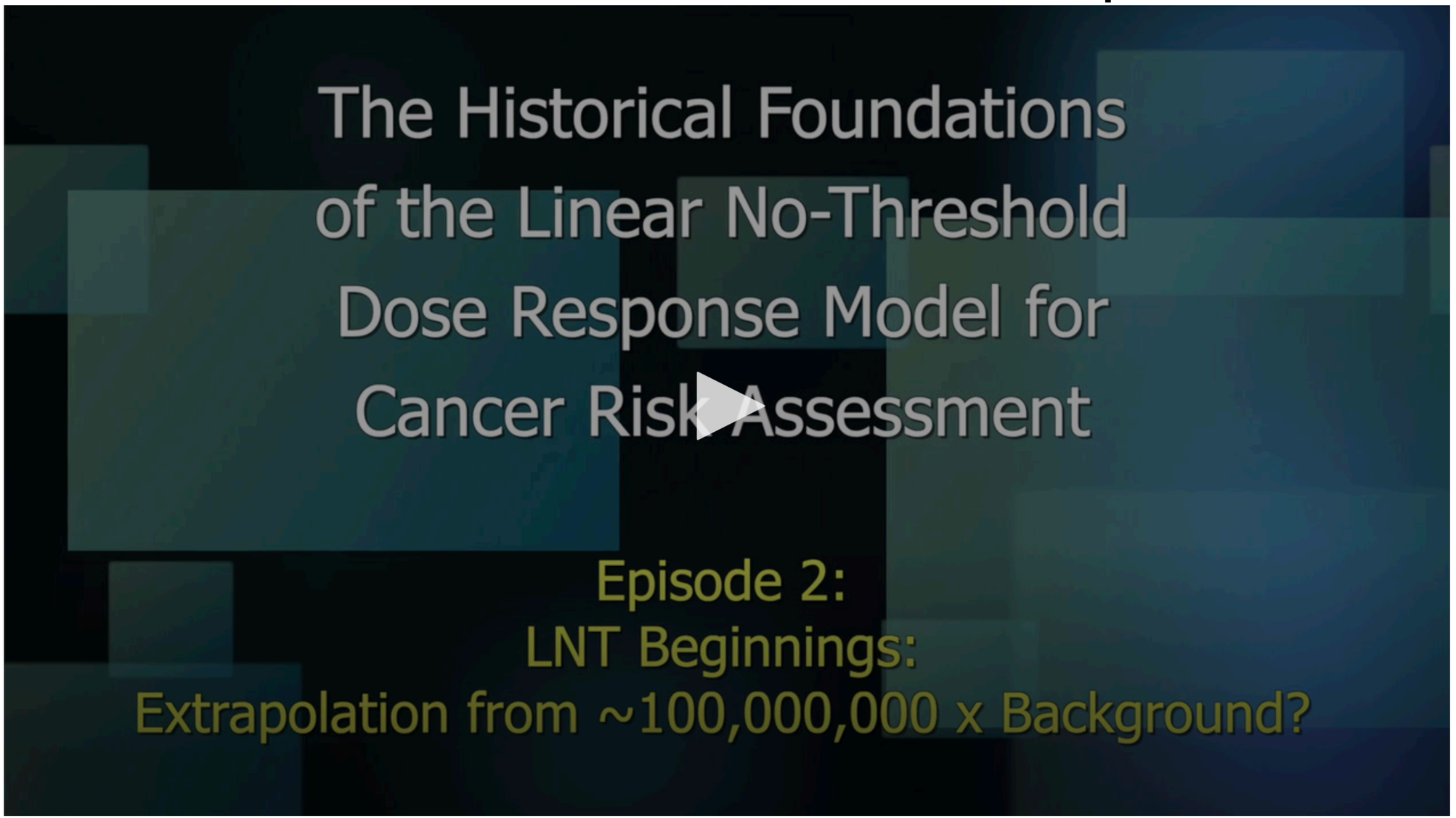
Free to download at:
https://www.ans.org/file/1336/special_session-low_level_radiation-fukushima-v1.4.pdf



https://www.ans.org/file/1336/special_session-low_level_radiation-fukushima-v1.4.pdf

Ed Calabrese uncovers LNT's scientic fraud.

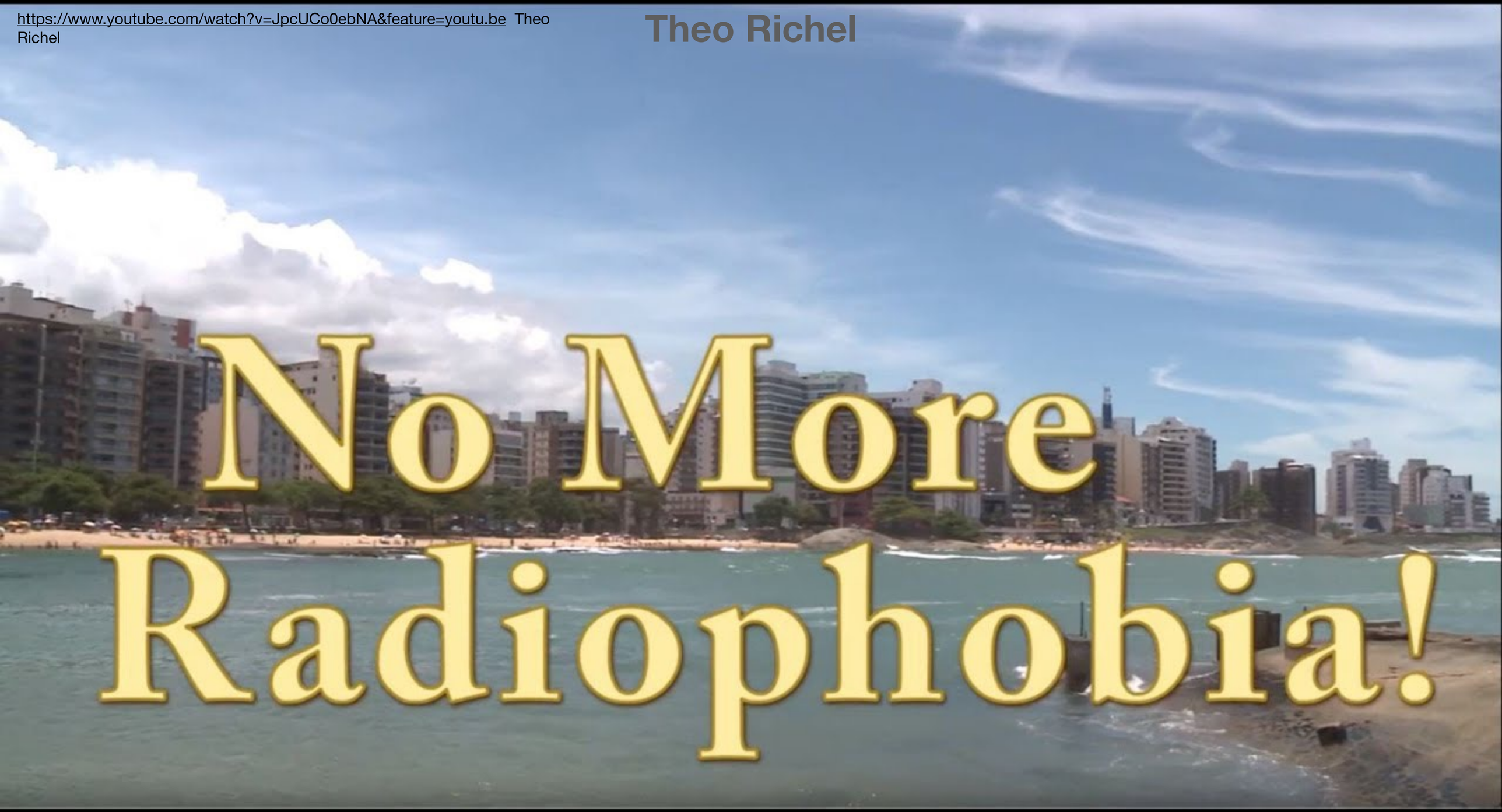
22 episodes, 12 hours



https://hps.org/hpspublications/historylnt/episodeguide.html

https://www.youtube.com/watch?v=JpcUCo0ebNA&feature=youtu.be Theo Richel

Theo Richel



8 Radiophobia

Fission is in Fashion

Fear sells

Fission power safest

Metabolism

DNA, cellular repair

Evidence ignored by authorities

Deadly evacuations unnecessary

Radiophobia policy, NRC, EPA

Educational video, book

Confounders, controls, p-hunting