



Electrify everything!

**Or will radiophobia and
politicized science
stymie cheap, 24x7
fission power?**

Radiophobia is the ideological barrier to allowing fission power to check global warming and overcome energy poverty in developing nations. In other words. It is the cause of burdensome regulations that make fission power too expensive. It's not an exaggeration to say...

Radiophobia causes global warming.

New York Times prints radiation scares. We Are Giving Ourselves Cancer

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

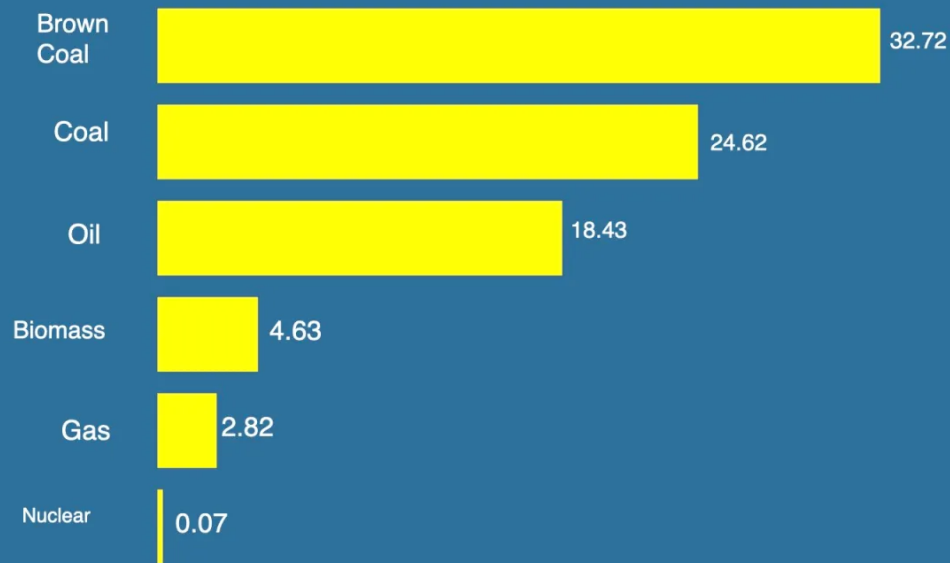
“a 2009 study from the National Cancer Institute estimates that CT scans conducted in 2007 will cause a projected 29,000 excess cancer cases and 14,500 excess deaths over the lifetime of those exposed.”



Even the [New York Times](#) participates in groupthink opposition to all ionizing radiation exposure. CT scans provide detailed 3D images of body parts, used by doctors for effective diagnoses of injuries and diseases. CT scan images are created by computer processing of multiple, low-dose exposures of the body part to X-rays.

The New York Times is dead [wrong](#).

Fission power is the safest energy source.



Deaths per thousand gigawatt hours

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

Construction and maintenance accidents for wind and solar sources are more deadly than **fission** power.

Small amount of waste is easily stored.

- Dry cask storage for 28 years of 620 MW Connecticut Yankee.
- 80 GW-yrs stored in casks on that pad for ThorCon.
- 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.



“What about the waste” is a common concern.

Answers: 1) There's not much of it. 2) It's not very dangerous.

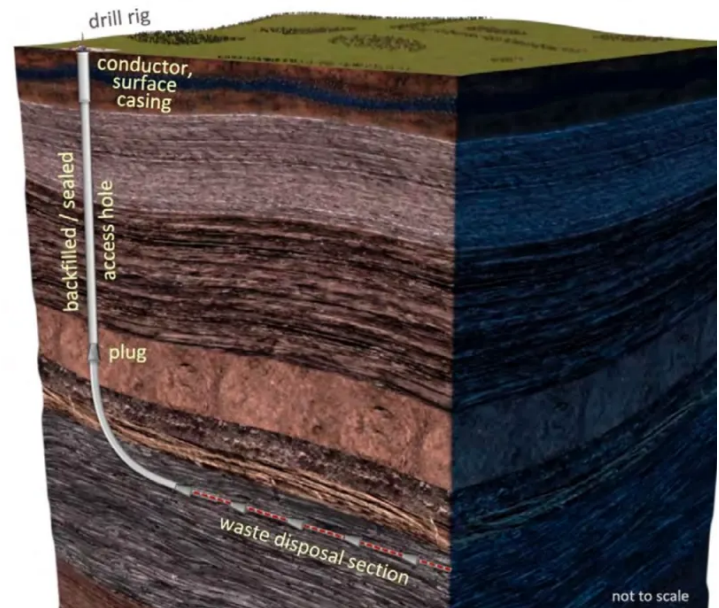
Commonly used fuel rods from today's fission power plants are placed in concrete casks to be stored on-site indefinitely. Alternatives such as reprocessing to recycle the useful uranium and plutonium are forbidden in the US and many countries.

In the US, the federal government insisted on owning the spent fuel. Underground repositories such as Yucca Mountain are expensive and opposed because of unfounded fear. Like the New York Times, the public and politicians assume all radiation is a deadly carcinogen so protest against all storage options.

Another simple, inexpensive way to store used fuel is marketed by Deep Isolation.

- 1 to 5 km deep
- below aquifer
- uses oil well drilling technology

<https://www.deepisolation.com>



This company has demonstrated the success of this storage technology, using non-radioactive spent fuel dummies. Years before this the US Department of Energy barely started attempts to drill a sample storage hole, caving to protests from the fearful public.

Summary: spent fuel has not been harmful, there's not much of it, and inexpensive, sequestered storage options exist.

**Radiation does NOT cause cancer,
except at very high exposures.**

Radiation is a **weak** carcinogen.

**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

You'll see absorbed radiation described in units of mSv (millisievert) and mGy (milligray), which is energy absorbed per unit of tissue. (mJ/kg). In these scrolls you can ignore the difference. Mammography is safe.

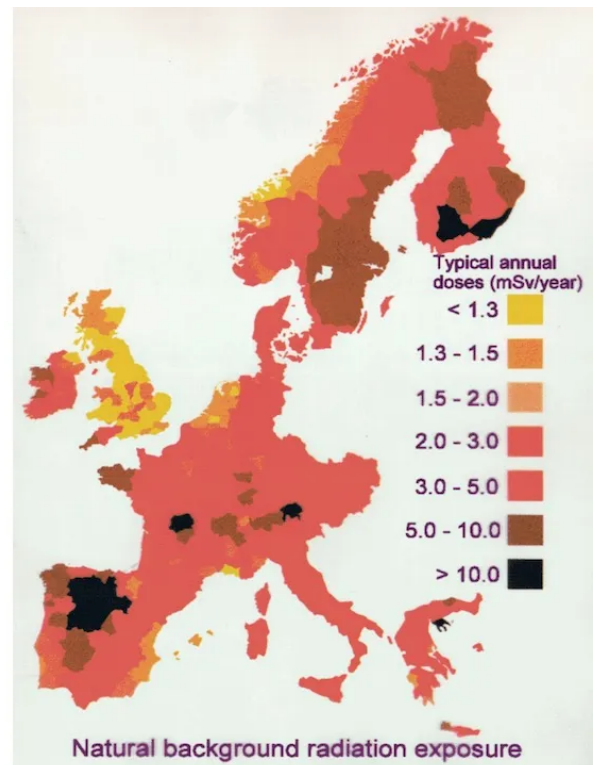
Natural background radiation dose rates are 1-10 mSv/year.

Sources

Radon
Cosmic rays
Food
Granite

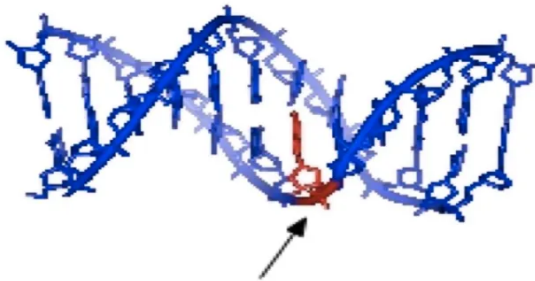
Places Ave dose rate

US	3 mSv/y
Denver	4
Finland	7



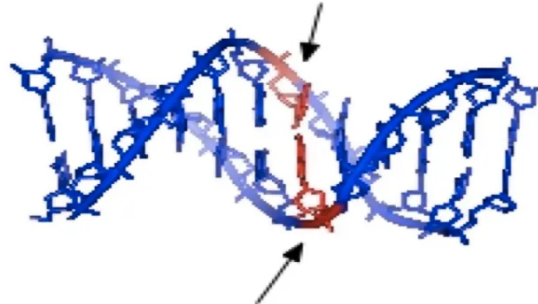
Note that the denominator is one year! These dose examples are the accumulations over a full year. Such low dose rates perfectly safe. Some radiation-fearful people claim all radiation effects must be cumulative, adding up to real harm.

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.

In the body's normal process of metabolism, the cells' mitochondria energy generators also release oxidants such as H_2O_2 (hydrogen peroxide) that are chemically reactive. At a rate of about once per second per cell, these reactive oxygen species can break a single strand of DNA. These single strand breaks are quickly [repaired](#) using the redundant information coded in the paired DNA strand.

100 mSv/y ionizing radiation effects are trivial in comparison to natural metabolic effects.

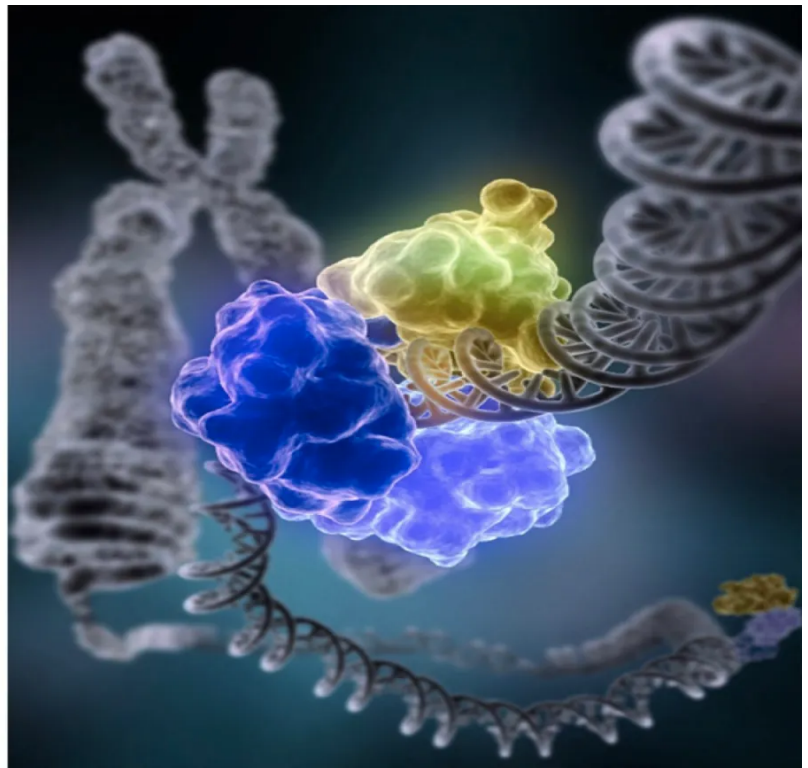
Double strand breaks occur naturally. They can occur by co-incidence. Slow, heavy ionizing alpha particles might create multiple local ionizations and break both strands. Alpha particles can not penetrate skin.

Feinendegen [writes](#) "at background radiation level, the probability of a radiogenic DSB to occur per day was calculated to be on average only about 1 in 10,000 cells"

Sylvain Costes writes “Double strand breaks occur one to 10 times per day per cell. (based on measurements made at Exogen with our finger prick kit)” [More](#).

DNA is repaired.

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

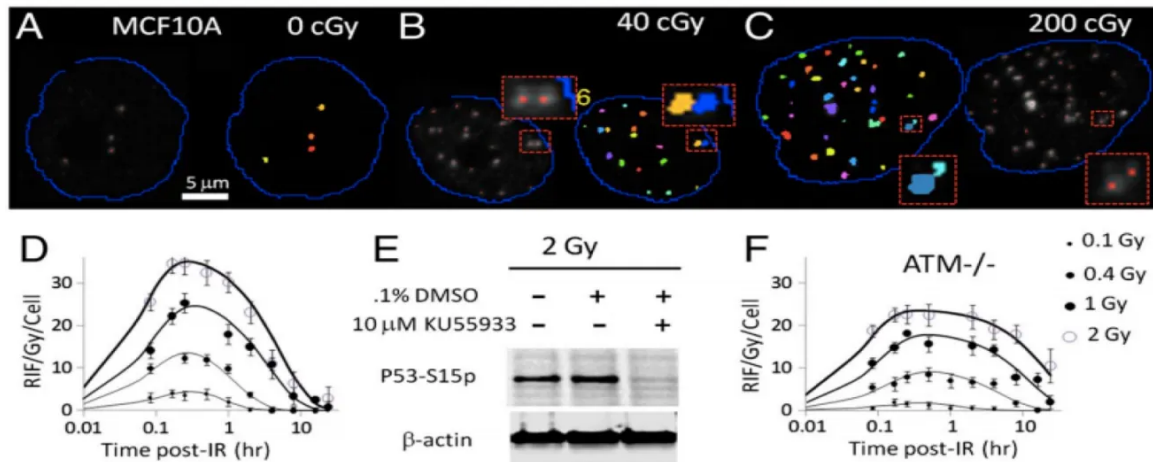


Even double strand [breaks](#) can be [repaired](#).

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 Asaithambv^e, David J. Chen^e, Mina J. Bissell^{d,1}, Stefan Thalhammer^a, and Sylvain V. Costes^{d,1}



Note that natural repairs of damage from radiation and metabolic ionization take place in [hours](#), not [years](#), which is the basis for regulated annual exposure limits.

[Video](#) from Lawrence Berkeley National Laboratory presents the evidence.

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-sancar-nobel-chemistry.html>

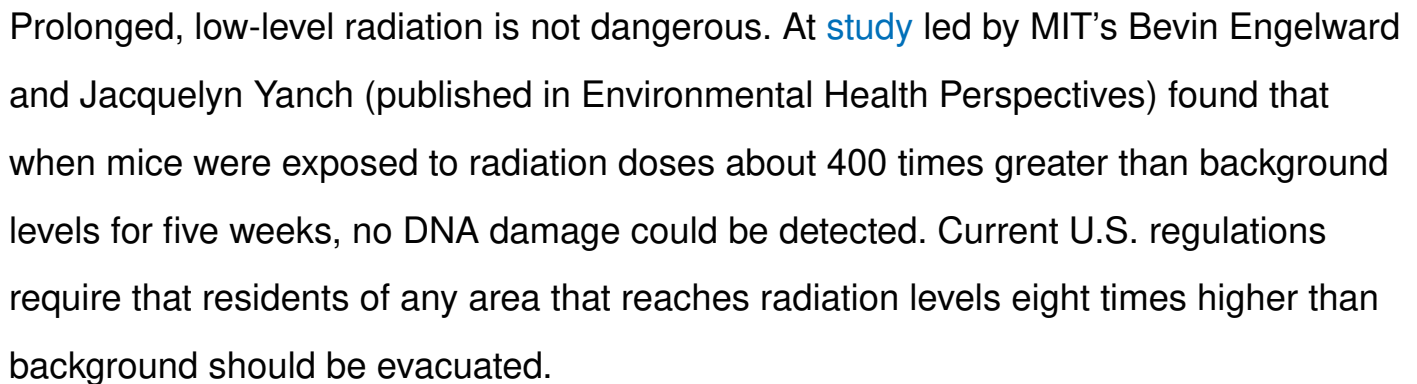
The process of **repair** of radiation ionization damage is well understood, but not by regulators, legislators, or the general public.



**Fukushima
evacuation
killed 1600
citizens.**

Not one citizen was killed or injured by radiation from the triple meltdown of fission power plants at Fukushima. 18,500 people died or disappeared in the earthquake and tsunami. Ignorantly frightened by low level radiation, the government forced 160,000 from hospitals and their homes, leading to the [deaths](#) of 1600.

IAEA published
recommendation:
evacuate the
red area.



Fukushima radiation was harmless.

"Radiation exposure following the nuclear accident at Fukushima-Daiichi did not cause any immediate health effects. It is unlikely to be able to attribute any health effects in the future among the general public and the vast majority of workers"

UN Scientific Committee on the Effects of Atomic Radiation

Japan's 2011 nuclear disaster 'unlikely' to have future health affects, says [draft UN report](#) and [press release](#) by United Nations.

A 2020 [article](#) by Church and Brooks compares the effects of radioactive fallout from 1953 atomic bomb testing in Washington County, Utah, to those of the Fukushima accident. Utah residents received 3-4 times the radiation doses of those in Japan.

People were not asked to shelter in place except in the city of St. George, There were no health effects. Cancer rates in Washington county remain among the lowest in Utah, which has the lowest cancer rates in the US.

In Japan 160,000 people were evacuated and 1600 died from the government's ignorant actions.

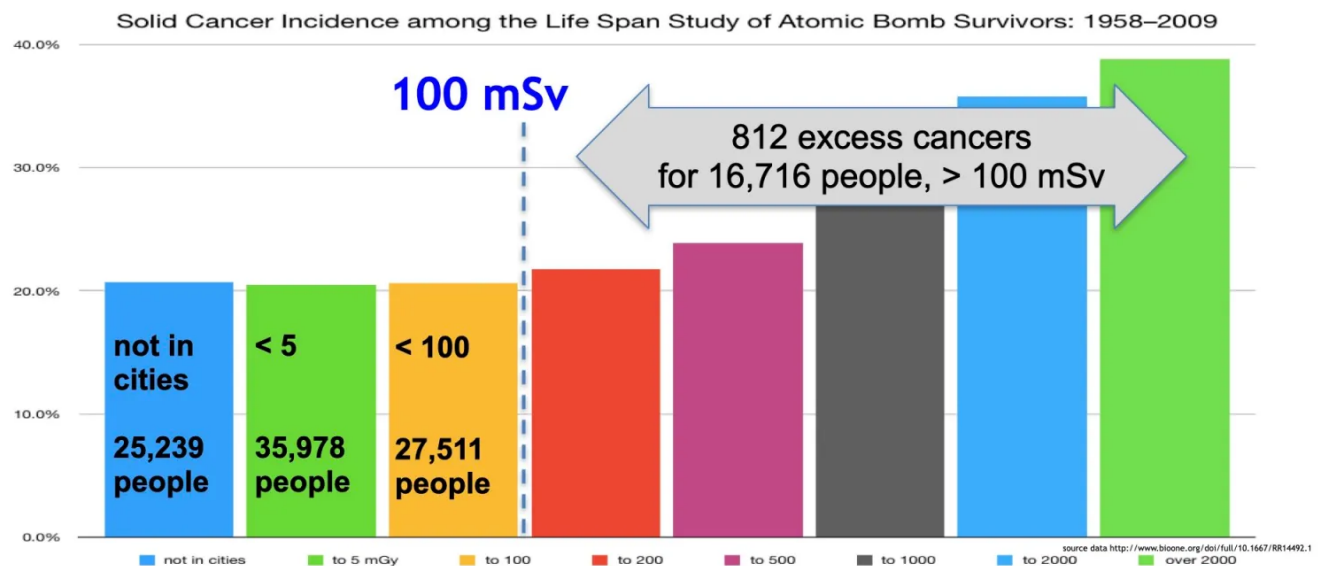
IAEA: 25 $\mu\text{Sv}/\text{hour}$ is safe for everyone.



$$25\ \mu\text{Sv}/\text{hour} = 220\ \text{mSv}/\text{year}$$

In an emergency the International Atomic Energy Agency [advises](#) families not to evacuate homes where radiation exposures are less than 25 microsieverts per hour.

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

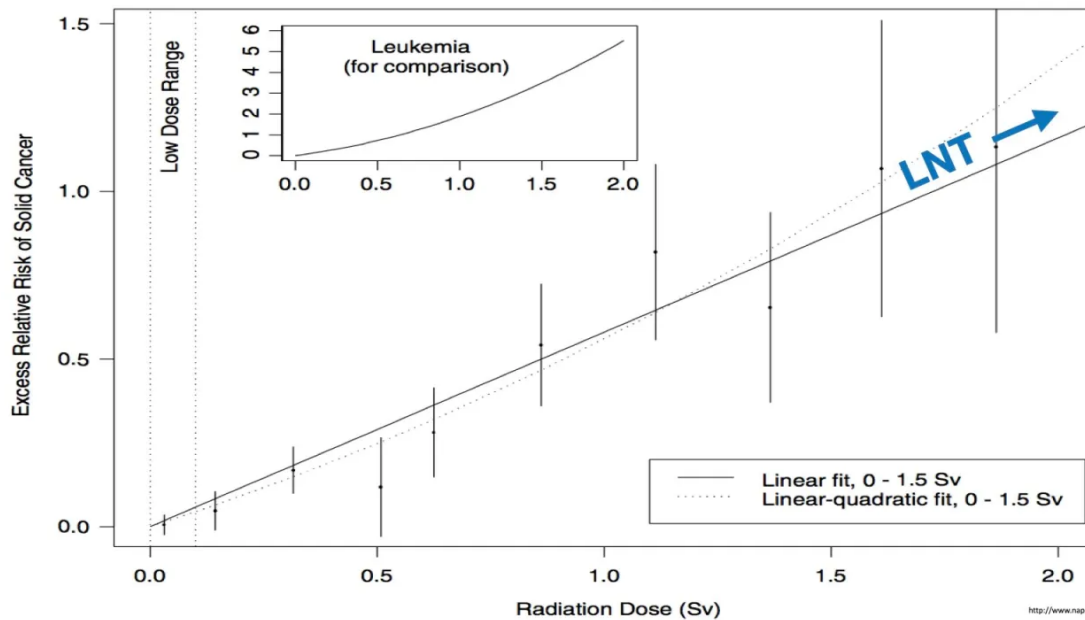


These [data](#) were collected by the joint US/Japan Radiation Effects Research Foundataion life span study of atomic bomb survivors. Simply putting cancer incidence data in bins of none, 0-5, 5-100, 100-200 etc make it obvious that there are no cancer effects for exposures below 100 mSv. The blue bin counts people who normally resided in Hiroshima or Nagasaki but were not there at the time of the atomic bombing.

Average cancer rates in Japan are lower than in the US, probably due to diet.

The RERF foundation does not publish articles that disprove the LNT model.

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



The [reports](#) by the US National Academies are designed to obscure the effects of low dose radiation because they conflict with the tradition of the LNT (linear no threshold) model of harm from radiation, the basis of radiation regulation.

The NAS infers linearity from a least-square fit to an *assumed* straight line starting at an *assumed* dose of zero mSv. Look at the lowest plotted data point, which shows no harm. Harm is simply inferred by extrapolation, ignoring observations.

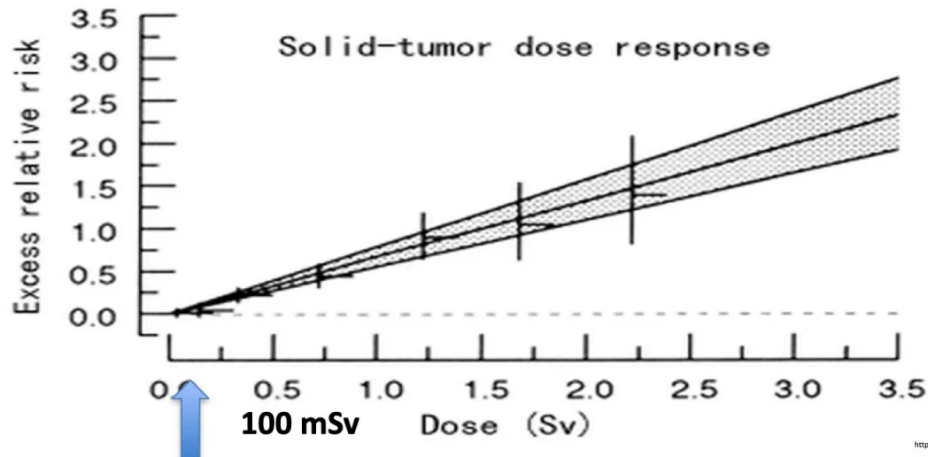
But atomic bomb survivor publications do not show the details of doses < 100 mSv.



Radiation Effects Research Foundation

A Cooperative Japan-US Research Organization

Extrapolating Life Span Study Cancer Risk Estimates to Low-dose Radiation Exposures

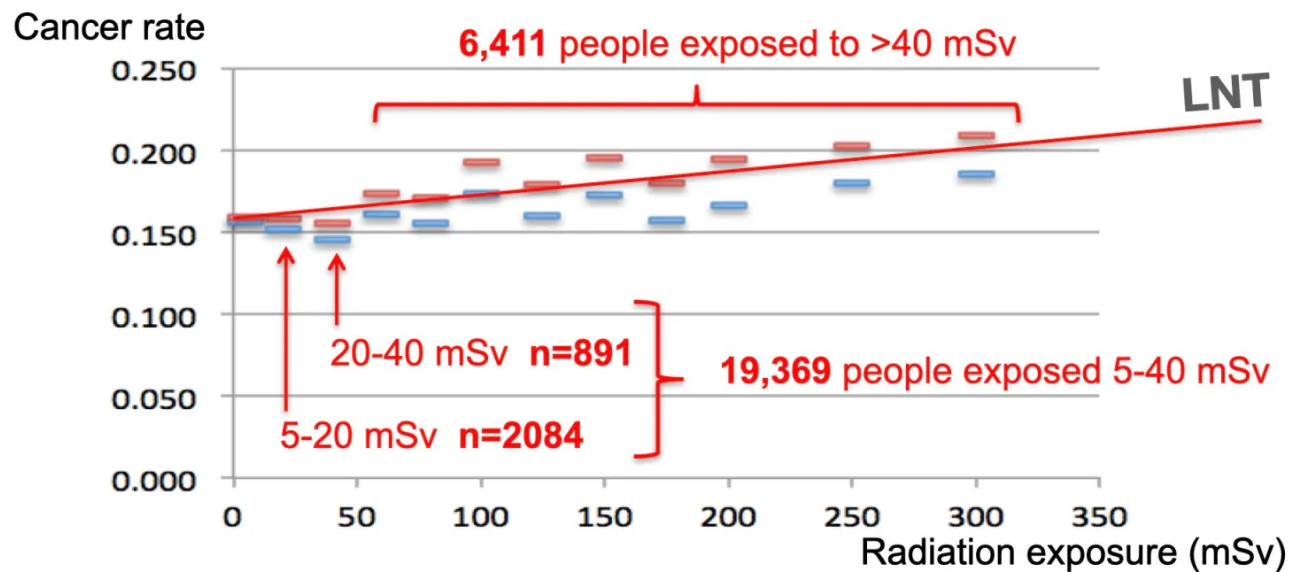


http://www.rerf.or.jp/library/update/rerfupdate_factfig/vaeth.html

Similarly [reports](#) by the RERF coalesce and blur displays of data below 100 mSv (at the superimposed blue arrow).

The RERF objective is to show that all radiation is possibly deadly, in order to raise fears to dissuade the future use of atomic weapons.

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



The Radiation Effects Research Foundation publishes its cancer incidence data, available in bins of 5-20, 20-40, 40-60, 60-80, 80-100, etc mSv. Plotted here are cancer incidences from low radiation exposure. The Radiation Effects Research Foundation and National Academy of Sciences do not publish such detailed data.

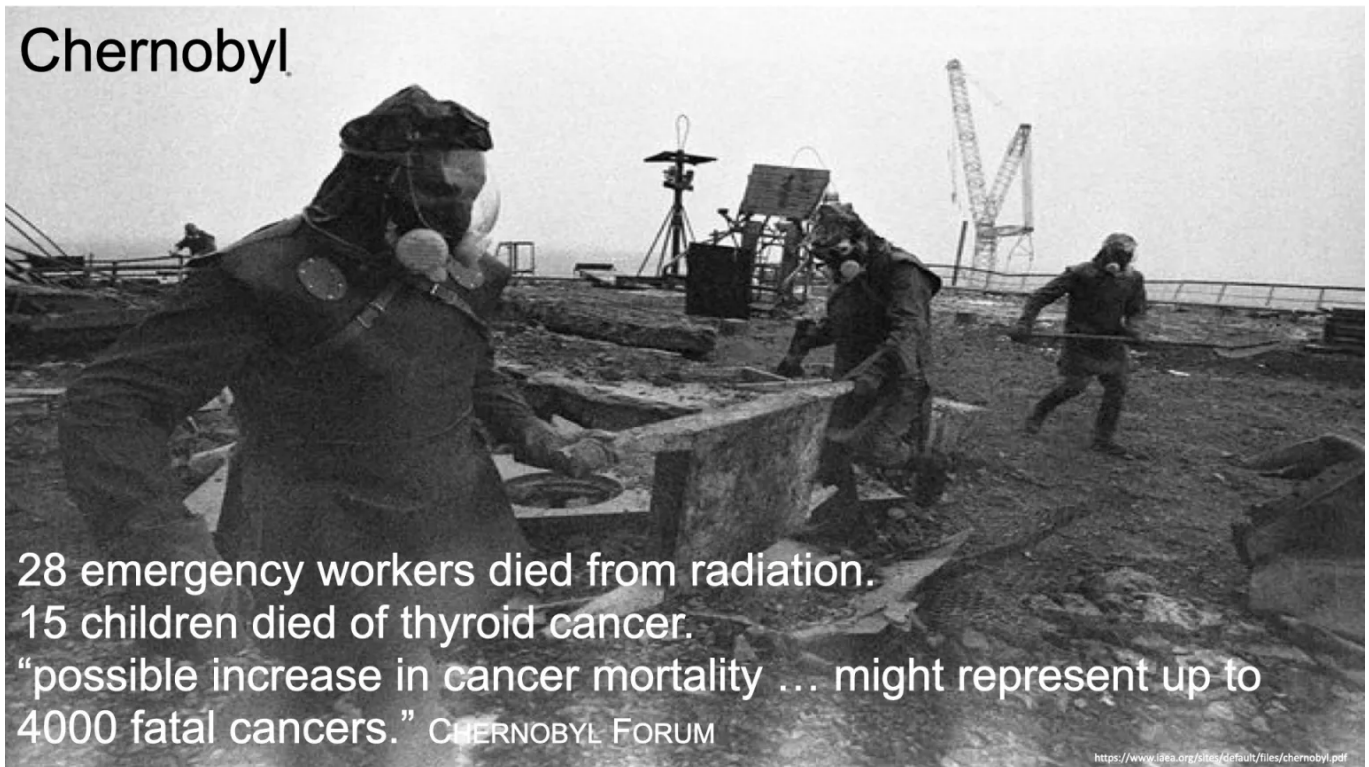
The data shows that at low doses, cancer rates go down, not up. The red and blue bars represent +/- 1 standard deviation in the counts. The large sample sizes at low doses (19,369 people) illustrate statistically more accurate relationships between cancer and radiation than at the 6,411 higher doses used to extrapolate LNT.

The RERF objective is to increase radiophobia, hoping to lessen likelihood of nuclear weapons use. Does the end justify the means? Here are a few more sample critiques of RERF's LNT advocacy.

- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2592990/> Luckey

- <http://www.ncbi.nlm.nih.gov/pubmed/24298226> Doss
- <http://www.ncbi.nlm.nih.gov/pubmed/23304106> Doss
- <http://www.thenewamerican.com/tech/environment/item/6932-the-effects-of-low-dose-radiation> Hiserodt

Chernobyl



28 emergency workers died from radiation.
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>

The accident at Chernobyl was the worst imaginable. The [Chernobyl Forum](#) report is the most authoritative summary, including psychological effects and agricultural land contamination. The radiation exposure levels are now not harmful to people and animals living in the vicinity, but there remain [hot spots](#) of radioactive materials.

Chernobyl survivors have fewer cancers.

Dr. Zbigniew Jaworowski, MD PhD DSc, former Chairman of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) wrote:

“What is really surprising, however, is that data collected by UNSCEAR and the Forum show **15% to 30% fewer cancer deaths among the Chernobyl emergency workers**

(though subsequent 2015 analysis by Kashcheev shows solid cancer incidence was higher for doses over 200 mGy)

and about **5% lower solid cancer incidence** among the people in the Bryansk district (the most contaminated in Russia) in comparison with the general population. In most irradiated group of these people (mean dose of 40 mSv) the **deficit of cancer incidence was 17%.”**

<http://db.world-nuclear.org/reference/jaworowski-ipn0406.html>

<http://www.belleonline.com/newsletters/volume15/vol15-2.pdf>

Despite the “possible increase in cancer mortality” cited by the Chernobyl Forum using LNT projections, the incidence of cancer caused by the Chernobyl accident is nil.

The emergency workers exposed to over 200 mGy did have more cancer than the general population, but better survival because of medical attention given to emergency workers.

Jarorowski was a physician and scientist before he became chairman of UNSCEAR. He wrote a professional, quantitative [summary](#) critical of the LNT projections of harm.

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.



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

LNT predicts a cancer risk of 1% for each 100 mSv of radiation absorption. Cancer tissue cells do not recover from intense radiation. Spillover radiation affects nearby, healthy tissue cells, which have repair capability. Radiation oncologists understand well the biological effects of ionizing radiation. Regulators do not.

Radiologist Mike Waligorski explains:

Radiotherapy – is a way to cure cancer by radiation

1-Extremely high doses of X-rays must be applied in order to kill all cancer cells in a small part of the patient's body.

2. To kill all cells in the cancer volume, doses of X-rays must be some 20 000 times higher than doses from natural background radiation, deposited in anyone's body during one year – and are then given in Gy (For X-rays, 1 Gy = 1000 mSv). [I believe

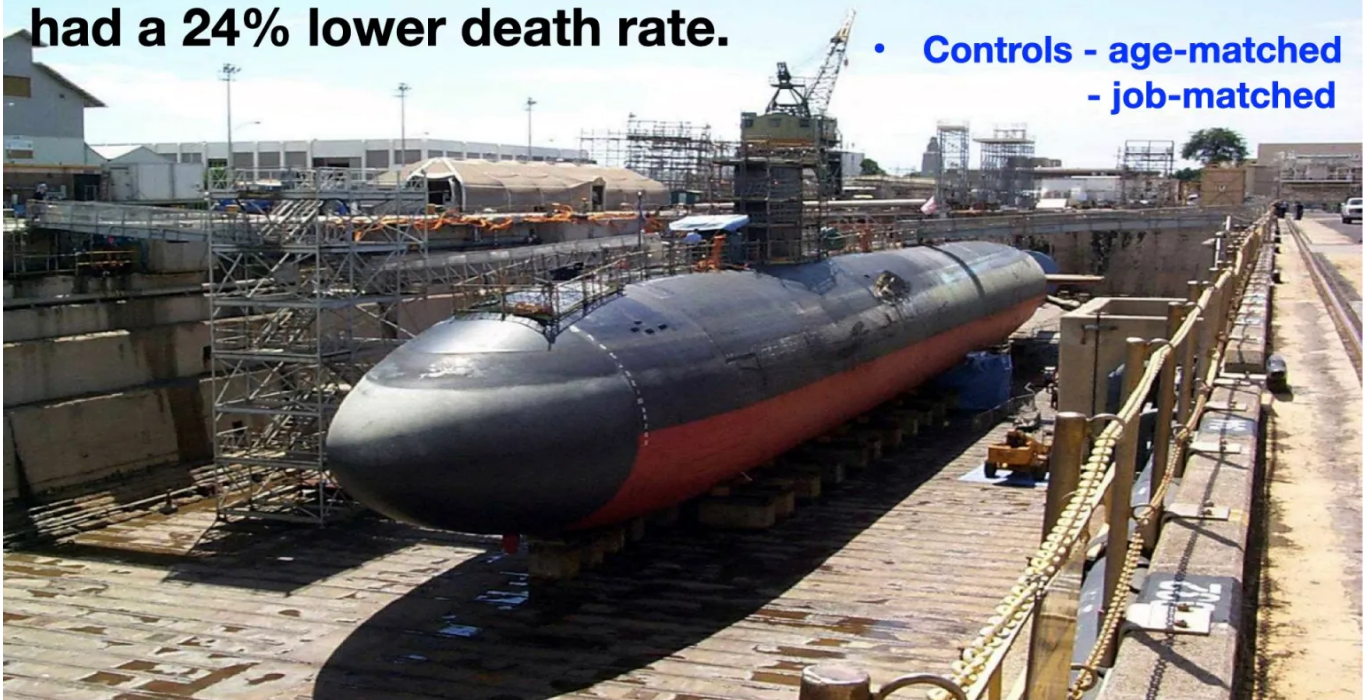
this may be the shortest cut to avoid Sv in cancer RT!]

3. To avoid harming the healthy tissues surrounding the cancer in the process of radiotherapy, the beam of X-rays must be well-focused on the cancer volume, and is often pointed from many directions.

4. A typical course of radiotherapy is about 60 Gy to the cancer volume, delivered in 30 daily “fractions” of 2 Gy each. Such “fractionated” delivery of radiation allows the irradiated healthy tissues to recover more readily than cancer cells, thus making the radiotherapy treatment mode effective.

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

- **Controls - age-matched
- job-matched**



LNT predicts that 100 mSv exposure creates a 1% chance of cancer, so the government launched a well-designed study to determine its liability to shipyard workers maintaining nuclear submarines. They measured health of 28,000 workers

exposed to low levels of radiation and 33,000 matched workers who were not. LNT predicts the average 8 mSv exposure would create a 8/100 % chance of cancer, about a 4/100 % increased rate of death (0.04%). Instead, this aged-matched, job-matched, controled study showed a surprising effect: Low level radiation seemed to **prolong** life.

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-aprt-cancer-data-analysis.blogspot.com/>
<http://www.ncbi.nlm.nih.gov/pubmed/18666807>



Cancer site	Men			Women			All		
	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 [†] (0.7, 1.0)
All cancers except Leukemia	36	52.0	0.7 [‡] (0.5, 0.9)	52	59.3	0.9 (0.7, 1.2)	88	111.6	0.8 [‡] (0.6, 0.9)
Solid cancers	32	50.9	0.6 [‡] (0.4, 0.8)	50	58.5	0.9 (0.6, 1.1)	82	109.5	0.7 [‡] (0.6, 0.9)

A steel-maker accidentally included a radioactive cobalt-60 radiation therapy source in a batch of recycled steel that was refabricated into steel beams. These slightly radioactive beams were unknowingly used in the construction of several apartment buildings in Taiwan. Because average absorbed doses were 48 mSv, the fallacious LNT model predicts cancer rates of 48/100 % for 7,271 persons, or 35 *more* cancers than normally expected in the Taiwanese population. The actual **results** were 20 *fewer* cancer cases than normal.

This is another example of hormesis, the stimulation of the immune system by low level radiation, improving health.

If you read the linked papers you'll note that the authors claim the opposite conclusion, writing

“The results suggest that prolonged low dose-rate radiation exposure appeared to increase risks of developing certain cancers in specific subgroups of this population in Taiwan.”

Because the authors (or the peer reviewers authorizing publication) believe LNT must be true, the authors chose to write a conclusion based on a smaller, less statistically significant, subset of the data (cherry picking) that supports LNT. This, in spite of the fact that the very first line of their own data (Hwang 2006) Table III (“All cancers”) blatantly screams out the truth.

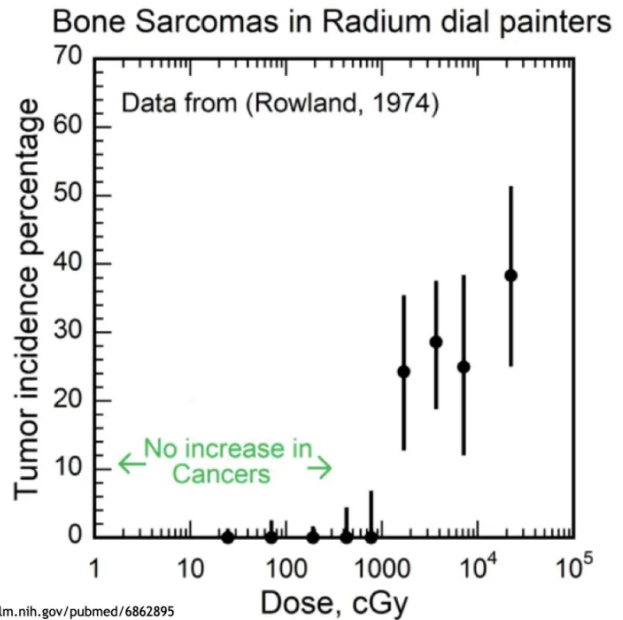
Hsieh published that the expected cancer rates would actually be higher because the residents were older at the end of the observation period. He also reduced the sample size because they had good dosimetry information on only 6242 residents. Mohan Doss then published a [letter](#) to the British Journal of Cancer and concluded that the headline on the slide above should actually read: “6,242 Taiwan apartment dwellers exposed to ~48 mSv had 47 fewer cancers than 296 predicted.” The chance of this observation being a fluke is 0.3%.

Radium dial painters' bone sarcomas occurred at a threshold over ~ 10,000 mGy.



http://journals.lww.com/health-physics/Abstract/1974/11000/Radium_in_Man_10.aspx

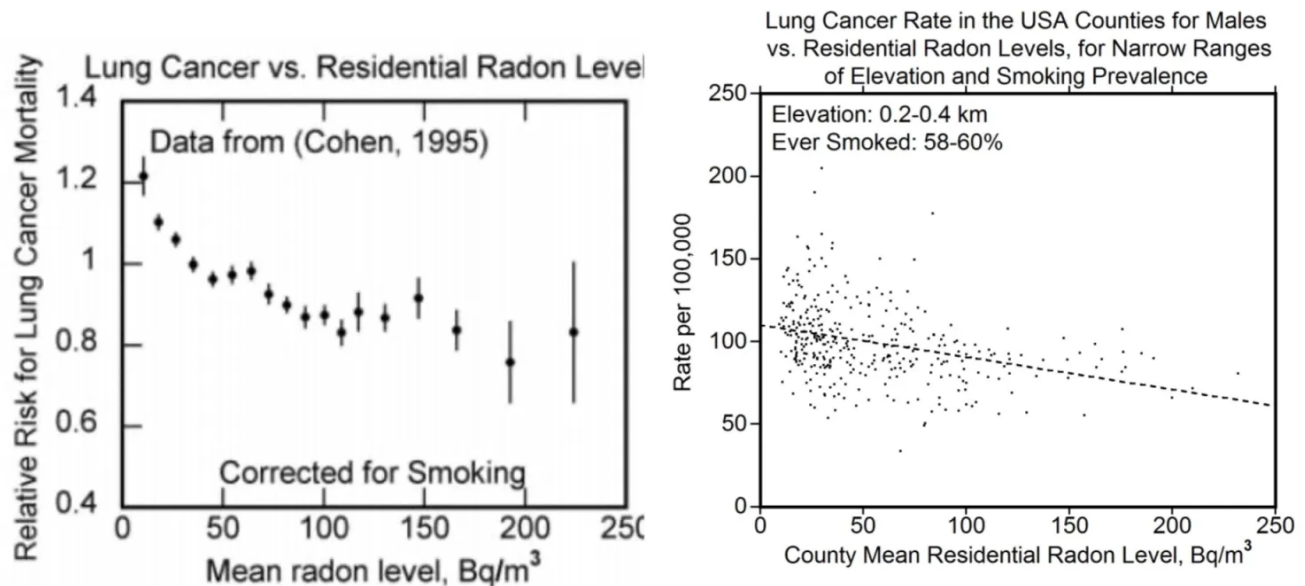
<http://www.ncbi.nlm.nih.gov/pubmed/6862895>



You may know the infamous story of young women hired to paint glow-in-the-dark numbers on watch dials. The paint contained radium which slowly decayed and stimulated phosphorescence. Unfortunately the women often pointed the brush tips with their tongues, slowly ingesting radium that lodged in their bones. Of the 3000 women, about 50 experienced bone sarcomas. Their radiation exposures were computed from analysis of radium in bone samples. We learned from this unfortunate accident that cancers were caused at exposure exceeding 2,000 mGy (200 centigray on the above chart). Subsequently dial painters were instructed not to lick the brush tips and no such cancers occurred.

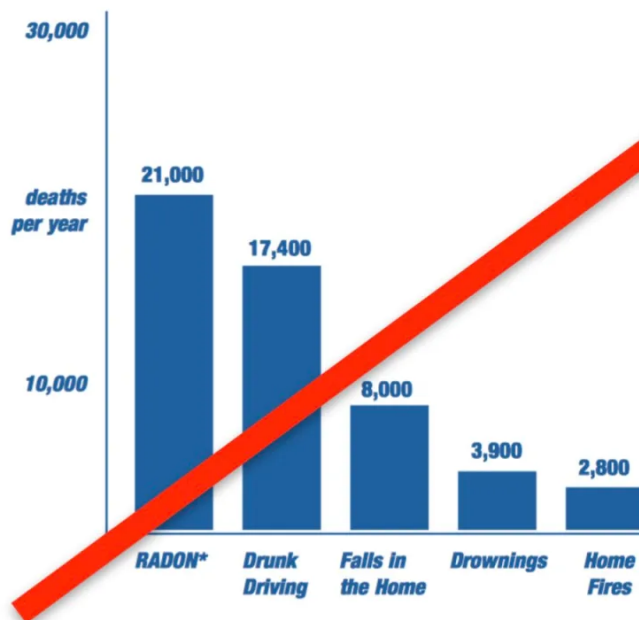
“At cumulative dosages below the order of 1000 skeletal average rads no clinically significant radiobiological injury has yet been observed in the M.I.T. series over a time span of 40–50 yr in more than 500 persons. It may be that in the low-dose domain the *rate of radiation injury is slower than the body's recovery and repair rates.*” [1000 rad = 10 Gray]

Lung cancer rates decrease with increasing residential radon levels.



Radon is a radioactive gas emanating from uranium omnipresent in granite. It was thought to cause lung cancer because of experiences of uranium miners, who smoked and worked in unventilated, dusty mines. To test radon's effect in normal environments, Bernard Cohen [correlated](#) 1,601 county-by-county measured levels of radon to corresponding county-by-county records of lung cancer incidence. His statistical analysis revealed the opposite. As low levels of radon increased, cancer rates diminished. Astonished, he analyzed other potential confounding factors that might have caused the statistical correlation; these included climate, altitude, geography, and 54 socioeconomic factors such as housing, and education. None explained decreasing cancer rates other than radon. The LNT model deviated from observed reality by 20 standard deviations, clearly proving LNT wrong. Regulators don't care and regulate with LNT.

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.

(Compare to humans, which are naturally slightly radioactive at about 200,000 pico-curies.)

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

There are no direct observations that show significant death rates from household levels of radon. EPA assumes LNT is true by extrapolation from dangerous radiation levels, then [warns](#) home buyers about radon.

This 2016 article [Rectifying Radon's Record: An Open Challenge](#) to the EPA shows the fallacy, but also is simply ignored by EPA.

The University of Oslo scientists wrote the free book, [Radon, Lung Cancer, and the LNT Model](#) to educate people.

National Academy of Science, other advisory and regulatory bodies continue to ignore science and LNT fraud history.

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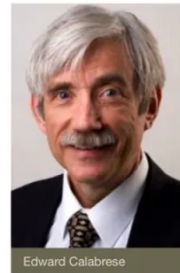
New Calabrese Paper Continues Criticism of NAS

September 1, 2020

Edward Calabrese, environmental health sciences, continues in a recent paper to question the legitimacy of the linear no threshold (LNT) model for risk assessment for ionizing radiation exposure as adopted by the U.S. Environmental Protection Agency and many others. This time, he offers evidence that he says shows National Academy of Science (NAS) panel members ignored human data that challenged their already-set conclusions.

He asserts that the science used to support of the LNT model adopted by the NAS's 1956 Biological Effects of Atomic Radiation (BEAR) I Genetics Panel is tainted by its leaders, who he says deliberately refused to include evidence from NAS's own Atomic Bomb Casualty Commission human genetic study, also known as the Néel and Schull 1956a report.

Calabrese says Néel and Schull showed "an absence of genetic damage in offspring of atomic bomb survivors in support of a threshold model," but this was not considered for evaluation by the genetics panel, "thus could not figure into its decision to recommend the linear non-threshold (LNT) dose-response model for risk assessment."



Edward Calabrese

University of Massachusetts Professor Edward Calabrese has written many papers exposing the original errors and false statements that evolved to become EPA LNT policy, agreed to by NRC and CDC. The National Academy of Sciences recently wrote an article defending their erroneous historical support of LNT, which Calabrese [critiqued](#), to no effect.

Joint Communique of SARI, XLNT, and SRI Regarding the Health Effects of Ionizing Radiation

(professional associations of radiologists, doctors, and radiation physicists)

- A radiation dose **under 100 mGy received over a short time (seconds or hours) is completely safe**. This exposure corresponds to 10 typical CT scans and will not contribute to the risk of cancer.
- In the case of the 2011 Great East Japan Earthquake, the residents of Fukushima **should not have been evacuated** because the radiation they would have received is low dose-rate radiation.
- We **challenge** ... advisory bodies ... that call for maintaining radiation doses **as low as reasonably achievable** ...and also challenge their **1 mSv annual dose limit for the public and the 20 mSv annual dose limit for radiation workers**. Such policies are not based on science; they are illogical, unwise, unhealthy, and irresponsible.

<https://www.x-lnt.org/joint-communique>

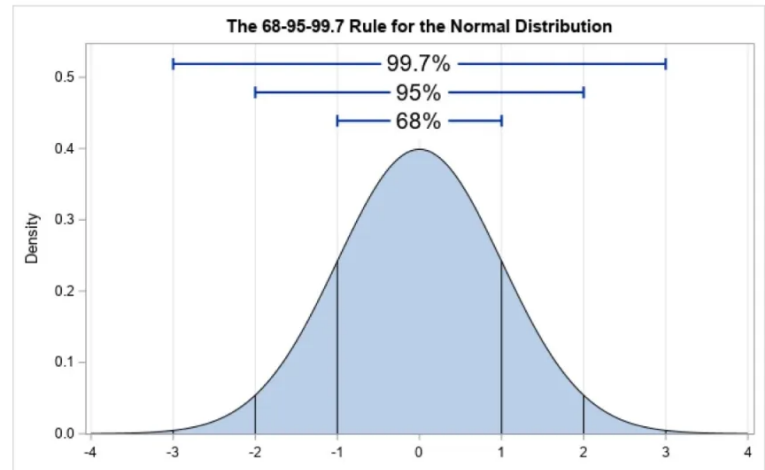
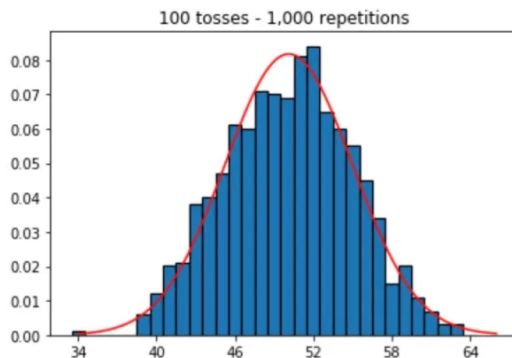
Concerned radiologists, doctors, and radiation physicists, members of Scientists for Accurate Radiation Information, issued this [statement](#). This contrasts with EPA and NRC regulations that prohibit exposures of as little as 1 mGy accumulated over an entire year.

What's a p-value?

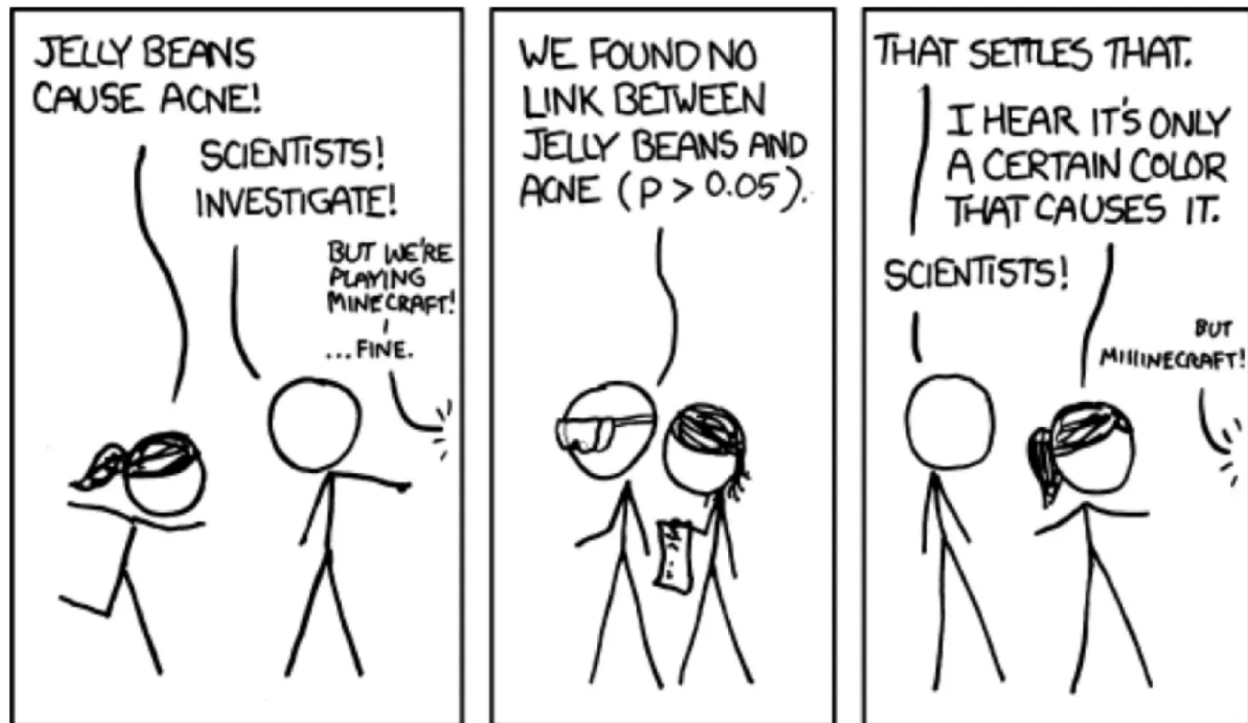
Null hypothesis: Every day is equally lucky.
My Hypothesis: Friday-the-13ths are lucky days.
I observed 66 heads on Friday the 13th! I'm right!

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

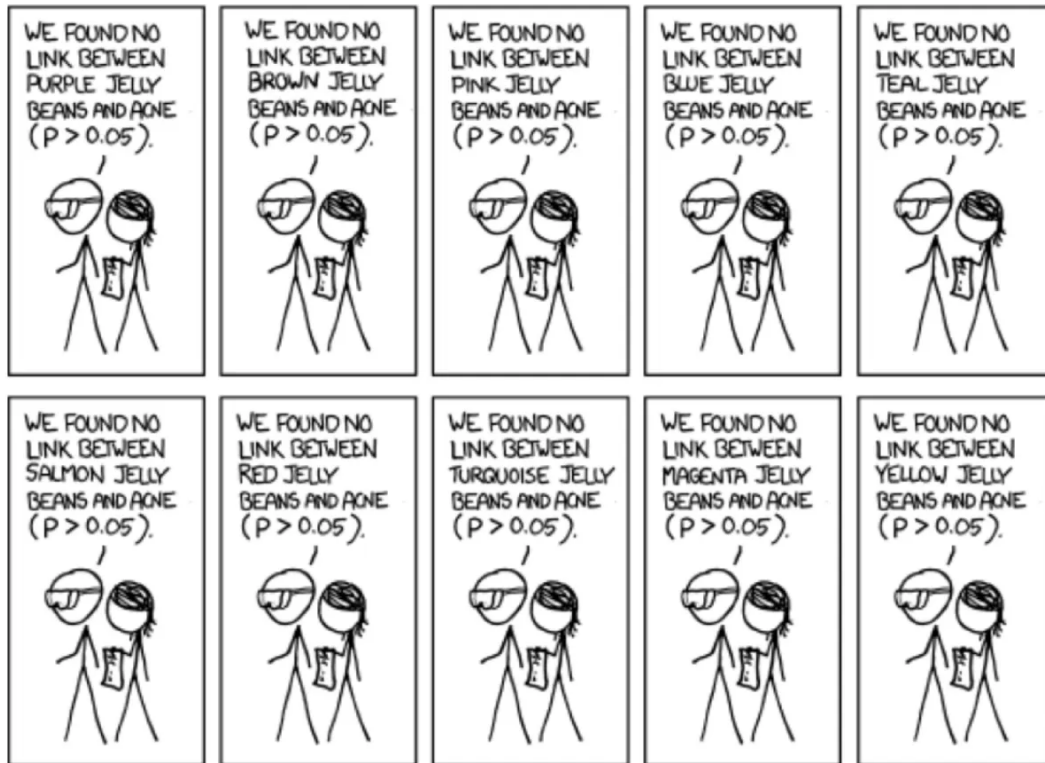
Toss a coin 100 times. Repeat.



Study this to learn a little statistics.

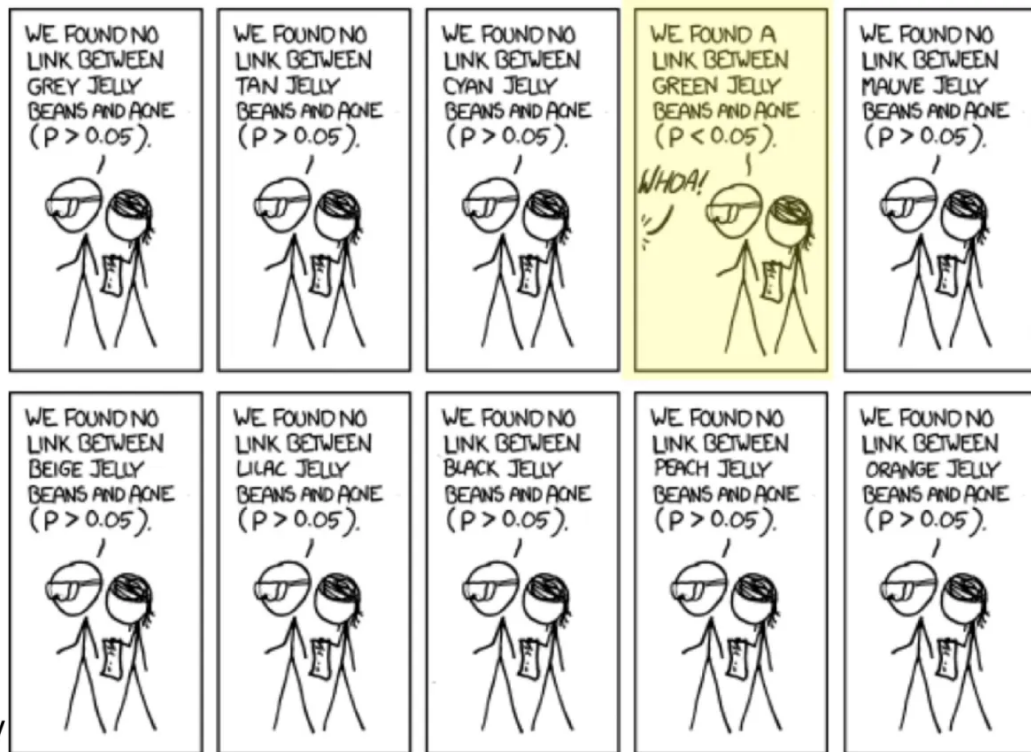


Sometimes enthusiastic scientists, disappointed in expected outcomes, seek a smaller data set that meets with their intuition.



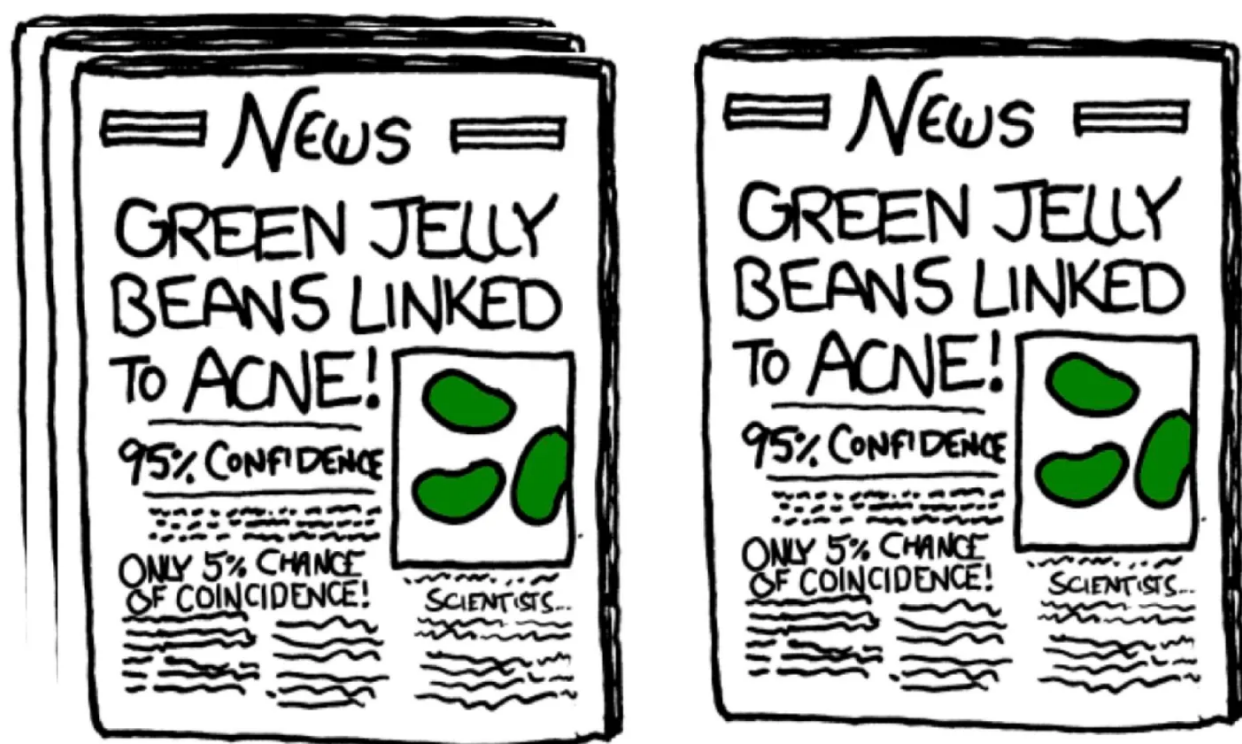
xkcd.com/882

Seeking but not finding...



xkcd.com/882/

One of 20 subsets of the data showed a correlation. The chance such a correlation would happen just by chance is only 5%. But by trying 20 different subsets of the data, finding such an accidental correlation is likely.



Two standard deviations, $p < 0.05$, 95% probably true, is the traditional hurdle for publishing a scientific result.

Publish or perish.

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

Richard Horton

Marcia Angell

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

No More Radiophobia!

Great 19 minute [video](#), filmed on the beach in Brazil. Low level radiation from thorium in beach sand is sought by people to cure their ills.

~~**LNT**~~

~~**ALARA**~~

- End **LNT** invalid regulation policy.
 - evidence-based safety limit ~100 mSv/year.
- End **ALARA** source of public fear.
- **Science-based regulation** is all we need to
 - let nuclear power thrive to
 - solve global energy/environmental/poverty crisis.

A single exposure of 100 mSv is not harmful, says SARI. Surely spreading it out over a full year is even more conservative and safe. Regulators claim the harm from radiation is linear, and it exists even at doses so low that harm can not be observed. Regulators typically set public safety limits at 1 mSv/year and worker limits of 20 mSv/year, but they then over-ride these limits with the ALARA rule (as low as reasonably achievable). They measure cumulative radiation exposure adding together exposures among large groups of people. Resulting regulations ratchet down constraints that raise cost of fission power plants to uneconomic levels.

Medical radiation experts ask NRC to end ALARA.



CAROL S. MARCUS, Ph.D., M.D.

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Professor of Radiation Oncology, of Molecular and Medical Pharmacology (Nuclear Medicine), and of Radiological Sciences; David Geffen School of Medicine at UCLA and Member of the ACMU, 1990-1994

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February 9, 2015

Annette L. Vietti-Cook
Secretary, USNRC
Attention: Rulemakings and Adjudications Staff
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Dear Ms. Vietti-Cook:

I am submitting this petition for rulemaking pursuant to 10 CFR Part 2.802. The petitioner requests that the NRC amend 10 CFR Part 20, *Standards for Protection Against Radiation*, based on new science and evidence that contradicts the Linear No-Threshold (LNT) hypothesis, a model that has served as the basis for radiation protection

Qualified scientists and doctors have [petitioned](#) the NRC to end reliance on ALARA and LNT and to set higher scientifically determined threshold radiation exposure limits.

Excerpts from Marcus 2015 petition to end LNT and ALARA.

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_

The [petition](#) also contains references to published scientific papers supporting the claims. A collection of such papers is at the web site of [SARI](#).

Consensus is not Science

"I'm talking about another theory, which rose to prominence a century ago.



Why Politicized Science is Dangerous

By Michael Crichton

Excerpted from *State of Fear*



Imagine that there is a new scientific

This theory quickly draws support for. Research is funded by distinguished reported frequently in the media. The

I don't mean global warming. I'm talking

Its supporters included Theodore Roosevelt, Woodrow Wilson, and Winston Churchill. It was approved by Supreme Court justices Oliver Wendell Holmes and Louis Brandeis, who ruled in its favor. The famous names who supported it included Alexander Graham Bell, inventor of the telephone; activist Margaret Sanger; botanist Luther Burbank; Leland Stanford, founder of Stanford University; the novelist H. G. Wells; the playwright George Bernard Shaw; and hundreds of others. Nobel Prize winners gave support. Research was backed by the Carnegie and Rockefeller Foundations. The Cold Springs Harbor Institute was built to carry out this research, but important work was also done at Harvard, Yale, Princeton, Stanford and Johns Hopkins. Legislation to address the crisis was passed in states from New York to California.

These efforts had the support of the

Its supporters included Theodore **Roosevelt**, Woodrow **Wilson**, and Winston **Churchill**. It was approved by Supreme Court justices Oliver Wendell **Holmes** and **Louis Brandeis**, who ruled in its favor. The famous names who supported it included Alexander Graham **Bell**, inventor of the telephone; activist Margaret **Sanger**; botanist Luther **Burbank**; Leland **Stanford**, founder of Stanford University; the novelist H. G. **Wells**; the playwright George Bernard **Shaw**; and hundreds of others. Nobel Prize winners gave support. Research was backed by the **Carnegie** and **Rockefeller** Foundations. The **Cold Springs Harbor** Institute was built to carry out this research, but important work was also done at **Harvard**, **Yale**, **Princeton**, **Stanford** and Johns **Hopkins**. Legislation to address the crisis was passed in states from New York to California.

These efforts had the support of the **National Academy of Sciences**, the **American Medical Association**, and the **National Research Council**." *Eugenics validated racism!*

<https://www.michaelcrichton.com/why-politicized-science-is-dangerous/>

One of the problems in overturning ALARA is that there are many scientists who have built their careers and reputations by using and endorsing the LNT model, publishing papers peer reviewed by like-minded people, establishing a consensus. However, science progresses when people reveal findings that conflict with accepted, settled science. Here's an example from [Michael Crichton](#), who studied science before becoming an author and movie producer.



US President John Kennedy said:

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.

<http://millercenter.org/scripps/archive/speeches/detail/3370> <https://www.youtube.com/watch?v=VrNEPA3igvY> Yale University commencement 1966

Listen to the [speech](#). The above quote appears at about 5:50 in the audio recording.

US nuclear power plants are far too expensive

because of unfounded radiation fears and consequent regulations.

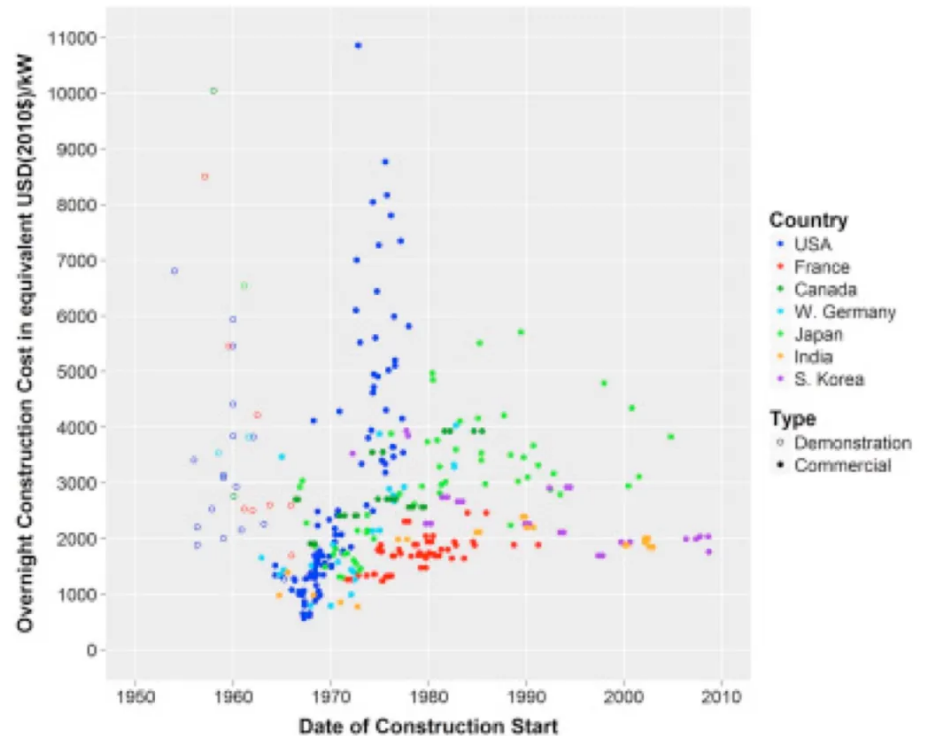
Not one has been designed and built since the NRC was founded in 1975.

Fission power plants became too expensive in the US.

\$2/W --> \$11/W

(\$2/W in S. Korea)

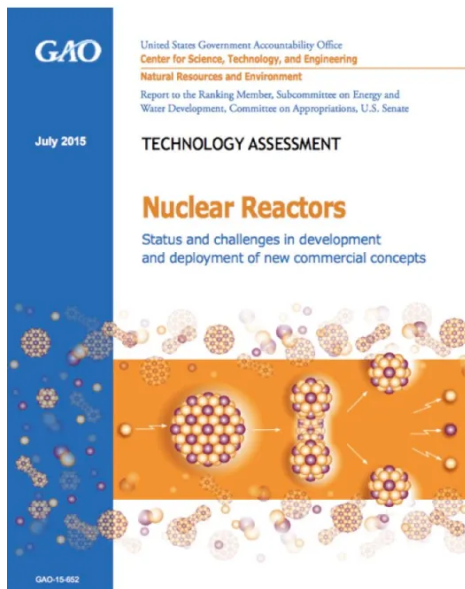
- regulation
- inexperience
- delays



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

Each dot **represents** the construction of a nuclear power plant. So called “overnight” construction costs exclude financing during construction. Fear and ALARA regulations have increased US fission power plants beyond economic viability.

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.

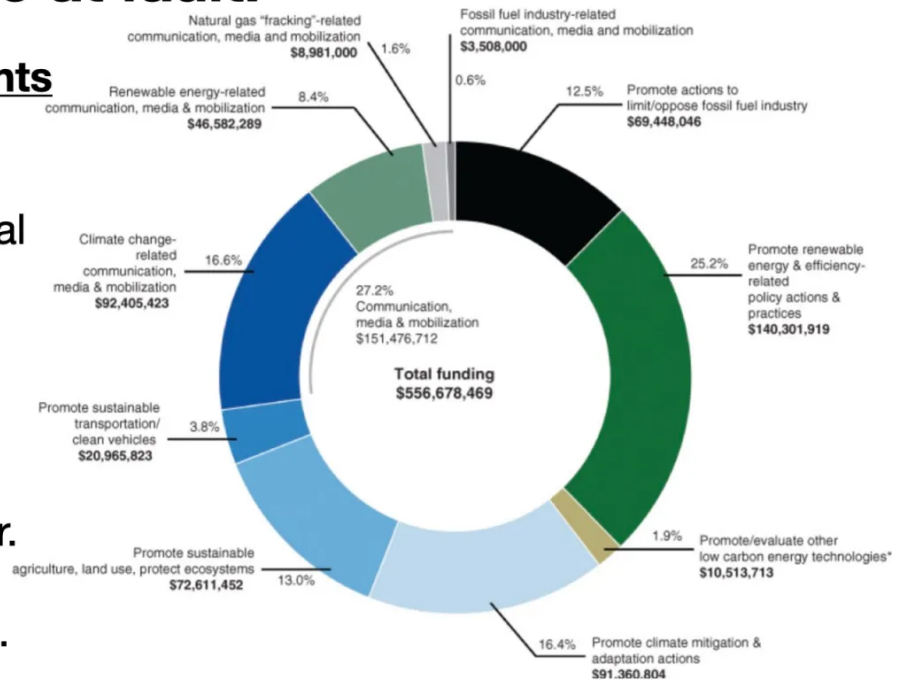
ThorCon founders presented plans to NRC before being [discouraged](#). No rational investor will risk \$1 billion depending on future NRC permission.

Foundations also at fault.

US climate/energy grants 2011-2015

- 19 major environmental grantmakers.
- \$557 million in 2,502 grants.
- None for fission power.
- \$175,000 to oppose it.

<https://onlinelibrary.wiley.com/doi/abs/10.1002/wcc.524>

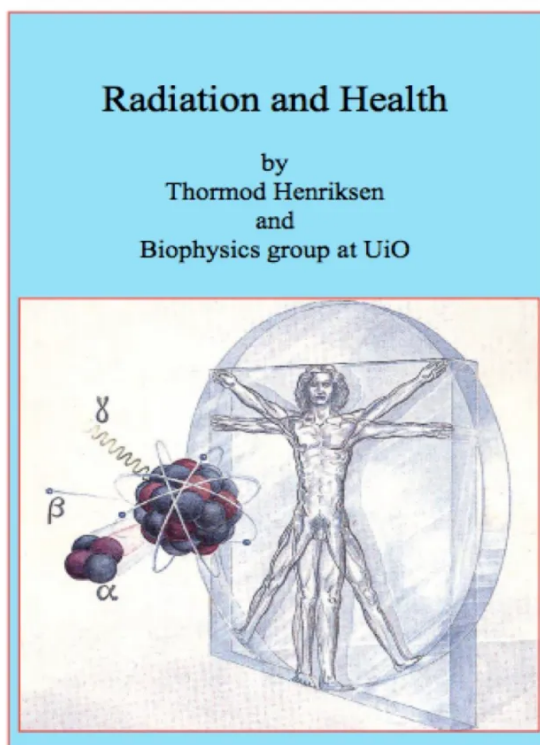


Consider the financial power that can be exercised by the above, supposedly pro-environmental, organizations, to campaign against nuclear power.

Radiation and Health, Thormod Henriksen

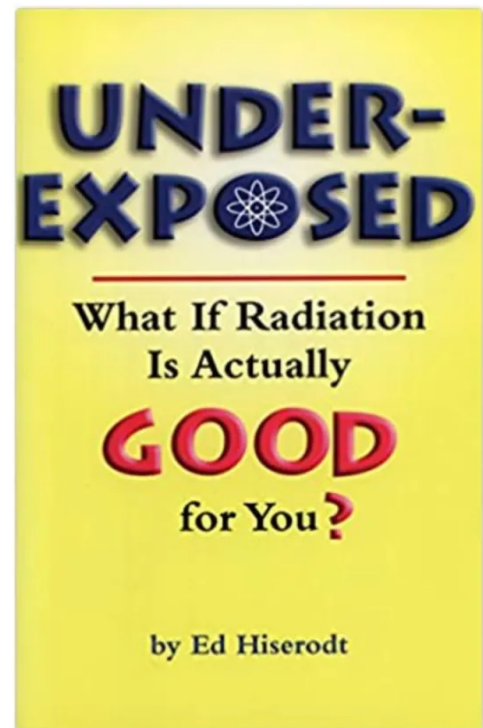
- superb
- readable
- free

<http://www.mn.uio.no/fysikk/tjenester/kunnskap/straling/radiation-and-health-2015.pdf>



Here's the best [book](#) on the subject, suited for readers who had a chemistry or physics course in college. Also available in print form at [Amazon](#).

*Readable for laypeople.
Humorous.
Graphic evidence.
Many backup references.*



Available at [Amazon](#).

Brochure, references, more at
<https://sites.google.com/site/radiationsafetylimits/>

Radiation: The Facts



Opening eyes to the facts

Radiation is safe within limits.

Nuclear power is a green environmental solution. It generates no CO₂. The fuel is cheap and inexhaustible.

Green nuclear power can solve the global crises of air pollution deaths and climate change. Cheap energy can help developing nations escape poverty and let industrialized nations improve economic growth.

Is it safe? The primary obstacle to nuclear power is misunderstanding of radiation safety.

Misunderstandings

- There is no safe level of radiation.
- Radiation effects are cumulative.
- Chernobyl killed nearly a million people.
- Nuclear waste is deadly for a million years.

These create public fear, so regulators adopted unnecessary rules to isolate the public from radiation. The excess costs and delays make nuclear power more expensive and impede its benefits to people.

Radiation is safe within limits.

I wrote this trifold handout. Jim Hansen posted my [flyer](#) at Columbia, too.



Radiophobia review

Fission power is safest.
Metabolism ionizes, too.
DNA, cells do repair.
Low dose hormesis ignored.
Thresholds ignored.
LNT harm is phantom.
Science politicized.

Fission is the safest power generation technology.

Metabolism within cells creates ionizing oxygen forms that cause thousands of times more DNA strand breaks than X-ray and CT scan machines do.

DNA strand breaks are repaired and cells and tissues regenerate, so cancer is a weak carcinogen.

The observed pro-health effects of radiation on Taiwan apartment dwellers, submarine workers, household radon breathers, and even some atomic bombing victims is ignored.

The safety thresholds are excluded by a priori assuming the LNT model of harm

starting a zero radiation dose.

The low dose harm predicted by LNT is an unobserved phantom of belief.

Science and statistics have been warped to comply with consensus to get papers published.

Back to [Electrifying Our World](#)