

Connie Kline, Past Chair, Ohio Sierra Club Nuclear Committee

The nuclear industry is notoriously ruthless and deceptive, so FirstEnergy's bribes to pass HB 6 and prevent its repeal were no surprise. Past falsehoods include:

- **Electricity too cheap to meter (1)** - Perry and Davis Besse cost \$8.7 billion and billions more in maintenance, repairs, and subsidies. **(2) (3) (4)**
- **Radioactive waste removed in five years (5)** - Unheeded warnings to resolve lethal waste before licensing reactors **(6)** means 88,000 tons sit in problematic pools and casks at 75 environmentally unsuitable reactor sites in 33 states. **(7)** The Nuclear Regulatory Commission (NRC) admits this waste will leak because no structure can last the eons required to protect humans and the environment. **(8)**
- **One in 1,000,000,000 serious accident chance. (9)** - Disasters occurred at Three Mile Island, Chernobyl, and Fukushima from 1979-2011, and elsewhere since the 1950s. **(10)** There are 23 Fukushima-type reactors at 16 U.S. sites. **(11)** The NRC and others predict a 50% chance of another catastrophic accident in approximately 20 years. **(12)**

The 1957 Price Anderson Act limits liability to \$12.6 billion. **(13)** A 1982 NRC study calculated a severe accident could cause 50,000 fatalities and \$314 billion in property damage which is \$720 billion today. **(14)** No private insurers cover reactor accidents. The NRC claims states will cover "injury, sickness, death, property damage, loss, and living expenses for evacuees." **(15)**

Dr. Gregory Jaczko, Ph.D, former NRC Chairman, is the latest expert to warn, "I oversaw the U.S. nuclear power industry. Now I think it should be banned. The danger from climate change no longer outweighs the risks of nuclear accidents." **(16)**

"Today's problems come from yesterday's `solutions'" **(17)** is a warning to distrust claims that nuclear power is:

- **"Indispensable"** - In 2018, grid operator PJM, determined that closing Perry and Davis-Besse would not destabilize the grid. **(18)** Other reactors have closed without consequence. **(19)**
- **"Carbon-free"** - Reactors produce and emit greenhouse gases like methane and radioactive Carbon-14, a highly volatile, biologically damaging, long-lived carbon isotope. **(20) (21)**

Energy experts like Dr. Benjamin Sovacool, Ph.D conclude that the nuclear life cycle emits more greenhouse gases per kWh than all renewables; carbon emissions are twice those of solar photovoltaic and six times more than wind or energy efficiency. **(22)**

- **"Clean"** - "A 1,000 MW reactor contains as much long-lived radiation as...1,000 Hiroshima-sized bombs." **(23)** Nuclear plants routinely leak and release into air, soil, and water deadly carcinogens, teratogens, and mutagens which are chemically indistinguishable from non-radioactive, life-sustaining elements. Scientists and physicians have determined that there is no safe dose or threshold of radiation exposure. **(24)**

Strontium-90 and cesium-137 replace calcium and potassium inducing bone and muscle cancer. Iodine-131 causes thyroid cancer. Cobalt-60 is a liver, kidney, and bone carcinogen. **(25)** Specks of inhaled plutonium-239, with a 24,000-year half-life, cause lung cancer. **(26)** Tritium - radioactive hydrogen - leaks from miles of buried, inaccessible, deteriorating pipes and cannot be removed from contaminated water. **(27)**

The NRC extends all reactor licenses no matter their operating record, **(28)**, and routinely waives and defers inspections, standards, maintenance, repairs, and upgrades. **(29)**

- **"Renewable"** - Uranium is a finite, non-renewable resource.

Ohio was 13th in the U.S. for wind power until a 2014 Ohio law severely restricted wind turbines, renewables, and efficiency; HB 6 eliminated them. **(30)**

Ohioans, including conservatives, strongly prefer solar, wind, and efficiency, oppose reactor subsidies, and consider HB 6 "a corporate welfare slush fund" that should be repealed. **(31) (32)**

Ohio must strengthen renewable energy and efficiency; reverse wind turbine restrictions; quickly phase out and close Perry and Davis Besse, and retrain workers in renewable energy jobs.

END NOTES

1. "Too cheap to meter..."

Lewis Strauss, member of the the Atomic Energy Commission (AEC)1946-50 and chair 1953-58 - Speech at the 20th anniversary of the National Association of Science Writers, New York City, September 16, 1954

https://todayinsci.com/S/Strauss_Lewis/StraussLewis-Quotations.htm
<https://timesmachine.nytimes.com/timesmachine/1954/09/17/83884025.html?action=click&contentCollection=Archives&module=ArticleEndCTA@ion=ArchiveBody&pgtype=article&pageNumber=5>

“Abundant power from atom seen” 9/17/54

<https://timesmachine.nytimes.com/timesmachine/1954/09/17/83884025.pdf>

New reactors costs approach \$20 billion and are so prohibitively expensive that they are canceled.

<https://www.bizjournals.com/charlotte/news/2017/07/31/s-c-utility-votes-to-stop-building-16b-v-c-summer.html>

https://www.postandcourier.com/business/georgia-s-nuclear-project-could-be-canceled-like-south-carolina/article_f8781644-d908-11e7-8116-37b0cbdd646.html

2. “First Energy customers lose chance to save billions in electricity costs” Plain Dealer 10/17/03

http://ohiocitizen.org/campaigns/electric/2003/lose_chance.htm

<http://northperry.org/community/north-perry-history.html>

“At a cost of six billion dollars, the Perry Nuclear Power Plant is one of the most expensive ever built.”

3. Millions in subsidies granted to FirstEnergy in 2016

<https://www.publicpower.org/periodical/article/ohio-regulators-modify-firstenergy-rate-proposal-scale-it-back>

<https://www.bricker.com/insights-resources/publications/consequences-of-first-energys-electric-security-plan-rehearing-decision>

4. Nuclear power subsidies

<https://www.commondreams.org/views/2019/04/06/nuclear-power-not-viable-solution-green-new-deal>

“Conservative estimates suggest that the nuclear industry has received more than \$85 billion in subsidies.” (in 2009 dollars)

<https://www.taxpayer.net/energy-natural-resources/nuclear-power-subsidies/> (in 2009 dollars)

<http://content.time.com/time/health/article/0,8599,1812540,00.html> (in 2008 dollars)

“Lovins notes that the U.S. nuclear industry has received \$100 billion in government subsidies over the past half-century.”

<https://www.counterpunch.org/2016/01/01/nuclear-energy-dangerous-to-your-wallet-not-only-the-environment/>

“...there so many different types of subsidies — but it amounts to a figure, whether we calculate in dollars, euros or pounds, in the hundreds of billions.” (In 2016 dollars)

<https://hubpages.com/politics/The-Hidden-Costs-of-Nuclear-Energy> (2018 dollars)

“The nuclear power industry is arguably the most heavily subsidized industry in the United States.”

<https://www.iisd.org/gsi/commentary/gambling-nuclear-power-how-public-money-fuels-industry> (2008 dollars)

“...studies have quantified subsidies to the nuclear-power industry over the decades, indicating aggregate subsidization at well over US \$150 billion, and a subsidy intensity (government support per kWh output) normally exceeding 30% of the market value of the energy produced.”

Peter Bradford 2016 (see Note 16)

<http://theconversation.com/compete-or-suckle-should-troubled-nuclear-reactors-be-subsidized-62069>

<https://www.marketwatch.com/press-release/experts-nuclear-bailout-could-cost-up-to-17-billion-a-year-and-destroy-renewables-industry-in-us-2018-06-06>

<https://www.ecowatch.com/nuclear-power-cost-renewables-2625524662.html>

https://www.ucsus.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear_subsidies_report.pdf

<https://www.ewg.org/news-and-analysis/2018/03/trump-administration-plans-spin-campaign-dying-nuclear-energy>

<https://thinkprogress.org/nuclear-power-is-so-uneconomical-even-bill-gates-cant-make-it-work-without-taxpayer-funding-faea0cdb60de/>

<https://www.brattle.com/news-and-knowledge/news/report-by-brattle-economists-assesses-potential-costs-associated-with-administration-policy-designed-to-prevent-the-retirement-of-all-coal-and-nuclear-plants>

<http://www.independent.org/news/article.asp?id=9082>

5. P. 19 - “NRC views long-term storage of wastes for more than five years as a significant safety and environmental matter...”

U.S. Nuclear Regulatory Commission, “Guide to the U.S. NRC’s 10CFR61,” Office of Nuclear Materials

Safety and Safeguards, August 1989

<https://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0121/>

<https://www.nrc.gov/docs/ML1207/ML120720225.pdf>

6. Unheeded warnings

From 1946-1950, David Lilienthal chaired the Atomic Energy Commission (AEC), predecessor of the present-day NRC which was created in 1974. His candid 1963 book *Change, Hope and the Bomb* was extremely critical of commercial nuclear power and radioactive waste:

“During the years since the first AEC, has the problem of disposition of these poisonous, radioactive wastes been made demonstrably manageable, either as to the danger or the cost? The answer is No!

Should not a program of large-scale atomic reactors wait at least until it is demonstrated that this waste-poison problem is decisively licked? Until such time, I believe that the future of atomic energy is in grave doubt. The risks may limit or even eliminate a nation-wide atomic-energy program.”

Lilienthal, David E., *Change, Hope and the Bomb* (Princeton, NJ: Princeton University Press, 1963), pp. 135-137.

<https://ia600200.us.archive.org/18/items/changehopeandthe013184mbp/changehopeandthe013184mbp.pdf>

The renowned international scientific body PUGWASH stated at its 23rd Conference in 1973:

“No general solution for the isolation of long-lived radioactive wastes from the biosphere, necessary for many of thousands of years, is yet in hand...`experts' still disagree on whether any proposals will suffice...It is impossible to be complacent about expansion in the use of nuclear power without having a solution in hand.”

Lash, Terry. R, Bryson, John E., and Cotton, Richard, “Citizens' Guide: the national debate on the handling of radioactive wastes from nuclear power plants” (Palo Alto, CA: Natural Resources Defense Council, Inc., 1975), p. 2.

<https://www.worldcat.org/title/citizens-guide-the-national-debate-on-the-handling-of-radioactive-wastes-from-nuclear-power-plants/oclc/500326701?referer=di&ht=edition>

PUGWASH

<https://pugwash.org/pugwash-international-conferences/>

<https://core.ac.uk/display/44193496>

7. Spent fuel pools and dry casks (Note conversion of metric tons to tons.)

https://www.gao.gov/key_issues/disposal_of_highlevel_nuclear_waste/issue_summary

Spent Fuel Pool Problems

Pools are not under robust containment like the reactor, itself, making accidents or attacks more likely to cause a disastrous release of radiation. The NRC admits that irradiated fuel which has been cooled in pools for decades could spontaneously combust if overheated due to partial water drainage or contact with air resulting from a loss of power, pump circulation failure, pool puncture from loading dry casks or a terrorist attack. A resulting fire could be catastrophic.

However, the NRC continues to minimize and inadequately address the vulnerability of spent fuel pools to accidents, attacks, and fires, justifying its position, in part, by assuming that populations in the 10 mile Emergency Planning Zones (EPZs) will be successfully evacuated. This assumption ignores the inadequacy of unproven evacuation plans and the fact that spent fuel can and will remain in pools long after reactor closure.

Further, the NRC can exempt utilities from maintaining EPZs within a mere 12-18 months after reactor shutdown. How can populations be evacuated if EPZs have been eliminated?

Problems are exacerbated by the increased use of high burn-up fuel which is thermally hotter, requiring cooling in spent fuel pools for a minimum of 20 years; more than twice as radioactive as lower burn-up fuel; and more susceptible to damage, cladding embrittlement, and storage instability than fuel initially used in commercial reactors. There is no way to transfer high burn-up fuel to dry cask storage.

Through incompetence, negligence, non-disclosure, and falsification, the nuclear industry ignored or hid spent fuel pool leaks of radioactive effluent (including Cobalt-60, cesium-137, and especially tritium) into soil and groundwater. (See Notes 23-

27) http://www.beyondnuclear.org/storage/documents/LeakFirst_FixLater_BeyondNuclear_April182010_FINAL.pdf

<https://www.propublica.org/article/status-of-spent-nuclear-fuel-in-question-at-crippled-japanese-power-plant>

<https://ratical.org/radiation/NuclearExtinction/SpentNuclearFuelPoolsInUS.pdf>

https://ips-dc.org/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage/
<http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=11263>
<https://www.freep.com/story/news/local/michigan/2018/10/19/nuclear-waste-great-lakes/1417767002/>

NRC cites problems with spent fuel pools at various reactors

<https://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1990/in90033.html>

Documented problems with spent fuel pools at various reactors

<https://allthingsnuclear.org/dlochbaum/spent-fuel-damage-pool-criticality-accident>

Scroll to bottom "United States"

<https://www.brookings.edu/opinions/preventing-nuclear-meltdown-assessing-regulatory-failure-in-japan-and-the-united-states/>

Dry-cask storage problems

Dry casks are much more costly than spent fuel pools. "A dry-cask storage facility at a plant can cost as much as \$20 million to build and \$7 million a year to maintain, according to the industry group Nuclear Energy Institute."

<https://republicans-energycommerce.house.gov/news/press-release/long-term-repository-needed-nuclear-waste-continues-pile/>

Casks are made of concrete, steel, and neutron shielding materials. Thin, metal inner canisters are loaded underwater in the spent fuel pools, the water is pumped out, and the lids are welded or bolted shut. Inner canister temperatures can reach 400 degrees F due to continued radioactive decay. The canisters are transferred outdoors to concrete silos or bunkers which sit on concrete pads where they are vulnerable terrorist targets. Dry casks are certified generically for 20 years meaning public hearings are prohibited, and the casks are approved with no site-specific study and no environmental impact statement.

Problems surfaced almost immediately with dry cask use. The NRC allowed manufacturers to build casks BEFORE issuing a certificate of compliance. There have been numerous quality control and quality assurance problems with Holtec, NUHOMS, TN-40, VSC-24 casks and others. There have been well documented departures from design and technical specifications, use of potentially inferior materials, structural integrity issues, and weld failures as well as problems with the concrete pads, themselves, at, for example, the Dresden reactor in Illinois. These concrete pads and casks weighing over 100 tons have been placed on unstable, sandy, erosion-prone soils like those at the Palisades reactor on the shores of Lake Michigan.

At the Davis Besse reactor in Ohio, fully loaded NUHOMS casks were built below technical specifications with poor quality aggregate in the outer concrete shells, and welds were ground too thin. The NRC reported in 2000 that a loaded TN-32 cask at the Surry plant in Virginia developed six inch long cracks in its outer concrete shield, loose bolts, and a helium leak.

Perhaps most disturbing have been the "hydrogen ignition incidents" (explosions) with the VSC-24 casks, most notably on May 28, 1996 at the Point Beach reactor in Wisconsin and in June 1999 at Palisades in Michigan.

Human error or equipment failure in moving loaded canisters could have catastrophic consequences. Dropping an empty or loaded canister inside the fuel pool building could severely damage critical safety equipment and impact the integrity of the entire pool. In some GE boiling water reactors (Fukushima-type Mark I), irradiated fuel storage pools are several stories high, making cask movement even more dangerous and potentially disastrous. A near-miss occurred on May 13, 1995 at Prairie Island in Minnesota when a loaded, 120 ton TN-40 canister became stuck and dangled precariously for 16 hours over the spent fuel pool which contained tons of irradiated fuel that had been stored for over 22 years. In August 2018, a canister at the San Onofre reactor nearly fell 18 feet as it was being moved from the spent fuel pool to a dry cask. <https://www.sandiegouniontribune.com/business/energy-green/sd-fi-songs-whistleblower-20180810-story.html>

The NRC assumes that this radioactive waste can be transferred into new casks every 100 years or less, yet no dry storage cask has ever been unloaded, and no safe unloading procedure exists as evidenced by an August 1994 situation at Palisades when a VSC-24 cask was discovered to have weld flaws. The utility, Consumers Energy, "volunteered" to unload the irradiated fuel from the cask and put it back into the storage pool, but insurmountable technical difficulties prevented that from occurring. Placing 400 degree F fuel back into 100 degree F pool water would result in radioactive steam hazardous to workers, and would thermally shock the fuel threatening to further degrade it. There was only a 50 hour window to cut open the welded inner canister and unload the cask before the fuel would begin to

overheat. So that fully loaded, known-defective cask and dozens more fully loaded VSC-24 casks of questionable integrity remain on the shores of Lake Michigan.

The NRC has failed to consider the very real possibility that irradiated fuel will so degrade with age that transfer operations cannot ever be accomplished.

<https://www.nirs.org/wp-content/uploads/radwaste/atreactorstorage/drycaskfactsheet07152004.pdf>

<https://www.nrc.gov/public-involve/conference-symposia/dsfm/2015/dsfm-2015-erica-gray.pdf>

<https://sanonofresafety.files.wordpress.com/2011/11/drycaskstorageissues2014-09-20a.pdf>

<https://sanonofresafety.files.wordpress.com/2013/06/highburnupexecutivesummary2014-01-02.pdf>

<https://sanonofresafety.org/2014/08/21/premature-failure-of-u-s-spent-nuclear-fuel-storage-canisters/>

https://www.songscommunity.com/internal_redirect/cms.ipressroom.com.s3.amazonaws.com/339/files/20182/Donna%20Gilmore%20-%20Public%20comment%20for%20CEP%20meeting%20-%202007-23-15.pdf

<https://www.agreenroadjournal.com/2016/04/dry-cask-long-term-high-level-nuclear.html>

<http://agreenroad.blogspot.com/2013/12/spent-fuel-pool-risks-at-nuclear-power.html>

Structural integrity of high burnup fuel rod under drop impact

<https://www.sciencedirect.com/science/article/pii/S0029549318303005>

Sandia National Lab report October 2018 Spent Fuel Transportation Casks

“Current designs for spent fuel transportation casks cannot ensure a cask’s integrity during shipment, nor is there any verifiable means of maintaining continuity of knowledge (CoK) on a cask’s contents.”

https://www.researchgate.net/publication/328642066_SANDIA_REPORT_Developing_Design_Criteria_for_Safeguards_Seals_for_Spent_Fuel_Transportation_Casks_-_Final_Report

https://www.researchgate.net/publication/328642066_SANDIA_REPORT_Developing_Design_Criteria_for_Safeguards_Seals_for_Spent_Fuel_Transportation_Casks_-_Final_Report

8. Waste will outlast disposal (See Note 5 - P. 19) - “There is no way to guarantee that any disposal facility, for any waste, will not release some amount of radioactivity...No structure or site can be guaranteed to contain radioactive waste in perpetuity. Given the fact that facilities deteriorate and human institutions may not maintain complete control, NRC chose to rely on the more realistic requirements of 100 years of institutional care...”

<https://www.nrc.gov/docs/ML1207/ML120720225.pdf>

9. Accident likelihood

1957 AEC Report - WASH-740 (aka "The Brookhaven Report") "Theoretical Possibilities and Consequences of Major Accidents in Large Nuclear Power Plants"

https://everipedia.org/wiki/lang_en/WASH-740/

<http://dictionary.sensagent.com/wash%20740/en-en/>

“Calculation of Reactor Accident Consequences” Sandia Labs 1982

<http://ccnr.org/crac.html>

<https://www.nirs.org/wp-content/uploads/reactorwatch/accidents/crac2.pdf>

10. Nuclear reactor disasters

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3606704/>

<https://www.cnn.com/2011/03/16/11-Nuclear-Meltdowns-and-Disasters.html>

<https://www.processindustryforum.com/hot-topics/nuclear-disasters>

11. Fukushima GE Mark I reactors used in U.S. and long criticized

<https://www.nytimes.com/2011/03/16/world/asia/16contain.html>

12. Probability of another nuclear plant disaster

<https://www.nytimes.com/1985/05/08/opinion/the-next-nuclear-meltdown.html>

<https://www.technologyreview.com/s/536886/the-chances-of-another-chernobyl-before-2050-50-say-safety-specialists/>

<https://www.nbcnews.com/storyline/fukushima-anniversary/u-s-nuclear-agency-hid-concerns-hailed-safety-record-fukushima-n48561>

<https://washingtonsblog.com/2011/04/a-u-s-nuclear-accident-could-be-a-lot-worse-than-japan.html>

https://www.huffpost.com/entry/five-years-after-fukushim_b_9402962

13. Price Anderson Act

https://money.cnn.com/2011/03/25/news/economy/nuclear_accident_costs/index.htm

<https://www.thenation.com/article/who-pays-nuclear-power/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3606704/>

14. Accident costs/consequences (See also Note 9)

https://money.cnn.com/2011/03/25/news/economy/nuclear_accident_costs/index.htm

<http://dictionary.sensagent.com/wash%20740/en-en/>

Consequences of a Reactor Accident 1982

<http://ccnr.org/crac.html>

Impact of a Meltdown 1982

<http://static1.1.sqspcdn.com/static/f/356082/10875171/1298351245463/CRAC+2+chart.pdf?token=PGuxgz5f4FZMvil8tC45ukdF8Ks%3D>

<http://cms.energypolicy.co.uk/243>

15. No private insurance (see also Notes 13 & 14)

https://money.cnn.com/2011/03/25/news/economy/nuclear_accident_costs/index.htm

16. Gregory Jaczko NRC commissioner from 2005 to 2009 and chairman from 2009 to 2012, author of *Confessions of a Rogue Nuclear Regulator*, founder of Wind Future LLC, and professor at Georgetown University and Princeton University.

https://www.washingtonpost.com/outlook/i-oversaw-the-us-nuclear-power-industry-now-i-think-it-should-be-banned/2019/05/16/a3b8be52-71db-11e9-9eb4-0828f5389013_story.html?utm_term=.29203c0e6872

downloadable PDF

<https://www.goodreads.com/book/show/40538729-confessions-of-a-rogue-nuclear-regulator>

Experts past and present who oppose nuclear power:

Dr. Peter Bradford, Ph.D, NRC Commissioner from 1977-1982 (see Note 4)

https://www.huffpost.com/entry/former-nrc-chair-emergenc_b_4060780

https://www.cleveland.com/business/2018/06/fes_nuclear_decommissioning_fu.html

<https://www.reformer.com/stories/former-nrc-commissioner-says-no-to-loan-guarantees,114746>

<https://www.forbes.com/sites/oshadavidson/2011/03/13/former-u-s-nuclear-official-warns-it-can-happen-here/#6ea183f558d2>

<https://washingtonsblog.com/2014/01/former-nrc-commissioner-trying-solve-global-warming-building-nuclear-power-plants-like-trying-solve-global-hunger-serving-everyone-caviar.html>

Dale Bridenbaugh nuclear safety engineer who along with Gregory Minor, and Richard Hubbard left GE in 1976 over prophetic concerns about the GE Mark I reactor, the type at Fukushima (see also *Nuclear Witness* below)

<https://www.cbsnews.com/news/nuclear-safety-expert-it-could-happen-here/>

<https://abcnews.go.com/Blotter/fukushima-mark-nuclear-reactor-design-caused-ge-scientist/story?id=13141287>

<https://www.nytimes.com/1976/02/03/archives/3-engineers-quit-ge-reactor-division-and-volunteer-in-antinuclear.html>

Robert Pollard nuclear reactor safety engineer with the Atomic Energy Commission (AEC), predecessor of the NRC, and a licensing project manager for the NRC which he left in 1976 after deciding that the NRC “was more interested in protecting the nuclear industry than the health and safety of the public.”

<https://www.the-scientist.com/news/ucs-marks-20-years-as-advocate-for-the-wise-use-of-technology-61734>

<https://www.upi.com/Archives/1986/09/16/Critics-warn-of-O-ring-danger-at-nuclear-plants/2474527227200/>

<https://www.upi.com/Archives/1989/06/14/Suit-filed-against-nuclear-licensing-rule/518961380000/>

<https://www.nytimes.com/1976/05/30/archives/tv-view-fair-play-or-foul-on-60-minutes-tv-view-fair-play-or-foul.html>

Arnie Gunderson nuclear engineer and licensed Critical Facility Reactor Operator with more than 44 years of nuclear industry experience who became a whistleblower in 1990.

<https://www.youtube.com/watch?v=3nF1Bqh55Tg>

<https://vermontconversation.com/tag/maggie-gunderson/>

David Lochbaum a nuclear safety engineer who worked in nuclear power plants for 17 years and taught safety to inspectors at the NRC; he became a whistleblower. His expertise is in nuclear power plant design, nuclear regulatory oversight, and nuclear waste issues. He recently retired from the Union of Concerned Scientists which he joined in 1996.

<https://thebulletin.org/biography/david-lochbaum/>

https://allthingsnuclear.org/author/dlochbaum#.XOhHQ5I_PDA

Edwin Lyman, Ph.D in physics from Cornell University. Worked in the Processing Needs Assessment conducted by the Department of Energy's Nuclear Material Stabilization Task Group from 1997-98.

<https://www.nrc.gov/public-involve/conference-symposia/ric/past/2013/docs/bios/bio1-932.html>

<https://inside.mines.edu/UserFiles/File/Nuclear/Edwin%20Lyman%20Seminar.pdf>

https://allthingsnuclear.org/author/elyman#.XOnIS5I_PDA

Dr. John Gofman, M.D., Ph.D cardiologist, nuclear chemist, nuclear physicist, author of *Poison Power*, *Radiation and Human Health* among other books

<https://www.latimes.com/archives/la-xpm-2007-aug-28-me-gofman28-story.html>

Gofman and Dr. Arthur Tamplin, Ph.D - *Poison Power*

<https://ratical.org/radiation/CNR/PP/PPtxt.html>

<https://wakeup-world.com/2015/09/27/cancer-coverups-and-contamination-the-real-cost-of-nuclear-energy/>

<https://ratical.org/radiation/CNR/JWG-Life+Work1.html>

Arthur R. Tamplin, Ph.D biochemist, biophysicist

<https://www.legacy.com/obituaries/bakersfield/obituary.aspx?pid=86128374>

Dr. Thomas Mancuso, M.D., Ph.D

<https://www.nytimes.com/2004/07/07/us/tf-mancuso-who-led-radiation-study-dies-at-92.html>

<https://spewingforth.blogspot.com/2004/07/dr-thomas-mancuso-1912-2004.html>

[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(04\)16749-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(04)16749-4/fulltext)

Dr. Alice Stewart, M.D.

<https://www.nytimes.com/2002/07/04/world/alice-stewart-95-linked-x-rays-to-diseases.html>

Dr. Helen Caldicott, M.D. (See also Notes 23 & 24)

http://ifyoulovethisplanet.org/dl/caldicott_bio.pdf

<https://www.helencaldicott.com/about/>

Author of *Nuclear Madness* and *Nuclear Power is not the Answer* among other books

Dr. Rosalie Bertell, M.D. consultant to U.S. NRC and U.S. EPA (See also Note 23 & 24)

<https://www.globalresearch.ca/remembering-rosalie-bertell/31448>

Author of *No Immediate Danger*, *Chernobyl*, ECRR 2010 Recommendations of the European Committee on Radiation Risk: The Health Effects of Exposure to Low Doses of Ionizing Radiation

Roger Sowell attorney and chemical engineer

<https://sowellslawblog.blogspot.com/2016/09/a-few-excellent-reasons-to-oppose.html>

Nuclear Witness Leslie J. Freeman

<https://searchworks.stanford.edu/view/1017681>

https://en.wikipedia.org/wiki/List_of_nuclear_whistleblowers

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https://everipedia.org/wiki/lang_en/Arjun_Makhijani/

http://www.ebook3000.com/Carbon-Free-And-Nuclear-Free_91771.html

<https://www.aps.org/units/fps/newsletters/200804/makhijani.cfm>

See also - Mark Z. Jacobson, Department of Civil & Environmental Engineering, Stanford Univ. & **Mark A. Delucchi**, Institute of Transportation Studies, Univ. of CA at Davis

<https://web.stanford.edu/group/efmh/jacobson/Articles/I/JDEnPolicyPt1.pdf>

“Providing all global energy with wind, water, and solar power, Part I: Technologies, energy resources, quantities and areas of infrastructure and materials”

“Providing all global energy with wind, water, and solar power, Part II: Reliability, system and transmission costs and policies”

<https://web.stanford.edu/group/efmh/jacobson/Articles/I/DJEnPolicyPt2.pdf>

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<http://web.stanford.edu/group/efmh/jacobson/Articles/I/susenergy2030.html>

See also - Derek Abbott, a physicist and electronic engineer, and professor in the School of Electrical and Electronic Engineering at the University of Adelaide in Australia and author of “Nuclear Power Game Over” and other publications

http://static1.1.sgspcdn.com/static/f/356082/27266889/1475068962187/NuclearPower_GameOver_Derek_Abbott.pdf?token=IEiIM7hFSxkOm%2BpRPYvQT5iQKE%3D

<https://researchers.adelaide.edu.au/profile/derek.abbott>

See also - “Nuclear power, the energy balance” by Jan Willem Storm van Leeuwen and Philip Smith - van Leeuwen is a physical chemist and energy consultant focused on sustainability whose numerous articles and reports have appeared in various peer-reviewed scientific journals.

<https://www.stormsmith.nl/aboutstudy.html>

<https://www.stormsmith.nl/Media/downloads/insights.pdf>

<https://www.stormsmith.nl/reports.html>

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<https://blindhypnosis.com/the-fifth-discipline-the-art--practice-of-the-learning-organization-pdf.html>

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<https://www.euci.com/pjm-says-proposed-closing-of-firstenergy-nuclear-plants-will-not-impact-grid-reliability/>

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19. **Closed reactors, nuclear-free states and countries**

<https://www.power-eng.com/articles/slideshow/2016/08/u-s-nuclear-power-plants-already-closed-or-closing.html>

<http://www.radiationtruth.org/nuclear-power-free-countries/>

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Pennsylvania did not pass a nuclear bailout bill in 2019. The Pilgrim reactor in Mass. is also closed in 2019.

20. **Production of carbon and greenhouse gases in nuclear plant life cycle**

Nuclear power plants create thermal water pollution; their cooling towers produce huge amounts of water vapor which is, itself, a major greenhouse gas and contributor to global warming/climate change.

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<https://www.newscientist.com/article/dn11652-climate-myths-carbon-dioxide-isnt-the-most-important-greenhouse-gas/>

<http://large.stanford.edu/courses/2019/ph241/clark1/https://progressive.org/dispatches/nuclear-power-causes-global-warming/>

<https://www.resilience.org/stories/2006-05-11/does-nuclear-power-produce-no-co2/>

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21. **Carbon-14**

<https://www.irsn.fr/EN/Research/publications-documentation/radionuclides-sheets/environment/Pages/carbon14-environment.aspx>

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22. **Carbon and nuclear fuel cycle**

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https://www.nirs.org/wp-content/uploads/climate/background/sovacool_nuclear_ghg.pdf

Benjamin Sovacool and Christopher Cooper, "Nuclear Nonsense: Why Nuclear power is no Answer to Climate Change and the World's Post-Kyoto Energy Challenge"

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"Final report on technical data, costs and life cycle inventories of nuclear power plants."

Claire Lecointe, David Lecarpentier, Vincent Maupu, Denis Le Boulch, Romain Richard

<http://www.needs-project.org/RS1a/RS1a%20D14.2%20Final%20report%20on%20nuclear.pdf>

"Life cycle and management of carbon-14 from nuclear power generation"

Man-Sung Yima, Francois Caron, Department of Nuclear Engineering, North Carolina State University,

<https://ramp.nrc->

<gateway.gov/system/files/66278bfc78cd1cc9267444534e1a7b34/Progress%20in%20Nuclear%20Energy%20Article.pdf>

<https://www.resilience.org/stories/2006-05-11/does-nuclear-power-produce-no-co2/>
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Dr. Helen Caldicott (see Note 16)

<http://www.spaulforrest.com/2011/03/warnings-of-nuclear-plant-dangers-were.html>

Dr. Rosalie Bertell (See Note 16)

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http://www.efmr.org/Xtra/TheNRC_%20What.pdf

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http://nukefreetexas.org/downloads/health_risks_nuclear_power.pdf

<http://nuclearfiles.org/menu/key-issues/nuclear-energy/basics/introduction.htm>

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<https://www.nrc.gov/docs/ML0530/ML053040355.pdf>

24. No safe dose/dose rate of radiation exposure

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http://www.inaco.co.jp/isaac/shiryo/pdf/ECRR_2010_recommendations_of_the_european_committee_on_radiation_risk.pdf

University of South Carolina (2012, November 13). “Even low-level radioactivity is damaging, scientists conclude,” Science Daily. <https://www.sciencedaily.com/releases/2012/11/121113134224.htm>

25. Radionuclides

In 2010 the NRC asked the National Academy of Sciences to conduct an “Analysis of Cancer Risks in Populations Near Nuclear Facilities: Phase I” which was completed in 2012. NAS was preparing to embark on Phase II of the study when the NRC abruptly canceled it.

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<https://nuclear-news.net/2014/05/02/dr-helen-caldicott-explains-the-facts-on-radiation/>

See also Notes 16, 23 Dr. Rosalie Bertell

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https://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/nuclear-power-radioactive-releases.pdf

<https://www.ucsusa.org/nuclear-power/us-nuclear-power-plants-database>

<https://www.usnews.com/news/articles/2016-03-15/nuclear-plants-leak-radiation-and-regulator-faces-scrutiny>

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Perry nuclear power plant operating license effluents pp. 393-397

<https://www.nrc.gov/docs/ML0530/ML053040355.pdf>

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2/19/19, 3/20/19, 5/16/19 - Perry Deferrals Beyond Design Basis Flooding Hazard

<https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML19035A655>

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<https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML19093B133>

3/4/2019 - NRC Response to Request for Deferral of Actions Related to Beyond-Design-Basis Flooding Hazard Reevaluations for Davis-Besse Nuclear Power Station, Unit 1

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML19031C930>

2/27/2019 - FENOC sheds workers and regulations Document Title: Davis-Besse Nuclear Power Station, Unit No. 1 - Supplement to License Amendment Request - Proposed Changes to Technical Specifications Sections 1.1. "Definitions," 5.0., "Administrative Controls." for Permanently Defueled Condition. License-Application for Facility Operating License (Amend/Renewal) DKT 50

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML19058A328>

2/19/2019 - License Amendment Request to avoid current regulation on core cooling system strainer debris. DTE slides. Proposing to use a risk-informed analysis of the impact of additional emergency core cooling system strainer debris that is beyond the current design basis values. Results of the analysis will provide the justification for the additional debris sources in the license amendment in accordance with Regulatory Guide 1.174.

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML19045A269>

9/7/2018 - Barbed wire is now grandfathered in as a security standard. FENOC Fleet - Individual FR Notice - Notice of Issuance of Exemption re: Exemption from the Definition of Physical Barrier

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML18178A588>

8-29-2018 - Approval of Barbed Wire As Is: Davis-Besse Nuclear Power Station, Unit 1 - FirstEnergy Nuclear Operating Company (FENOC); FirstEnergy Nuclear Generation, LLC; Environmental Assessment

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML18130A849>

8-29-2018 - Barbed Wire document: FENOC Fleet - Beaver Valley; Davis-Besse; Perry - Environment Assessment and Finding of No Significant Impact Related to Exemption Request for a Physical Barrier Requirement

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML18130A885>

1/22/2018 - NRC has given permission to FirstEnergy to run its 4 reactors with leaking on Class 2 & 3 Piping.

<https://adamswebsearch2.nrc.gov/webSearch2/view?AccessionNumber=ML18004A122>

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1/10/2017 - The NRC allowed Davis-Besse to increase liquid effluents tenfold, with a Finding Of No

Significant Impacts (FONSI) approved. The NRC notice of this FONSI did not come through to the public until December 2017. Full document here: Final EA and FONSI Davis-Besse Effluent Release Controls.

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5/10/2016 - According to these documents Davis-Besse exceeded standards of radiological releases for isotopes including: Co-57, Co-60, Sr-90, Cs-134, Cs-137, K-40, Xe-65, Fe-55, Pu239/240.

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http://www.cleveland.com/open/index.ssf/2015/01/ohio_renewable_energy_policies.html

<https://windexchange.energy.gov/states/oh>

<https://www.cleveland.com/open/2020/06/lake-erie-wind-turbine-developer-asks-state-regulators-to-reconsider-ruling-that-could-doom-the-project.html>

31. Poll - Conservatives oppose bailouts and nuclear power, support renewables

<https://www.cleveland.com/business/2019/02/conservative-ohio-voters-want-most-of-ohios-electricity-to-come-from-renewable-sources.html>

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<https://static1.squarespace.com/static/568c2a10c647ad1e5182756c/t/5f3ff12bc06aa76ba05900bd/1598026029663/HB6+Repeal+Polling+Memo.pdf>

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<https://energynews.us/2019/05/06/midwest/conservatives-criticize-firstenergy-nuclear-bailout-bill-as-corporate-welfare/>