

"Power to Save the World; The Truth About Nuclear Energy" by Gwyneth Cravens, 2007 Finally a truthful book about nuclear power.

Page 13 has a chart of greenhouse gas emissions from electricity production. Nuclear power produces less greenhouse gas [CO<sub>2</sub>] than any other source, including coal, natural gas, hydro, solar and wind. Building wind turbines and towers also involve industrial processes such as concrete and steel making. Wind turbines produce a total of 58 grams of CO<sub>2</sub> per kilowatt hour. Nuclear power plants produce a total of 30 grams of CO<sub>2</sub> per kilowatt hour, the lowest. Coal plants produce the most, between 966 and 1306 grams of CO<sub>2</sub> per kilowatt hour. Solar power produces between 100 and 280 grams of CO<sub>2</sub> per kilowatt hour. Hydro power produces 240 grams of CO<sub>2</sub> per kilowatt hour. Natural gas produces between 439 and 688 grams of CO<sub>2</sub> per kilowatt hour. Remember the total is the sum of direct emissions from burning fuel

and indirect emissions from the life cycle, which means the industrial processes required to build it. Again, nuclear comes in the lowest. Nuclear would produce even less CO<sub>2</sub> per kilowatt hour if the safety were lowered to the same level as other sources of electricity. Switching from coal to nuclear is a 97% reduction in electricity's 40% of our CO<sub>2</sub> output.

Page 15: The Sierra Club used to favor nuclear power over hydro but switched for political reasons.

Page 17: Coal kills 24000 Americans and 400000 Chinese every year. Nuclear has killed ZERO Americans total. Hydro has killed 1000 Americans and hundreds of thousands of Chinese.

Page 35: Your golf clubs may contain depleted uranium [DU]. Don't worry, and don't confuse DU with spent fuel. DU is what is removed from the uranium to make it enriched in U235. DU is pure U238. U238 has such a long half life that it is almost not

radioactive. DU is safe to handle, but don't eat it because it is a chemical poison. Heavy metals in general are poisons, radioactive or not. DU has other uses that depend on its high density.

Page 50: Power reactors make Plutonium 240 [Pu240].

Pu240 is

useless for making bombs. Plutonium bombs require Pu239.

Pu239 is made in reactors that are specialized for making Pu239.

Governments own Pu239 makers, not power companies.

Page 60: 0.0007 pounds of uranium enriched to 4%

without

recycling produces as much energy as 149 gallons of oil or 157

gallons of regular gasoline or 17000 cubic feet of natural gas or

1780 pounds of coal.

Page 70: Natural background radiation where the author happens

to be at the time is higher than what people living at

Chernobyl are

getting. The US national average background radiation is 360

millirems/year.

Page 71: The natural background radiation in northeastern

Washington state is 1700 millirem/year.

The natural background radiation on the Zuni uplift is 500 to 700

millirem/year.

The natural background radiation in New Mexico is greater than the

calculated dose from the Three Mile Island meltdown, if you were

next to the reactor.

A chest x-ray gives you 10 millirem.

Page 72: The natural background radiation inside Grand Central

Station is 600 millirem/year because Grand Central Station is made

of granite. [ALL rocks are radioactive.]

The allowed exposure to the public from a nuclear power plant is

15 millirem/year.

A set of dental X-rays gives you 39 millirem.

Page 74: Smoking a pack and a half of cigarettes a day gives your

bronchial airways 1300 millirems/year according to the NCRP OR

8000 millirems/year according to the National Academy of Sciences.

Page 75: A coal fired power plant gives you 100 to 400 times as

much radiation as a nuclear power plant. Worldwide, an average person gets 0.01 millirem/year from nuclear power plants, the same as eating one banana. Bananas contain potassium and some of the potassium is radioactive potassium 40. This has always been the case.

Page 76: The cancer rate in New Mexico is much lower than the national average but the natural background radiation is much higher than average. The highest rates of cancer are around heavy industry, chemical factories and petrochemical factories. [Benzene, a petroleum distillate, is a very powerful carcinogen.]

Page 77: Natural gas contains radon, a radioactive gas.

Page 86: Among 80000 nuclear bomb survivors from Hiroshima and Nagasaki, the cancer rate was only 6% higher than expected. Radiation is very weak at causing cancer.

Page 90: At Chernobyl, only 13 to 30% of the reactor's 190 metric tons of fuel evaporated.  $.13 \times 190 = 24.7$  tons.  $.3 \times 190 = 57$  tons. [Much lower than the previous estimate of 200

tons, and trivial to what coal fired power plants give you.]

Page 98: There is a table of millirems per year from the background in a list of inhabited places.

Chernobyl: 490 millirem/year

Guarapari, Brazil: 3700 millirem/year

Tamil Nadu, India: 5300 millirem/year

Ramsar, Iran: 8900 to 13200 millirem/year

Zero excess cancer deaths are recorded. All are natural except for

Chernobyl.

Page 99: There was an epidemic of PSYCHOSOMATIC illnesses

caused by the Chernobyl accident.

Page 100: Only 50 deaths can be directly attributed to radiation at

Chernobyl.

Page 140: "Troublemakers know we humans instinctively tend to"

think of the worst case as the prediction. People think the false

urban legends about Chernobyl are the norm. [Human instincts

were evolved over the past 400 Million years of pre-stone-age.

Human instincts are no longer applicable, but, without training as a

scientist, most people operate instinctively. Your instincts, and mine, are just plain wrong.] Probabilistic Risk Assessment is a much better method of making decisions, but it requires a lot of science, math and computer time. We have accumulated 12 Thousand reactor years of safe operation. [Chernobyl is unlike any reactor in the western world. American reactors can NOT do what Chernobyl did.]

Page 144: "[A] terrorist trying to crash a jet into a spent-fuel pool would fail to cause a disaster."

Page 153: "By 2013 a total of 500 metric tons, or the equivalent of 20,000 warheads, will be turned into low-enriched fuel with the energy equivalent of three billion tons of coal (thirty million coal cars)."

Page 173: "The life span of people in lands with electricity is double that of people in places where there is none,"

Page 178: A discussion of the generations of reactors. The author omits Generation Zero, the very first reactor ever built, in 1944. The reactors at Chernobyl [there are 3 left] are much like Generation Zero and lack true containment buildings.

Page 179: The USA is now on Generation 4 reactors. Generation 4 reactors are impossible to melt down, no matter what the operators do.

Page 180: ""In 2006, more than 435 reactors in thirty two countries supplied 16 percent of the world's electricity with a safety record far superior to that of fossil fuel or hydroelectric generation -- and that's including the Chernobyl fatalities."

Page 181: The core of the reactor at Three Mile Island melted down as badly as the core at Chernobyl, but the reactor at Three Mile Island had a containment building. The containment building did its job. NOBODY was injured.

Page 183: A helicopter above Three Mile Island measured radiation. [If the radiation released from a nuclear plant was deuterium or tritium, the hydrogen goes straight up and leaves the planet earth, never to return. Deuterium and tritium are "heavy" hydrogen. The earth does not have enough gravity to hold hydrogen or helium. A release of deuterium or tritium gives you and the earth zero radiation.] There was never any danger to people on the ground at Three Mile Island.

Page 184: The New York Times wrote 120 articles per year on automobile accidents covering 50,000 deaths and 200 articles per year on nuclear power plant accidents covering ZERO deaths. TV news coverage uses inflammatory

language regardless of the fact that nobody died and nobody was injured by accidents at nuclear power plants.

Page 187: The health effects of the Three Mile Island meltdown were psychological.

Page 190: "In over twelve thousand cumulative reactor-years of nuclear plants making electricity in thirty two countries, there have been only two major accidents in the history of nuclear power, Chernobyl and Three Mile Island-2." [Reactor number 2 at Three Mile Island.]

Page 193: Gwyneth Cravens visits a coal fired power plant. It is everything she expected of a nuclear power plant.

Page 195: The coal fired power plant at Riverbend, North Carolina makes 500 megawatts. It requires 14,300 train cars of coal per year. Coal is 44% of the tonnage for Class I railroads and provides 21% of the railroad's revenue. There were 154 coal mining fatalities from 2002 to 2006. The Riverbend plant consumes 4,500 tons of coal per day. The plant is super dirty and super noisy.

Page 196: The captured fly ash includes arsenic, lead, molybdenum, cadmium, chromium, uranium and thorium. The fly ash is mixed with water, then dried out. Coal waste goes into bowling balls, golf balls, wallboard, paving materials and land fills. Mercury is an invisible gas as it exits the stacks. "Coal-fired plants are the biggest producers of mercury emissions in the country, spouting fifty unregulated tons per year." "A 1,000-megawatt coal plant

also freely disperses about twenty-seven metric tons of radiological material a year, exposing people to much more low-level radiation than a nuclear plant would."

Page 197: "If you live within fifty miles of a coal-fired plant, you're exposed to 0.03 millirem a year. Living near a nuclear plant exposes you to 0.009 millirem a year."

"Those [soft coal burning] plants give off four hundred times more radio nuclides a year than a nuclear plant—one to four millirem." "In the United States in 1999, coal combustion produced over 1,000 tons of uranium and 2,500 tons of thorium. This is enough fissile material to exceed the amount consumed by all the nuclear power reactors in the country in a year. After World War II, when scientists believed uranium to be rare, they considered extracting it from fly ash."

Page 198: "Every year a single 500-megawatt coal-fired plant alone sends up into the sky the same amount of carbon dioxide as 750,000 cars do."

Page 199: "The average American city-dweller today is responsible for about four tons of coal a year going up as smoke. Since electricity generation accounts for 92 percent, or 1.039 billion tons, of the coal we burn, it's our reliance on it that helps make our nation the biggest single per capita contributor to the earth's burden of anthropogenic greenhouse gasses. Our nation's 626 coal-fired plants, over 500 of them quite old, are major offenders. America's coal production reached a record 1.133 billion tons in 2005, while consumption reached a record 1.128 billion tons."

"[C]oal combustion.....causes an estimated twenty-four thousand premature deaths a year."

Page 200 "The industry is planning about 154 new American coal-fired plants." "Gregory H. Boyce, Peabody's president and chief executive officer, and one of the biggest donors to the Republican Party, served as chairman of a Department of Energy advisory panel that recommended exemptions to the Clean Air Act that boost coal's clout over the next two decades."

Page 201: "Two truckloads of uranium ore contain the same energy to make electricity as two million tons of coal. "To get a million BTUs, fuel oil costs nine dollars, natural gas six dollars, coal a dollar-eighty-five, nuclear fifty cents."

Page 202: Gwyneth Cravens visits a nuclear power plant. She is amazed at the quiet, the cleanliness, the safety and the security.

Page 208: "To replace the power generated by Indian Point with a wind farm would require three hundred thousand acres."

Page 211: "In 2005, the production cost of electricity from nuclear power on average cost 1.72 cents per kilowatt-hour; from coal-fired plants 2.21; from natural gas 7.5, and from oil 8.09. American nuclear power reactors operated that year around the clock at about 90 percent capacity, whereas coal-fired plants operated at about 73 percent, hydroelectric plants at 29 percent, natural gas from 16 to 38 percent, wind

at 27 percent, solar at 19 percent, and geothermal at 75 percent." The costs per kilowatt hour for solar and wind are 600 or more times the cost for coal, and that is in sunny and windy places, respectively.

Page 214: "[T]he [nuclear] industry is self-insured."  
Liability insurance is NOT paid by tax payers.

Page 216: Barriers. Terrorists will never get into a nuclear power plant. Quit being paranoid.

Page 227: "The containment structures for power reactors,... are among the most durable structures on the planet: they're constructed to withstand 200-mile-per-hour hurricanes, tornadoes, earthquakes, floods, all of which can provide a more energetic impact than anything terrorists would have at their disposal apart from a hydrogen bomb."  
[What a waste of a perfectly good H-bomb!]

Page 238: "As of 2006, nuclear powered submarines and ships had safely traveled a total of 134 million miles, and registered 5,700 naval reactor-years of safe operation of a total of 254 reactors."

Page 244: To replace our gasoline with hydrogen in the US, we would have to build 4,000 new nuclear reactors to provide power to make hydrogen and oxygen from water.

Page 245: "Gasoline is denser and contains thousands of times more energy than its equivalent [volume] in hydrogen, so you can have a relatively small gasoline tank in your car."

Page 246: "Even a few watts from time to time have been found to make a difference in health and life expectancy."

Page 249: "The manufacture of photovoltaic panels requires highly toxic heavy metals, gasses, and solvents that are carcinogenic. .... If a residential fire burns a solar panel, people would be at risk for exposure to toxic vapors and smoke, ... . If modules are dumped into municipal landfills, then heavy metals such as arsenic and lead can leach into the soil and water table. Hundreds of thousands of years from now, some of those substances will still not have decayed: their life spans are essentially eternal."

Page 250: "Solar farms big enough to supply 1,000 megawatts per year [sic] or more would cover over fifty square miles and produce a quantity of toxic waste that would be significant."

"For the 70 to 80 percent of the time when nature isn't cooperating [with your solar power scheme], you need the grid or a fossil-fuel generator."

"The largest systems of unsubsidized solar energy in a sunny place range from 22 to 40 cents per kilowatt-hour, in other words, solar is the costliest alternative energy of all."

Page 251: Solar power requires cutting down trees to keep the trees from shading your solar panels.

"Wind tends to fail during heat waves. ... Wind power turned out to be highly unreliable, with capacity plunging from its usual 33 percent to 4 percent during the time of peak demand."

Page 257: World CO2 emissions from electricity generation come to 9,500 million metric tons a year. Using a small footprint, hundreds of nuclear plants in more than thirty countries cut carbon emissions by 600 million metric tons every year."

Page 269: "[E]very day the collective households and industries of America throw away nearly a million tons of garbage containing toxic heavy metals and dangerous chemicals, as well as plastics that will never break down. That garbage will be our culture's real legacy, enduring for millions of years after all the present nuclear waste has decayed."

Page 290: There is a mistake: She says that the Waste Isolation Pilot Plant in New Mexico is the only nuclear waste repository in operation. France has one.

Page 363: France can build a nuclear power plant in 5 years.