



Written by [Rebecca Terrell](#) on January 22, 2014

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## Fukushima Fear and Fallout

Scientists predict unprecedented disaster should an earthquake hit Japan and further damage the Tokyo Electric Power Company's (TEPCO) Fukushima Nuclear Power Plant. The facility was crippled in March 2011 when the 9.0 magnitude Tohoku earthquake triggered violent tsunami waves, claiming almost 16,000 lives and injuring or displacing thousands of others in a catastrophe the Japanese prime minister called the "toughest and most difficult crisis" for his country since World War II.



TEPCO is still cleaning up the damage at the six Fukushima reactors, a project some say will be far more devastating than the natural disaster should anything go awry. The object of concern is spent fuel rods stored in damaged cooling stations at the plant. The rods must remain submerged in water; otherwise, they could ignite and discharge radioactive materials into the environment. Fears run rampant that another high-magnitude earthquake will drain the cooling pools completely, expose the fuel, demolish Japan, and spew lethal nuclear radiation across the globe.

"I have seen a paper which says that if, in fact, the fourth plant goes under an earthquake, and those rods are exposed, it's 'Bye, bye Japan,' and everybody on the west coast of North America should evacuate," environmentalist David Suzuki told his audience at an October 2013 University of Alberta symposium. "Now, if that isn't terrifying, I don't know what is."

Some of his terrified colleagues agree and urge Northern Hemisphere evacuation in the event of further seismic damage. "If there's another earthquake and Building 4 collapses," said author and physician Helen Caldicott, "I'm going to evacuate my family from Boston." She made the remark during an address sponsored by the Physicians for Social Responsibility, an anti-nuclear organization she co-founded in the 1970s. Caldicott named her native Australia a safe haven.

"It would certainly destroy Japan as a functioning country," claimed former nuclear industry executive Arnie Gunderson in a 2012 KGO Radio interview. "Move south of the equator if that ever happened. I think that's probably the lesson there."

Are these warnings realistic? Should governments be making evacuation plans for the Northern Hemisphere? Are nuclear bombs mere firecrackers in comparison to exposed fuel rods? Must we revert to the 1950s, build fallout shelters, and dust off old *Duck and Cover* filmstrips? Or are these predictions simply rantings of anti-nuclear agitators promoting a decades-old propaganda campaign touting a no-nuke-is-good-nuke party line and preying on the ignorance of the public about the benefits, safety, economics, and efficiency of nuclear power?

### Accident or Armageddon?

The oft-quoted Gunderson is considered an expert in the field of atomic energy, with more than 40 years experience as a nuclear engineer and industry executive. Believing he is now blacklisted by the



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industry, he claims he was fired in 1990 for exposing safety violations at his company. Gundersen now serves as chief engineer for his non-profit Fairewinds Energy Education, and he is a self-proclaimed nuclear whistleblower.

During an interview following Japan's 2011 accident, Gundersen told *Peak Prosperity's* Chris Martenson that according to calculations in a 1997 U.S. Nuclear Regulatory Commission (NRC) report, "If a fuel pool went dry and caught on fire, it could cause 187,000 fatalities." The NRC report, *Severe Accidents in Spent Fuel Pools in Support of Generic Safety*, actually published in 1987, investigated the risks and consequences of a complete draining of spent fuel storage pools. It is unclear where Gundersen gleaned "187,000 fatalities" since that number appears nowhere in the 137-page paper. In fact, the authors repeatedly stressed substantial uncertainties in their calculations "beyond those characteristic of traditional risk assessment studies," because of the large number of variables at play. Moreover, they based forecasts strictly on mathematical formulae and computer models because there was "no case on record of a significant loss of water inventory" from a spent fuel storage pool, a testimony to the safety of nuclear power in its then 30-year history in the United States. (The spent fuel safety record remains unvarnished in its now 55-year history.)

However, researchers made one precise calculation. In their discussion of off-site radiological consequences, they wrote, "It is important to note that no 'prompt fatalities' were predicted and the risk of injury was also negligible," even in worst-case scenarios. Additionally, investigators saw fit to calculate environmental effects to distances of at most 500 miles. This is certainly a sizable area. But it does not even reach from Fukushima to Hiroshima, and certainly not to mainland Asia, the North American west coast, or the entire Northern Hemisphere. Perhaps we won't have to vacate this half of the globe after all.

## **Fuel Rods Exposed**

For an idea of what might actually happen if another earthquake hits and exposes the fuel rods to air, let's look at what *did* happen when the 2011 earthquake partially exposed them. Josef Oehmen, Ph.D., of Boston's Massachusetts Institute of Technology offered a "layman's summary" of the event.

Oehmen explained that when Tohoku hit, the Fukushima plant lost all power, including its tsunami-flooded backup diesel generators, and all nuclear chain reactions came to a halt. But the handicapped cooling system couldn't maintain a water level above the tops of the fuel rods. They therefore heated up, converting some of the water to steam, which reacted with the melting rods to produce hydrogen, a highly combustible gas. Sheltered from outside air, the hydrogen was safe in the containment structure. But when workers vented the gas to release pressure within the containment structure and preserve its integrity, the hydrogen reacted with outside air causing explosions that damaged outer buildings surrounding the containment structure. (It is important to note the outer buildings protect the reactor from Mother Nature and not Mother Nature from the reactor.) The inner containment structures remained intact, despite the violent earthquake, devastating tsunami, and subsequent hydrogen explosions.

Meanwhile, reactor workers began pumping in sea water to compensate for coolant losses. Within four days TEPCO reported stable water levels and temperatures, and offsite power restored. Bravo to the quick-witted, clear-thinking plant employees working under such extremely adverse conditions, and to the ingenious architects and builders of a structure hit by an earthquake of far greater magnitude than



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it is rated to withstand!

But the important questions are: How much radioactive gas did the explosions release, and how many people died? Writing for *The New American* after the incident, Jane Orient, M.D., executive director of the Association of American Physicians and Surgeons, explained, "If you stood at the gate of the plant for 10 hours at the highest dose-rate, you'd get as much radiation as from [a] total-body CT scan." And since the intensity of electromagnetic radiation varies with the inverse square of distance, the dose-rate fell off dramatically at locations farther away than the gate.

As to deaths, then-NRC chairman Gregory Jaczko admitted during an October 2011 roundtable discussion in Washington, "There have been no fatalities that we're aware of that are directly related to radiation exposure." He said power plant workers received abnormally high doses from airborne radiation and contaminated water, but "nothing that is going to lead to an immediate loss of life."

Regrettably, there was loss of life at the Fukushima plant. Six people died from drowning or other storm-related accidents. In May 2012, the UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) announced that none of them were "attributed to exposure to ionizing radiation."

What about long-term effects on the living? In workers who received the highest radiation doses, "no clinically observable effects were reported." UNSCEAR also found "no health effects attributable to radiation" in children or "any other member of the population." Thyroid monitoring of children near Fukushima revealed none received a hazardous dose.

## **Fukushima Death Toll**

The true Fukushima disaster was *and still* is the forced evacuation of some 200,000 people, according to estimates from the International Atomic Energy Agency (IAEA). As of August 2013, Reuters reported, "The number of people in Fukushima who have died since the accident from illness related to prolonged evacuation rose to 1,539, nearing the prefecture's tsunami death toll of 1,599." In September 2012, when Japan's tally of these "disaster related deaths" stood at 700 and rising, Lawrence Solomon, executive director of Energy Probe, lamented, "These people died in a chaotic scramble to escape presumably deadly radiation," and called the evacuation "a man-made disaster born of human ignorance and incompetence."

How much radiation did evacuees escape? In July 2011, the Japanese government published results of monitoring in restricted areas and planned evacuation zones. Air dose rates varied from one to 10 microsieverts ( $\mu\text{Sv}$ ) per hour, results that coincided closely with airborne monitoring of Fukushima conducted by the U.S. Department of Energy.

That doesn't mean much to the average layman with no frame of reference for measuring radiation. In his book *Underexposed: What if Radiation Is Actually Good for You?*, Ed Hiserodt provides some practical comparisons. A sievert (Sv) is a measure of the effect of radiation on the human body, and a microsievert is one millionth of a sievert. The dose of ionizing radiation from one U.S. coast-to-coast jet flight is about 50  $\mu\text{Sv}$ , and a single barium enema delivers a whopping 8,000  $\mu\text{Sv}$ . Radiation sickness — nausea, vomiting, diarrhea, headache, fever — ensues in 50 percent of the population at 1,000,000  $\mu\text{Sv}$  (1 Sv), but "sickness results from an acute exposure of 1 Sv over a period of a couple of days or less," notes Hiserodt. "The same radiation over a longer exposure time gives no symptoms."

Unlike heavy metals that stick around forever, radioactive elements decay, so it is hardly surprising that



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weekly measurements since May 2011 by the Japanese Nuclear Regulation Authority (NRA) have shown gradual declines in air dose rates in the 20-kilometer evacuation zone around the power plant. Perhaps making the situation more heart-rending for those still suffering effects of the forced evacuation is a 2013 World Health Organization report, *Health Risk Assessment From the Nuclear Accident After the 2011 Great East Japan Earthquake and Tsunami*, which accounted for all internal and external sources of radioactive material. The study found radiation levels within the Fukushima prefecture well below threshold levels known to induce adverse health effects such as skin reddening and cataracts and “also too low to affect fetal development or outcome of pregnancy.” Researchers anticipate no increases in health or cancer risks above baseline rate expectations outside Japan or “outside the geographical areas most affected by radiation, *even in locations within Fukushima prefecture.*” (Emphasis added.) As for limited areas “most affected” in the prefecture, “The lifetime risk for some cancers may be somewhat elevated above baseline rates in certain age and sex groups.”

That might seem like a vague forecast, especially considering their precision in naming the radiation effective dose — a measure of cancer risk — in these “most affected” areas. It ranged from 12 to 25 millisieverts (mSv) — or 12 to 25 thousandths of a sievert — in the first year after the earthquake, which hints at why their predictions of elevated lifetime cancer risk seem fuzzy. Many areas of the world bask in background radiation from natural sources (e.g., cosmic and terrestrial) that meet or exceed these doses, without any detrimental effects. For example, the journal *Health Physics* published a study in its January 2002 issue highlighting the city of Ramsar, Iran, where residents in some areas absorb 260 mSv annually. Researchers found no significant differences in cancer rates for people in high versus normal background radiation regions in and near the city, and laboratory tests revealed a natural radio-immunity to one-time large doses of radiation in white blood cells of those with chronic exposure to high background levels.

## **Worst-case Scenario**

But nay-sayers worry another violent earthquake could drain Fukushima’s spent fuel pools completely, ostensibly a much more extreme scenario than that which played out in the hours after the Tohoku earthquake. According to Paul Blustein of Slate, this was precisely the concern of scientists at the Lawrence Livermore National Laboratory, a premier U.S. research facility specializing in airborne hazards. Livermore scientists launched into action after the Fukushima hydrogen explosions to determine whether to evacuate three U.S. military bases near Tokyo, roughly 150 miles from the plant.

Their motivation was not the explosions or immediate release of radioactivity but fears about the structurally compromised spent fuel pools. Could an aftershock drain them, exposing U.S. military personnel to harmful levels of radiation? Doses exceeding U.S. Environmental Protection Agency (EPA) guidelines would mandate evacuation.

Even the worst-case scenario generated by their computer models — a complete meltdown in extremely adverse weather conditions — predicted radiation doses below EPA limits. Evacuation averted. The EPA website identifies its standard as a full-body dose of gamma radiation measuring 1 rem (i.e., 10 mSv) of acute exposure within a few days. For comparison’s sake, a full-body CT scan delivers 10 to 30 mSv of gamma radiation within a few minutes.



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## Worse Than Chernobyl?

Before Livermore staff completed their research, Obama's chief science advisor John Holdren feared a spent-fuel catastrophe. Blustein reported the science czar e-mailed a colleague: "We are now looking, as you've probably surmised from information available publicly, at a high likelihood of releases as large as Chernobyl or even larger." Yet after reviewing the study, he admitted at worst "sheltering in place might be all you'd want to do." Obviously, Livermore proved how wrong "information available publicly" can be.

Gundersen, on the other hand, concocts shameless fictions comparing Fukushima to Chernobyl. He claimed in a 2012 interview with *Democracy Now*, "The amount of radiation released was clearly as much as Chernobyl, but most of it headed out to sea." About the same time, the IAEA estimated total radioactive release from Fukushima to be roughly 5.5 percent that of Chernobyl, as reported by the science journal *Nature*. Furthermore,

The Fukushima fallout is notable for what it doesn't contain. Some very nasty contaminants like strontium-90, americium-241 and various plutonium isotopes are all absent in any significant quantity because the concrete vessels around the reactors appear to be largely intact. In Chernobyl, the explosion and subsequent fire spewed these extremely dangerous isotopes far and wide.

Those "nasty contaminants" spewed far and wide because in building the Chernobyl plant the Soviet government, with shameless disregard for human life and basic safety principles, failed to build a containment structure around the reactor. (All reactors in Japan and the United States include containment buildings.)

But that is not the only difference between the two plants. Following the 2011 quake, retired nuclear engineer James Russell told *The New American*, "What happened at Chernobyl could not happen in Japan because Chernobyl was a carbon block moderated reactor," and Fukushima is composed of light-water reactors. The latter uses water as a moderator and coolant, which means the laws of physics dictate the nuclear reaction stops when there is a loss of coolant water. The former used combustible graphite as a moderator because Chernobyl was built to generate more than electricity; the Soviet government also produced bomb-grade plutonium there. The reactor itself caught on fire, spewing those "nasty contaminants" from its core.

Thirty-one workers died in the Chernobyl blast, making it "the only nuclear power station disaster that ever resulted in an occupational death toll," according to former UNSCEAR chairman Dr. Zbigniew Jaworowski. In the January 2010 issue of *Dose-Response*, he exposes other facts that highlight ironic similarities between Chernobyl and Fukushima. First, nobody in the surrounding countryside died from fallout. Second, the radiation limits for evacuating Russians were less than the natural background radiation in many places of the world such as areas of Iran, Norway, Brazil, and southwestern France.

In addition, studies by the United Nations found no increase in the incidence of cancers in the population of affected areas, except thyroid cancers. Jaworowski notes the first increase occurred in 1987, one year after the Chernobyl accident, and the greatest increase, 0.027 percent, was found in 1994. The number has declined since 1995. "This is not in agreement with what we know about radiation induced thyroid cancers whose latency period is about 5-10 years after irradiation exposure and whose risk increases until 15-29 years after exposure," said Jaworowski, who attributed the



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increased registration of thyroid cancers to a “classical screening effect.” Worried by exaggerated media reports, more people are screened, so more cancers are found.

Sadly, however, thousands did die in the wake of Chernobyl. According to the IAEA, overdramatized reports of radiation risks to unborn children led to an increase of between 100,000 and 200,000 European babies intentionally aborted by their mothers, who feared they might be carrying “nuclear monsters.” Jaworowski said Chernobyl “sheds light on how easily the global community may leave the realm of rationality when facing an imaginary emergency.”

## **Pacific Ocean Leaks**

Without radiated bodies dotting the countryside and cancers popping up helter-skelter, the media is focusing on another contrived crisis: radioactive water leaking into the ocean from Fukushima. In August 2013, Reuters quoted Shinji Kinjo, a Japanese NRA official, calling the situation “an emergency.” The BBC reported, “TEPCO admitted ... a cumulative of 20 trillion to 40 trillion becquerels of radioactive tritium may have leaked into the sea since the disaster.” Its only explanation of this particularly technical statement was, “The operators of the Fukushima plant are in deep trouble.” In the mind of the average layman, this bodes disaster for any living thing in the 187 quintillion gallons of the Pacific Ocean.

Actually, it’s not a problem at all. Tritium is a radioactive isotope of hydrogen and is, according to the U.S. EPA website, most commonly found in water. It is a very weak beta emitter. (Beta particles, a form of radiation far less potent than gamma and x-rays, are easily stopped by solid matter.) Medical manufacturers use tritium to test the safety of potential new drugs. Without this radioactive element, we would have no self-luminous wrist watch dials, exit signs, aircraft gauges, or paints.

But surely 20 to 40 trillion becquerels of *anything* would induce mutations in marine life? “This is actually around and about (perhaps a little over) the amount of radiation the plant was allowed to dump into the environment *before* the disaster,” wrote *Forbes* contributor Tim Worstall. Based on current statistics the discharge from Fukushima is less than half the exposure “we all get from the global consumption of bananas,” he quipped, pointing out we *eat* the radioactive potassium in that fruit.

This hasn’t stopped anti-nukes profiting from irrational fears. Amidst media fervor decrying the leaks, Dr. Christopher Busby, scientific secretary of the European Committee on Radiation Risks, wrote an article entitled “Worse than Chernobyl: The inner threat of Fukushima crisis” predicting skyrocketing cancer rates from humans ingesting radionuclide contamination from Fukushima. Busby is known in the nuclear industry for his controversial theories about negative health effects of very low-dose ionizing radiation.

George Monbiot and Justin McCurry of *The Guardian* exposed him in 2011 marketing expensive products and services in Japan to ward off the supposedly harmful effects of Fukushima fallout. These included mineral supplements he sold for more than five times their market value in Tokyo, as well as costly tests for radioactive contaminants in food and urine. In his YouTube video promoting the products, Busby accused the Japanese government of spreading Fukushima contamination across the country to “increase the cancer rate in the whole of Japan so that there will be no control group.”

Monbiot and McCurry pointed out that the Japanese government already conducts standard food and water monitoring with “stricter radiation limits than the EU” and has added Fukushima-specific testing.



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They also quoted several scientists and government officials calling Busby's claims "baseless" and "ridiculous" and his anti-radiation pills completely useless. Gerry Thomas, professor of molecular pathology at London's Imperial College, told them, "Dr. Busby should be ashamed of himself."

Those interested in monitoring actual radiation levels in Japan's seawater can access the information updated weekly on the NRA website. Dozens of monitoring points are scattered in a 100-kilometer radius around the plant, as well as in the open sea off Japan's coast and along the coastlines of the Miyagi, Ibaraki, and Chiba Prefectures which border Fukushima. On a regular basis, many of these measuring devices do not return readings for the particular isotopes of concern because their levels are undetectable.

The measurements are summarized in a September 2013 statement by the Japanese Ministry of Foreign Affairs (MFA), which found the effects of contaminated water limited to the harbor of the plant with an area smaller than 0.3 km<sup>2</sup>, equivalent to 74 acres. This "contaminated" water's radiation is "constantly below" limits for "Radioactive Substances in Bathing Areas" set long ago by Japan's Ministry of the Environment.

The MFA pointed out Japan has the highest food and water quality standards in the world. The government conducts regular, rigorous inspections and is quick to either destroy food that exceeds set radionuclide limits or at least restrict its distribution. Less than 0.7 percent of items monitored from April 2012 to August 2013 exceeded those limits. "In practice, even in Fukushima Prefecture where the accident occurred, annual radiation exposure from food and water is lower than one hundredth of one millisievert," noted the MFA.

Independent reviews confirm these data. A study of migrating Pacific bluefin tuna (PBFT), a species that sent shockwaves through California in 2011 for carrying radioactive isotopes from Fukushima, is particularly telling. Researchers from Stanford University, Stony Brook University, and the Institute for Radiation Protection and Nuclear Safety found doses received by anyone who consumed the tainted PBFT were "comparable to, or less than, the dose all humans routinely obtain from naturally occurring radionuclides in many food items, medical treatments, air travel or other background sources." Despite the public perception that all radiation is bad, the authors explained, "The biological effects of any contaminant are generally dependent on the dose received."

In other words, *the poison is in the dose*, a basic principle of toxicology called *hormesis*. For example, it could be fatal to take 100 aspirins at once, but many people take one aspirin daily to improve health.

## **The Dose Makes the Poison**

Evidence suggests the same principle holds true for ionizing radiation. Survivors of the 1945 bombings of Hiroshima and Nagasaki offer compelling proof. Japan teamed with the United States in the 1950s to analyze health effects on the cities' populations. Through the past six decades, the Radiation Effects Research Foundation (RERF) has meticulously chronicled the medical histories of more than 100,000 A-bomb survivors. Dr. T.D. Luckey, retired chair of the biochemistry department at the University of Missouri School of Medicine, gave a summary of RERF's findings in the Summer 2011 *Journal of American Physicians and Surgeons*.

"Exposures greater than 200 mSv showed increased cancer death rates commensurate with increasing dose," wrote Luckey. But something interesting has happened among survivors who received doses less



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than 200 mSv. Their cancer mortality rates are lower than those of unexposed control groups. The “healthiest” dose appears to have been between 10 and 19 mSv, with a cancer mortality rate in that range equal to 68.5 percent of controls.

These results are consistent with “thousands of scientific papers showing benefit from low doses of ionizing radiation,” says Luckey. He estimates average background radiation in most places on Earth, 3 mSv per year, to be “insufficient for vibrant health” and maintains that “cancer would be a rare disease” if people received adequate doses. Scientists have known for years radiation’s hormetic effect is not limited to cancer. In 1994, UNSCEAR reported:

Manifestations of the adaptation described in mammals after exposure to low doses of radiation include accelerated growth rate in the young, increase in reproductive ability, extended life-span, stimulatory effects on the immune system, and a lower than expected incidence of spontaneous tumors.

## **Nuclear Industry Fallout**

What of the Chernobyl-style exclusion zones around Hiroshima and Nagasaki? They never existed. The Japanese rebuilt both cities, and they are thriving industrial and cultural centers today. Similarly, life goes on around the Three Mile Island (TMI) reactors in Pennsylvania, where a 1979 accident triggered widespread, unwarranted panic. For 18 years the state’s Department of Health monitored more than 30,000 people living within five miles of the plant and found no adverse health effects.

The nuclear power industry suffered the real meltdown. Instead of serving as a “field test of nuclear safety,” wrote Dr. Petr Beckmann in his book *The Health Hazards of Not Going Nuclear*, TMI “became the bugle call for the biggest brain-washing campaign in American history.” TMI myths have stonewalled U.S. industry expansion to this day.

Fukushima reaches even further. Not only did Japan pull the nuclear plug, but Germany, Italy, Switzerland, and Belgium all nixed nuclear or canceled future plants in response to the Japanese accident. Attempting to replace it with inefficient and unreliable “renewables,” Europe is now threatened with continent-wide blackouts as electricity prices soar.

Media sensationalism spawned this nuclear crisis; the facts prove there is little danger. Why the exaggerations, vituperation, and lies? The attack on nuclear energy is part of a larger war on industrial society.

“The antinuclear movement has become part of the political establishment,” says Beckmann, and is peopled with radical environmentalists using “clean air and clean water only as a bait to mobilize the gullible” in their campaign to stifle economic growth and control population. Access to energy promotes a prosperous society and stymies environmentalists’ goals. Government interference in energy markets is the surest way to restrict access to clean, plentiful, safe, and affordable sources such as nuclear.

A fearful public cowers to this bureaucratic bullying because radiation is an enigma to most. Unfortunately, fears have grown ridiculously out of control. Instead of ridiculing the absurd notion of evacuating a hemisphere, the manipulated public is willing to sacrifice liberty for a false sense of security — a harbinger of tyranny. In order for liberty to prevail, so must reason. Though Fukushima now implies nuclear peril, let us hope in years to come it is not the poster child of 21st-century lunacy.

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