The Unraveling of Nuclear Energy

Contributed by Tony Pereira
27 June 2011

About three decades ago, the Swedes considered the risks of nuclear energy, added up the costs and did the math. What they found was that the astronomical amounts that the Swedish economy was paying in subsidies to produce electricity from nuclear energy far exceeded what they were getting out of it. Swedes aren't dumb, and voted in a national referendum to shut down and decommission all their nuclear energy reactors by 2010. The Swedish nuclear weapons program had already been terminated early on when Sweden signed the nuclear non-proliferation treaty in 1968.
With two units closed, one in
1999 and another in 2005, Sweden now operates three nuclear facilities, with a total of 10 reactors generating about 45% of the country's total electricity. By the narrowest of margins of only two votes in 2009, the Riksdag, currently under a conservative spell, allowed for the replacement of existing reactors only, without any government subsidies, with no new construction permitted. Reactor replacements will not be needed until 2030, if ever, because the opposing parties who represent the desires of the clear majority of the population already vowed to overturn this legislation.

About a decade ago, Germany arrived at identical conclusions, and the country voted landmark legislation to replace all fossil and nuclear fuels with solar, wind, geothermal and biomass renewable energy by 2030. It was under the direction of Dr. Hermann Scheer, elected member of the Bundestag for 28 years and Alternate Nobel Prize Laureate, whom I had the great honor of inviting for a lecture at UCLA.

Germany is already producing about 20% of its electricity from renewables, solar and wind. The same laws that were passed in Germany have already been approved by the 24 member nations of the European Union, and are being considered by some other 40 nations around the planet.

The US, French and Japanese nuclear programs are not any different. These programs exist only at the expense of hundreds of billions in subsidies in taxpayers' money, government loan guarantees, tax exemptions, culminating with the U.S. Price-Anderson Act: in case of a nuclear accident, the owner-operator of the nuclear plant is liable to pay damages of up to about $12 billion US Dollars. Any amount above that -- well, did you guess right? -- becomes public liability: want it or not, we, you and me taxpayers foot the bill and pay the damages, whatever they might be. Corporations pocket the profits, the clean up costs are socialized. What a deal. One single accident could total upwards of US$500 billion, and go up to US$1 trillion, no one can tell. National and international polls show the public's opposition, and want their nuclear industries shut down. A recent landslide vote in Italy forced the Berlusconi administration to abandon plans to restart Italy's nuclear program.

The worst has already happened, not once but at least one hundred incidents in the USA alone at nuclear power plants between 1952 and 2000. The US federal government requires that incidents resulting in the loss of human life or causing more than US$50,000 of property damage must be reported to the Nuclear Regulatory Commission (NRC). In the above period, a total of US$20.5 billion in property and other damages were reported, including emergency response, environmental remediation, evacuation, lost production, fines, and court claims. At least three of these accidents involved partial core meltdowns.

The most serious of these was the Three Mile Island accident in 1979, with a price tag of US$2.4 billion in damages, and the earliest the Santa Susanna partial core meltdown in Simi Valley, California, in 1959. Cleaning up of this site is still ongoing, the final price tag and cancer effects on the local population is not known or has just been ignored. With little or no press coverage or debate, the Davis-Besse Nuclear Generating Station in Oak Harbor, Ohio, was the source of two of the top five most dangerous nuclear incidents in the United States since 1979, one of those in 1985, according to much later findings done in 2004 by the NRC.

Since the early nuclear reactor experiments in the 1940s and today, some odd 60 other accidents occurred involving nuclear weapons in military nuclear facilities and operations, including loss of life by irradiation and property damage, amounting to untallied staggering totals. No one knows the exact numbers.

In 1986, an explosion followed by fire at one of the two nuclear reactors at Chernobyl, Ukraine, released vast quantities of radioactive materials that were subsequently carried into Western Europe, over half of it to Belarus. The Russian government enlisted about 800,000 workers to perform menial tasks like dropping one bag of sand in highly radioactive areas around the damaged reactor and receive hundreds of times the legal allowed radiation yearly limits in the one single excursion, for periods of exposure lasting 90 seconds at most. Hundreds of thousands from Belarus, Russia, and Ukraine were evacuated and resettled. Entire cities were abandoned. To date about US$50 billion have been paid in direct costs alone. The total cleanup costs are extremely hard to estimate; they most likely will add up into the hundreds of billion -- to many the real reason for the downfall of the former Soviet Union.

The IAEA, the International Atomic Energy Agency, a staunch proponent and supporter of nuclear energy, routinely downplayed the amount of materials damage and loss of life at Chernobyl. A recent peer reviewed publication originating from Russia puts the cancer death toll between 1986 and 2004 at a whopping one million human lives. The recent claim by the IAEA that ‘no one will die in Japan’ is nothing but another criminal lie.

Enter Fukushima and 3/11. With six nuclear reactor cores packed in close vicinity to each ohther in a single nuclear facility, it is exceedingly clear that if even a single reactor suffers a minor accident, it becomes exponentially complex if not altogether impossible to maneuver around the plant in any normal way, putting the other reactors at risk of a series of largely predictable cascading events, i.e., successive meltdowns.

With three of the nuclear reactors operating when a whopping 9.0 Richter scale earthquake centered offshore Japan hit the country, a series of powerful tidal waves followed shortly thereafter. We now know that the earthquake damaged the cooling systems of the Fukushima plant, and that fuel core meltdown occurred before the tsunami hit Japan. Once cooling stops, temperatures rise very fast within the densely packed nuclear core fuel rods, and whatever cooling water is left rapidly boils and evaporates.

Zirconium (Zr) is used as the cladding material for the nuclear fuel rods due to its high permeability to neutrons, the essential particle needed to promote nuclear fission reactions. However, Zr is highly reactive and burns violently in air at extremely high temperatures of about 2,400F, sufficient to melt and vaporize the packed uranium, plutonium and other highly radioactive deadly isotopes into the air and surrounding areas from where it becomes impossible to ever recover them. As soon as the coolant water in the pressurized water reactor (PWR) reactor evaporates, Zr catches fire and burns intensely. It gets more complicated. With Zr acting as a catalyst, water at high temperature splits into its elements and produces hydrogen, and the possibility of a violent explosion becomes very real. That happened.

Thirty kilometers offshore Fukushima, current radioisotope readings show levels tens of times higher than those measured in the Baltic and Black Seas following the Chernobyl accident. TEPCO, the Tokyo Electric Power Company and Fukushima's owner/operator has confirmed that the core fuel rods at the Unit One reactor had melted before the arrival of the tidal wave. By damaging the cooling systems at the Fukushima plant, the earthquake that shook Japan also initiated the early core meltdown of at least one of its reactors. Once radiation begins to be released in huge amounts in and around the plant, things become extremely difficult if not entirely impossible to control, and events run their own course.

TEPCO has now confirmed that there are numerous holes in the containment covering Unit Two, and at least one at Unit One. The global nuclear industry has long argued that containments are virtually impenetrable. They are not. The domes at Fukushima are of a very similar design and strength as many in the US [1].

Virtually all of Japan's 55 reactors sit on or near earthquake faults, and along the coast where, in addition, they are also vulnerable to tsunamis. After the 3/11 tsunami, Japan shut down 35 of its 54 reactors for safety evaluations. A 2007 earthquake forced seven reactors to shut at Kashiwazaki. Japan has ordered shut at least two more nuclear reactors at Hamaoka because of their seismic vulnerability. Numerous reactors in the United States sit on or near major earthquake faults. Two each at Diablo Canyon and San Onofre, California, are within three miles of major fault lines. So is Indian Point, less than 40 miles from Manhattan, New York. Millions of people live within 50 miles of Diablo Canyon, near San Franciso, California, San Onofre between San Diego and Los Angeles, California, and Indian Point, just outside of New York. On January 31, 1986, the Perry reactor, 35 miles east of Cleveland on Lake Erie, was damaged by an earthquake rated between 5.0 and 5.5 on the Richter Scale, about 200,000 times weaker than the one that struck Fukushima, or the ones that could and will eventually hit the sites in California, New York and elsewhere around the globe.

TEPCO, Fukushima's owner operator, has confirmed after months of silence that at least three of the six Fukushima reactors -- Units One, Two and Three -- have suffered at least partial fuel melts. In at least one case, the fuel has melted through part of the inner containment system, with liquid highly radioactive materials at extremely high temperatures melting through to the reactor floor. A wide range of sources confirm that fission is still going on in at least one Fukushima core. This clearly points out that the reactors went through complete core melts, not just partial meltdowns. The complete cleanup costs and number of victims, as in Chernobyl, are extremely hard to estimate, and will likely escalate in the hundreds of billions, and as in Russia, the possible downfall of Japan. Cancer victims due to the fallout of radioactive isotopes will continue for hundreds, thousands, hundreds of thousands of years. Fukushima is far from over.

It is beyond a shadow of any doubt that these are extremely dangerous, difficult, if not completely impossible situations to solve or deal with in physics, engineering, materials science and chemistry. We do not have the technology to safely handle such high levels of concentrated radiation. Let's repeat this. We do not have the technology to deal with such massive levels of radiation, not now, not anytime soon. The core melts require massive cooling that will send vast quantities of radioactive water into the global ocean food chain, local water tables, surrounding soil areas, food crops, and the global atmosphere for a long time, and a much longer time still to come, for present and future generations.

These are nothing short of crimes against the planet and crimes against humanity perpetrated by the dissemination of torrents of unchecked lies and falsehoods during a period of decades that began with the end of WWII. "Electricity from nuclear power will be too cheap to meter." So the harp played, served with refreshments. It is time to demand an answer, from all those who have been perpetrators and accomplices in these crimes, to the question 'Is this the best you can do, lie?" and hold them accountable.

Notes

[1]
Is Fukushima Now Ten Chernobyls into the Sea?
by Harvey Wasserman, May 26, 2011

[2] "'Melt-through' at Fukushima? / Govt report to IAEA suggests situation worse than meltdown" -- official Japanese Government report to The International Atomic Energy Agency: yomiuri.co.jp

"A 'melt-through' -- when melted nuclear fuel leaks from the bottom of damaged reactor pressure vessels into containment vessels -- is far worse than a core meltdown and is the worst possibility in a nuclear accident."

* * * * *

Used by permission of the author. © Prof. Dr. Tony Pereira, UCLA ME PhD – All Rights Reserved. Tony is Founder of the Institute for Sustainable Engineering (ISE), website
ise-now.com.