VIEWPOINT

Fukushima: Different Reactions In the West and East

by Thomas Grønlund Nielsen

The earthquake on March 11, 2011, with its epicenter near the coast of Japan, was 9.0 on a Richter scale, the highest ever recorded in Japan territories. It gave rise to a 10-meter high tsunami that reached the east coast of Japan shortly after. This wave killed 20,000 people when it hit and flooded vast parts of Japan—a catastrophe of unseen proportions in a rich industrialized country. To my knowledge, however, not one of these casualties was caused by the accident at Fukushima Daichi Nuclear Power Plant.

As severe earthquakes are not unusual in the "land of the rising Sun," all Japan's nuclear reactors were prepared for earthquakes and shut down immediately on March 11, by lowering the reactor control rods. This stopped the fission process in the reactors, i.e. the chain reactions where the uranium-235 isotopes are bombarded with neutrons that cause them to split, emitting two or three new neutrons that hit other uranium isotopes, which split and continue the process.

This safety measure did certainly work as it should all across Japan, and so any kind of a new Chernobyl was ruled out from the beginning of the accident.

Still, the nuclear reactors need to be cooled long after shutdown because of the radioactive decay that produces heat. Right after shutdown, this heat production corresponds to 6 percent of full-power capacity of the nuclear plant, that is, 60 megawatts for a 1 gigawatt plant—a massive amount of heat that needs to be channeled away from the core of the reactor to avoid damaging the core and making it useless.

Since most of these radioactive decays have half-life periods of seconds, minutes, or hours, the power of the heat production quickly decreases after shutdown; after one week it is only a fraction of 60 megawatts, but still not insignificant. Therefore, the reactors need to be cooled for weeks or even months after shutdown.

This is normally done with water circulation within the reactor core. If this circulation is stopped, the heat from the radioactive decay will evaporate the water, until, finally, the uranium fuel melts down.

In the 1970s, there was some hysteria among anti-nuclear protesters that this fuel could melt through the steel vessel that encapsules the nuclear reactor core and farther through the concrete containment building, and in the end all the way through the Earth to China! This was popularized as "the China Syndrome."

But after the accident at Three-Mile Island in 1979, this threat could be fully dismissed, as it was proven there that even though the reactor core fully melted, it was incapable even of melting anything of importance in the steel vessel.

Continued on next page

economist Lyndon H. LaRouche.[1] First, the immediate reinstatement of the Glass Steagall Act, which asserts the principle of separation of commercial banking from speculation. This will allow, and require, the government to legally separate itself from the mass of fraudulent unpayable paper which hangs over the heads of all citizens, so long as the obligation to bail out the firms supposedly "too big to fail" can be invoked.

Second, the reinstitution of a Hamiltonian credit system embodying the principle of the National Bank.[2] New issue of government credit is required to fund the great projects of today, equivalent to the canals, roads, and improvement of harbors and waterways of the previous National Bank. Today that means space exploration, the North American Water and Power Alliance, a vastly expanded and open-ended nuclear and fusion energy development program, and an expansion and upgrading of the nation's transportation, utility, and infrastructure grid.

The small-minded patter we hear from our friends who try to fight a piecemeal battle for the little crumbs, which they define as "practical," must end.

The future of the nation today depends on securing a reliable and plentiful power supply. For an advanced industrial economy, this means the most energy-flux-dense form of power—fission now, fusion tomorrow, and new more advanced forms of power production yet to be discovered in the future. New nuclear plants and research into advanced energy are properly the sphere of Federal credit, long-term credit at low-interest for projects—over 25, 50, and 100 years—that will guarantee the electricity and process heat needed for a growing industrial economy and a population with a high standard of living.

The Apollo program, a giant Federal program, *paid for itself*—as will an Apollo-style nuclear program. Every dollar put into the Apollo program, yielded $10 to the economy, measured by conservative standards. Hundreds of thousands of young people became scientists, engineers, or technicians. A similar number of entrepreneurial businesses flourished, as did spinoff inventions. In the days of Apollo, there was a "can-do" spirit, the scientific optimism that any problem could be solved, because the nature of man and society was to progress.

How pitiful the contrast with today's nuclear situation, where beleaguered nuclear supporters lobby for one reactor type against another, or make cost/benefit arguments within the controlled monetarist straitjacket. Of course nuclear is "cost-effective"! Without it, we will not survive as a nation.

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1. Information on Glass Steagall can be found here.

2. For more on Hamiltonian economics, see "A Matter of Principle: Hamilton's Economics Created Our Constitution," by Nancy Spannaus.

Continued from previous page

The Damage at Fukushima

The earthquake and tsunami at the Fukushima Power Plant destroyed three reactors and buildings, but there was no devastating radioactive leakage. The problems at this plant, close to the sea, started when the 46 to 49-foot-high (14-15 meters) tsunami waves hit, about 41 minutes after the earthquake. The emergency diesel-driven generators started up, to keep on the water circulation system to cool the reactors that had automatically shut down, as mentioned above.

But these generators became flooded and stopped operating, which halted the circulation of water in the reactor cores. Thus, the core temperatures started to increase to a critical level. In the following weeks, voluntary operators and engineers fought to get things under control at the plant. Radioactive gases were released from the reactor, but these consisted of iodine and cesium in limited amounts, and thus were not of critical long-term danger, although the plant had to be evacuated temporarily for some hours after leakage until the radioactivity dropped again.

Also, hydrogen gas from the evaporated water had to be released, causing the explosions in the plants that damaged the roof of the reactor buildings. This gave birth to a lot of hysteria in the mass media, but the important factor here is that the reactor cores remained fully isolated by both the steel vessel and the concrete surrounding it, and thus no highly radioactive materials like uranium or plutonium had a chance to escape.

As was repeatedly underscored by the International Atomic Energy Agency and other nuclear authorities, no radioactivity of threat to human health had been leaked from the power plant.

Comparison with TMI

The Fukushima accident had many similarities with the 1979 accident at Three-Mile Island. Both plants were built in the beginning of the 1970s, and as first-generation nuclear plants, they do not have the enhanced safety systems of the second-generation plants and the passive safety systems of the third-generation plants in construction today.

Mishina/Yazawa Science Office

Many areas in Japan remain to be restored to normal after the devastating tsunami that caused 20,000 deaths. Here, a July 2011 scene in Kesennuma Miyagi Prefecture, which was ravaged by the tsunami.

But what was more critical at the Fukushima plants was the difficulty of supplying electricity and other means to the emergency crew, as the rest of the surrounding Japanese society was reeling from the disaster that struck.

Not Like Chernobyl

The accident/disaster at Chernobyl was a totally different (and very long) story, which I shall only briefly mention here. The Chernobyl reactor was poorly designed, with inherent instabilities. The control rods, for instance, had the fault that when lowered into the core (to decrease activity) they would quickly increase the fission activity, causing more nucleons to be split and hence more energy to be released, before starting to decrease it. (This is called a positive void coefficient.)

As the reactor was already in a critical unstable stage, this very short moment was enough to totally loosen the operator's grip on the chain reaction. In few seconds, the reactor went from 200 megawatts power to 350,000 megawatts. The reactor exploded, sending massive amounts of highly radioactive materials more than 1,000 meters into the atmosphere, from where it was spread by the wind.

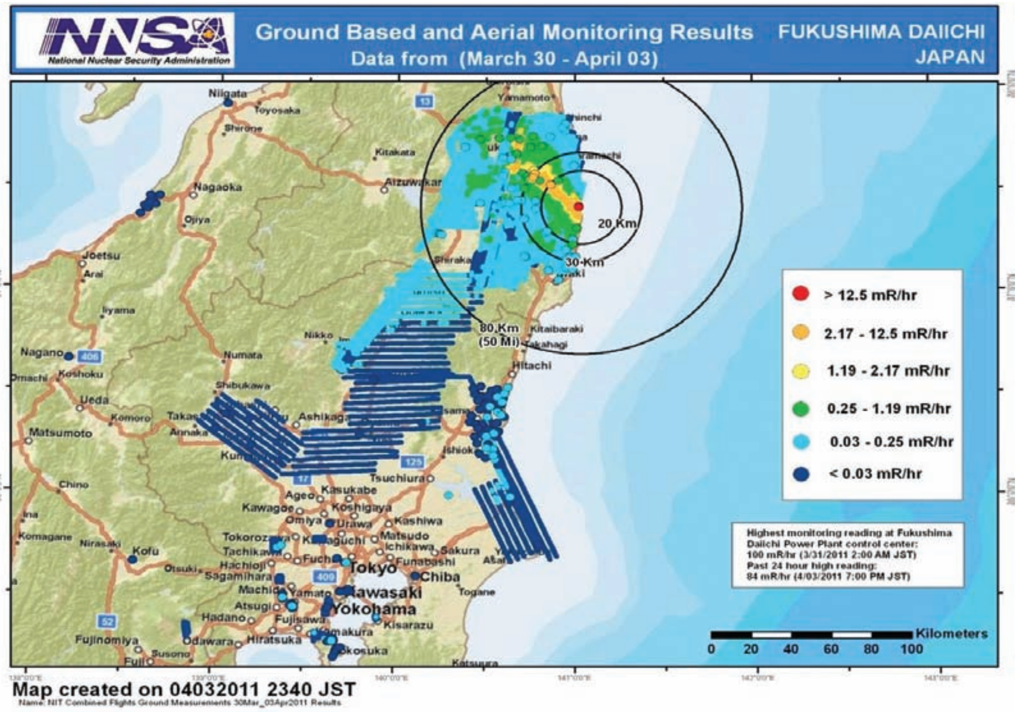
Unlike all reactors in the Western world, the Chernobyl RBMK reactor had no concrete containment structure, so the radioactive materials were free to disperse, after the steel vessel had been blown apart.

Moreover, the Chernobyl reactor used graphite as moderator (to slow down the neutrons), instead of water, and because graphite is flammable, a fire was started that lasted for 10 days, sending more highly radioactive material in the air. Thus, there were measured radioactive levels of 200,000 millisieverts/hr, 4 miles away from the Chernobyl plant. The highest readings I have heard of at Fukushima were 400 millisieverts/hr (which do pose a threat to health) *inside* the plant and orders of magnitude less outside.

Differing Reactions

The reactions around the world to the Fukushima accident have been widely different. Germany has retreated to its former law, which mandated closing all nuclear reactors by 2022. Just months before the accident, Germany had extended this deadline to 2034. There does not seem to be any scientific reasoning behind this decision, as it is highly unlikely that Germany should ever be hit by a 10-meter high tsunami.

China has taken a completely different approach. Although extra safety checks



National Nuclear Security Administration (NNSA)/U.S. Department of Energy

The map shows the combined results of 211 flight hours of aerial monitoring operations and ground measurements made by the Department of Energy, Department of Defense, and Japanese monitoring teams from March 30-April 3, 2011.

To put these levels in perspective, U.S. nuclear pioneer Dr. Ted Rockwell has pointed out: "The reality is that, while some people in the Fukushima housing area are wearing cumbersome rad-con suits, filtered gas-masks, gloves and booties, and putting the same on their children, other people are living carefree in places like Norway, Brazil, Iran, India where folks have lived normal lives for countless generations with radiation levels as much as a hundred times greater than the forbidden areas of the Fukushima homes."

A technical review of the Fukushima accident can be found here.

are being conducted at its nuclear plants, there is no sign of change to the 2020 plan of doubling the present nuclear capacity of the nation. In fact, I have talked with Chinese nuclear experts who tell me that the Chinese Central Government sees the accident as a reason to promote nuclear reactors with passive safety mechanisms, where water circulation will not be shut off by lack of electricity, but be kept in circulation by the physical laws of gravity and convection.

China is importing such technology from the United States, for example, the so-called Westinghouse AP-1000 reactors, and China and the United States have signed a memorandum of understanding on cooperation on nuclear technology.

The U.S. Situation

The United States is the nation that gave birth to nuclear technology. It was here that the first man-controlled nuclear chain reaction took place in 1941, and the U.S. is still a technical and industrial leader in civilian nuclear power. But this is on the threshold of abrupt change—if the White House does not take a much more active stand, and start walking the walk instead of just talking the talk.

America's nuclear industry has been in decline for the last 30 years, and although both Democrats and Republicans speak as though they support the technology, in reality, very little is moving forward. Westinghouse, for instance, is owned today by the Japanese company Toshiba. And, just to take one example, the only American company that enriches uranium for nuclear power plants, the United States Enrichment Corp. (USEC), has long been appealing to the Federal government to fund its ongoing construction of a modern plant that will hugely save energy and cost.

In August 2008, the USEC applied for a $2 billion loan from the Department of Energy with its project, which is "in close alignment with the objectives and regulations of The Loan Guarantee Program." The Energy Policy Act of 2005 made nuclear power a clear priority for the United States. Yet, USEC could not begin construction of the plant before 2007, after waiting two and a half years for the Nuclear Regulatory Commission to issue a license to build and operate the plant.

To this day, USEC has not been granted the loan, and the only thing that has kept the project from shutting down is investments from Toshiba. Thus, it is a Japanese company and not the U.S. government that has been promoting world-class American nuclear technology, which would create 8,000 high-level jobs for American industry, and help lower the dependence on imported oil. As could be expected, the Fukushima accident has for now not promoted further investment from the Japanese in USEC. But, interestingly, many local Japanese in the Fukushima area, have been voting in favor of nuclear power after the accident.

The question of nuclear power is becoming an issue of whether a country believes in industrializing new technologies, or if it prefers not to invest in its future, leaving the nation's welfare to financial bubbles.

The author has a M.Sc. in Physics from the Niels Bohr Institute. He has lived and worked in Canada, Switzerland, and Denmark, and is a founder of UPstream Invest A/S, which invests in nuclear energy and other 21st Century technology.