FREEZE OUR FUKUSHIMAS

A BEYOND NUCLEAR FACT SHEET

March 2012

Introduction

On March 11, 2011, a 9.0 magnitude earthquake in Japan knocked out electric grid power to the six reactor units at the coastal Fukushima Daiichi nuclear power plant complex operated by Tokyo Electric Power Company. A short time later, a tsunami possibly as high as 21 meters (68.9 feet) inundated the reactor site destroying the emergency backup power systems. Over the next several days, three reactor cores overheated, exploded and melted down. Different accident scenarios can lead to the same root cause of the nuclear catastrophe; the extended loss of electrical power to reactor safety and cooling systems followed by containment failure and the release of radioactivity.

Among many responses, Beyond Nuclear has launched a nationwide *Freeze our Fukushimas* campaign, working with Mark I communities and other interested parties around the country toward the goal of halting operation at the country's 23 GE Mark I boiling water reactors, close to identical in design to those at Fukushima Daiichi.

Hard lessons from Fukushima Daiichi, Japan

Nuclear accidents happen. In times of national crisis and natural catastrophe, nuclear power is a dangerous liability. During routine operation, reactor safety systems rely upon power from the electric grid. While reactors are designed to shut down when the grid fails, if emergency backup power systems fail, or if cooling pumps are destroyed, the reactor core overheats causing fuel damage, hydrogen gas explosions, core meltdowns and the release of dangerous amounts of long-lasting radioactivity into the environment.

The radioactive releases from the Japan nuclear accident foiled earthquake and tsunami relief efforts, causing the US 7th Fleet to retreat from coastal operation.

Large portions of a 12-mile radius area evacuated around the destroyed reactor site will not be recovered for generations because it is too radioactive for human habitation.

Radioactive fallout containing iodine-131, plutonium-239, cesium-137 and strontium-90 has contaminated the land, agriculture and groundwater well beyond the prohibited re-entry zone and uncontrolled releases of highly radioactive cooling water are leaking offshore into ocean currents, threatening the marine food chain.

Even highly technological societies can lose control of atomic power with deadly and long-term consequences that threaten environmental quality and human health for decades, even centuries.

The GE Mark I Boiling Water Reactor: Warnings covered up and repeatedly ignored

The destroyed Fukushima Daiichi reactors were the same design as 23 General Electric Mark I Boiling Water Reactors (Mark I) now operating in the United States.[1]

GE marketed the 1960s vintage Mark I "pressure suppression containment" design to economically undercut its competitors. The Mark I containment is one-sixth the volume of Pressurized Water Reactor containment structures. As a result, the Mark 1 has long been known to be vulnerable to containment failure during a severe accident.

On September 20,1972, Dr. Stephen Hanauer, a senior safety officer with the Atomic Energy Commission warned, "I recommend that the agency adopt a policy to discourage further use of the pressure suppression containments**,** and that such designs not be accepted for construction permits filed after a date to be determined."[2]

On September 25, 1972, Joseph Hendrie, the AEC deputy director, replied "Steve's idea to ban pressure suppression containment is an attractive one in some ways."[3] However, Hendrie stated "Reversal of this hallowed policy, particularly at this time, could well be the end of nuclear power."[4] Ignoring Hanauer's warning, the AEC and its successor, the Nuclear Regulatory Commission (NRC), would issue 16 more Mark I operating licenses including three new construction permits.

On February 2, 1976 three GE engineers publicly resigned prestigious [ ] management positions. Testifying before Congress, they stated nuclear power was "so dangerous that it now threatens the very existence of life on this planet."[5] Singling out the Mark I containment they said, "The consequences of containment failure are frightening. It is unthinkable that plant operation can be continued on the very tenuous argument that the probability of the accident occurring is low."[6]

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[1] List of US GE Mark I Boiling Water Reactors

[2] Memo from Dr. Stephen Hanauer to O'Leary, Kruesi, Rogers, US AEC, September 20, 1972

[3] Note to John O'Leary, Joseph Hendrie, AEC, September 25, 1972

[4] Ibid, Hendrie to O'Leary

[5] "Testimony of Dale Bridenbaugh, Richard B. Hubbard, and Gregory C. Minor before the Joint Committee on Atomic Energy, February 18, 1976," from The Silent Bomb: A guide to the nuclear energy controversy, 1976, Appendix A, p. 281

[6] Ibid, p. 298

Vent containment to save it: The voluntary "fix" that didn't work

In June 1986, Dr. Harold Denton, the chief safety officer with the NRC, told an industry conference that if a GE Mark I reactor had a severe nuclear accident there was a 90% chance of containment failure. Rather than close the dangerous reactors, however, they concluded that a severe accident was highly improbable and allowed continued operations.

In 1989, the NRC asked Mark I owners to voluntarily design and install a "hardened vent" on the small, weak containments so that control room operators would have the option to "temporarily" vent unfiltered, radioactive, pressurized steam and the hydrogen gas generated during a nuclear accident, to the environment as a "last resort".

The voluntary vents were installed without NRC oversight and inspections. In fact, the Fitzpatrick nuclear power plant in Oswego, NY refused to install the hardened vent and instead relies on "venting" a nuclear accident by blowing out double doors on an adjacent building to relieve the radioactive pressure and explosive hydrogen gas.[7]

Following the March 2011 triple catastrophe, Fukushima demonstrated that both the Mark I containment and its experimental vent are unreliable. The NRC now wants operators to make yet another dangerous containment modification with the installation of a supposedly more "reliable" hardened vent system, so that these badly designed and aging reactors can extend their operations for decades longer.[8]

However, the NRC's own documents identify that the hardened vent is not reliable for all severe accident scenarios and in certain accident conditions the act of venting itself can increase the likelihood of reactor core damage and containment failure.[9]

Rooftop Nuclear Waste Storage Pools Outside Primary Containment

The storage pools for high-level radioactive waste at Mark I reactors sit several stories high, and are located outside of any primary radiological containment structure. They have long been recognized as at risk of accidents – such as heavy load drops or natural disasters – as well as intentional attacks.

A sudden drain down, or a slow motion boil down, of pool cooling water, exposing densely packed irradiated nuclear fuel to air, would very likely lead, in a short few hours, to an unstoppable waste inferno and catastrophic radioactivity release to the environment.

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[7] "Hardened Wetwell Vent Capability at the James A. Fitzpatrick Nuclear Power Plant," US NRC Safety Evaluation Report, September 28, 1992

[8] "Recommendations for Enhancing Nuclear Safety in the 21st Century: The Near-Term Task Force for Review of Insights from the Fukushima Dai-Ichi Nuclear Accident," US Nuclear Regulatory Commission, July 2011, Recommendation 5, p. 41

[9] Filtered Venting Considerations in the United States," Idaho National Energy Laboratory and US Nuclear Regulatory Commission, 1988, joint presentation in Paris, France

Evidence has mounted that a radioactive waste fire occurred at Fukushima Daiichi Unit 4, resulting in large-scale releases of hazardous Cesium-137 into the environment; many U.S. Mark Is have more waste packed into their individual pools than Fukushima Daiichi Units 1 to 4 put together.

Even NRC-commissioned studies have acknowledged that many tens of thousands of latent cancer fatalities, out to 500 miles downwind, could result from a waste pool fire, as well as thousands of square miles of agricultural land condemned, and economic costs due to evacuation running into the hundreds of billions of dollars. The National Academy of Sciences have confirmed such risks are real.

Beyond Nuclear and countless environmental allies have petitioned the NRC for safety upgrades – such as backup power, make-up water, and needed monitors – on pools until they can be emptied into Hardened On-Site Storage (HOSS): monitorable, retrievable, very high quality dry casks, safeguarded against accidents, fortified against attacks, and built well enough to last for centuries.

Environmental Contamination and Public Health

Contamination from a nuclear catastrophe like Chernobyl or Fukushima will not diminish for hundreds of years. The result of generations of human beings being exposed to this sort of contamination is not known, but since 90% of genetic mutations are not beneficial, humans risk their very existence by living in these areas, spreading this contamination around or consuming foodstuffs grown in radiologically contaminated areas.

After Fukushima exploded, the government of Japan instituted a “cleanup” policy of spreading the radioactive rubble throughout the country, and even urning it, in order to “share the burden”. But this burden has to be isolated. It cannot be “shared,” or re-released into the environment without causing more disease.

The Japanese government opted to “clean up” rather than permanently close some areas. The destruction of vegetation, trees and removal of top-soil will permanently destroy habitat, decimate indigenous species and destroy drainage to the landscape, thus creating a new environmental disaster.

The release of radioactivity from Fukushima - both as atmospheric fallout and direct discharge to the ocean - represents the largest accidental release of radiation to the ocean in history, according to Woods Hole Oceanographic Institute. In June and July 2011, radioactive contamination was 10-10,000 times higher than background, reaching from the Japan coast out to 400 miles and contaminating seafood.

The US quickly stopped any emergency monitoring of contamination levels from the Fukushima catastrophe on US soil, and while some regularly scheduled monitoring has continued, it is woefully inadequate.

Consequences of catastrophic radioactive releases and impacts on public health

Under current radiation standards and assessment methods, radiation doses to the Japanese population downwind, downstream, and up the food chain from Fukushima are likely being significantly underestimated, as are the negative health consequences for current and future generations.

Radiation dose estimates and protection standards do not fully account for the most vulnerable populations, leaving children, the immune compromised, and women to disproportionately suffer more risk.

The Safe Energy Solution

In 1999, The Institute for Energy and Environmental Research (IEER) produced a "Wind versus Plutonium" case study on Japan, showing that renewable energy sources could economically compete. The utility of wind versus nuclear was demonstrated during the Fukushima accident when Japan's offshore wind turbines continued supplying vitally needed electricity to the grid despite the earthquake and tsunami of March 11th, while the melting reactors contributed to, rather than aided, the crisis.

In its 2007 book "Carbon-Free, Nuclear-Free," IEER proved that both dirty, dangerous, and expensive fossil fuels and nuclear power could be completely eliminated from the U.S. economy, and replaced entirely by renewable sources and maximized efficiency, by 2040, without any further technical breakthroughs required and for the same amount of our GDP we currently spend on energy.

In the aftermath of Fukushima, Germany, the fourth largest economy in the world, decided to completely phase out nuclear power by 2022, while remaining committed to climate goals of dramatically lowering greenhouse gas emissions over the course of coming decades; Germany aims to be 80%-100% renewable and efficient by 2050, as does Denmark.

In October 2010, the U.S. Energy Information Administration announced that renewables were tied with nuclear power in terms of their share of primary energy production, at just over 11% each; since then, renewables have surpassed nuclear power. Wind power has long been cost competitive with new nuclear, and solar PV became so in 2010, despite the historic, large disparity in subsidies; efficiency is still by far the most cost effective way to reduce greenhouse gas emissions, while renewables continue to decrease, and nuclear to increase, in price.

Beyond Nuclear has challenged proposed 20-year license extensions at old, degraded, unsafe atomic reactors like Seabrook, NH and Davis-Besse, OH by arguing that renewables, such as offshore wind and solar PV, combined with energy efficiency and storage, can readily replace dirty, dangerous, and expensive nuclear power.

Actions for a Safe Energy Future

Beyond Nuclear in coalition with other groups around the country, has long been advocating for shutdown of the US GE Mark I BWRs. The March 2011 Fukushima meltdowns provided the unfortunate opportunity to fully launch the campaign under the umbrella, *Freeze our Fukushimas*, to shut down the country's most dangerous reactors first, the Fukushima 23.

On April 13, 2011, Beyond Nuclear, eventually joined by 8,000 others, submitted an emergency enforcement petition to the NRC urging the suspension of the Mark I operating licenses. The NRC agreed to review two of our arguments but dismissed a key request for public meetings in each of the 17 emergency planning zones around US Mark Is. Given the NRC's refusal, the "Freeze" campaign plans to:

- Organize independent public hearings in Mark I communities for educational purposes and to help organize opposition to their continued operation.

- Hold governmental hearings, town hall meetings, press conferences, conduct media campaigns and, where appropriate, hold demonstrations, to raise awareness of the risks posed by the Mark I and to pressure for closure.
- Provide analysis of renewable energy replacement power capacity when Mark Is are shut down.
- You can join *Freeze our Fukushimas*. Visit: [httpwww.beyondnuclear.org/freeze-our-fukushimas/](). Or contact Beyond Nuclear directly: 301.270.2209 or [info@beyondnuclear.org]().

Conclusion

The GE Mark I Boiling Water Reactor is not a quality product and does not have reasonably adequate margins of safety for the all important containment structure, the final barrier to a radioactive catastrophe.

Nuclear promotion, corporate financial protection and an electrical production agenda have been prioritized over the protection of public health and safety, resulting in the continued operation of a dangerous design, aging reactors and diminished margins of safety.

If public health and safety is to be the priority, all GE Mark I boiling water reactors must be permanently shut down. Let's *Freeze our Fukushimas* before the next catastrophe!

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