Nuclear power is "so dangerous that it now threatens the very existence of life on this planet." GE engineers, 1976.

INTRODUCTION

On March 11, 2011 a 9.0 magnitude earthquake in the ocean off Japan knocked out electric grid power to the six units at the coastal Fukushima Daiichi nuclear power plant complex operated by Tokyo Electric Power Company. A short time later, a tsunami inundated the complex, 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: the extended loss of electrical power to reactor safety and cooling systems, followed by containment failure and the catastrophic release of radioactivity. The destroyed Fukushima Daiichi reactors were the same design as 23 General Electric Mark I Boiling Water Reactors now operating in the US.

LESSONS OF FUKUSHIMA

► During routine operation, reactor safety systems rely on power from the electric grid. While reactors are designed to shut down when the grid fails, if emergency backup power systems also fail, the reactor core overheats, causing fuel damage, hydrogen gas explosions, core meltdowns and the release of dangerous amounts of long-lasting radioactivity.

► The radioactive releases from the Japanese nuclear accident worsened the crisis and defeated earthquake and tsunami relief efforts and animal rescue.

► Although a 12.4-mile radius around the destroyed reactor site was officially evacuated, an even greater area could be too radioactive for human habitation for generations.

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

► The disaster demonstrated that 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.

RISKS IGNORED

► GE marketed the 1960s vintage Mark I "pressure suppression containment" design to economically undercut its competitors. As a result, the Mark I has long been known to be vulnerable to containment failure during a severe accident.

The disaster demonstrated that highly technological societies can lose control of atomic power with deadly and long-lasting consequences.

► On September 20,1972, Dr. Stephen Hanauer, a senior safety officer with the Atomic Energy Commission, recommended discontinuing "use of the pressure suppression containments, and that such designs not be accepted for construction permits filed after a date to be determined." Five days later, Joseph Hendrie, the AEC deputy director, agreed that such a ban was "attractive" but that: "Reversal of this hallowed policy, particularly at this time, could well be the end of nuclear power." But the warnings were ignored and16 more Mark I operating licenses and three new construction permits were issued.

► In February 1976 three senior-level GE engineers resigned and, testifying before Congress, stated that nuclear power was "so dangerous that it now threatens the very existence of life on this planet." Singling out the Mark I, 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."

► In June 1986, Dr. Harold Denton, the chief safety officer with the NRC, stated publicly that if a GE Mark I reactor had a severe nuclear accident, there was a 90% chance of containment failure. But the NRC dismissed this as too "improbable" and allowed continued operation.

THE FLAWED VENT

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

► The voluntary vents were installed without NRC oversight and inspections. 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 steam pressure and release explosive hydrogen gas.

►The massive hydrogen explosions and radiation releases from Fukushima demonstrate that both the Mark I containment and its experimental vent are unreliable. In 2012, the NRC ordered more unproven modifications to "enhance" the vent systems of Mark I and II containments.

► The 2012 NRC Order does not include any requirements for this "enhanced" containment venting system to manage severe accident conditions; namely, venting hydrogen gas and preventing explosions or installing filters in a containment vent line to reduce harmful radiation releases downwind.

ROOFTOP WASTE POOLS

► Storage pools for the irradiated fuel rods at every Mark I and II reactor sit several stories high, located outside of any primary radiological containment structure, at risk of accidents as well as intentional attacks.

► A sudden drain down, or gradual boil down, of pool cooling water, exposing densely packed irradiated nuclear fuel to air, could quickly lead to an unstoppable waste inferno and catastrophic radioactivity release.

► Many US Mark I and II BWRs have more waste packed into their individual pools than Fukushima Daiichi Units 1 to 4 put together.

► NRC-commissioned studies have shown that a waste pool fire could cause tens of thousands of latent cancer deaths out to 500 miles downwind. Thousands of square miles of agricultural land could be condemned, and economic costs due to evacuation could run into the hundreds of billions of dollars. Such risks are confirmed by the National Academy of Sciences.

► Beyond Nuclear and thousands of 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).

ENVIRONMENTAL CONTAMINATION

► Post Fukushima, the government of Japan instituted a "cleanup" policy of spreading the radioactive rubble throughout the country and even burning 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.

► Releases from Fukushima — both due to atmospheric fallout and direct discharge – represent the largest accidental ejection of radioactivity into 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 400 miles out from the Japanese coastline 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.

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 women, children, and the immune-compromised to disproportionately suffer greater risk.

SEEKING A SAFE ENERGY FUTURE

In April 2011, BEYOND NUCLEAR launched the *Freeze our Fukushimas* campaign, to shut down the country's Mark I and Mark II BWRs. We also submitted an emergency enforcement petition to the NRC, joined by 8,000 others, urging the suspension of the Mark I operating licenses. The campaign will include town hall meetings in reactor communities, media outreach, "occupy" actions and rallies.

Operating US Mark I Reactors

Browns Ferry Units 1,2,3 (AL)
Brunswick Units 1,2 (NC)
Cooper Unit 1 (NE)
Dresden Units 2,3 (IL)
Duane Arnold Unit 1 (IA)
Fermi Unit 2 (MI)
FitzPatrick Unit 1 (NY)
Hatch Units 1,2 (GA)
Hope Creek Unit 1 (NJ)
Monticello Unit 1 (MN)
Millstone Unit 1 (CT — closed but pool still full)
Nine Mile Point Unit 1 (NY)
Oyster Creek Unit 1 (NJ)
Peach Bottom Units 2,3 (PA)
Pilgrim Unit 1 (MA)
Quad Cities Units 1,2 (IL)
Vermont Yankee Unit 1 (VT)

Operating US Mark II Reactors

Columbia Unit 1 (WA)
LaSalle Units 1,2 (IL)
Limerick Units 1,2, (PA)
Nine Mile Point Unit 2 (NY)
Susquehanna Units 1,2 (PA)

Join Beyond Nuclear's campaign:
Freeze our Fukushimas!
Learn more on our website:
WWW.BEYONDNUCLEAR.ORG

BEYOND NUCLEAR

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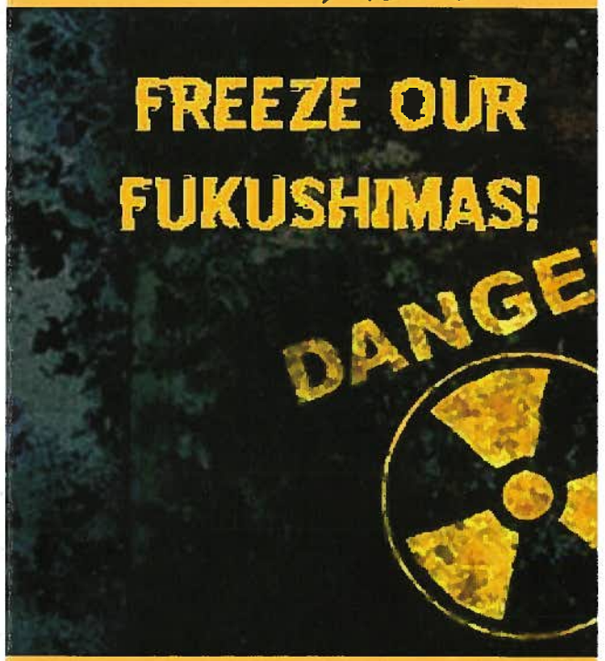
FREEZE OUR FUKUSHIMAS!



A campaign to close US GE Mark I and II Boiling Water Reactors