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Nuclear regulator puts public in danger by not fixing potentially fatal reactor flaw

Group files enforcement petition urging agency to address key safety problem in 19 US "Fukushima" reactors

Takoma Park, MD, October 20, 2020 – The 19 US nuclear reactors of the same boiling water design as those that melted down in Fukushima, Japan, should immediately cease operation until a potentially fatal flaw is fixed, Beyond Nuclear and its technical advisor warned today.

In a federal enforcement petition submitted on October 16 to the US Nuclear Regulatory Commission (NRC), Beyond Nuclear and co-petitioner, Mark Leyse, requested that the agency immediately suspend the operating licenses of the country's 19 operational General Electric Mark I Boiling Water Reactor (BWR) units until their currently deficient hardened containment vents are replaced.

The 19 reactors are sited in 10 US states: Alabama, Georgia, Illinois, Michigan, Minnesota, North Carolina, Nebraska, New Jersey, New York, and Pennsylvania.

The hardened vents are an added safety feature intended to prevent the rupture of the containment structure and an uncontrolled release of radioactive material in the event of a severe accident.

But the science presented in the petition demonstrates unequivocally that the hardened containment vents in the 19 BWR Mark I units are far from adequate to cope with the vast amounts of thermal energy, steam, and explosive hydrogen gas produced during a partial or complete meltdown accident.

The Beyond Nuclear petition asks for the inadequate vents to be replaced with vents that could mitigate a serious accident, an upgrade that could prevent catastrophic explosions of the kind that occurred at the three Fukushima-Daiichi reactors that were operating at full power at the time of the March 11, 2011 earthquake and tsunami.

"It's clear that the NRC does not intend to plan for a severe accident," said Paul Gunter, Director of the Reactor Oversight Project at Beyond Nuclear. "Instead, the regulator and the operators downplay the likelihood of a catastrophe to justify their decision not to install a hardened vent that would be effective during such an eventuality.

“This is unacceptable, given the NRC has known for decades that the Mark I containment is volumetrically too small to contain the dynamic force of a severe accident, not to mention the evidence the world witnessed when the Fukushima reactors exploded,” Gunter added.

“Under the current NRC stipulations, if an accident happened at a US Mark I, it would be like attempting to depressurize a pressure cooker through a soda straw,” Gunter said.

The petition states that the NRC failed to consider how much thermal energy may be generated in a severe accident by the reactor’s contents burning in steam.

Consequently, it stipulated an insufficient capacity for hardened containment vents, a failure that could lead to a catastrophic accident putting thousands if not millions of American lives at risk.

Mark Leyse, who researched and wrote the enforcement petition, said, “The NRC’s mistake is egregious: one may wonder how the US nuclear regulator could be so incompetent. How could the NRC, which presumably bases its decisions on sound science, not pseudoscience, fail to realize that core contents burning in steam during a severe accident generate vast quantities of thermal energy?”

In the early 1970s, when many Mark I units were still under construction, the U.S. Atomic Energy Commission (AEC) — the NRC’s predecessor — concealed design information about the vulnerabilities of BWR Mark I primary containments. The agency feared disclosing their defects would lead to lawsuits demanding the shutdown and termination of construction of reactors employing the flawed design.

The AEC ignored warnings from its top safety analyst, Stephen Hanauer, who advised the AEC in 1972 to stop licensing the pressure-suppression containments used in the GE BWR Mark I design, warning that they are prone to overpressurization in the event of a severe accident.

“The NRC is effectively perpetuating this same deception by failing to warn the public of this risk and by refusing to close the country’s most dangerous reactors in order to address a potentially fatal flaw,” Gunter said.

BACKROUND

Three decades ago, the NRC and owners of most BWR Mark I units voluntarily retrofitted the Mark I containment with a hardened vent to the primary containment of each unit in an attempt to compensate for its design limitations. In the “unlikely” event of a nuclear accident, the hardened vent was intended to depressurize and discharge the

extreme heat and explosive gas from the primary containment directly to the atmosphere. It was believed a hardened vent would assist plant workers in their efforts to either prevent or mitigate a severe accident. Japanese nuclear authorities followed suit for their BWRs.

In the Fukushima Daiichi accident, the hardened vents that were installed in BWR Mark I primary containments failed to prevent hydrogen gas from leaking into reactor buildings and exploding, which released large amounts of radioactive material into the environment. The Fukushima accident revealed potential deficiencies of the hardened vents that had been installed in U.S. BWR Mark I units. The NRC determined that the original U.S. containment vents were similarly not a dependable design.

In the aftermath of the Fukushima Daiichi accident, the NRC ordered owners of BWR Mark I and Mark II units to install new “reliable” hardened vents in primary containments. Unfortunately, as the petition asserts, the post-Fukushima vents that have been installed do not have the capacity to handle the total amount of thermal energy that could be generated, potentially quite rapidly, during a severe accident.

The NRC stipulated that the new hardened containment vents must have the capacity to handle just one percent of a reactor’s thermal power level under accident conditions.

Such a capacity is insufficient by a wide margin: in order to prevent the failure of the primary containment during a severe accident, a vent needs to be capable of removing at least 25 times as much thermal power as the NRC stipulated in its order.

As Leyse describes, provided steam is available under severe accident conditions, the reactor essentially becomes a furnace burning large quantities of zirconium fuel cladding, which contains the highly radioactive uranium fuel pellets, and other core contents, generating tremendous amounts of thermal energy. In some severe accident scenarios, the burning of zirconium in steam (the zirconium-steam reaction) alone may generate as much thermal energy, over a brief period of time, as an operating coal-burning power plant rated at 250 megawatts electric.

In one minute’s time, 6,800 kilograms of zirconium may react with 2,700 kilograms of steam to yield 300 kilograms of hydrogen and 12,200 kilowatt-hours of thermal energy, which is capable of producing enough electricity to power more than 135 average American homes for a full day. The primary containment would be overwhelmed if such a large amount of thermal energy swiftly entered it. If it did not rupture catastrophically, it would certainly leak hundreds of kilograms of hydrogen gas into the reactor building inevitably leading to an explosion that would destroy the reactor building and release radioactive material into the environment.

List of US GE Mark I reactors by state

OPERATIONAL GE MARK I BOILING WATER REACTORS BY STATE (19 UNITS)

AL	Browns Ferry Nuclear Station Units 1, 2, and 3
GA	Edwin I. Hatch Nuclear Station Units 1 and 2
IL	Dresden Nuclear Power Station Units 2 and 3
	Quad Cities Nuclear Power Station Units 1 and 2
MI	Enrico Fermi Nuclear Generating Station Unit 2
MN	Monticello Nuclear Generating Station
NC	Brunswick Steam Electric Plant, Units 1 and 2
NE	Cooper Nuclear Station
NJ	Hope Creek Generating Station
NY	James A. FitzPatrick Nuclear Station
	Nine Mile Point Nuclear Station Unit 1
PA	Peach Bottom Atomic Power Station Units 2 and 3

Beyond Nuclear is a 501(c)(3) nonprofit membership organization. Beyond Nuclear aims to educate and activate the public about the connections between nuclear power and nuclear weapons and the need to abolish both to safeguard our future. Beyond Nuclear advocates for an energy future that is sustainable, benign and democratic. The Beyond Nuclear team works with diverse partners and allies to provide the public, government officials, and the media with the critical information necessary to move humanity toward a world beyond nuclear. Beyond Nuclear: 7304 Carroll Avenue, #182, Takoma Park, MD 20912. Info@beyondnuclear.org. www.beyondnuclear.org.