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Re: Docket ID No. NRC-

Fax Cover Sheet 2012-0246

From: Kevin Kamps

To: NRC Nuclear Waste Confidence Directorate & Secretary US NRC

Date: 12/20/13

Re: NUREG-2157, WC DGEIS

# of pages: cover sheet + 1 page cover letter + 3 page fact sheet = 5 pages total

Notes:

Jan. 2012 "Catastrophic Risks of GE BWR Mark I High-Level Radioactive Waste Storage Pools"

Public Comment Re: Docket ID No. NRC-2012-0246, WC DGEIS, NUREG-2157

Dec. 20, 2013

Dear NRC Nuclear Waste Confidence Directorate,

Please find attached a three-page fact sheet I wrote in January 2012 entitled "Catastrophic Risks of GE BWR Mark I High-Level Radioactive Waste Storage Pools."

I do not share NRC's "confidence" that high-level radioactive waste storage pools across the U.S. are safe, sound, and secure, whether in the here and now, during up to 80 years of reactor operations, for 60 years beyond reactor shutdown, for a century beyond the end of decommissioning, or forevermore into the future (what NRC calls "indefinite storage," which could also be called "infinite storage").

This is especially true regarding General Electric Mark I and Mark II Boiling Water Reactor high-level radioactive waste storage pools. The U.S. has 23 Mark I reactors, and another 8 Mark II reactors, that are identical (Mark I) or very similar (Mark II) in design and even vintage to the four reactors at Fukushima Daiichi destroyed by the nuclear catastrophe there which began on March 11, 2011.

A lesson to be learned from Fukushima Daiichi is that dense storage of irradiated nuclear fuel in storage pools, as done in the U.S., is a mega-catastrophe just waiting to happen, whether sparked by a natural disaster, accident (such as heavy load drop), or intentional attack (in this sense, these pools are unimaginably large dirty bombs in our backyards, pre-deployed, and just waiting to be triggered).

At this point, NRC is guilty of a cover up, and complicity with industry, regarding the mega-risk represented by densely-packed pools filled to capacity with ultra-hazardous, high-level radioactive waste, pools that NRC does not even require be connected to back-up power for running cooling water circulation pumps. Although NRC is considering requiring it, incredibly, even at this late point in time, nearly three years after the Fukushima Daiichi catastrophe began, with its horrific images of helicopters dropping water, and fire trucks spraying water, in desperate, ad hoc attempts to ensure cooling water was present in severely damaged, catastrophically vulnerable high-level radioactive waste storage pools, NRC still does not yet require that storage pools here even have in place make-up water supplies or capacities.

Thank you.

Sincerely,

Kevin Kamps
Radioactive Waste Watchdog, Beyond Nuclear
6930 Carroll Ave., Ste. 400
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Beyond Nuclear Fact Sheet

Catastrophic Risks of GE BWR Mark I High-Level Radioactive Waste Storage Pools

High-Level Radioactive Waste Storage Pool Fire at Fukushima Daiichi

The Fukushima Nuclear Catastrophe has clearly shown just how risky General Electric Boiling Water Reactors of the Mark I design are, including their high-level radioactive waste (HLRW) storage pools. Although the U.S. nuclear power establishment is still trying to deny it, evidence has mounted that Fukushima Daiichi Unit 4's pool boiled dry to the point that highly radioactive irradiated nuclear fuel assemblies were exposed to air, overheated, caught fire, and discharged catastrophic amounts of radioactive cesium-137 directly into the environment. This is because GE BWR Mark I pools – as with most pools at nuclear plants – are not located within a primary radiological containment structure. Also, at Fukushima the reactor meltdowns and explosions damaged or destroyed the secondary containment structures (referred to as reactor buildings), at Units 1, 3, and 4, leaving those pools open to the sky. Unit 1 has since been covered with a tent. Unit 2 did suffer a relatively small hole in its reactor building, as well.

As Stohl et al. have reported: "Our results indicate that ^{137}Cs emissions peaked on 14–15 March but were generally high from 12 until 19 March, when they suddenly dropped by orders of magnitude exactly when spraying of water on the spent-fuel pool of unit 4 started. This indicates that emissions were not only coming from the damaged reactor cores, but also from the spent-fuel pool of unit 4 and confirms that the spraying was an effective countermeasure."[1] Thus, the HLRW fire in the Unit 4 storage pool caused some of the worst radioactive Cs-137 releases during the catastrophic first week at Fukushima. It was his concern that the Unit 4 pool had boiled dry that prompted U.S. Nuclear Regulatory Commission (NRC) Chairman Gregory Jaczko, in the very first days of the catastrophe, to order an emergency warning to Americans in Japan to evacuate to at least 50 miles away from the Fukushima Daiichi nuclear power plant.

The Reactor No. 4 pool contained 135 tons of irradiated nuclear fuel; Reactor No. 1's pool had 50 tons, No. 2's 81 tons, and No. 3's 88 tons. It took months for Tokyo Electric Power Company (TEPCO) and emergency responders to restore regular cooling water flow to certain of the pools. Some may still lack it. To restore water to the pools, as the thermally hot irradiated nuclear fuel boiled it away, ad hoc cooling efforts have included attempts to drop water by helicopter, as well as water spraying by fire truck, concrete pump truck, and even riot control water cannons. The Unit 4 reactor building is severely listing; its pool floor is supported by steel jacks, for fear that it could fall out. A large aftershock could collapse the pool, instantly drain its cooling water, and reignite a radioactive waste fire. Unit 3's pool appears filled with debris, so the condition of its irradiated fuel is unclear. Given the dangers on-site, including high radiation dose rates, when and how TEPCO and/or the Japanese federal government will be able to remove the HLRW to a safer location is yet to be determined. Also, it is unclear when, or even if, a close examination of the four pools will occur, to determine what exactly happened where, why, and how bad the radioactivity releases have been.

What are the risks?

While all nuclear power plant HLRW storage pools are risky, GE BWR Mark I pools are especially vulnerable to accidents or attacks. A boil down or drain down of the cooling water could spark a fire in the irradiated fuel, as seen at Fukushima. GE BWR Mark I pools are elevated four to six stories high, above the reactor as well as outside the primary containment structure. The reactor building is not robust, as shown by the explosions at Fukushima. The design made it easier for the plants to remove irradiated fuel from the reactor core directly into the pool, but puts the pools at increased risk of heavy load drops, attacks by airplanes, etc. Emergency response is complicated by the pools' high elevation above ground. NRC has not required pools to have emergency backup power connected to cooling systems, nor emergency make up water. Thus, they remain vulnerable to loss of power, as happened at Fukushima due to earthquake and tsunami. In the U.S., the

primary electrical grid has failed due to tornadoes, hurricanes, floods, fires, ice storms, human error, wildlife[2], etc., and there has been a troubling pattern of failures with emergency backup diesel generators at American nuclear plants.[3]

Repeated Warnings Have Fallen on Deaf Ears

The NRC has long known about pool risks for decades, reporting in early 2001 that a HLRW fire could cause around 25,000 latent cancer fatalities as far as 500 miles downwind.[4] In 2003, in the aftermath of the 9/11 attacks, Alvarez et al. published a report explaining how an irradiated nuclear fuel pool fire in the U.S. could render an area uninhabitable that would be as much as 60 times larger than that created by the Chernobyl accident.[5] The U.S. National Academies of Science confirmed Alvarez et al.'s findings in 2005.[6] Given the heightened risks at GE BWR Mark Is, the Nuclear Security Coalition, comprised of dozens of environmental groups, urged decision makers to prioritize emptying the HLRW from these pools into hardened on-site storage (HOSS), to safeguard it against accidents and fortify it against attacks; nearly 200 organizations now endorse HOSS.[7] In another major report, Alvarez repeated his warnings about the risks of BWR pool storage in the U.S. in the aftermath of Fukushima.[8] Beyond Nuclear filed an emergency enforcement petition with NRC a month after the Fukushima catastrophe began, demanding emergency backup power be installed on GE BWR Mark I pools. Although NRC did agree in Dec. 2011 to have its Fukushima Task Force review the issue, a year after Fukushima, NRC has yet to require safety upgrades.[9]

Where are the 24 GE BWR Mark I HLRW storage pools in the U.S.?

There are 23 operating reactors in the U.S. of an "identical twin" design to Fukushima Daiichi Units 1 to 4. They are: Browns Ferry 1, 2 & 3 (AL); Brunswick 1 & 2 (NC); Cooper 1 (NE); Dresden 2 & 3 (IL); Duane Arnold 1 (IA); Fermi 2 (MI); FitzPatrick 1 (NY); Hatch 1 & 2 (GA); Hope Creek 1 (NJ); Monticello 1 (MN); Nine Mile Point 1 (NY); Oyster Creek 1 (NJ); Peach Bottom 2 & 3 (PA); Pilgrim 1 (MA); Quad Cities 1 & 2 (IL); Vermont Yankee 1 (VT). In addition, at Millstone Unit 1 in CT, although the reactor has been permanently shut down since 1995, its owner, Dominion Nuclear of Richmond, VA, "concluded that they would keep the Millstone Unit 1 fuel in the Spent Fuel Pool, in a SAFSTOR status, until 2048 rather than move the fuel to an ISFSI [Independent Spent Fuel Storage Installation]."[10]

U.S. pools contain vastly more HLRW than Fukushima Daiichi's

As documented in Alvarez's 2011 report, GE BWR Mark I pools in the U.S. are among the most packed with HLRW as any nuclear power plant pools in the U.S. About 75% of the 65,000 metric tons of commercial irradiated nuclear fuel in the U.S. is stored in pools, while 25% has been transferred to dry casks. Nuclear utilities tend to keep their pools as full as possible, in order to defer the costs of dry cask storage into the future. This greatly increases pool risks. Frighteningly, most GE BWR Mark I pools in the U.S. contain much more HLRW than all four Fukushima Daiichi reactor units put together (354 tons).[11] For example, **Oyster Creek** (NJ), the oldest still-operating atomic reactor in the U.S. (1969 to 2012), has generated about 750 metric tons of HLRW containing 125 million curies of radioactivity; even though some of its irradiated fuel has been transferred to dry cask storage, the vast majority still resides in the pool. **Vermont Yankee** has generated about 650 metric tons of HLRW, containing 100 million curies of radioactivity; it suffered a near-miss heavy load drop in recent years. **Fermi 2** (MI) has generated nearly 600 metric tons of HLRW, containing 90 million curies; all of its irradiated fuel is stored in its pool, because the plant's structure is not welded strongly enough to support the heavy weight of a crane and fully loaded cask for transfer operations; Detroit Edison has admitted that station blackout would lead to pool boiling within 4 hours 12 minutes. Likewise, **Pilgrim** (MA) stores all of its more than 550 metric tons of HLRW, containing over 70 million curies, in its pool. *January 2012*

The footnoted version of this backgrounder is posted at:
http://www.beyondnuclear.org/radioactive-waste-whatsnew/2012/2/6/catastrophic-risks-of-ge-bwr-mark-i-high-level-radioactive-w.html

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References

[1] Stohl et al., "Xenon-133 and caesium-137 releases into the atmosphere from the Fukushima Dai-ichi nuclear power plant: determination of the source term, atmospheric dispersion, and deposition," *Atmos. Chem. Phys. Discuss.*, 11, 28319-28394, 2011, http://www.atmos-chem-phys-discuss.net/11/28319/2011/acpd-11-28319-2011.html.

[2] In the 1980s, a raccoon was electrocuted at the Fermi 2 nuclear power plant in Monroe, Michigan, and power was lost to the plant from the electric grid. Fermi 2, by the way, is the largest GE BWR Mark I in the world, at 1,122 megawatts-electric.

[3] http://markey.house.gov/press-release/august-24-2011-nrc-va-earthquake-highlights-need-update-us-nuclear-safety-standards

[4] "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," (NUREG-1738), Feb. 2001, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1738/.

[5] Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane, Gordon Thompson, and Frank N. von Hippel published "Reducing the hazards from stored spent power-reactor fuel in the United States" in *Science & Global Security*, Vol. 11, No. 1, 2003.

[6] The National Academy of Sciences Report on "Safety and Security of Commercial Spent Nuclear Fuel," April 6, 2005.

[7] See the Statement of Principles for Safeguarding Nuclear Waste at Reactors, including the list of signatories, at http://www.ieer.org/reports/DOE_WasteContracts2010/HOSS_PRINCIPLES_3-23-10x.pdf.

[8] Robert Alvarez, Introduction, "Spent Nuclear Fuel Pools in the U.S.: Reducing the Deadly Risks of Storage," Institute for Policy Studies, Washington, D.C., May, 2011, http://www.ips-dc.org/reports/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage.

[9] http://www.beyondnuclear.org/nuclear-reactors-whatsnew/2012/1/3/nrc-accepts-beyond-nuclear-petitioned-actions-for-review-at.html.

[10] http://www.nrc.gov/info-finder/decommissioning/power-reactor/millstone-unit-1.html

[11] U.S. Department of Energy, Final Environmental Impact Statement for Yucca Mountain, Table A-7, Feb. 2002.