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“Lessons Learned from the Fukushima Nuclear Accident for Improving Safety and Security of U.S. Nuclear Plants”
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THE COMMENTS OF PAUL GUNTER, BEYOND NUCLEAR,
ON THE
LESSONS UNLEARNED
FROM THE FUKUSHIMA DAI-ICHI NUCLEAR DISASTER:

UNRELIABLE GE MARK I AND MARK II BOILING WATER REACTOR
CONTAINMENT STRUCTURES

These comments are offered to the National Academy of Sciences at the initiation of its study on the implications of the Fukushima catastrophe for US reactors as commissioned by the United States Nuclear Regulatory Commission (NRC).

The most important lesson of the Fukushima Dai-Ichi nuclear catastrophe is that in the event of a severe accident, once fuel damage occurs in the reactor core of any General Electric Mark I Boiling Water Reactor, there is a very high likelihood that the accident will proceed to a catastrophic containment failure with widespread radioactive contamination to the environment. Yet, the United States
Nuclear Regulatory Commission (NRC) and the nuclear industry have expressly disregarded this most critical lesson in post-Fukushima Orders and actions.

The images of exploding atomic reactors causing the release of radioactivity, the evacuation and perhaps permanent relocation of as many as 100,000 Japanese citizens from their homes and land have renewed worldwide attention to the inherent dangers of nuclear power. The Fukushima Dai-ichi reactors Units 1-5 are the General Electric Mark I Boiling Water Reactors (Mark I). Unit 6 is a General Electric Mark II Boiling Water Reactor (Mark II). There is now a renewed focus on the generic risks posed by these same unreliable Fukushima-designed reactors, thirty-one (31) operating in the United States like in New Jersey at the Oyster Creek nuclear power station (the first and oldest Mark I in the world commissioned in October 1969) and Vermont at the Vermont Yankee nuclear power station (which was provided a 20-year license extension by the NRC just ten days into the March 2011 Fukushima Dai-ichi nuclear accident.

The nuclear catastrophe has forced a re-examination of the adequacy of safety systems of the Mark I and now additionally the Mark II containment design. The Mark I containment design has long been identified as vulnerable to failure under severe accident conditions; first by the Atomic Energy Commission in 1972 and then by the NRC in 1986. In 1989, the NRC requested through Generic Letter 89-16 that the operators of the Mark I reactors voluntarily install a “hardened vent” that would provide operators with the option to temporarily defeat the flawed and vulnerable containment design rather than risk permanently rupturing it during a reactor accident. Most US Mark I operators installed the experimental vent system. The “Direct Torus Vent System” was not uniformly installed with many variations at the various Mark I reactors and was not inspected by NRC. Tokyo Electric Power Company similarly installed the DTVS at Fukushima in the early 1990’s where the “hardened vent” in March 2011 would demonstrate a 100% failure rate along with the unreliable Mark I containment structures under multiple severe accident conditions.
The concern now focuses on what the NRC and the nuclear industry have and have not done to address these unreliable containments and the demonstrated vulnerability of what is still represented to the public today as the final safety barrier in the event of a nuclear accident.

**TWENTY-THREE (23) MARK I AND EIGHT (8) MARK II REACTORS CONTINUE TO OPERATE WITH UNDERSIZED AND UNRELIABLE CONTAINMENT SYSTEMS**

The fundamental problem of the GE Mark I and Mark II reactors is that the license approved and credited containment system (the pressure suppression containment) is by design and construction critically undersized and unreliable to perform its required safety function during a nuclear accident. The flawed containment design is roughly one–third (1/3) the volume of the large dry containment structures for Pressurized Water Reactor like the Three Mile Island nuclear power station. This constitutes a violation of the General Design Criteria (GDC 16) of the operating license. The NRC has refused to acknowledge and open hearings for the revocation or modification of the operating license. The agency has sought to avoid any public hearings such as requiring licensees to pursue the formal license amendment process to provide the public with due process and independent evaluation of modifications to the all important containment system.

Despite significant design vulnerability, the NRC and the nuclear industry continue to operate and provide 20-year license extensions for these GE reactors and unreliable containment systems as back-fitted in the early 1990's with what are now also demonstrated to be unreliable venting systems. The containment and venting issues were significant safety concerns even before the Fukushima catastrophe.
The NRC actions requested in 1989 in Generic Letter 89-16 and the subsequent industry modifications volunteered in the early 1990’s to the unreliable Mark I containment system were categorized and treated as “non-safety related systems.” As a result, there was and remains a significant lack of NRC oversight of the current installed containment vent configurations. Given the Fukushima disaster and aging reactors, this situation is alarming. As one example of the complete lack of NRC oversight and disregard for public safety, the operators of the FitzPatrick nuclear power plant in Upstate New York opted not to install the experimental vent as requested under the NRC voluntary initiative. Instead, the NRC would “OK” the FitzPatrick operator’s plan for an accident mitigation system involving an over-temperature and over-pressure accident from the reactor core by venting the accident through a pre-existing duct work system from the vulnerable containment to an adjacent auxiliary building. The high pressure release through the low pressure duct work system (not intended for accident conditions but routine containment purges during refueling, inspections and repairs) which is acknowledged by both NRC and the operator to rupture at the Standby Gas Treatment System (the reactor’s current radiation filtration system for routine purging) in the auxiliary building, over-pressurizing the room and blowing out a set of double doors to vent the accident’s steam pressure, non-fuel damage-related radioactivity and high temperature from the core to the environment at ground level. Should such an accident also involve nuclear fuel damage, the “venting” will not only include high pressure steam, high-temperatures, but now a large volume of explosive hydrogen gas and a release of a range of concentrations of fuel damage related radioactivity. Because the current venting system was installed as and currently considered a “non-safety related system,” the “operator action” is currently approved by the NRC without an adequate safety evaluation of the radiological consequences of vent operation to the environment, site workers and neighboring civilian populations as well as a disregard for ignition points that could similarly explode into a radiological catastrophe as in Japan.
The NRC and the nuclear industry are currently operating these GE Mark I and Mark II reactors on the premise that a nuclear accident is a very remote and low probability event. Given this low probability, they claim, there is no immediate danger to public health and safety despite the recognized systems vulnerabilities and lack of safety oversight. These post-Fukushima “probabilities” versus GE Mark I and II “vulnerabilities” that is being used to justify continued risky operations are unacceptable to a growing sector of the public living around these dubious nuclear facilities.

THE NRC HAS ISSUED ORDERS THAT INADEQUATELY PROTECT HEALTH AND SAFETY FROM CONTINUED OPERATIONS AND PLACE THE PUBLIC AT UNDUE RISK FROM A SEVERE ACCIDENT AT MARK I OR MARK II NUCLEAR POWER PLANTS

The NRC “Near-Term Task Force on the Fukushima Accident” presented twelve (12) recommendations to the federal agency for action at US reactors. These recommendations developed into three (3) NRC Orders to industry and a set of requests for additional information.

One of these federal “Enforcement Actions” regards an Order (EA-2012-050) to all Mark I and Mark II operators to install a “Hardened Containment Vent System.”

In fact, the so-called “Hardened Containment Vent System” (HCVS) has absolutely nothing to do with actually hardening the weak Mark I and Mark II containment system. To the contrary, it is another attempt to provide a more reliable vent system to temporarily by-pass the still vulnerable Mark I and now the Mark II containment systems. The enhanced vent is designated for the purpose of relieving the containment of high pressure steam and high temperature in operator actions aimed solely at preventing fuel damage from
occurring. The Order provides for such containment modifications to be completed by operators by December 31, 2016.

The NRC is therefore allowing all Mark I and Mark II operators at least two complete refueling cycles (a total of 48 months) to evaluate any changes and make modifications in the next experiment with the Hardened Containment Vent Systems on the unreliable containment. This effectively in the interim defers current public health and safety concerns arising from the unreliable containment and the demonstrated unreliability of the DTVS at Fukushima (the so-called “reliable hardened vent” as installed on most US Mark I reactors per Generic Letter 89-16) to the nuclear industry’s production agenda and financial interest. This presents an undue and unacceptable risk to the public health and safety.

Of further concern, the NRC Interim Staff Guidance for the “enforcement action” document for licensee’s to follow the Order explicitly states:

1.0 “The HCVS has no requirements for severe accident service.”

[p.5, lines 14-15]

There are a number of irrational risks and unacceptable consequences that follow on from this glaring lack of regard by staff and agency action for public safety which essentially unlearns the most fundamental and design-specific lesson from the Fukushima Dai-Ichi nuclear catastrophe; a severe accident that results in fuel damage will generate explosive environments and threaten massive radiation releases with widespread radioactive contamination.

The Order thus constitutes a dangerous half measure that jeopardizes public health and safety by excluding any consideration of the post-fuel damage accident, whereby;
1) the Order does not require the designers and operators of the new 
Hardened Containment Vent System to evaluate, analyze or consider explosive hydrogen gas generation as the direct result of fuel damage 
including potential ignition points in the new hardened vent system;

2) the Order does not require the designers and the operators to evaluate, 
analyze or consider the release of radiation into the Hardened 
Containment Vent System following fuel damage in a nuclear accident, 
therefore there is no requirement in the Order to install a radiation filtration 
system that would provide an added measure of defense-in-depth for 
public health and safety from operator actions to deliberately open reactor 
containment during an accident to attempt to save it from permanent 
rupture;

3) the Order does not require that the designers and operators of the new 
Hardened Containment Vent System to consider installing radiation 
monitoring equipment that would monitor and indicate ranges of 
radioactive release above normal reactor operations.. Therefore, in the 
event of a fuel damage accident, the Order’s design for the in-line 
radiation monitoring system will not provide the public with accurate 
readings of the radiation releases through the vent to the environment 
generated from a severe accident involving fuel damage. The public 
objects to such actions that constitute a deliberate "information blackout" 
that would handicap emergency notifications potentially affecting public 
health and safety.

Ironically and inconsistently, the NRC and the industry will admit that the Order 
does require the Mark I and Mark II Hardened Containment Vent System to 
reliably close and remain closed during an accident post-fuel damage.
The irony here is that the regulator and the industry and the fate of public health and safety come full circle to return to the fundamental and still unaddressed issue of the unreliable Mark I and Mark II containment system without any evaluation and analysis for re-opening the experimental vent should the over-pressurization and over-temperature accident continue along with the now acknowledged reactor fuel damage, explosive hydrogen gas environment and unanalyzed ignition sources and unmonitored intense radioactivity gases and particulate capable of widespread land and resource contamination requiring the evacuations and long term relocation of large populations.

These half measures and inconsistencies lead the public interest community to further believe that the NRC action plan as implemented by EA 2012-050 does not regard the agency’s mandate to protect the public health and safety but instead defers to protect the regulated industry’s production margins and financial interests.

In the Post-Fukushima world, this is not acceptable and significantly erodes the public confidence in and the credibility of “a captured regulator,” marginal government oversight and academic institutions that advocate for and shield such dangerous half measures.

Sincerely,

Paul Gunter, Director
Reactor Oversight Project
Beyond Nuclear
6930 Carroll Avenue Suite 400
Takoma Park, MD 20912
Tel. 301.270.2209
paul@beyondnuclear.org
www.beyondnuclear.org

REFERENCE DOCUMENTS