UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE NUCELAR REGULATORY COMMISSION

In the Matter of	EA-12-050
All Operating Boiling Water Licensees	
With Mark 1 and Mark II Containments	April 2, 2012

PILGRIM WATCH REQUEST FOR HEARING REGARDING INSUFFICIENCY OF ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS

In accordance with 10 C.F.R § 2.309, Pilgrim Watch files a Request for Hearing challenging the adequacy of NRC's Issuance of the Order to Modify Licenses With regard To Reliable Hardened Containment Vents (EA-12-050) issued March 12, 2012.

I. Petitioners Have Standing:

A Petitioner is entitled to party status by establishing that they are "adversely affected by this Order." (Order at 9, Section V) Pilgrim Watch ("PW") is a non-profit citizens' organization that serves the public interest in issues regarding the Pilgrim Nuclear Power Station, a Mark I BWR. The organization is located at 148 Washington Street, Duxbury, Massachusetts, 02332. Many of its members live within the immediate neighborhood of the reactor, and others either within the 10 -mile Emergency Planning Zone or within the 50-mile ingestion pathway. Mary Lampert who represents PW makes her residence and place of occupation and recreation within an approximate six (6) miles of Pilgrim Nuclear Power Station. Therefore, Petitioners believe that it has standing to intervene in this proceeding and, indeed, deserve to be afforded their due process with all formal hearing rights.

In addition, PW is a party to Pilgrim's license renewal adjudication proceedings; its June 1, 2011 Request for Hearing was directed specifically towards safety issues regarding Pilgrim's DTV and site specific lessons learned from Fukushima. From review of the filings[1], available on NRC's Electronic Hearing Docket, it reasonably can be expected that PW will meaningfully contribute to the record.

PW submits that the public in communities surrounding Pilgrim NPS (and for that matter others communities around the nation affected by Mark I and Mark II reactors) should be afforded their due process with all formal hearing rights to redress inadequacies of past and future modifications to containment in context of EA12-050.

The possible effect of any order that may be entered in the proceeding on the requestor's/petitioner's interest includes the following.

Petitioners believe that if Pilgrim, and other BWR Mark I and Mark II reactors, is allowed to operate without filtered vents that are passively actuated by means of a rupture disc,

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[1] Pilgrim Watch Request For Hearing On A New Contention Regarding Inadequacy Of Environmental Report, Post Fukushima, June 1, 20122; Pilgrim Watch Reply to Entergy's and NRC Staff's Answers Opposing Request for Hearing on New Contention (January 7, 2011); Pilgrim Watch Reply to Entergy's and NRC Staff's Answers to Pilgrim Watch Request for Hearing on [a] New Contention Regarding Inadequacy of Environmental Report, Post Fukushima (July 5, 2011); Pilgrim Watch Reply to Entergy's Motion to Strike Portions of Pilgrim Watch Reply to Entergy and the NRC Staff Answers Opposing Pilgrim Watch's Request for Hearing on a New Contention (07/15/11) (July 18, 2011); Pilgrim Watch Request for Leave to Supplement Pilgrim Watch Request for Hearing on a New Contention Regarding the Inadequacy of the Environmental Report, Post-Fukushima filed June 1, 2011 (Aug. 8, 2011) at 1 (citing Near-Term Task Force Report); Pilgrim Watch's Petition For Review Of Memorandum And Order (Denying Pilgrim Watch's Requests For Hearing On New Contentions Relating To Fukushima Accident) Sept. 8, 2011; Pilgrim Watch Reply To Entergy's Answer To Pilgrim Watch's Petition For Review-available NRC's EHD

so that neither water nor electrical supply is needed and operator intervention is not necessary, that there will be an unacceptable risk to the environment jeopardizing the health, safety, property and finances of Petitioners' members who live, recreate, conduct business and own property within the vicinity of the Pilgrim Nuclear Power Station and other Mark I and Mark II BWRs. The Request for Hearing thereby addresses a significant public safety and environmental issue.

The Petitioner Has Pleaded a Valid Contention:

Petitioners hereby respectfully submit the following contentions for consideration:

1. Based on new and significant information from Fukushima, the Order Modifying Licenses With Regard To Reliable Hardened Containment Vents issued March 12, 2012 (EA-12-050) is insufficient to protect public health, safety and property because it lacks a requirement for licensees to install filters in the direct torus vents (DTVs)
2. Based on new and significant information from Fukushima, the Order Modifying Licenses With Regard To Reliable Hardened Containment Vents issued March 12, 2012 (EA-12-050) is insufficient to protect public health, safety and property because it does not require the hardened DTV to be passively actuated by means of a rupture disc, so that neither water nor electrical supply is needed and operator intervention is not necessary to actuate the system.

II. Introduction

Pilgrim, like the other Mark I reactors in the U.S., are the same design as the failed Fukushima reactors – all are GE, Mark I, BWRs. Almost forty years ago, the NRC identified a serious design flaw in these reactors - in certain accident scenarios the containment would fail in the event of pressure build up.

A supposed "fix" was recommended, and put into place – a direct torus vent (DTV) to relieve pressure in order to save the containment by releasing unfiltered material directly into the atmosphere. Pilgrim, like the other Mark I's, assumed that the DTV would work, and that theoretical assumption was the underpinning of its assumed probabilities in accident sequences. "The use of the direct torus vent as a means of containment heat removal has been shown to have a major impact upon the results of Class II accident sequences.[2]" The DTV functioned as a backup to containment heat removal by the suppression pool cooling mode and the containment spray modes of the residual heat removal system.

But this "major impact" was "shown" only by theoretical analysis. The only real tests of the DTV – Unit 1, Unit 2, and Unit 3 at Fukushima, March 2011 – all failed. Three out of three failures is not a good score.

The new and significant information concerning the likely failure of the DTV to prevent containment failure that now must be considered includes:

(1) Properly trained operators decided not to open the DTV when they should have because they feared the effects offsite of significant unfiltered releases;
(2) When the operators finally decided to open the DTV, they were unable to do so;
(3) The failure of the DTV to vent led to containment failure/explosions that resulted in significant ongoing offsite consequences.

Prior to Fukushima, concerns regarding the operational safety of the DTV focused simply on accidental releases - measures to assure no single operator error in valve operation could activate

[2] Pilgrim Nuclear Power Station Individual Plant Examination for Internal Events Per GL-88-20, Volume 1, Prepared for Boston Edison Co., September 1992, pg, 5.0-13 (Exh.,1)

the DTV and mistakenly release unfiltered radiation into the environment. Now, after the DTV's first and only real test, it is clear that what is most important is not a theoretical mistaken release; rather the new and significant issue is the likelihood that the DTV simply won't work as currently designed when release is required to save the containment. Both a filter system, and rupture disc must be part of NRC's requirement.

III. CONTENTION 1- FILTERS

Contention I reads:

> Based on new and significant information from Fukushima, the Order Modifying Licenses With Regard To Reliable Hardened Containment Vents issued March 12, 2012 (EA-12-050) is insufficient to protect public health, safety and property because it lacks a requirement for licensees to install filters in the direct torus vents (DTVs)

A. Introduction

Install filtered vent systems. In an accident like the one at Fukushima, a filtered vent system could reduce the possibility of containment-building explosions, by releasing radioactive gases to the atmosphere through a large filter system. This system traps the most dangerous radioactive species, including cesium 137 and iodine 131, and prevents them from spreading beyond the containment building. A group of nuclear engineers at the University of California originally suggested this idea in 1977. Some countries -- including France, Sweden, and Germany -- have installed filtered vent system at their reactors; and Japan based on lessons learned from Fukushima is installing filtered vents on its reactors. (Bloomberg, Exhibit 6) The United States has lagged behind and not adopted filtered vents. The NRC has a second chance.

A filtered vent system would also supplement the cooling options available to prevent and mitigate reactor core damage. "Feed and bleed" cooling options – where makeup water is supplied to the reactor vessel, removes decay heat from the reactor core as it warms up, and gets discharged through the safety/relief valves into the suppression pool within primary containment – need some means to remove heat from the primary containment. A filtered vent system enables the containment heat to be removed when other systems have failed to do so.

Fukushima and Pilgrim Watch's filings in Pilgrim Nuclear Power Station's license renewal proceedings (beginning June 1, 2011, Ibid) clearly showed the importance of requiring filtered DTV's in order to:

1. Protect public health in the event that it is necessary to vent.
2. Assure operators follow orders to open the vent. As in Japan, properly trained operators here are likely to decide not to open the DTV when they should because they fear the effects offsite of significant unfiltered releases.

The industry's two main arguments against filtering are:

1. The water in the suppression chamber (wetwell) is an effective filter system.
2. Filters are dangerous because of creating backpressure.

Both arguments are disingenuous.

B. The Contention Is Within Scope of These Proceedings

This contention addresses a defect in the Order. The NRC must consider new and significant information arising from the accident at Fukushima before finalizing the Order whether or not that information ultimately leads to modification of its requirements. "Regardless of its eventual assessment of the significance of the information, the [agency] ha[s] a duty to take a hard look at the proferred evidence." Marsh v Oregon Natural Resources Council, 490 U.S. 360, 385 (1989) (emphasis added)

The fundamental purpose of the National Environmental Policy Act, NEPA, 42 USC § 4332, is to "help public officials make decisions that are based on understanding of environmental consequences, and take decisions that protect, restore and enhance the environment." 40 CFR § 1500.1(c) (Emphasis added).

This contention seeks compliance with NEPA and is based on the NRC's Order EA-12-050 modifying current Mark I and Mark II Boiling Water Reactors.

C. The Issue Raised In the Contention Is Material

The issue raised in this contention is material to the findings the NRC must make to support the action that is involved in the proceeding. The deficiency highlighted in this contention has enormous independent health and safety significance.

D. The Contention is Supported by a Concise Statement of Fact or Expert Opinion Supporting the Contention, Along With Appropriate Citations to Supporting Scientific or Factual Materials

A Petitioner is not required to prove its case at the contention filing stage; in support of this request Pilgrim Watch relies here on government documents, scientific materials, and reports from Japan. In any hearing, PW expects to rely on expert testimony from Dr. Jan Beyea[3], Dr. Frank von Hipple[4], Mr. David Lochbaum,[5] Dr. Edwin Lyman,[6] and Mr. Arnold Gundersen[7].

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[3] Dr. Jan Beyea is a nuclear physicist who has studies the consequences of real and hypothetical nuclear accidents as well as strategies for mitigation. He is a regular member of panels and boards of the National Research Council of the National Academy of Sciences and an advisor to the Division of Engineering and Physical Sciences. Dr. Beyea's personal background is described in the *Report to The Massachusetts Attorney General On The Potential*

E. There is a Substantial Basis for the Contention

NRC is petitioned to require that U.S. reactors install filtered DTV's in order to:

- Protect public health in the event that it is necessary to release.
- Assure operators follow orders to open the vent. As in Japan, properly trained operators here are likely to decide not to open the DTV when they should because they fear the effects offsite of significant unfiltered releases.

The industry's two main arguments against filtering are disingenuous. They include:

- The water in the suppression chamber (wetwell) is an effective filter system
- Filters are dangerous because of creating backpressure

1. Lessons Learned From Japan:

The Japanese have learned their lesson from Fukushima and Japan's power utilities plan to install vent systems with filters for nuclear reactors to reduce radioactive releases in

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Consequences Of A Spent Fuel Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant, Jan Beyea, PhD., May 25, 2006 on NRC's EHD, Pilgrim Docket.

4 Dr. von Hipple is a theoretical physicist, and a Professor of Public and International Affairs at Princeton University.[3] He has worked on nuclear policy issues for over thirty years. Prior to coming to Princeton, he worked for ten years in the field of theoretical elementary-particle physics. From 1993 to 1994, he was the Assistant Director for National Security in the White House Office of Science and Technology Policy. In the 1980s, as chairman of the Federation of American Scientists, Von Hippel partnered with Evgenyi Velikhov in advising Mikhail Gorbachev on the technical basis for steps to end the nuclear arms race. In 1994-5, he served as Assistant Director for National Security in the White House Office of Science and Technology Policy.[He is Co-Chair of the International Panel on Fissile Materials

5 David Lochbaum is director of UCS's Nuclear Safety Project. A nuclear engineer by training, Lochbaum worked at nuclear power plants for 17 years, including many similar to the General Electric reactors at the Fukushima plant. He left the industry in the early 1990s after blowing the whistle on unsafe practices and joined UCS in 1996. He left UCS in 2009 to work for the NRC as a reactor technology instructor and returned to his post at UCS a year later. Lochbaum has authored numerous reports.

6 Dr. Edwin Lyman is a physicist with the Union of Concerned Scientists. Before joining UCS, Lyman was president of the Nuclear Control Institute, a Washington, D.C.-based organization focused on nuclear proliferation. From 1992 to 1995, he was a postdoctoral research associate at Princeton University's Center for Energy and Environmental Studies (now the Science and Global Security Program). He earned a doctorate degree in physics from Cornell University in 1992.

7 Arnold Gundersen is a nuclear engineer and began his career as a reactor operator and instructor in 1971 and progressed to the position of Senior Vice President for a nuclear licensee. expert witness before the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board (ASLB) and Advisory Committee on Reactor Safeguards (ACRS), the State of Vermont Public Service Board, the State of Vermont Environmental Court, and the Florida Public Service Commission. His CV is available on NRC's EHD, Pilgrim Docket, PW Request for Hearing June 1, 2011 and November 11, 2011,

the event of an accident; Americans impacted by U.S. BWR Mark I and Mark II reactors deserve the same protection.

Bloomberg - Japan to Install Vent System for Reactors after Fukushima Crisis , Bloomberg, Tsuyoshi Inajima, February 8, 2012 (Attached, Exhibit 6), reported that:

> Japan's power utilities plan to install vent systems with filters for nuclear reactors to reduce radioactive releases in the event of an accident, an industry group said.
>
> The system will cut emission of radioactive particles to less than one-thousandth of usual volumes, the Federation of Electric Power Companies, a group of 10 regional utilities, said in presentation materials at a government meeting yesterday. The companies will also install equipment to remotely vent steam and gas, it said.
>
> Meltdowns and the release of radiation at Tokyo Electric Power Co.'s Fukushima Dai-Ichi nuclear station after the March 11 earthquake and tsunami forced about 160,000 people to evacuate and made areas near the plant uninhabitable. Japan's utilities are trying to improve the safety of nuclear plants, with three of the country's 54 reactors on-line and no date set to resume commercial operations at the others.

2. Suppression Chamber (Wetwell) Insufficient Filter System

The US industry and TEPCO defended their decisions not to add filters to the DTVs by claiming that the water pool in the suppression chamber (wetwell) is as effective as some other kind of filter system that it could have installed when adding the DTVs.

This claim is incorrect. The FILTRA system installed at the Swedish Barsebäck nuclear power station, for example, was **in addition to** any filtration provided by the wetwell pool, not in place of it.[8] Barsebäck had boiling water reactors like in Fukushima and those in the US (the

[8] The filtered venting system under construction at Barseback,1 Aug 1985 **...** A filter venting containment system, bearing the acronym FILTRA will be installed at the Swedish nuclear power plant Barseback. http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=6309422

plant has since been decommissioned). Filters were also added to BWRs in Germany and Switzerland.

Furthermore, it's not clear how effective the filter effect of the wetwell on its own really is. A U.S. report from 1988 entitled "Filtered venting considerations in the United States[9]" writes:

> Within the United States, the only commercial reactors approved to vent during severe accidents are boiling water reactors having water suppression pools. The pool serves to scrub and retain radionuclides. The degree of effectiveness has generated some debate within the technical community. The decontamination factor (DF) associated with suppression pool scrubbing can range anywhere from one (no scrubbing) to well over 1000 (99.9 % effective). This wide band is a function of the accident scenario and composition of the fission products, the pathway to the pool (through spargers, downcomers, etc.), and the conditions in the pool itself. Conservative DF values of five for scrubbing in MARK I suppression pools, and 10 for MARK II and MARK III suppression pools have recently been proposed for licensing review purposes. These factors, of course, exclude considerations of noble gases, which would not be retained in the pool. (Emphasis added)

The decontamination factor of 5 for the Mark I containment (as used in units 1 through 5 of Fukushima Daiichi and the 23 in the U.S.) means that 80% of the radioactive substances (excluding noble gases) is retained, while 20% is released. The FILTRA system installed at 10 Swedish nuclear power plants and one in Switzerland is designed to ensure that in a severe accident 99.9% of core inventory is retained in the containment or the filters.

[9] Filtered Venting Considerations in the United States, R. Jack Oallman, L.G. (Jerry) Human, John (Jack) Kudrick:: http://www.osti.gov/energycitations/purl.cover.jsp?purl=/6945722-maXGrD/6945722.pdf (Attached, Exhibit 7)

The difference between releasing up to 20% versus 0.1% is huge; it means up to 200 times more radioactivity is released in the system defended by TEPCO and U.S. BWR Mark I operators versus the enhanced system used in Europe and commercially available worldwide.

Japan has shown that the U.S. industry's and NRC assumptions of the scrubbing effectiveness of the wetwell are wrong. Dr. Frank von Hippel explained over thirty years ago in a briefing to the NRC that,

> For accidents in which the damage is sufficient to open large pathways from the core to the containment, there will not be sufficient water available to trap the radioactive materials of concern, nor will the pathway be so torturous that a significant amount wills tick to surfaces before reaching the containment atmosphere. Similarly if the containment fails early enough, there will be insufficient time for aerosols to settle in the reactor building floor.[10]

Further, Dr. von Hipple concluded in *Second chances: Containment of a reactor meltdown,* Bulletin of Atomic Scientists, March 14, 2012[11] that:

> The unspoken argument against requiring that US nuclear power plants be retrofitted with filtered vents was that the industry thought that they were already safe enough and that the expense would be wasteful. And, as today, the commission did not want to force the industry to do more than it was willing to do.
>
> In 2002, the NRC, despite alarming evidence that a pressure vessel had almost corroded through, refused to force an owner to shutdown the reactor for inspection before its regular refueling shutdown. After a review, the NRC's own inspector general concluded: "NRC appears to have informally established an unreasonably high burden of requiring absolute proof of a safety problem, versus lack of a reasonable assurance of maintaining public health and safety."
>
> We failed after Three Mile Island in 1979 to reform the Nuclear Regulatory Commission or force improved containment designs. The tragedy in Japan may have given us another opportunity

[10] Bulletin of Atomic Scientists: Containment of a Reactor Meltdown, Frank von Hippel, March 15, 2011, note 16 (Attached, Exhibit 8)

[11] http://thebulletin.org/print/web-edition/features/second-chances-containment-of-reactor-meltdown

3. Backpressure- No Excuse

Industry has argued that filters would be dangerous due to backpressure. Not so. Their argument is about saving money, not safety. Backpressure is an issue, but not an obstacle. Backpressure is an issue that is repeatedly faced at nuclear reactors, and successfully managed. For example:

- In the flow path for water drawn from the condenser and returned to the reactor vessel (BWRs) and steam generators (PWRs), there are filter/demineralizer units that create a backpressure issue.
- In the flow path from the condenser to the offgas stack for BWRs, there are HEPA and charcoal filters that create a backpressure issue.
- In the flow path from the secondary containment of BWRS to the elevated release point, there are HEPA and charcoal filters that create a backpressure issue.

The filters impose backpressure because they introduce a resistance to the flow moving through the piping and ducting. To push the flow through the filters requires a differential pressure that would not be present if the filters were not there.

In the case of the condensate paths to the reactor vessel/steam generators, the filters require the condensate pumps installed between the condensers and filters to have greater horsepower to make sure the flow goes through the filters. It costs more money up front to buy the larger motored pumps and then more money to operate them, but those costs are outweighed by the benefits of cleaner/purer water entering the reactor vessels/steam generators.

In the case of the torus vent, if one placed a filter in the existing 8-inch diameter hardened vent pipe, it would result in the pressure inside the containment having to rise to a higher value so as to be able to push the same amount of flow through the hardened vent. This is the backpressure effect. But any engineer worth his or her salt could easily design a system to work despite this effect. This is so by the examples cited. Look at the cases of the condensate filter/demineralizer and the HEPA/charcoal filters already installed at nuclear power plants. They also faced backpressure challenges. In the condensate case, designers did not squeeze the filter/demineralizers into the existing piping. Instead, the existing piping is connected to big metal tanks called demineralizer vessels. They are many feet in diameter and there are typically around 8 of them for a plant the size of Pilgrim. By having water in two pipes flow into larger vessels, the water pressure drops along the way. The backpressure effect is offset by increasing the size of the flow pathway.

In the HEPA/charcoal filter case, the designers did the same thing. The ducting/piping is connected to a larger vessel.

In the torus vent case, a competent designer could install a sand/water/whatever filter system between the connection to the torus and the elevated release point that enabled the desired flow rate to be processed successfully. We understand that it is a ridiculously simple exercise -- the controlling factors are the design containment pressure (which is fixed), the ambient air pressure (which is defined over a fairly narrow range), the specified flow rate through the torus vent line, and the pressure drop across the selected filter media. With these values known, one can easily determine how large the container for the filter media needs to be in order to handle the specified flow rate within the prescribed differential pressure.

It is true that installing filters in the torus vent lines will cause higher pressure inside containment than if no filters were present; but, this is not a "show-stopper." Now, operators are instructed to open the torus vents when containment pressure reaches (x) pounds per square inch (psi). At (x) psi, the opened torus vents keeps the containment pressure below the value that could cause it to catastrophically fail. When the properly designed filters are installed in the torus vent lines, the procedures may need to be revised to guide the operators to open the vent valves at (y) psi (with y psi likely being slightly below x psi to accommodate the backpressure from the filters). With a properly designed filter, the pressure reduction - if any - will be negligibly small.

Therefore, the only reason that a filter could not be installed in the torus vent line is incompetence (capable engineers are unavailable) or cheapness (funds for the capable engineer or their designs is unavailable). We have the skill set to design such a filter system. We simply need the spine to make it happen; we trust NRC will have the spine after Fukushima.

4. Multiple Filtered Designs Available & In Use Today

FILTRA-MVSS (circled) at Forsmark 3, Sweden

One example: Westinghouse FILTRA-MVSS (multi-venturi scrubber system) is described as a passive, self-regulating system for filtered pressure relief of BWR/PWR reactor containments[12]. The system is passively actuated by means of a rupture disc. A typical design basis for the system is a total loss of AC power for 24 hours leading to loss of core cooling

[12] http://www.westinghousenuclear.com/Products_&_Services/docs/flysheets/NS-ES-0207.pdf

ability. This includes a total loss of electrical power from both the external grid and all plat-specific power back-up systems, as well as loss of steam turbine-driven core cooling pumps. It says that

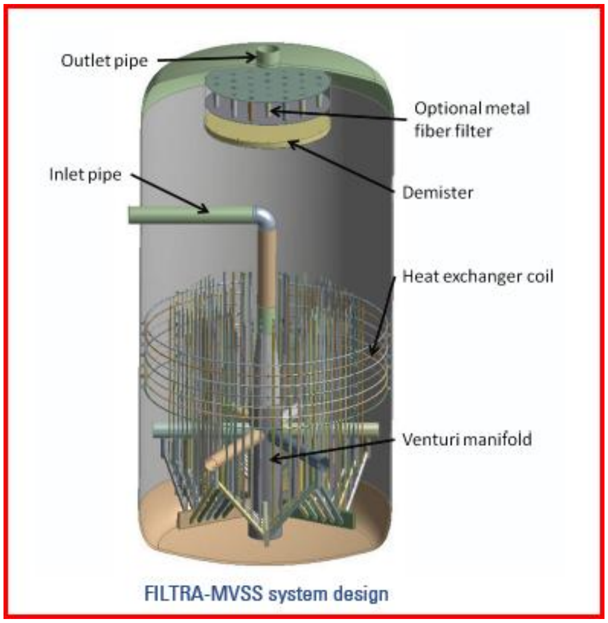
It is designed on Swedish regulations requiring 99.9 % of the core inventory of radioactivity (excluding noble gasses) be retained in the containment or filtered in case of venting; and it has high decontamination factors for gas -carried particles, aerosols and elemental iodines. It is fully passive for at least 24 hours after initial venting and requires no startup time.

For a BWR, the FILTRA-MVSS would be connected to the hardened vent. The filter consists of several filtration steps, all of which are contained in the tank: the multi-venturi scrubber, a water pool, a moisture separator, and finally an optional metal fiber filter.

<u>Westinghouse describes its benefits as:</u>

- Passive design for at least 24-hours-no operator action required to activate system
- Very high removal efficiencies:
    - Aerosols > 99.00 % decontamination factor (D) > 10,000 with optional fiber filter for smallest particles
    - Elemental Iodine> 99.99% (DF> 10,000)
    - Organic Iodine: > 80% (DF>5)
    - Same DF for all flow rates
- Designed all seismic loads
- Designed wide range postulated accidents
- Ability to avoid and cope with oxyhydrogen combustion
- May be used in feed-and-bleed mode for long-term core cooling

<u>Experience:</u> Westinghouse's FILTRA-MVSS in installed in 10 Swedish NPPs and one Swiss NPP.



IV. CONTENTION II

Contention II reads:

> Based on new and significant information from Fukushima, the Order Modifying Licenses With Regard To Reliable Hardened Containment Vents issued March 12, 2012 (EA-12-050) is insufficient to protect public health, safety and property because it does not require the hardened DTV to be passively actuated by means of a rupture disc, so that neither water nor electrical supply is needed and operator intervention is not necessary to actuate the system.

A. Contention 2 is within scope, material, and provides a concise statement of the alleged facts or expert opinions to support the contention with reference to specific sources and documents for reasons described above, Contention 1.

B. There is a Substantial Basis for the Contention

1. **Order, EA-12-050, Attachment 2,** describes the *Requirements for Reliable Hardened Vent Systems at Boiling Water Reactors with Mark I and Mark II Containments*, it says that:

1.1 The design of the HCVS shall consider the following performance objectives:

1.1.1 The HCVS shall be designed to minimize the reliance on operator actions.

1.1.2 The HCVS shall be designed to minimize plant operators' exposure to occupational hazards, such as extreme heat stress, while operating the HCVS system.

1.1.3 The HCVS shall also be designed to minimize radiological consequences that would impede personnel actions needed for event response.

1.2 The HCVS shall include the following design features:

1.2.2 The HCVS shall be accessible to plant operators and be capable of remote operation and control, or manual operation, during sustained operations.

Nowhere is there mention of rupture discs that would satisfy the NRC's specified performance objectives.

2. Rupture Discs: The New York Times reported after Fukushima that[13] five years before the DTVs at the Fukushima Daiichi nuclear plant were disabled by the accident the DTVs were supposed to handle, engineers at a reactor in Minnesota warned American regulators about the very problem. One of the engineers, **Anthony Sarrack**, notified staff members at the NRC that the design of venting systems was seriously flawed at his reactor and others in the United States similar to the ones in Japan. He later left the industry in frustration because managers and regulators did not agree. As Mr. Sarrack said, and Fukushima proved,

> [T]he vents, which are supposed to relieve pressure at crippled plants and keep containment structures intact, should not be dependent on electric power and

[13] *U.S. Was Warned on Vents before Failure at Japan's Plant,* NYT, Matthew Wald, May 18, 2011

workers' ability to operate critical valves because power might be cut in an emergency and workers might be incapacitated.

Mr. Sarrack recommended rupture disks, relatively thin sheets of steel that break and allows venting without any operator command or moving parts when the pressure reaches a specified level. But the NRC gave into those in the industry that argued that if a disk is used that there would be not be a way to close the vent once pressure is relieved in order to hold in radioactive materials – put the "genie back in the bottle." Rather than requiring that such a "way" be provided, the NRC again saved the industry money, and effectively forgot that the major problem that needed to be faced was containment failure.

Rupture discs are provided, for example, on the Westinghouse FILTRA-MVSS described above and used in 10 Swedish reactors and one Swiss reactor.

In a 1988 document, Filtered Venting Considerations in the United States[14] (at 9), it was argued there that "[t]he main restriction by a rupture disc is the inability to vent the containment at low pressures. Postulated reasons for venting at low containment pressure include (a) to reduce driving force from the containment when anticipating vessel failure with an early drywell liner melt-through, b) to remove the containment hydrogen prior to vessel failure and early drywell liner melt- through, and (c) to reduce the containment pressure prior to a high pressure vessel failure to prevent an early containment overpressure failure."

If in fact this is an issue, an easy fix would be a bypass that would likely cost two more valves and extra pipe.

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[14] Filtered Venting Considerations in the United States, Oallman, Hulman, and Kudrick, OSTI (Exhibit 7)

The 1988 document concluded that, "Obvious advantages of a rupture disc system include (a) suppression of venting during design basis accidents and (b) minimizing unnecessary or inadvertent venting."

Further, if the NRC had required a filtered vent, the problem of "clos[ing] the vent once pressure is relieved" would largely alleviate continued release of radioactive materials.

A rational requirement would require both filtering and redesign of the DTV venting system to include rupture discs

Further, the opening through containment created by a rupture disc in a filtered vent system is comparable to the containment bypass pathway created when steam generator tubes in pressurized water reactors fail. While the size of the opening may be larger for BWR filtered vent systems (unless multiple steam generator tubes fail), any radioactivity passing through that opening on the BWR passes through a filter before reaching the atmosphere. The flow passing through failed steam generator tubes on a PWR reach the atmosphere with no filtering. The NRC accepts the unfiltered releases through failed steam generator tubes; it should also accept filtered releases through BWR filtered vent systems.

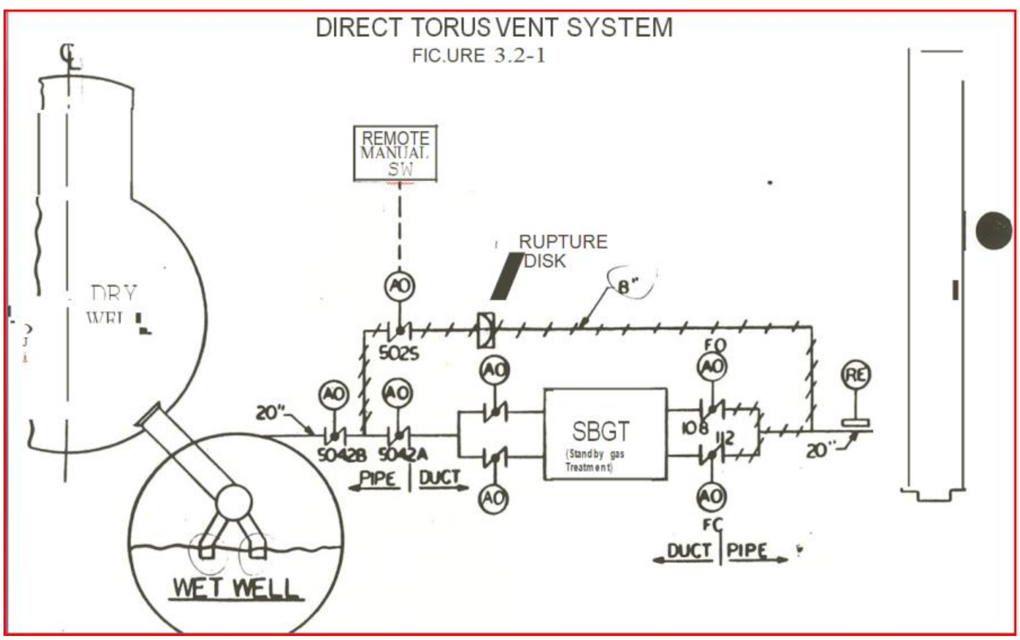
V. Pilgrim's DTV- how it works- an example of what's wrong with the status quo

Pilgrim's DTV is described in Boston Edison's *Initial Assessment of Pilgrim Safety Enhancement, Section 3.2, Installation of DTVS* (Exh.,1) *Attachment to BECO letter 88-126, Section 3.2 Revision 1 "Installation of a Direct Torus Vent System (DTVS)* pages 14,-19B, Rev. 1 (7/25/88) (Exh., 2)

The Initial Assessment says:

> Pilgrim's DTVs provides a direct vent path from the torus air space to the main stack, in parallel with and bypassing the Standby Gas Treatment System (SGTS). The DTVS provides a new 8" line branching off the existing torus purge exhaust line between the containment isolation valves (outside containment) with a reconnection to the existing torus purge exhaust line downstream of the SGTS. The new torus vent line is also provided with its own containment isolation valve and rupture disc, set to relieve at 30 psig.

The following diagram, that shows the branch line with its own containment isolation valve 5025 and Rupture Disc, is included in the attachment to BECO's letter. It will be noted that the Rupture Disc is downstream of valves AO-5042B and AO-5025, and that both of these values are normally closed and are designed to be opened either remotely from the control room or manually.[15]



[15] Some initial reports indicated that the Fukushima DTV did not include "updates" that were present in US Mark I Reactors such as that at PNPS. Those reports were apparently not correct. Pilgrim Watch's understanding is that the Fukushima DTVs had been upgraded, and are essentially the same as that at PNPS (Exh. 2)

The accompanying discussion in the BECO letter attachment says, among other things:

- The vent line provides a direct vent path from the torus to the main stack bypassing the SBGTS. The bypass is an 8" line (hatched line in diagram) –the upstream end is connected to the pipe between the primary containment isolation valves AO-5042 A & B. The downstream end of the bypass is connected to the 20" main stack line downstream of the SBGTS valves AON-108 and AON-112.
- An 8" butterfly valve (AO-5025), which can be remotely operated from the control room, is added downstream of 8" valve AO-5052B. This valve acts as the primary containment outboard isolation valve for the DTV line. Test connections are provided upstream and downstream of AO-5025.

- AO-5042B was replaced in 1988 with a DC solenoid valve (powered from essential 125 volt DC) so that it would operate without dependence on AC power. AO-5025 is also provided with a DC solenoid powered from a redundant 125 volt DC source. Both valves are normally closed and are closed in a "fail-safe" position. One inch nitrogen lines are added to provide nitrogen to valves AO-5042B and AO-5025.
- Valve AO-5025 is controlled by a remote manual key-locked control switch. During normal operation, power to AO-5025 DC solenoid will also be disabled by removal of fuses in the wiring to the solenoid valve to assure it cannot be inadvertently opened. The 7/25/88 document said that an additional fuse will be installed to power valve status indication for AO-5025 in the main control room.
- A rupture disc is included in the piping to provide a second leakage barrier. It is designed to open below containment design pressure, but will remain intact up to pressures equal to or greater than those which cause automatic containment isolation during accident conditions.

See also, Chairman Kenneth M. Carr, Responses to Concerns raised by W.R. Griffin, June 21, 1990, Enclosure 2 Possibility Of A Vacuum Breaker Remaining Open (Q.2 Response, pp.,2-3, 5) (Exh.,3)

- Each penetration consists of a vacuum breaker and an air operated butterfly valve in series. During normal operation, valves are closed; the vacuum breaker is maintained closed by the weight of the disc, and the butterfly valve is maintained closed by positive actuator air pressure.
- Therefore, during the entire positive pressure profile of the event, the penetration has two closed barriers in series. It is only during the end of the pressurization phase that the penetration is aligned into its vacuum breaker role. Because of this double barrier protection and the fact the both valves are not expected to change position during the pressurization phase of the event, the staff has concluded that failure of the penetration as a leak tight barrier is not credible and need not be considered in design basis.
- The fact the Pilgrim DTVS rupture disc is designed to rupture at 30 psi is not related to the NRC's recommendation that specified the venting pressure at the containment design pressure. The set pressure for the rupture disc does not control the venting pressure because there are two closed isolation valves in the flow path.
- These two valves are normally closed and will open manually by the operator if venting is needed. The maximum containment pressure at which the operators are expected to open the vent valve is 56 psig (not 60 psi), which is the NRC recommendation on venting pressure.
- The rupture disc is designed to serve as an additional leakage barrier at pressures below 30 psi. It is designed to open below the containment design pressure, but will be intact up to a pressure equal or greater that those pressures that cause an automatic containment isolation during an accident conditions. Therefore, its presence in the line can effectively eliminate the negative consequences of inadvertent actuation of the vent valves at pressures below 30 psi. The set pressure of 30 psi for the rupture disc satisfies these design objectives.
- The isolation valves, AO-5025 and AO-5042B, are designed with ac independent power supplies. These two valves are powered from essential dc power and are backed up with diverse nitrogen actuation capability. Therefore

> in case of an SBO event, the valves would be available for venting. The venting concept is mainly designed to slow overpressure transients of the containment. During some ATWS (anticipated transient without scram) events, the pressure in the containment will rapidly increase. Venting pressure could be reached in a matter of minutes rather than hours. Therefore venting may not prevent containment failure because of the high containment pressurization rate but would provide additional time to scram the reactor and delay the core melt.

In other words and greatly simplified, the DTV will vent excess pressure from the containment *only* if normally closed valves AO-5025 and AO-5042b can be opened.

At Fukushima, TEPCO was unable to open the normally closed valves in all three DTV's, and there is no redundancy.[16]

Pilgrim's control room has 2 key locked switches in series that have to be opened manually when the need to use the DTV occurs. If, as happened at Fukushima, the normally-closed isolation valves cannot be opened from the control room, the next step is to try to open the isolation valves manually – but this also proved impossible at Fukushima since radiation levels were too high.

Failed Valves: Pilgrim's DTV isolation valves appear to be essentially the same as those that failed at Fukushima. Supposedly "automatic" systems do fail (as they did at Fukushima) and manual systems may also (both mechanically and because radiation is too high to permit manual operation). Why is there no redundancy?

[16] Redundancy, of course, could have been provided at both Fukushima and Pilgrim, e.g., by a parallel vent line with a 50-55 psig rupture disc followed by a normally open valve that would be closed when pressures had dropped to an accept able level, but that would have cost the industry more money.

DC Batteries: *Pilgrim Nuclear Power Station Individual Plant Examination For Internal Events Per Gl-88-20, Volume 1*, Prepared by Boston Edison Co., September 1992 (Exh.4) says that:

- [T] he direct torus vent requires both DC batteries for operation (C.2-10)
- 125VDC Bus (Battery) "A" This bus is required for operation of the direct torus vent. (C.2-14)
- 125VDC Bus (Battery) "B" This bus is also required for operation of the direct torus vent. (Ibid)
- The containment torus venting system would be unavailable if one DC division is unavailable. (C-4-8)

VI. CONCLUSION

It is not new that Pilgrim's, or any other BWR Mark I's, containment will not hold up if too much pressure builds up inside nor that U.S. Mark I's like their sister Fukushima reactors installed an unfiltered vent to let radioactive gases out in an accident. What is new are two significant pieces of information.

The first is that we now know that an unfiltered vent has unintended consequences beyond poisoning unnecessarily offsite neighborhoods – it makes operators hesitant to use the vent until perhaps too late, upping the probability of containment failure/explosions.

The second is the likely failure of the DTV itself absent being made completely passive by properly installing relief valves as described n the foregoing. Before Fukushima the DTV had not been tested. At Fukushima, DTV systems failed three times in their first real-world tests.

The final cost of the Fukushima disaster remains to be calculated, but it is clearly billions of dollars making these requested fixes cheap. The cost is fully justified; risk for the public will be reduced significantly. Citizens should not be faced with the equivalent of having been assured that we had life boats but not told either that crewman won't launch them or that that they don't float.

Respectfully submitted,

(Electronically signed)
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April 2, 2012

EXHIBITS
(Attached Separately)

Exhibit	**Title**
1	Boston Edison's *Initial Assessment of Pilgrim Safety Enhancement, Section 3.2, Installation of DTVS*
2	*BECO 88-126 Revised Information Regarding Pilgrim Station Safety Enhancement Program*
3	*Commissioner Kenneth Carr correspondence Town of Plymouth*
4	*Pilgrim Nuclear Power Station Individual Plant Examination for Internal Events per GL-88-20*
5	*Japanese Official Faults design, AP, 02.12*
6	*Bloomberg - <u>Japan to Install Vent System for Reactors After Fukushima Crisis</u> - Tsuyoshi Inajima, 02.08.12*
7	*Filtered Venting Considerations in the United States, Oallman, Hulman, Kudrick, OSTI, December 1988*
8	*Containment of A Reactor Meltdown, Jan Beyea and Frank von Hippel, Bulletin Atomic Scientists, 1982*