

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
ALL OPERATING BOILING WATER	)	Docket Nos. (as shown in Attachment 1)
REACTOR LICENSEES WITH MARK I AND	)	License Nos. (as shown in Attachment 1)
MARK II CONTAINMENTS	)	EA-12-XXX
	)	

**ORDER MODIFYING LICENSES  
WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS  
(EFFECTIVE IMMEDIATELY)**

I.

The Licensees identified in Attachment 1 to this Order hold licenses issued by the U.S. Nuclear Regulatory Commission (NRC or Commission) authorizing operation of nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." Specifically, these Licensees operate boiling-water reactors (BWRs) with Mark I and Mark II containment designs.

II.

On March 11, 2011, a magnitude 9.0 earthquake struck off the coast of the Japanese island of Honshu. The earthquake resulted in a large tsunami, estimated to have exceeded 14 meters (45 feet) in height, which inundated the Fukushima Dai-ichi Nuclear Power Plant site. The earthquake and tsunami produced widespread devastation across northeastern Japan, and significantly affected the infrastructure and industry in the northeastern coastal areas of Japan.

When the earthquake occurred, Fukushima Dai-ichi Units 1, 2, and 3 were in operation and Units 4, 5, and 6 were shut down for routine refueling and maintenance activities. The Unit 4 reactor fuel was offloaded to the Unit 4 spent fuel pool. Following the earthquake, the three operating units automatically shut down and offsite power was lost to the entire facility. The emergency diesel generators (EDGs) started at all six units providing alternating current (ac) electrical power to critical systems at each unit. The facility response to the earthquake appears to have been normal.

Approximately 40 minutes following the earthquake and shutdown of the operating units, the first large tsunami wave inundated the site, followed by additional waves. The tsunami caused extensive damage to site facilities and resulted in a complete loss of all ac electrical power at Units 1 through 5, a condition known as station blackout (SBO). In addition, all direct current electrical power was lost early in the event on Units 1 and 2, and for some period of time at the other units. Unit 6 retained the function of one air-cooled EDG. Despite their actions, the operators lost the ability to cool the fuel in the Unit 1 reactor after several hours, in the Unit 2 reactor after about 70 hours, and in the Unit 3 reactor after about 36 hours, resulting in damage to the nuclear fuel shortly after the loss of cooling capabilities.

Operators first considered using the facility's hardened vent to control pressure in the containment within an hour following the loss of all ac power at Unit 1. The Emergency Response Center began reviewing accident management procedures and checking containment venting procedures to determine how to open the containment vent valves without power.<sup>1</sup> However, without adequate core and containment cooling, primary containment (drywell) pressure and temperature in Units 1, 2, and 3 substantially exceeded the design values for the containments. When the operators attempted to vent the containments, they were significantly

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<sup>1</sup> See Institute of Nuclear Power Operations (INPO) report "INPO 11-005, *Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, Revision 0*," issued November 2011, p. 72

challenged opening the hardened wetwell (suppression chamber) vents because of complications from the prolonged SBO, and high radiation fields that impeded access.

At Fukushima Dai-ichi Units 1, 2, 3, and 4, venting the wetwell involved opening motor- and air-operated valves. Similar features are used in many hardened vent systems that were installed in U.S. BWR Mark I containment plants following issuance of Generic Letter (GL) 89-16, "Installation of a Hardened Wetwell Vent." In the prolonged SBO situation that occurred at Fukushima, operator actions were not possible from the control room because of the loss of power, and the loss of pneumatic supply pressure to the air-operated valves. The resultant delay in venting the containment precluded early injection of coolant into the reactor vessel. The lack of coolant, in turn, resulted in extensive core damage, high radiation levels, hydrogen production and containment failure. The leakage of hydrogen gas into the reactor building precipitated explosions in the secondary containment buildings of Units 1, 3, and 4, and the ensuing damage to the facility contributed to the uncontrolled release of radioactive material to the environment.

Fukushima Dai-ichi Units 1, 2, 3, and 4 use the Mark I containment design; however, because Mark II containment designs are only slightly larger in volume than Mark I containment designs and use wetwell pressure suppression, it can reasonably be concluded that a Mark II under similar circumstances would have suffered similar consequences.

Following the events at the Fukushima Dai-ichi nuclear power plant, the NRC established a senior-level agency task force referred to as the Near Term Task Force (NTTF). The NTTF was tasked with conducting a systematic and methodical review of the NRC regulations and processes and determining if the agency should make additional improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a comprehensive set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan,"

dated July 12, 2011. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the staff's efforts is contained in SECY-11-0124, "Recommended Actions To Be Taken Without Delay From the Near-Term Task Force Report," dated September 9, 2011, and SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011.

As directed by the Staff Requirements Memorandum (SRM) for SECY-11-0093, the NRC staff reviewed the NTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the staff's prioritization of the recommendations based upon the potential safety enhancements.

Current regulatory requirements and existing plant capabilities allow the NRC to conclude that a sequence of events such as the Fukushima Dai-ichi accident is unlikely to occur in the U.S. Therefore, continued operation and continued licensing activities do not pose an imminent threat to public health and safety. However, NRC's assessment of new insights from the events at Fukushima Dai-ichi leads the staff to conclude that additional requirements must be imposed on Licensees to increase the capability of nuclear power plants to mitigate beyond-design-basis external events. These additional requirements are needed to provide adequate protection to public health and safety, as set forth in Section III of this Order.

In SRM-SECY-11-0137, the Commission directed the NRC staff to take certain actions and provided further guidance including directing the staff to consider filtered vents. The staff has determined that there are policy issues that need to be resolved before any regulatory action can be taken to require Licensees to install filtered vents. These policy issues include consideration of severe accident conditions in the design and operation of the vent, the addition of filters to hardened reliable vents, and consideration of vents in areas other than primary

containment. However, the NRC has also determined that Licensees should promptly begin the implementation of short-term actions relating to reliable hardened vents and to focus these actions on improvements that will assist in the prevention of core damage. As such, this Order requires Licensees to take the necessary actions to install reliable hardened venting systems in BWR facilities with Mark I and Mark II containments to assist strategies relating to the prevention of core damage. With respect to the policy issues discussed above, the NRC staff plans to submit a Policy Paper to the Commission in July 2012.

Additional details on an acceptable approach for complying with this Order will be contained in final Interim Staff Guidance (ISG) scheduled to be issued by the NRC in August 2012. This guidance will also include a template to be used for the plan that will be submitted in accordance with Section IV, C.1 below.

### III.

Reasonable assurance of adequate protection of the public health and safety and assurance of the common defense and security are the fundamental NRC regulatory objectives. Compliance with NRC requirements plays a critical role in giving the NRC confidence that Licensees are maintaining an adequate level of public health and safety and common defense and security. While compliance with NRC requirements presumptively assures adequate protection, new information may reveal that additional requirements are warranted. In such situations, the Commission may act in accordance with its statutory authority under Section 161 of the Atomic Energy Act of 1954, as amended, to require Licensees to take action in order to protect health and safety and common defense and security.

To protect public health and safety from the inadvertent release of radioactive materials, the NRC's defense-in-depth strategy includes multiple layers of protection: (1) prevention of

accidents by virtue of the design, construction and operation of the plant, (2) mitigation features to prevent radioactive releases should an accident occur, and (3) emergency preparedness programs that include measures such as sheltering and evacuation. The defense-in-depth strategy also provides for multiple physical barriers to contain the radioactive materials in the event of an accident. The barriers are the fuel cladding, the reactor coolant pressure boundary, and the containment. These defense-in-depth features are embodied in the existing regulatory requirements and thereby provide adequate protection of public health and safety.

The events at Fukushima Dai-ichi highlight the possibility that extreme natural phenomena could challenge the prevention, mitigation and emergency preparedness defense-in-depth layers. At Fukushima, limitations in time and unpredictable conditions associated with the accident significantly challenged attempts by the responders to preclude core damage and containment failure. In particular, the operators were unable to successfully operate the containment venting system. The inability to reduce containment pressure inhibited efforts to cool the reactor core. If additional backup or alternate sources of power had been available to operate the containment venting system remotely, or if certain valves had been more accessible for manual operation, the operators at Fukushima may have been able to depressurize the containment earlier. This, in turn, could have allowed operators to implement strategies using low-pressure water sources that may have limited damage to the reactor core. Thus, the events at Fukushima demonstrate that reliable hardened vents at BWR facilities with Mark I and Mark II containment designs are important to maintain core and containment cooling.

Accordingly, the NRC has concluded that there is a need to redefine the level of protection of public health and safety regarded as adequate under the provisions of the backfit rule, 10 CFR 50.109(a)(4)(iii), and is requiring Licensee actions to meet the new level of protection. In addition, pursuant to 10 C.F.R. 2.202, the NRC finds that the public health, safety and interest

require that this Order be made immediately effective.

The Commission has determined that adequate protection of public health and safety requires that all operating BWR facilities with Mark I and Mark II containments have a reliable hardened venting capability for events that can lead to core damage. These new requirements provide greater mitigation capability consistent with the overall defense-in-depth philosophy, and therefore greater assurance that the challenges posed by severe external events to power reactors do not pose an undue risk to public health and safety. To provide reasonable assurance of adequate protection of public health and safety, all licenses identified in Attachment 1 to this Order shall be modified to include the requirements identified in Attachment 2 to this Order.

#### IV.

Accordingly, pursuant to Sections 161b, 161i, 161o, and 182 of the Atomic Energy Act of 1954, as amended, and the Commission's regulations in 10 C.F.R. § 2.202, "Orders," and 10 C.F.R. Part 50, IT IS HEREBY ORDERED, EFFECTIVE IMMEDIATELY, THAT ALL LICENSES IDENTIFIED IN ATTACHMENT 1 TO THIS ORDER ARE MODIFIED AS FOLLOWS:

- A. All Licensees shall, notwithstanding the provisions of any Commission regulation or license to the contrary, comply with the requirements described in Attachment 2 to this Order except to the extent that a more stringent requirement is set forth in the license. These Licensees shall promptly start implementation of the requirements in Attachment 2 to the Order and shall complete full implementation **no later than two (2) refueling cycles following the submittal of the overall integrated plan, as required in Condition C.1. (schedule to be issued in August 2012), or December 31, 2016, whichever comes first.**

- B. 1. All Licensees shall, within **twenty (20) days** of the date of this Order, notify the Commission (1) if they are unable to comply with any of the requirements described in Attachment 2, (2) if compliance with any of the requirements is unnecessary in their specific circumstances, or (3) if implementation of any of the requirements would cause the Licensee to be in violation of the provisions of any Commission regulation or the facility license. The notification shall provide the Licensees' justification for seeking relief from or variation of any specific requirement.
2. Any Licensee that considers that implementation of any of the requirements described in Attachment 2 to this Order would adversely affect the safe and secure operation of the facility must notify the Commission, within **twenty (20) days** of this Order, of the adverse safety impact, the basis for its determination that the requirement has an adverse safety impact, and either a proposal for achieving the same objectives specified in the Attachment 2 requirement in question, or a schedule for modifying the facility to address the adverse safety condition. If neither approach is appropriate, the Licensee must supplement its response to Condition B.1 of this Order to identify the condition as a requirement with which it cannot comply, with attendant justifications as required in Condition B.1.
- C. 1. All Licensees shall, **by February 28, 2013**, submit to the Commission for review an overall integrated plan including a description of how compliance with the requirements described in Attachment 2 will be achieved.
2. All Licensees shall provide an initial status report **sixty (60) days** following issuance of the final ISG, and at **six (6)-month intervals** following submittal of the



overall integrated plan, as required in Condition C.1, which delineates progress made in implementing the requirements of this Order.

3. All Licensees shall report to the Commission when full compliance with the requirements described in Attachment 2 is achieved.

Licensee responses to Conditions B.1, B.2, C.1, C.2, and C.3 above shall be submitted in accordance with 10 C.F.R. § 50.4, "Written Communications."

The Director, Office of Nuclear Reactor Regulation may, in writing, relax or rescind any of the above conditions upon demonstration by the Licensee of good cause.

#### V.

In accordance with 10 C.F.R. § 2.202, the Licensee must, and any other person adversely affected by this Order may, submit an answer to this Order, and may request a hearing on this Order, within twenty (20) days of the date of this Order. Where good cause is shown, consideration will be given to extending the time to answer or to request a hearing. A request for extension of time in which to submit an answer or request a hearing must be made in writing to the Director, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555, and include a statement of good cause for the extension. The answer may consent to this Order.

If a hearing is requested by a Licensee or a person whose interest is adversely affected, the Commission will issue an Order designating the time and place of any hearings. If a hearing is held, the issue to be considered at such hearing shall be whether this Order should be sustained. Pursuant to 10 CFR 2.202(c)(2)(i), the licensee or any other person adversely affected by this Order, may, in addition to demanding a hearing, at the time the answer is filed or sooner, move the presiding officer to set aside the immediate effectiveness of the Order on the

ground that the Order, including the need for immediate effectiveness, is not based on adequate evidence but on mere suspicion, unfounded allegations, or error.

All documents filed in NRC adjudicatory proceedings, including a request for hearing, a petition for leave to intervene, any motion or other document filed in the proceeding prior to the submission of a request for hearing or petition to intervene, and documents filed by interested governmental entities participating under 10 CFR 2.315(c), must be filed in accordance with the NRC E-Filing rule (72 FR 49139, August 28, 2007). The E-Filing process requires participants to submit and serve all adjudicatory documents over the internet, or in some cases to mail copies on electronic storage media. Participants may not submit paper copies of their filings unless they seek an exemption in accordance with the procedures described below.

To comply with the procedural requirements of E-Filing, at least 10 days prior to the filing deadline, the participant should contact the Office of the Secretary by e-mail at [hearing.docket@nrc.gov](mailto:hearing.docket@nrc.gov), or by telephone at (301) 415-1677, to request (1) a digital ID certificate, which allows the participant (or its counsel or representative) to digitally sign documents and access the E-Submittal server for any proceeding in which it is participating; and (2) advise the Secretary that the participant will be submitting a request or petition for hearing (even in instances in which the participant, or its counsel or representative, already holds an NRC-issued digital ID certificate). Based upon this information, the Secretary will establish an electronic docket for the hearing in this proceeding if the Secretary has not already established an electronic docket.

Information about applying for a digital ID certificate is available on NRC's public Web site at <http://www.nrc.gov/site-help/e-submittals/apply-certificates.html>. System requirements for accessing the E-Submittal server are detailed in NRC's "Guidance for Electronic Submission," which is available on the agency's public Web site at <http://www.nrc.gov/site-help/esubmittals.html>. Participants may attempt to use other software

not listed on the web site, but should note that the NRC's E-Filing system does not support unlisted software, and the NRC Meta System Help Desk will not be able to offer assistance in using unlisted software.

If a participant is electronically submitting a document to the NRC in accordance with the E-Filing rule, the participant must file the document using the NRC's online, web-based submission form. In order to serve documents through the Electronic Information Exchange, users will be required to install a web browser plug-in from the NRC web site. Further information on the web-based submission form, including the installation of the Web browser plug-in, is available on the NRC's public web site at <http://www.nrc.gov/site-help/esubmittals.html>.

Once a participant has obtained a digital ID certificate and a docket has been created, the participant can then submit a request for hearing or petition for leave to intervene. Submissions should be in Portable Document Format (PDF) in accordance with NRC guidance available on the NRC public Web site at <http://www.nrc.gov/site-help/e-submittals.html>. A filing is considered complete at the time the documents are submitted through the NRC's E-Filing system. To be timely, an electronic filing must be submitted to the E-Filing system no later than 11:59 p.m. Eastern Time on the due date. Upon receipt of a transmission, the E-Filing system time-stamps the document and sends the submitter an e-mail notice confirming receipt of the document. The E-Filing system also distributes an e-mail notice that provides access to the document to the NRC Office of the General Counsel and any others who have advised the Office of the Secretary that they wish to participate in the proceeding, so that the filer need not serve the documents on those participants separately. Therefore, applicants and other participants (or their counsel or representative) must apply for and receive a digital ID certificate before a hearing request/petition to intervene is filed so that they can obtain access to the document via the E-Filing system.

A person filing electronically using the agency's adjudicatory E-Filing system may seek assistance by contacting the NRC Meta System Help Desk through the "Contact Us" link located on the NRC web site at <http://www.nrc.gov/site-help/e-submittals.html>, by e-mail at [MSHD.Resource@nrc.gov](mailto:MSHD.Resource@nrc.gov), or by a toll-free call at (866) 672-7640. The NRC Meta System Help Desk is available between 8 a.m. and 8 p.m., Eastern Time, Monday through Friday, excluding government holidays.

Participants who believe that they have a good cause for not submitting documents electronically must file an exemption request, in accordance with 10 CFR 2.302(g), with their initial paper filing requesting authorization to continue to submit documents in paper format. Such filings must be submitted by: (1) first class mail addressed to the Office of the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemaking and Adjudications Staff; or (2) courier, express mail, or expedited delivery service to the Office of the Secretary, Sixteenth Floor, One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, Attention: Rulemaking and Adjudications Staff. Participants filing a document in this manner are responsible for serving the document on all other participants. Filing is considered complete by first-class mail as of the time of deposit in the mail, or by courier, express mail, or expedited delivery service upon depositing the document with the provider of the service. A presiding officer, having granted an exemption request from using E-Filing, may require a participant or party to use E-Filing if the presiding officer subsequently determines that the reason for granting the exemption from use of E-Filing no longer exists.

Documents submitted in adjudicatory proceedings will appear in NRC's electronic hearing docket, which is available to the public at [http://ehd.nrc.gov/EHD\\_Proceeding/home.asp](http://ehd.nrc.gov/EHD_Proceeding/home.asp), unless excluded pursuant to an order of the Commission, or the presiding officer. Participants are requested not to include personal privacy information, such as social security numbers, home

addresses, or home phone numbers in their filings, unless an NRC regulation or other law requires submission of such information. With respect to copyrighted works, except for limited excerpts that serve the purpose of the adjudicatory filings and would constitute a Fair Use application, participants are requested not to include copyrighted materials in their submission.

If a person other than the Licensee requests a hearing, that person shall set forth with particularity the manner in which his interest is adversely affected by this Order and shall address the criteria set forth in 10 CFR 2.309(d).

In the absence of any request for hearing, or written approval of an extension of time in which to request a hearing, the provisions specified in Section IV above shall be final twenty (20) days from the date of this Order without further order or proceedings. If an extension of time for requesting a hearing has been approved, the provisions specified in Section IV shall be final when the extension expires if a hearing request has not been received. AN ANSWER OR A REQUEST FOR HEARING SHALL NOT STAY THE IMMEDIATE EFFECTIVENESS OF THIS ORDER.

FOR THE NUCLEAR REGULATORY COMMISSION

Eric J. Leeds, Director  
Office of Nuclear Reactor Regulation

Dated this \_\_\_\_ day of March 2012

OPERATING BOILING WATER REACTOR LICENSES  
WITH MARK I AND MARK II CONTAINMENTS

Browns Ferry Nuclear Plant, Unit 1  
Tennessee Valley Authority  
Athens, AL  
Docket No. 50-259  
License No. DPR-33

BWR-Mark I

Browns Ferry Nuclear Plant, Unit 2  
Tennessee Valley Authority  
Athens, AL  
Docket No. 50-260  
License No. DPR-52

BWR-Mark I

Browns Ferry Nuclear Plant, Unit 3  
Tennessee Valley Authority  
Athens, AL  
Docket No. 50-296  
License No. DPR-68

BWR-Mark I

Brunswick Steam Electric Plant, Unit 1  
Carolina Power and Light  
Southport, NC  
Docket No. 50-325  
License No. DPR-71

BWR-Mark I

Brunswick Steam Electric Plant, Unit 2  
Carolina Power and Light  
Southport, NC  
Docket No. 50-324  
License No. DPR-62

BWR-Mark I

Columbia Generating Station, Unit 2  
Energy Northwest  
Richland, WA  
Docket No. 50-397  
License No. NPF-21

BWR-Mark II

Cooper Nuclear Station  
Nebraska Public Power District  
Brownville, NE  
Docket No. 50-298  
License No. DPR-46

BWR-Mark I

Dresden Nuclear Power Station, Unit 2 Exelon Generation Co., LLC Morris, IL Docket No. 50-237 License No. DPR-19	BWR-Mark I
Dresden Nuclear Power Station, Unit 3 Exelon Generation Co., LLC Morris, IL Docket No. 50-249 License No. DPR-25	BWR-Mark I
Duane Arnold Energy Center FPL Energy Duane Arnold, LLC Palo, IA Docket No. 50-331 License No. DPR-49	BWR-Mark I
Edwin I. Hatch Nuclear Plant, Unit 1 Southern Nuclear Operating Co. Baxley , GA Docket No. 50-321 License No. DPR-57	BWR-Mark I
Edwin I. Hatch Nuclear Plant, Unit 2 Southern Nuclear Operating Co. Baxley , GA Docket No. 50-366 License No. NPF-5	BWR-Mark I
Fermi, Unit 2 The Detroit Edison Co. Newport, MI Docket No. 50-341 License No. NPF-43	BWR-Mark I
Hope Creek Generating Station, Unit 1 PSEG Nuclear, LLC Hancock Bridge, NJ Docket No. 50-354 License No. NPF-57	BWR-Mark I
James A. FitzPatrick Nuclear Power Plant Entergy Nuclear Operations, Inc. Scriba, NY Docket No. 50-333 License No. DPR-59	BWR-Mark I

LaSalle County Station, Unit 1 Exelon Generation Co., LLC Marseilles, IL Docket No. 50-373 License No. NPF-11	BWR-Mark II
LaSalle County Station, Unit 2 Exelon Generation Co., LLC Marseilles, IL Docket No. 50-374 License No. NPF-18	BWR-Mark II
Limerick Generating Station, Unit 1 Exelon Generation Co., LLC Limerick, PA Docket No. 50-352 License No. NPF-39	BWR-Mark II
Limerick Generating Station, Unit 2 Exelon Generation Co., LLC Limerick, PA Docket No. 50-353 License No. NPF-85	BWR-Mark II
Monticello Nuclear Generating Plant, Unit 1 Northern States Power Company Monticello, MN Docket No. 50-263 License No. DPR-22	BWR-Mark I
Nine Mile Point Nuclear Station, Unit 1 Nine Mile Point Nuclear Station, LLC Scriba, NY Docket No. 50-220 License No. DPR-63	BWR-Mark I
Nine Mile Point Nuclear Station, Unit 2 Nine Mile Point Nuclear Station, LLC Scriba, NY Docket No. 50-410 License No. NPF-69	BWR-Mark II
Oyster Creek Nuclear Generating Station, Unit 1 Exelon Generation Co., LLC Forked River, NJ Docket No. 50-219 License No. DPR-16	BWR-Mark I



Peach Bottom Atomic Power Station, Unit 2 Exelon Generation Co., LLC Delta, PA Docket No. 50-277 License No. DPR-44	BWR-Mark I
Peach Bottom Atomic Power Station, Unit 3 Exelon Generation Co., LLC Delta, PA Docket No. 50-278 License No. DPR-56	BWR-Mark I
Pilgrim Nuclear Power Station Entergy Nuclear Operations, Inc. Plymouth, MA Docket No. 50-293 License No. DPR-35	BWR-Mark I
Quad Cities Nuclear Power Station, Unit 1 Exelon Generation Co., LLC Cordova, IL Docket No. 50-254 License No. DPR-29	BWR-Mark I
Quad Cities Nuclear Power Station, Unit 2 Exelon Generation Co., LLC Cordova, IL Docket No. 50-265 License No. DPR-30	BWR-Mark I
Susquehanna Steam Electric Station, Unit 1 PPL Susquehanna, LLC Salem Township, Luzerne Co., PA Docket No. 50-388 License No. NPF-22	BWR-Mark II
Susquehanna Steam Electric Station, Unit 2 PPL Susquehanna, LLC Salem Township, Luzerne Co., PA Docket No. 50-387 License No. NPF-14	BWR-Mark II
Vermont Yankee Nuclear Power Plant, Unit 1 Entergy Nuclear Operations, Inc. Vernon, VT Docket No. 50-271 License No. DPR-28	BWR-Mark I

REQUIREMENTS FOR RELIABLE HARDENED VENT SYSTEMS  
AT BOILING-WATER REACTOR FACILITIES WITH  
MARK I AND MARK II CONTAINMENTS

1. Hardened Containment Venting System (HCVS) Functional Requirements

Boiling-Water Reactor (BWR) Mark I and Mark II containments shall have a reliable hardened vent to remove decay heat and maintain control of containment pressure within acceptable limits following events that result in the loss of active containment heat removal capability or prolonged Station Blackout (SBO). The hardened vent system shall be accessible and operable under a range of plant conditions, including a prolonged SBO and inadequate containment cooling.

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:

1.2.1 The HCVS shall have the capacity to vent the steam/energy equivalent of 1 percent of licensed/rated thermal power (unless a lower value is justified by analyses), and be able to maintain containment pressure below the primary containment design pressure.

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.

1.2.3 The HCVS shall include a means to prevent inadvertent actuation.

1.2.4 The HCVS shall include a means to monitor the status of the vent system (e.g., valve position indication) from the control room or other location(s). The monitoring system shall be designed for sustained operation during a prolonged SBO.

1.2.5 The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication in the control room or other location(s), and shall be designed for sustained operation during a prolonged SBO.

1.2.6 The HCVS shall include design features to minimize unintended cross flow of vented fluids within a unit and between units on the site.

- 1.2.7 The HCVS shall include features and provision for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.
- 1.2.8 The HCVS shall be designed for pressures that are consistent with maximum containment design pressures as well as dynamic loading resulting from system actuation.
- 1.2.9 The HCVS shall discharge the effluent to a release point above main plant structures.

## 2. Hardened Containment Venting System Quality Standards

The following quality standards are necessary to fulfill the requirements for a reliable HCVS:

- 2.1 The HCVS vent path up to and including the second containment isolation barrier shall be designed consistent with the design basis of the plant. These items include piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication components.
- 2.2 All other HCVS components shall be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. These items include electrical power supply, valve actuator pneumatic supply and instrumentation (local and remote) components.

## 3. Hardened Containment Venting System Programmatic Requirements

- 3.1 The Licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during SBO conditions.
- 3.2 The Licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during SBO conditions.