Draft Amendment to

Order EA-12-050

Severe Accident Capable Vents

(with subsequent rulemaking for filtering strategies with drywell filtration and severe accident management of BWR Mark I and II containments)

7590-01-P

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	)	License Nos. (as shown in Attachment 1)
MARK I AND MARK II CONTAINMENTS	)	EA-12-XXX
	)	

[NRC-20YY-0157]

ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF OPERATION UNDER SEVERE ACCIDENT CONDITIONS (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 12, 2012, the NRC issued Order EA-12-050 requiring the Licensees identified in Attachment 1 to this Order to implement requirements for reliable hardened vents for Mark I and Mark II containments. This Order supersedes Order EA-12-050 by revising requirements imposed in Order EA-12-050 and imposing additional requirements on reliable hardened vent

systems and related procedures to ensure that venting functions are available during severe accident conditions, The severe accident conditions to be considered include the elevated temperatures, pressures, radiation levels, and hydrogen concentrations that are associated with accidents involving extensive core damage, including those involving a breach of the reactor vessel by molten core debris.

Order EA-12-050 required that licensees of BWR facilities with Mark I and Mark II containment designs shall ensure that these facilities have a containment venting system that meets certain requirements for reliable and dependable operation to support strategies to control containment pressure and prevent core damage following events causing a loss of heat removal systems (e.g., an extended loss of electrical power). The NRC determined that the issuance and implementation of the requirements in Order EA-12-050 were necessary to provide reasonable assurance of adequate protection of the public health and safety and assurance of the common defense and security. As described in Order EA-12-050:

> 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 or prevented 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.

The Commission has determined that ensuring 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.

Accordingly, the NRC has concluded that these measures are necessary to ensure adequate protection of public health and safety under the provisions of the backfit rule, 10 CFR 50.109(a)(4)(ii), and is requiring Licensee actions. In addition, pursuant to 10 CFR 2.202, the NRC finds that the public health, safety and interest require that this Order be made immediately effective.

In developing the requirements included in Order EA-12-050, the NRC acknowledged that questions remained about possible ways to maintain containment integrity and limit the release of radioactive materials if the venting systems were used during severe accident conditions The NRC staff described various options for Commission consideration in SECY-12-0157, “Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments”. Option 2 in SECY-12-0157 was to revise the requirements in Order EA-12-050 to ensure that venting functions are available during severe accident conditions. Other options discussed in the Commission paper included the installation of engineered filtered containment venting systems (Option 3) and the development of a severe accident confinement strategy (Option 4). In its Staff Requirements Memorandum (SRM) for SECY-12-0157 dated March 19, 2013, the Commission stated:

> The Commission has approved Option 2 to issue a modification to Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," to require licensees of Boiling Water Reactors (BWRs) with Mark I and Mark II Containments to upgrade or replace the reliable hardened vents required by Order EA-12-050, with a containment venting system designed and installed to remain functional during severe accident conditions.

The purpose of revising the requirement for reliable hardened vents in EA-12-050 is to ensure that venting functions are available during severe accident conditions. Ensuring that the venting functions are available will support the strategies in the severe accident management guidelines for the protection or recovery of the containment, which serves as a barrier to the release of radioactive materials. This Order will ensure that this additional venting capability is provided while minimizing delays in achieving the original purpose of EA-12-050, which requires venting systems to control containment pressure and prevent core damage following the loss of heat removal functions. As described in SECY-12-0157 and highlighted in the related Commission meeting held on January 9, 2013, it is also important to protect the containment from other severe accident conditions, such as reducing the chances that core debris that has melted through the reactor vessel will lead to failure of containment structures (i.e., drywell liner melt-through for Mark I containments and suppression pool bypass events for Mark II containments). So while this order addresses issues related to containment venting before and after severe accident conditions, other issues remain about containment performance during severe accidents and how licensees might improve accident management capabilities and limit releases of radioactive materials by developing and implementing filtering strategies. The Commission directed the staff to address the broader questions about filtering strategies and severe accident management for Mark I and Mark II containments using the NRC's rulemaking process. Specifically, in the SRM for SECY-12-0157, the Commission stated:

> The Commission has approved the development of technical bases and rulemaking for filtering strategies with drywell filtration and severe accident management of BWR Mark I and II containments. The technical bases and

rulemaking should consider Option 3 – design and installation of an engineered filtered containment venting system intended to prevent the release of significant amounts of radioactive material following the dominant severe accident sequences at BWRs with Mark I and Mark II containments; and Option 4 – development of requirements and technical acceptance criteria for confinement strategies and requirements for licensees to justify operator actions and systems or combination of systems, such as suppression pools, containment sprays, and separate filters to accomplish the function and meet the requirements.

III.

The NRC may impose safety measures on licensees or applicants over and above those required by the adequate-protection standard cited in Order EA-12-050. Such requirements may be pursued to protect health or to minimize danger to life or property. As described in various NRC regulations and guidance documents, the requirements established to reduce risk (beyond measures needed for adequate protection) will not attempt to eliminate all risk but will instead pursue reasonable reductions. An evaluation of the costs and benefits of proposals within this category has been used as part of the determination of what is a reasonable requirement to reduce risks to public health and safety and the common defense and security. The NRC process for evaluating costs and benefits to help determine if additional requirements should be imposed are defined in Section 50.109, “Backfitting,” of Title 10 of the *Code of Federal Regulations.* Additional information and guidance related to these assessments are provided in NUREG/BR-0058, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” and NUREG/BR-0184, “Regulatory Analysis Technical Evaluation Handbook.”

An evaluation of the costs and benefits associated with providing a venting function for BWRs with Mark I and Mark II containments that remains available during severe accident conditions was summarized in SECY-12-0157. As discussed in SECY-12-0157, the NRC’s determination that a venting system should be available during severe accident conditions considered both quantitative assessments of costs and benefits as well as various qualitative

factors. SECY-12-0157 identified changes to make the venting systems capable of operating during severe accident conditions as a vital part of developing filtering strategies and improving the performance of Mark I and Mark II containments during severe accidents. Among the qualitative factors, one of the more important is enhancing the defense-in-depth characteristics of Mark I and Mark II containments by addressing the high conditional failure probabilities that those containments have should an event lead to a core melt. As discussed in SECY-12-0157, other qualitative factors supporting installation of severe accident capable vents include addressing significant uncertainties in the understanding of severe accident events, supporting severe accident management and response, improving the control of hydrogen generated during severe accidents, improving readiness for external and multi-unit events, and reducing uncertainties about radiological releases and thereby improving emergency planning and response.

As previously described, 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, including EA-12-050 issued in March 2012, and thereby provide adequate protection of public health and safety.

The events at Fukushima Dai-ichi highlight the possibility that events such as rare natural phenomena could challenge the prevention, mitigation and emergency preparedness defense-in-depth layers. At Fukushima Dai-ichi, limitations in time and unpredictable conditions associated with the accident significantly hindered attempts by the operators to prevent core

damage and containment failure. In particular, the operators were unable to successfully operate the containment venting system. These problems with venting the containments under the challenging conditions following the tsunami contributed to the progression of the accident from inadequate cooling of the core leading to core damage, to compromising containment functions from overpressure and over-temperature conditions, and to the hydrogen explosions that destroyed the reactor buildings (secondary containments). The loss of the various barriers led to the release of radioactive materials and further hampered operator efforts to arrest the accidents that ultimately led to the contamination of large areas surrounding the plant. The evacuation of local populations minimized the immediate danger to public health and safety from the loss of control of the large amount of radioactive materials within the reactor cores.

The safety improvements to Mark I and Mark II containment venting systems added by this amendment to EA-12-050 are intended to increase confidence in maintaining the containment function following core damage events. Although venting the containment during severe accident conditions could result in the release of radioactive materials, the act of venting could prevent containment structural and gross penetration leakage failures that would hamper accident management (e.g., continuing efforts to cool core debris) and result in larger releases of radioactive material later in the progression of the accident. Additional actions to maintain the integrity of Mark I and Mark II containments and to limit the release of radioactive materials during severe accidents are being considered as part of the rulemaking activity included in the Commission's SRM for SECY-12-0157. The NRC recognizes that plant differences and other factors may result in a variety of strategies to limit the release of radioactive materials. Licensees wishing to propose alternatives may do so in accordance with Section IV of this Order. Some licensees may also voluntarily develop and implement plant changes that go beyond the requirements of this order, including the installation of engineered filtering systems. The NRC

staff and the Advisory Committee for Reactor Safeguards have identified desirable design characteristics such as the use, where practical, of passive components to reduce the need for operator actions.

The NRC is empowered to require plant improvements beyond those needed to provide reasonable assurance of adequate protection of public health and safety when engineering approaches are available to provide a cost-justified substantial safety improvement. An evaluation of possible improvements for Mark I and Mark II containment vents was provided in SECY-12-0157 and a more detailed regulatory analysis is available in the NRC's agencywide documents access and management system (ADAMS). These evaluations included both quantitative and qualitative factors and led the Commission to determine that the safety improvements required by this Order are justified. 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 appropriate action to reduce the risks posed to the public from the operation of nuclear power plants.

The Commission has determined that it is a cost-justified substantial safety improvement to require BWR facilities with Mark I and Mark II containments to make the necessary plant modifications and procedure changes to provide a reliable hardened venting capability that is capable of performing under severe accident conditions. These new requirements supplement those imposed in the original EA-12-050 and are needed to protect health and minimize danger to life or property by having licensees provide greater capabilities to respond to severe accidents and contain radioactive materials, which is consistent with the NRC's overall defense-in-depth philosophy.

For Mark I containments, the preferred venting path is from the wetwell portion of containment because the water in the suppression pool provides a degree of decontamination

before release to the environment. The benefits of the suppression pool in the scrubbing of possible releases when using the wetwell vents for pressure control was described in Generic Letter 89-16, “Installation of a Hardened Wetwell Vent.” In addition, this venting path has been incorporated into other parts of the mitigating strategies to address lessons learned from the Fukushima Dai-ichi accident. For those severe accidents involving molten core debris breaching the reactor vessel, mitigating strategies include the addition of water to the containment to help prevent failure of the drywell, which would lead to a pathway directly into the reactor building. However, water injection can eventually result in increasing the water level in the suppression pool to a point where venting from the wetwell would no longer be possible. For this reason, severe accident management guidelines for containment pressure control include provisions for venting from the drywell if the capability of venting from the wetwell is not available.

The Mark II severe accident management guidelines also include provisions for use of both wetwell and drywell vents. In general, wetwell venting for Mark II containments provides similar benefits to Mark I containments in terms of scrubbing of possible releases. However, in the unlikely event of core debris melting through the reactor vessel, there is for Mark II containments a potential for failing drain line or downcomer pipe penetrations in the floor between the drywell and wetwell. This condition, first identified in the 1980’s during NRC severe accident research, is referred to as suppression pool bypass and is described in more detail in SECY-12-0157. In a suppression pool bypass scenario, the primary concern is the loss of the suppression pool as a means of filtering the release out of the vents. Therefore, this issue will be resolved as part of the rulemaking directed by the Commission to address broader severe accident management and filtering strategies. To address those severe accident scenarios that do not include molten core debris causing a bypass of the suppression pool, this Order requires Mark II containments to have a wetwell venting system that remains functional during severe

accident conditions Any licensee wishing to resolve the suppression pool bypass issue by installing a severe accident capable containment drywell venting system with an engineered filter, rather than awaiting the results of the rulemaking, could do so voluntarily as a part of a proposed alternative to the requirements within this order.

In recognition of the relative importance of venting capabilities from the wetwell and drywell, a phased approach to implementation is being used to minimize delays in the implementation of the original requirements in EA-12-050. Phase 1 includes upgrading of the venting capabilities from the containment wetwell to provide reliable, hardened vents capable of operating to help prevent core damage and if necessary during severe accident conditions. Phase 2 includes providing additional protections for severe accident conditions and includes addressing the possible need for venting capabilities from the containment drywell. Following the issuance of this order, the NRC staff will work with stakeholders on the development of more detailed guidance on specific capabilities and other aspects of implementing the requirements defined in Attachment 2 to this order within the schedules defined in the next section of this order. These requirements will also support developing further improvements to filtering strategies and severe accident management for BWR Mark I and Mark II containments, which is expected to result from the related rulemaking described in the Commission's SRM for SECY-12-0157. To provide an enhanced level of safety, all licenses identified in Attachment 1 to this Order are hereby modified to include the requirements identified in Attachment 2 to this Order.

Accordingly, the NRC has concluded that (1) the requirements needed to address the original Order EA-12-050 (March 12, 2012) are necessary to ensure reasonable assurance of adequate protection of public health and safety, and (2) the additional measures defined in this amendment to Order EA-12-050 are appropriate cost-justified safety improvements under the provisions of the backfit rule, 10 CFR 50.109(a)(3). The NRC is therefore requiring Licensee

actions. In addition, pursuant to 10 CFR 2.202, the NRC finds that the public health, safety and interest require that this Order be made immediately effective.

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 CFR 2.202, “Orders,” and 10 CFR 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. The requirements of Attachment 2 to this Order supersede those set forth in Attachment 2 to Order EA-12-050 dated March 12, 2012. These Licensees shall promptly start implementation of the requirements in Attachment 2 to the Order and shall complete the two phases of implementation as follows:

- Phase 1 (severe accident capable wetwell venting system): no later than startup from the second refueling outage that begins after June 30, 2014.
- Phase 2, (severe accident capable drywell venting system): no later than startup from the first refueling outage that begins after June 30, 2017.

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 Licensee's 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. 1.1 All Licensees shall, by June 30, 2014, submit to the Commission for review an overall integrated plan including a description of how compliance with the "Phase 1" requirements described in Attachment 2 will be achieved.

1.2 All Licensees shall, by December 31, 2015, submit to the Commission for review an overall integrated plan including a description of their approach to the "Phase 2" requirements described in Attachment 2 and how compliance will be achieved within the required schedule.

2. All Licensees shall provide status reports at six (6)-month intervals following submittal of the Phase 1 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 for Phase 1 and Phase 2 described in Attachment 2 are achieved.

Licensee responses to Conditions B.1, B.2, C.1, C.2, and C.3 above shall be submitted in accordance with 10 CFR 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 CFR 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. Licensees that consent to this Order and waive their right to a hearing pursuant to 10 CFR 2.202(d) may submit their answers in accordance with 10 CFR 50.4 instead of following the requirements of the NRC E-filing Rule described below.

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, 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/e-submittals.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/e-submittals.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, 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://ehd1.nrc.gov/ehd/*, 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 th day of

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

Browns Ferry Nuclear Plant, Units 1, 2, and 3	BWR-Mark I
Brunswick Steam Electric Plant, Units 1 and 2	BWR-Mark I
Columbia Generating Station	BWR-Mark II
Cooper Nuclear Station	BWR-Mark I
Dresden Nuclear Power Station, Units 2 and 3	BWR-Mark I
Duane Arnold Energy Center	BWR-Mark I
Edwin I. Hatch Nuclear Plant, Units 1 and 2	BWR-Mark I
Fermi	BWR-Mark I
Hope Creek Generating Station	BWR-Mark I
James A. FitzPatrick Nuclear Power Plant	BWR-Mark I
LaSalle County Station, Units 1 and 2	BWR-Mark II
Limerick Generating Station, Units 1 and 2	BWR-Mark II
Monticello Nuclear Generating Plant	BWR-Mark I
Nine Mile Point Nuclear Station, Units 1 and 2	BWR-Mark I & II
Oyster Creek Nuclear Generating Station	BWR-Mark I
Peach Bottom Atomic Power Station, Units 2 and 3	BWR-Mark I
Pilgrim Nuclear Power Station	BWR-Mark I
Quad Cities Nuclear Power Station, Units 1 and 2	BWR-Mark I
Susquehanna Steam Electric Station, Units 1 and 2	BWR-Mark II
Vermont Yankee Nuclear Power Station	BWR-Mark I

REQUIREMENTS FOR RELIABLE HARDENED VENT SYSTEMS CAPABLE OF OPERATION UNDER SEVERE ACCIDENT CONDITIONS AT BOILING-WATER REACTOR FACILITIES WITH MARK I AND MARK II CONTAINMENTS

In accordance with Order EA-12-050 dated March 12, 2012, Boiling-Water Reactors (BWRs) with Mark I and Mark II containments were required to have a reliable hardened containment venting system (HCVS). This revision of EA-12-050 requires that these facilities ensure that the HCVS also provides a reliable hardened venting capability from the wetwell under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris. The severe accident capable HCVS is intended to keep the original function of the HCVS, which is to help prevent severe accidents from occurring, and to add the capability of helping to mitigate the consequences of a severe accident should one occur. The development and implementation of the severe accident capable HCVS consists of two phases. The first phase consists of providing a venting system from the containment wetwell that meet the functional, quality, and programmatic requirements listed below. The second phase is associated with capabilities to vent from the drywell during severe accident conditions and involves either installing a venting system or developing a reliable strategy to limit the possible need to vent from the containment drywell during severe accident conditions.

The HCVS shall meet the requirements in Sections 1, 2, and 3, below.

A PHASE 1 (containment wetwell venting systems)

1. HCVS Functional Requirements

BWRs with Mark I and Mark II containments shall have a reliable HCVS to remove decay heat; vent the containment atmosphere including steam, hydrogen, non-condensable gases, aerosols, and fission products; and control containment pressure within acceptable limits using a vent path from the containment wetwell. The HCVS shall be designed for those accident conditions for which containment venting is relied upon to prevent containment failure; including accident sequences that result in the loss of active containment heat removal capability or extended loss of ac power (ELAP).

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 account for radiological conditions that would impede personnel actions needed for event response.

1.1.4 The HCVS controls and indications shall be accessible and functional under a range of plant conditions, including a severe accident environment, extended loss of ac power, and inadequate containment cooling.

1.2 The HCVS shall include the following reliable hardened venting 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 and the primary containment pressure limit (PCPL).

1.2.2 The HCVS shall discharge the effluent to a release point above main plant structures.

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

1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location. "Sustained operations" means until such time that reliable containment heat removal and pressure control is reestablished independent of the HCVS.

1.2.5 The HCVS shall, in addition to the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.

1.2.6 The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of ac power.

1.2.7 The HCVS shall include means to prevent inadvertent actuation.

1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from the control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of ac power.

1.2.9 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 from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of ac power.

1.2.10 The HCVS shall be designed consistent with containment pressures and temperatures during severe accident conditions as well as dynamic loading resulting from system actuation. The design is not required to exceed the current capability of the limiting containment components.

1.2.11 The HCVS shall be designed and operated to ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation.

1.2.12 The HCVS shall be designed to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

1.2.13 The HCVS shall include features and provision for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.

2. HCVS 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. HCVS 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 an extended loss of a c power.

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 an extended loss of ac power.

B. PHASE 2 (drywell venting systems)

1. HCVS Functional Requirements

Licensees with BWRs with Mark I and Mark II containments shall have either:

(1) a reliable HCVS to remove decay heat; vent the containment atmosphere including steam, hydrogen, non-condensable gases, aerosols, and fission products; and control containment pressure within acceptable limits using a vent path from the containment drywell, or

(2) a strategy and supporting documentation which provides confidence that the need to vent from the containment drywell would be highly unlikely given an accident has occurred and resulted in severe accident conditions.

1.1 If pursued, the drywell venting systems that are installed as part of the HCVS shall have the same performance objectives (reflecting accident conditions in the drywell), design features, quality requirements, and programmatic requirements as those defined in Section A for wetwell venting systems.

1.2 If pursued, the strategy providing confidence that venting from the drywell would not be necessary during severe accident conditions shall be part of the overall accident management for Mark I and Mark II containments. Supporting analyses shall show that containment failure as a result of overpressure can be prevented without a drywell vent for a variety of severe accident scenarios. Implementation of the strategy shall include necessary procedures, functional capabilities for plant systems (e.g., pumps and valves), and needed instrumentation.