SECRETARY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 19, 2013

COMMISSION VOTING RECORD

DECISION ITEM: SECY-12-0157

TITLE: CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

The Commission acted on the subject paper as recorded in the Staff Requirements Memorandum (SRM) of March 19, 2013.

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Commission.

Annette L. Vietti-Cook
Secretary of the Commission

Attachments:
1. Voting Summary
2. Commissioner Vote Sheets

cc: Chairman Macfarlane
Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
OGC
EDO
PDR

VOTING SUMMARY - SECY-12-0157

RECORDED VOTES

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIP	COMMENTS	DATE
CHRM. MACFARLANE	X				X	1/29/13
COMR. SVINICKI	X	X			X	2/27/13
COMR. APOSTOLAKIS	X	X			X	2/15/13
COMR. MAGWOOD	X	X			X	2/22/13
COMR. OSTENDORFF	X				X	2/22/13

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Chairman Allison M. Macfarlane

SUBJECT: SECY-12-0157 – CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

Approved __X__ Disapproved _____ Abstain _____

Not Participating _____

COMMENTS: Below ____ Attached __X__ None ____

SIGNATURE

1/29/13

DATE

Entered on "STARS" Yes _X_ No ___

Chairman Macfarlane's comments on SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors With Mark I and Mark II Containments"

I approve:

- Option 2, which requires that boiling-water reactors (BWRs) with Mark I and Mark II containment designs have severe accident capable containment vents;
- Option 3, which requires the installation of an engineered filtered containment venting system; and
- The consideration of Option 4, which explores additional severe accident confinement strategies, only if done in addition to Option 3.

Introduction

First, I want to acknowledge the quality of the NRC staff's effort, and the thoroughness of its paper. I appreciate the staff's openness and its engagement with the public in the process of developing the paper. I applaud, in this regard, the staff's conduct of ten public meetings to obtain and consider external views. The combination of both detailed technical evaluation and thoughtful qualitative considerations provides the Commission with an appropriately balanced presentation to aid in its decision-making.

I also want to acknowledge the consideration of this issue by the Advisory Committee on Reactor Safeguards (ACRS), as well as the subsequent evaluation of the ACRS' recommendation by the staff's Fukushima steering committee before making the SECY paper final. The entire process has been open and transparent and involves input from a wide array of interested parties and this has resulted in a high quality paper.

My decision reflects, in part, my experiences during a recent trip to the Fukushima Dai-ichi plant in Japan. The visit to the reactors required travel through deserted villages, full of abandoned homes and businesses overgrown with weeds, and past fallow fields, and unused industrial buildings, roads and railroad tracks, all of which emphasized the impact of the accident from a power plant that was over 10 kilometers away. Over 160,000 people who lived in the fallout zone remain displaced from their homes, with no clear knowledge of when they might, if ever, return. The level of destruction at the plant site was equally disturbing, with debris from the exploded reactor buildings littering the area near the reactors and hundreds of temporary tanks holding contaminated water pumped from the reactor buildings distributed throughout the site. I came away from the visit with a strong conviction that this must never happen again.

Severe Accident Capable Vents

The Fukushima accident highlighted the importance of hardened containment venting systems at BWRs with small containment structures, but this matter is only the most recent consideration of the merits of their installation. Since the early 1980s, the NRC and the nuclear industry have recognized the potential need to vent Mark I and Mark II containment designs to cope with severe accidents. As noted by the staff in the SECY paper on page 5,

> In 1983, the NRC approved Revision 2 to the Boiling Water Reactor Owners' Group Emergency Procedure Guidelines, which included guidance for operators to vent Mark I and Mark II containments in response to containment overpressure conditions. The emergency procedure guidelines are used to develop plant

> specific emergency operating procedures. Though emergency procedures have existed since the 1980s for Mark I and Mark II containment venting systems for beyond-design-basis accidents and severe accidents, the NRC's actions to date, for operating reactors, have not required containment venting systems for Mark I and Mark II containments be designed for severe accident conditions. p. 5

The NRC issued orders in March 2012 requiring reliable hardened containment vents for those licensees with BWR facilities with Mark I and Mark II containment designs. Venting containment can help prevent or delay the loss of, or facilitate recovery of, important safety functions such as reactor core cooling, reactor coolant inventory control, containment cooling, and containment pressure control.

Since we have now seen first hand the results of a severe accident at a Mark I facility, it is time to align the approach the NRC endorsed over 20 years ago to use containment vents to mitigate severe accidents with the actual physical capability of those vents to operate in severe accident conditions. For this reason, I support the provisions of Option 2.

Engineered Filtered Containment Venting System

Engineered filtered containment venting systems can help protect the public and the environment by significantly reducing the amount of radiological effluent released from containment during a severe accident. All currently available information indicates that the ability to vent containment through filters would be an improvement to safety. In evaluating whether justification for filters exists per 10 CFR 50.109, known as the Backfit Rule, the NRC staff performed both a quantitative cost-benefit analysis and qualitative assessment to determine if the proposed modifications could be considered cost-justified substantial safety improvements.

Quantitative Analysis

From a quantitative cost-benefit perspective, the staff performed the cost-benefit analysis for both Option 2 and Option 3, using two different core damage frequency values, 2×10^{-5}/year and 2×10^{-4}/year, to demonstrate the sensitivity of the results to these uncertain values. For both cases using a core damage frequency of 2×10^{-5}/year, the staff did not find the enhancements to be cost-beneficial, while for both cases using a core damage frequency of 2×10^{-4}/year, the staff found the enhancements to be cost-beneficial. Given the uncertainty of estimating an actual core damage frequency, I argue that the results of the cost-benefit analysis demonstrate that the proposed modifications are cost effective.

While the postulated frequencies of accidents at nuclear power facilities in the U.S. are often expressed anywhere from one in 1,000 years to one in 1,000,000 years, it's important to recognize that the world has seen three severe accidents at nuclear facilities in the past 33 years – or essentially one every 10 years, on average. Even though the circumstances, regulatory requirements, and plant designs differed from one accident to the next, these distinctions do not reassure most members of the public. To the contrary, this recurrence rate feeds much of the concern the public expresses about the safety of nuclear power. The existing record for severe accidents at nuclear power facilities worldwide over the past three decades, versus the theoretical performance of nuclear power facilities in the U.S., highlights our struggle to assign uncertainties to these types of quantitative measurements.

Significantly, I note that the staff used current agency guidance while performing the cost-benefit analysis. They did not include the potential costs of offsite releases similar to those experienced by Japan after the Fukushima accident, for instance. Any postulated changes to the way the agency addresses the evaluation of economic consequences of accidents would clearly increase the costs-averted side of the equation and move the results in the direction of being even more cost-beneficial.

Qualitative Analysis

While the cost-benefit analysis provided an arguably cost-justified result when considering uncertainty, I, like the NRC staff, also turned to reviewing qualitative aspects of the implementation of enhanced containment vents. To this end, the staff notes that assessing the uncertainties and sensitivities of modeling economic consequences is best done qualitatively. I discuss below the qualitative factors of defense-in-depth, uncertainties, operator action and decision-making, international practice, liability, and finally, whether a qualitative underpinning for requiring installation of engineered filter systems would be precedent setting,

Defense-in-Depth

The staff notes in Enclosure 1 to the SECY:

> A key principle of NRC's regulation and oversight of nuclear power plants has historically been and continues to be "defense in depth." An aspect of defense in depth traditionally has been to have multiple barriers to the release of radioactive materials and to have equipment and personnel to (1) prevent accidents from occurring or progressing, (2) contain radioactive materials if released from the fuel, and (3) mitigate the possible release through protective actions, such as evacuation. The containment systems at nuclear power plants play a key role in helping confine fission products within the plant if an accident progresses to a point where significant core damage has occurred. Containment designs also help to control accidents by absorbing the energy released from the reactor coolant system, holding water for long-term core cooling, and protecting systems from external hazards. Given the key role of containment performance as an essential element of defense in depth, concerns about the performance of Mark I and II containments during severe accident conditions have been discussed for many years. p. 27

Defense-in-depth is one of the primary ways the agency accounts for uncertainties in quantitative estimates of component failure or accident frequency. While the existing Order requiring reliable, hardened vents focuses on the prevention of an accident, it's prudent to consider an accident scenario in which an operator, using plant systems, is not able to preclude core damage and the accident escalates. Such a scenario illustrates where the mitigation and containment aspects of defense-in-depth provide their primary benefit. As the paper notes in Enclosure 1,

> While it may not be necessary or practical to ensure the complete independence of each barrier to the release of radiation, it is desirable to minimize dependencies and address the high conditional failure probability of Mark I and Mark II containments following a compromise of the preceding barriers (fuel and coolant system). The filtered system would provide the most independence while

the unfiltered vent could result in large releases in the attempts to reduce containment overpressure conditions. p. 34

Much like emergency preparedness is viewed as the last line of defense to public health and safety, the containment is the last engineered line of defense, and I believe it's important to ensure that in all situations, containment is given a similar focus.

Uncertainties

The uncertainties in attempting to quantify an accident frequency should be offset by prudent defense-in-depth. Being a geologist, I have an acute appreciation for the challenge of predicting the Earth's behavior. Since the Earth is constantly changing and our recorded knowledge represents roughly one millionth of the Earth's history, there is much we don't know. In light of this, we must be wise in balancing confidence in our engineering prowess with the humble recognition that natural systems have repeatedly demonstrated the ability to confound us. The staff also points out the large uncertainties involved in estimating the economic consequences given a large release of radioactive material (using the existing NRC economic consequences framework). Any increase in either the event frequency or economic consequences of a severe accident at a nuclear power facility could easily push a filtered vent into cost-beneficial space.

Operator Action and Decision-making

Another important uncertainty regarding severe accident management is human performance and reliability during a crisis. As raised by Commissioner Apostolakis during the January 9, 2013, Commission meeting, an important element of defense-in-depth is not over-relying on programmatic or human actions. I agree and I support a passive filtered containment vent design that requires as little operator action as practical. Making the vent operation passive will free up operators to focus on other actions needed to restore reactor safety. At the January 9 meeting, one of the external panel members, David Lochbaum noted that in a severe accident scenario, operators might not have the required information needed to follow an alternative mitigation strategy because of loss of power and equipment failures. Indeed, the industry's focus in developing new reactor systems is to add as many passive features as possible, reducing the need for human action. Moreover, the importance of reliable instrumentation and equipment that facilitates an operator's ability, during an accident, to devote attention and resources to the areas where it is most essential, was a key consideration underlying Order EA-12-051, issued on March 12, 2012, to require installation of spent fuel pool instrumentation.

While I appreciate that operators in the United States have indicated that they would open containment vents when required to protect the reactor, operators I've spoken to have also indicated that having a filter on the vent would give reassurance to their actions. I also agree with the staff that a filtered vent system affords decision-makers the confidence that conducting a venting operation will avoid adverse radiological impacts to the surrounding area. Filtered vents remove a potential consideration that could delay a decision to vent the system.

International Practice

Now, more than ever, the accident at Fukushima has shown us that nuclear safety is a global responsibility, and that an accident anywhere is an accident everywhere. I commend the staff for their work on Enclosure 3 of the paper that outlines foreign experience with filtered vent systems.

The NRC's analysis of the Fukushima accident highlighted the importance of an independent regulatory body that is well-funded and supported by the federal government. But it also showed that other factors, beyond regulatory function, were important elements in the accident, such as assessments of hazardous Earth processes like seismicity and flooding, the existence of mitigating equipment on site, and the ability to safely vent containment when necessary. There are 10 BWRs with Mark I containments and 15 BWRs with Mark II containments located outside the United States. Of these 25 units, 7 have operational filtered vents, 14 have committed to installing filtered vents, and only 4 have not yet committed to filtered vents (in Mexico and India). In addition, all 19 non-U.S. plants with other BWR containment designs have either filters installed or are committed to installing them. In summary, this equates to 91% of all non-U.S. BWRs worldwide that either have filters or are committed to them.

Since foreign regulators began requiring filtered vents as early as the 1980s, there is significant operating experience with the design, construction, and operation of these systems. Additionally, vendors have refined the size and effectiveness of designs over the years. Filters are a proven, mature technology. In fact, the staff notes that discussions with foreign regulators and licensees did not reveal any adverse systems interactions or potential negative consequences associated with the installation of filtered containment venting systems. This broad base of experience, including the thorough technical analysis performed by the NRC staff, gives me confidence that concerns over repeating mistakes that resulted in unintended consequences when NRC imposed regulations after the Three Mile Island accident have been dispelled.

U.S. adoption of a widely accepted international standard for venting and filtration of BWR containments will help strengthen the U.S. leadership role, especially in setting an example for developing nuclear countries. As the staff notes in Enclosure 1, "Pursuing Option 3 would also place the United States among the majority of countries that have required filtered venting systems, and maintain its stature as a leader in nuclear safety." (p. 39) I believe our responsibility as an international partner in the global nuclear safety regime is a significant qualitative factor that favors filtered vents.

I believe it's also noteworthy that at the Point Lepreau nuclear power plant in Canada, the addition of a filtered containment venting system was supported by the quantitative analysis of a Level 2 probabilistic risk assessment. The system, costing approximately $14 million U.S. dollars, was found to be cost-beneficial when using a large release frequency metric.

Liability

Another qualitative factor not mentioned in the staff's paper is that of liability and insurance. In reality, the estimated $16 million cost of installing a filtered venting system is a comparatively small price to pay to avoid billions in decontamination costs, not to mention all the additional costs loss of land area would entail. In many ways, a filtered vent serves as an added insurance policy for the plant, with the potential to avert billions of dollars of decontamination costs given certain severe accident scenarios. To this end, licensees could legitimately view filters as liability protection. While the NRC does not set nuclear energy liability insurance premiums, the industry may wish to lead an effort to explore whether insurers would consider decreasing nuclear energy liability insurance premiums for a facility that installs a filtered venting system.

Precedent

There has been some discussion surrounding whether the use of qualitative factors to cost-justify a rule is setting a precedent. In fact, there are numerous examples of this practice. In 2011, the Commission's revisions to the emergency preparedness (EP) regulations were based on qualitative cost justifications and were approved by the Commission unanimously. As noted in the rulemaking's regulatory analysis contained in Enclosure 3 to SECY-11-0053:

> The analysis relies on a primarily qualitative (rather than quantitative) evaluation of several of the affected attributes (public health, occupational health, offsite property, and onsite property) due to the difficulty in quantifying the impact of the current rulemaking... Quantification of any of these attributes would require estimation of factors such as (1) the frequency of various types of emergencies and emergency events, (2) the radiological consequences of such emergencies, and (3) pre-rule and post-rule impacts associated with such emergencies and hostile action... Specifically, the benefits include a reduced risk that public health and occupational health will be affected by radiological releases resulting from radiological emergencies, including hostile action... The final rule also will reduce the risk that off-site and on-site property will be affected by radiological releases resulting from emergencies, including hostile action. Although EP cannot affect the probability of the initiating hostile action, a high level of EP increases the likelihood of accident mitigation if the initiating event proceeds beyond the need for initial operator actions. An augmented EP program will reduce the risk that off-site and on-site property will be affected by radiological releases by improving the response to initiating events that could lead to severe accidents in the absence of mitigative response. p. 9

It has also been suggested that the Commission has never overridden a quantitative cost-benefit analysis using qualitative factors. The Commission should weigh quantitative and qualitative factors for all of its decisions, since relying solely on one or the other would be only looking at half the equation. While I do not find that the use of qualitative factors in this instance sets a new precedent, I agree that the Commission should be cautious and deliberative in its use of qualitative factors. The thorough analysis by the staff in this paper meets these criteria and gives the Commission a solid foundation on which to base a decision that incorporates both quantitative and qualitative factors.

Performance-Based Approach

After reviewing the issue of upgrading vents, the ACRS, in its letter dated November 8, 2012, recommended what I see as a combined approach. The ACRS clearly states that additional defense-in-depth measures should be considered to compensate for quantitative uncertainties. To this end, the ACRS recommended the performance-based approach of Option 4. In discussing its recommendation, the ACRS also notes that installation of filtered vents might be a logical outcome of this performance-based analysis. In addition, they note that making vents severe accident capable per Option 2 is also a desired approach. I view this combined approach as Option 2 and Option 4, not precluding Option 3. The ACRS notes the justification of this approach as allowing more scope for innovation that may result in more effective solutions.

I appreciate the desire to innovate and find additional solutions. I have reviewed the BWR Owners' Group report, "Plant Evaluation of Severe Accident Mitigation Strategies, Rev. 1," and I applaud the detailed thinking that they apply to severe accident mitigation. However, these efforts should be supplementary to – and not a replacement for -- the proven engineered filter technology. This view is also supported by analysis in the January 25, 2013, letter from the Nuclear Energy Institute, "Filtering Strategies and Filtered Vents," that also shows a combination of strategies would provide the best protection[1]. I have several substantial concerns with using solely an Option 4 approach.

The most significant drawback to Option 4 is the relatively unknown amount of time and money it would take to 1) develop performance-based targets, 2) quantitatively analyze various methods to achieve those targets, 3) conduct site-specific application of those methods, 4) reach consensus on acceptable strategies, and 5) implement those changes. Given competing priorities within the agency and the industry, and given other similarly complex analytical challenges (i.e., fire protection, mitigation of large fires and explosions due to aircraft impact, containment sump clogging, etc.), I view this process as conservatively taking a decade to complete[2]. This is simply too long a time to potentially reach the conclusion that filters must be installed.

During the January 9, 2013, Commission meeting on venting systems, the NRC staff reported that in all likelihood, testing of industry-planned equipment and systems would be required. Industry-backed containment spray systems, for example, would require extensive analysis of fluid dynamic behavior in the complex geometries of Mark I and Mark II containments to determine if the sprays would actually perform as promised. Testing of these systems, the only way to actually confirm their behavior, would further delay actual implementation of alternative strategies to reduce offsite exposures.

Another competing factor in considering Option 4 is the potential cost. The costs of years of research, analysis, design, and implementation could easily exceed the costs of installing filtered vents. In fact, during the January 9, 2013, Commission meeting on this topic, the nuclear industry representatives agreed with this consideration. Tennessee Valley Authority Executive Vice President and Chief Nuclear Officer Preston Swafford stated that the cost of a wet filter system could be on the order of $20 million (in contrast to the approximately $16 million value used by the NRC staff). In comparison, potential site-specific Option 4 strategies

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[1] As shown in Attachment 2, a review of Figures 1-6 and 1-7 indicate a combination of Options 3 and 4 would provide the most containment integrity and least accident consequences.

[2] In its letter to the Commission dated October 5, 2012, the Nuclear Energy Institute noted:

> Applying the findings of the EPRI [Electric Power Research Institute] study to individual plants will take significant effort and time. At a minimum, each plant (or class of plants) will have to perform a specific evaluation based on the EPRI methodology to determine the appropriate strategy to implement. This would require, prior to initiation of the study, alignment with NRC on the filtering strategy performance-basis, development of a regulatory vehicle, implementation guidance, design basis assumptions, severe hazard considerations, accident scenario requirements, etc. Experience suggests that this will involve numerous meetings among NRC staff, industry and other stakeholders over at least 24 months. Following development of the performance-basis, etc., a significant amount of time is required to perform the required analysis, engineering, design, development, procurement, plant walk-downs, installation, testing, training, and so on. These timeline considerations apply regardless of whether or not the filtering strategy selected by an individual plant includes an external filter.

would incur costs including additional FLEX equipment (portable pumps, fittings, etc.), drain line modifications for Mark II containments, and a $12 million wetwell and drywell vent. This would be on top of the costs of the testing and site-specific analysis that would be necessary prior to any modifications.

Therefore, adopting only Option 4 without a clear expectation of time to actual implementation and a reasonably certain estimate on the costs involved would be a risky endeavor. In the interest of the desire for clarity and stability of our regulatory approach, I believe Option 3 is a better approach because it also serves those goals. As noted in the BWR Owners' Group report and the Nuclear Energy Institute letter from January 2013, there may be additional actions, in addition to an engineered vent, that are worth pursuing. To this end, I support exploration of Option 4 if done in addition to Option 3.

Conclusion

As discussed at the Commission meeting, potential changes to the underlying regulatory framework for dealing with beyond-design-basis accidents[3], could have a bearing on the matter of containment venting. However, I believe a decision on the issue of filtered vents can be made on its own merits and within the current regulatory framework. I do not believe a decision on this matter should be contingent on the outcome of these future policy considerations.

Inclusion of filters on containment vents is a straightforward and cost-beneficial way to provide a significant additional level of protection to the public and the environment, as well as potentially averting billions of dollars of clean-up cost to the nuclear operator, the nuclear industry, and taxpayers of the United States. Other than the additional incurred cost, there are no substantive downsides to implementation of filters and they are the international standard. While some may argue about whether filtered vents are the most cost-beneficial or appropriate solution, there does not seem to be any dissent on whether filtered vents would be a valid and important safety improvement.

On balance, all of the available data suggests that the installation of filtered vents is a prudent and appropriate safety enhancement that is within the NRC's current regulatory framework. As a result, I believe it is the correct choice.

Allison M. Macfarlane — 4/29/13
Date

[3] Recommendation 1 of the Near-Term Task Force, and potential changes to how the agency addresses economic consequences of accidents as outlined in SECY-12-0110, "Consideration of Economic Consequences Within the U.S. Nuclear Regulatory Commission's Regulatory Framework," address these issues.

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSIONER SVINICKI

SUBJECT: SECY-12-0157 – CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

Approved XX In Part Disapproved XX In Part Abstain _____

Not Participating _____

COMMENTS: Below ___ Attached XX None ___

SIGNATURE

02/7/13
DATE

Entered on "STARS" Yes ✓ No ___

Commissioner Svinicki's Comments on SECY-12-0157
Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments

I approve in part and disapprove in part the staff's proposed plan of action to address the potential filtering of containment venting systems for boiling water reactors (BWRs) with Mark I and Mark II containments. Specifically, I approve the staff's Option 2, to require, via amendment to an existing order, the installation of severe accident capable hardened venting systems. I join a Commission majority in approving the development of technical bases and rulemaking alternatives for the staff's Options 3 and 4. I disapprove the immediate movement to require the installation of engineered filtered containment venting systems for BWRs with Mark I and Mark II containments via order.

The staff should proceed to amend order EA-12-050, "Order to Modify Licenses With Regard to Reliable Hardened Containment Vents," March 12, 2012, to now require a hardened containment vent capable of remaining functional during certain severe accident conditions. This amended order should be transmitted to the Commission for its review five business days prior to issuance. The need to re-evaluate the requirements contained in this order less than one year after its issuance presents a troubling parallel with NRC issuance and subsequent modification or revocation of some requirements after the accident at Three Mile Island. The Commission has already commented on the suboptimal sequencing of certain NRC post-Fukushima evaluations in its votes on other matters and direction to the staff may yet arise therefrom.

The immediate issuance of orders under the staff's Option 3 (installation of engineered filters), has not been sufficiently justified. Throughout our deliberations on this question, the Commission has been presented with a wealth of information on severe accident progression at BWRs with Mark I and Mark II containments. The analyses presented by the staff comprise a subset of the existing body of knowledge that is relevant to this matter. Consequently, this complex issue would benefit from a full evaluation under the notice and comment rulemaking process of the Administrative Procedure Act.

Although the staff described aspects and considerations associated with an approach utilizing strategies for filtering (Option 4: Severe Accident Confinement Strategies), the staff did not provide an evaluation of this option. Consequently, it is not possible to compare the two approaches offered by Options 3 and 4, respectively. Both can achieve the objective of filtering. Option 4 provides protection to the containment with greater operational flexibility for maintaining containment integrity in a severe accident, and could result in superior treatment of defense-in-depth. The Commission's Advisory Committee on Reactor Safeguards (ACRS) has recommended that the Commission approve a performance-based approach (Option 4) and has further concluded that this approach has characteristics "important to reducing the likelihood of unintended negative consequences."

These are important matters, deserving of a full and balanced evaluation, consistent with NRC's Principles of Good Regulation. The staff's analysis presents a single point solution. Further, the staff has utilized and relied upon qualitative factors over quantitative factors in its analysis to a high degree. As the late Commissioner McGaffigan once observed, such efforts "can result in a false or misleading estimate of the costs and benefits of the rules being considered."[1] I share the view of Commissioner Magwood that significant implications to regulatory stability potentially arise from this issue and support his proposal for a separate voting paper on the matter.

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[1] Vote of Commissioner Edward McGaffigan, joining a Commission majority disapproving the issuance for public comment of the proposed Shutdown Rule, SECY-97-0168, dated October 7, 1997.

The completeness and quality of the staff's evaluation are lacking and do not provide a basis for deciding a matter of this complexity. To remedy this, the Commission should direct the staff to proceed immediately with the following actions:

Within one year of the date of the staff requirements memorandum arising from this paper, the staff should provide a notation vote paper to the Commission presenting the technical bases and rulemaking alternatives that would support a Commission decision on filtration of BWR Mark I and Mark II containments during severe accidents. This paper should consider – without prejudice – options to include the installation of an engineered filter as well as performance-based methods to provide filtration. Ultimately, these performance-based methods may, or may not, on a plant-specific basis, result in the installation of an engineered filter.

Since the Commission will already have proceeded to compel the installation of severe accident capable hardened venting systems via order, the technical bases should assume the installation of these systems and, as a consequence of that action, should assume that the benefits of these vents accrue equally to engineered filters and to filtration strategies. This approach is intended to eliminate a defect of the analyses now before the Commission, which conflate the benefits of severe accident capable hardened vents with those attributed to filters. In addition, consistent with a performance-based approach, the technical bases should assign equal weight to active and passive mitigative measures.

The technical bases, for both engineered filters and filtration strategies, should evaluate a variety of performance criteria, such as a decontamination factor, equipment and procedure availability similar to those required to implement 10 CFR 50.54(hh), or other measures that may be developed during the stakeholder engagement described below.

The notation vote paper should include a discussion of validation and testing that would be required to support either option. Specifically, for engineered filters, the staff should present its plan of research to validate vendor assertions regarding filter performance, including the avoidance of performance adverse to safety such as clogging and the effects of backpressure induced by clogged filters on severe accident progression.

The staff should engage a diversity of external stakeholders throughout the development of the technical bases and should present to the Advisory Committee on Reactor Safeguards at appropriate points in the process. To engage a diversity of stakeholders and viewpoints most effectively, the staff should consider various formats, to include public meetings, workshops, and tabletop exercises to foster detailed discussion of analytical methods, modeling assumptions, and potential performance criteria.

Kristine L. Svinicki 02/27/13

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Commissioner Apostolakis

SUBJECT: SECY-12-0157 – CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

Approved __X__ Disapproved __X__ Abstain _____

Not Participating _____

COMMENTS: Below ___ Attached __X__ None ___

SIGNATURE

2/15/13

DATE

Entered on "STARS" Yes __x__ No ___

Commissioner Apostolakis' Comments on SECY-12-0157
Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments

The staff's comprehensive paper justifies additional regulatory action to address the vulnerabilities of BWR Mark I and II containment designs. I approve a modified version of Option 3 that includes elements of Option 4. I support the installation of an engineered filtered containment venting system for BWRs with Mark I and Mark II containments. I also approve modifying the reliable hardened vents required by NRC Order EA-12-050 to make them severe accident capable, as proposed in Option 2.

Although there is wide agreement that it is appropriate to require severe accident capable vents by modifying the existing order for reliable hardened vents, the same cannot be said about new requirements for an engineered filtered venting system. Vibrant debate continues to take place on this issue and there remain technical questions to be resolved regarding the installation and performance requirements of an engineered filter. Pursuing such requirements through the rulemaking process will give all stakeholders the opportunity to discuss candidate performance criteria and other technical issues. The issuance of orders constrains the extent of stakeholder interaction on new generic requirements and associated implementation issues. For these reasons, I support use of the rulemaking process to implement my proposed modified Option 3.

Given the significant uncertainties associated with the modeling of severe accident scenarios, the staff's invocation of defense in depth as one of the main qualitative factors favoring Option 3 is appropriate in this case. Defense in depth has been the cornerstone of the NRC's regulatory framework and a fundamental safety principle since the early days of nuclear power development. It protects against the infamous "unknown unknowns." Release of radioactive materials from the reactor to the environment is prevented by multiple barriers including the fuel cladding, the reactor coolant pressure boundary, and the containment structure. The containment is the ultimate barrier to the release of radioactivity.

Regarding the case before us, there are long-recognized vulnerabilities in the ability of Mark I and Mark II containments to perform their function of containing radioactive materials during a severe accident due to their relatively small volume. These vulnerabilities necessitate venting to prevent overpressure conditions, thus reducing the conditional containment failure probability. To compensate for the loss of the containment barrier due to venting, the installation of an engineered filter is justified and would strengthen the important defense-in-depth function of these containments.

There are aspects of Option 4 that could inform the establishment of performance criteria for the filters. Option 4 addresses the issue of severe accident management in a more holistic way and provides a context within which the filter performance criteria can be defined. However, by requiring the installation of filters, we would avoid long debates over the effectiveness of filtering strategies for which significant uncertainties exist. Option 4 strategies that are likely to rely heavily on programmatic activities and human actions (e.g., procedures for operator cycling of containment vents and use of containment sprays) should not be the principal mechanism for managing the severe accident. Regulatory Guide 1.174 states that consistency with the defense-in-depth philosophy means, among other things, that: (1) a reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation; (2) over-reliance on programmatic activities as compensatory measures is avoided; and (3) defenses against human errors are preserved.
These conditions would best be met by installation of a severe-accident-capable and filtered vent.

As I stated in my vote on SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," the Commission is faced with the prospect of making a number of significant policy decisions that are clearly linked and it may not be optimal for the Commission to decide these issues independently of each other. I stated that a decision on the regulatory treatment of economic consequences of severe accidents could have a real impact on the analysis used to judge the significance of filtered vents and whether to require them. Nonetheless, even if a Commission decision on SECY-12-0110 is reached in the near-term, any decision that directs changes to our regulatory analysis guidance would not be realized for quite some time. Although a decision of the treatment of economic consequences might shed additional light on the quantitative evaluation of new requirements for containment vents, it is not essential to moving forward.

In closing, I commend the staff for an excellent job in preparing SECY-12-0157. I especially appreciate the historical perspective and analyses provided in the enclosures. I found these documents very informative and helpful in my deliberations. I also had the benefit of the comments submitted by external stakeholders such as Pilgrim Watch[1] and the Nuclear Energy Institute (NEI)[2]. Finally, as it did for Chairman Macfarlane, the accident at Fukushima played an important role in my thinking about this issue.

George Apostolakis
2/15/13

[1] Comment from Mary Lambert, Director, Pilgrim Watch, to the NRC Chairman and Commissioners. Subject: *Pilgrim Watch Comment Regarding Additional Requirements for Containment Venting Systems for BWRs with Mark I and Mark II Containments in Support of Filters (Option 3) and Rupture Discs.* November 19, 2012.
[2] Letter from A. R. Pietrangelo, Senior Vice President, NEI, to A. M. Macfarlane, Chairman, NRC. Subject: *Filtering Strategies and Filtered Vents*. January 25, 2013.

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSIONER MAGWOOD

SUBJECT: SECY-12-0157 – CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

Approved X Disapproved X Abstain _____

Not Participating _____

COMMENTS: Below ____ Attached X None ____

SIGNATURE

22 February 2013

DATE

Entered on "STARS" Yes X No ___

Commissioner Magwood's Comments on SECY 12-0157,
"Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments"

Since the disaster at the Fukushima Daiichi nuclear site in Japan two years ago, the NRC staff has worked diligently to consider steps to further enhance the safety of U.S. nuclear power plants. While—as the Near-Term Task Force (NTTF) highlighted in its conclusions—the agency remains confident about the safety of all U.S. nuclear power plants in the aftermath of Fukushima, we are a learning organization and it has been NRC's responsibility to learn and apply vital lessons from the Japanese disaster.

The Commission has committed itself to oversee a careful, technically-sound response to the lessons of Fukushima that assures that we neither overreact nor under react to this event. While recognizing the important differences between the nuclear safety regulations and operational practices in the U.S. and those in place in Japan before Fukushima, we concluded that there are both specific regulatory issues and broad lessons to be addressed in the face of the Japanese experience. A specific lesson, for example, has been the potential for a common cause failure of both offsite and onsite AC power; this is an aspect of the Fukushima disaster for which we had not previously prepared. We are now addressing this as a high-priority issue.

A broad lesson of Fukushima has been the need to develop an appropriate regulatory approach to beyond design basis events. We have taken vital steps to address this area and more remains to be done. Of all the issues associated with this *terra incognita,* the subject of whether to provide filtering as a part of certain containment venting systems has proven to be the most contentious—both within the agency and outside it.

As highlighted by SECY 12-0157, this issue has the most relevance to a subset of U.S. nuclear power plants. While we have ordered a variety of enhancements to be applied at all U.S. plants—such as the implementation of new measures to mitigate severe accidents—BWRs with Mark I and Mark II containments (similar to the plants that were struck by the tsunami in Japan) were always the center of attention as safety enhancements have been considered. These plants have relatively small containments and, by design, require the ability to vent their containments in the event of a severe accident (and thus control containment pressure in order to prevent the failure of the containment, which would lead to the uncontrolled release of radioactivity). It is for this reason that prominent among the orders the Commission authorized last year was one focused on the assurance of reliable, hardened vents for these reactors.

SECY-12-0157 goes much further. Importantly, the staff recommends that vents on Mark I and Mark II containments be further hardened to assure that they will function under severe accident conditions. Because severe accidents are low probability, beyond design-basis events, staff could not provide a regulatory justification to implement these changes under a determination of adequate protection—which was the regulatory rationale used to issue the reliable hardened vents order last year (which was designed to assure the ability of vents to contribute to strategies to *prevent* rather than *respond* to severe accidents). For further enhancements associated with severe accident performance, staff is obligated by the Backfit Rule to perform a regulatory analysis to assess the benefits of regulatory changes against the cost of implementation.

The staff's analysis of the elements represented by Option 2 appears to demonstrate a clear safety benefit. Given the importance of these vents in preventing circumstances such as were observed at the Fukushima site in 2011, I believe Option 2 provides a worthy enhancement and therefore fully approve it. I recommend that EA-12-050, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents," be modified to reflect staff's recommendations in Option 2.

As a separate matter, SECY-12-0157 asks whether vent filtering is also needed. In considering this potential enhancement, staff's backfit analysis found that the quantified safety benefits do not justify regulatory action. As staff states in SECY-12-0157, "The best estimate quantitative evaluations, excluding any qualitative factors and sensitivity analysis, indicate that the costs of the proposed actions outweigh the benefits." At this stage, staff took the extraordinary step of introducing "qualitative factors" to demonstrate the value of adding external wet scrubbers to containment vents. This step breaks with previous NRC precedent. The use of qualitative factors as applied by the staff in this SECY goes well beyond previous Commission guidance and the use of such an approach renders the Backfit Rule essentially meaningless.

In supplemental information provided to the Commission, the staff gave examples of rules where qualitative arguments have been used including Part 73 (Plant Access Control), Part 26 (Fitness for Duty), and Part 50 (Enhancements to Emergency Preparedness). These are areas where the benefits of new requirements have not been considered amenable to quantification. Changes to the licensing basis of operating nuclear power plants do not fall under this category of regulatory action. The Commission asked staff for specific past examples in which changes have been made by the NRC to nuclear power reactors based on a backfit analysis that relies on qualitative factors. Staff proved unable to cite any such examples.

Should the Commission approve any regulatory change using such an approach, it would be the first use of qualitative analysis to justify changes to nuclear power plants rather than relying on PRA models or other quantitative assessments. Were the approach in SECY-12-0157 approved by the Commission, the agency could use this methodology to justify essentially *any* regulatory change, including requiring vents on *all* containments, requiring the installation of core catchers, or requiring that all reactor buildings be painted chartreuse.

The regulatory stability the NRC has developed over the decades would be lost. This Commission and each individual Commissioner has a responsibility to assure that this does not happen. I therefore reject staff's approach to the backfit analysis in this paper and recommend that staff seek detailed Commission guidance regarding the use of qualitative factors in a future notation voting paper.

Further, it is important to recall that the NTTF believed that BWRs with Mark I and Mark II containments were safe and saw no need to delay their relicensing. The agency did, in fact, renew the license of such a plant just last year. Moreover, Fukushima showed us nothing new about how these plants respond under severe accident conditions—the incident actually verified our analyses and expectations. As noted by the ACRS in their Nov. 8, 2012 letter, "additional measures for accident source-term mitigation in Mark I and Mark II containments are not justified by risk-informed cost-benefit analyses that rely on the generic PRA models, risk metrics, estimates of averted costs, and uncertainties that were examined by the staff."

Fukushima also highlighted the vital importance of excellence in operations. Venting is a vital aspect of the operation of BWRs with Mark I and Mark II containments and a delay in performing this operation is unacceptable. Some have suggested that U.S. operators might delay venting in the event of an emergency. Operators with whom I have spoken are shocked by this idea. Operators of nuclear plants—like firemen, soldiers and sailors, police, and many other highly-trained individuals—are relied upon to execute difficult actions in crisis situations. They state that venting is not a judgment call; it would be implemented under very clear technical procedures that dictate actions based on plant conditions.

In any event, the use of external scrubbers does not obviate the need for trained operators to manage a severe accident; if anything, adding this equipment may well deprive operators of the choice of how best to respond to evolving events. One of the most vital lessons of Fukushima is that operators must be armed with an array of tools and options that enable them to apply their judgment and training to respond to extreme events. If operators were not to take appropriate action in the event of a severe accident, a loss of containment integrity is almost certain even if external scrubbers are present.

For all the reasons discussed above, staff has failed to make a clear regulatory case for either Option 3 or Option 4.

Option 3, which staff recommends, has a further problem in that it is only a partial solution. External scrubbers would be useless if containment integrity were lost. If the liner is compromised by corium flow, plant operators will have no control over how radioactive materials are released. Staff has informed me that they anticipate that the mitigating strategies ordered last year would allow operators to keep the liners intact; I find this problematic. The mitigating strategies order did not require equipment capable of injecting water into a reactor already undergoing a severe accident. We observed the inability of such measures to inject cooling water into a pressure vessel during the early stages of the severe accidents at Fukushima. Whether existent requirements adequately address these vulnerabilities simply has not been analyzed. It is clear that remedial regulatory steps would be needed to assure that plants have the ability to cool core debris in the event of a site-wide disaster.

As a result, containment integrity must be considered separately from Option 3 and it is likely that a follow-up order or rulemaking would be required. While Option 4 does provide the opportunity to deal with this aspect of the issue, the subject SECY does not provide nearly sufficient detail to support a clear path forward.

With regard to filtering, Option 1 (to do nothing beyond the existing orders) is the only outcome strictly warranted under our existing, predictable, regulatory framework and our current policies. This is particularly true given the fact that SECY-12-0157 relates only to situations where these units experience certain severe, beyond design basis external events. The Commission has not formally decided to expand our regulatory footprint into beyond design basis events. There are several ongoing analyses the staff is conducting regarding that question—including Recommendation #1 from the Near Term Task Force and Commissioner Apostolakis' Risk Management Task Force. Moreover, the value of vent filtering is quite clearly a matter of preventing socioeconomic disruption rather than strictly protecting public health and safety. This is another area under active Commission consideration. I would prefer to make this decision after the Commission has dispositioned all these matters, thus enabling us to make a sound decision on a firm regulatory basis that will endure.

Nevertheless, while staff has objectively failed to make a regulatory case for any recommendation other than Option 2 (as the ACRS has tactfully highlighted), the staff has made a reasoned technical case such that the Commission could consider additional measures under its broad policy-making authority. While, thus far, we have learned nothing very new from the Fukushima experience about the nature of Mark I and Mark II containments, we have all seen the suffering caused by the widespread contamination

released by the tsunami-damaged reactors. Further, and despite the fact that decisions are still pending regarding whether and how our regulatory processes should be further adjusted to consider socioeconomic disruption, the narrow case of Mark I and Mark II containments—designs which rely on venting as an integral component of their severe accident response strategies—justify a careful, special consideration of the effects of venting as well as the strategies necessary to maintain the overall integrity of these containments during severe accidents.

Some of my colleagues have recently explored whether some aspects of SECY-12-0157 should be addressed through a formal rulemaking rather than orders. Unlike the orders issued last year, the presently proposed order is not a matter of assuring adequate protection of the public, but instead addresses very low-probability, beyond design basis events. The issue of containment filtering, in my view, is precisely the type of issue that should be vetted through a careful, thoughtful, transparent rulemaking process. Such a process would allow for a full consideration of site-specific issues, alternative strategies, and broad public comment and input.

I propose that staff develop a containment filtering rulemaking that would explore, in full public view, attributes of both Option 3 and Option 4. Both staff options present potential benefits that require careful exploration. At the same time, as the ACRS noted as it recommended Option 4, a "performance-based" approach "allows more scope for innovation and may result in more effective solutions." A rulemaking should allow a full consideration of such innovation, be risk-informed and performance-based, and be appropriate for the particular characteristics of each plant. Ideally, the right solution will emerge for each facility, which may include the use of external scrubbers, dry filters, in-containment sprays, or some optimized combination of measures. Finally, and very importantly, this rulemaking should fully explore and establish the methodologies and requirements associated with assuring containment integrity—including assuring the ability to cool core debris.

As it proceeds to develop this rulemaking and the regulatory guidance that would be issued with it, staff will need to identify acceptable performance objectives and requirements for these containments so that their severe accident management response capabilities can be evaluated. This work should include extensive engagement with external stakeholders and the ACRS. Staff should also ensure that the performance and risks of the various filtering strategies and equipment considered are validated fully. In order to facilitate this effort, staff should present to the Commission technical bases that support the development of the rulemaking.

Finally, while I disagree with staff's application of "qualitative factors" in SECY-12-0157, it is important to note that this staff paper provided the Commission and the agency's many stakeholders with a wealth of valuable and important technical analyses, which I believe has advanced this issue significantly. I appreciate the staff's hard work on this complex issue and particularly appreciate the many individuals on the staff who have participated in many informative (and often passionate) discussions with me and my staff as the Commission has reviewed the staff's consideration of this very important matter.

2/22/13

William D. Magwood, IV **Date**

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSIONER OSTENDORFF

SUBJECT: SECY-12-0157 – CONSIDERATION OF ADDITIONAL REQUIREMENTS FOR CONTAINMENT VENTING SYSTEMS FOR BOILING WATER REACTORS WITH MARK I AND MARK II CONTAINMENTS

Approved _X_ Disapproved _____ Abstain _____

Not Participating _____

COMMENTS: Below ___ Attached _X_ None ___

_____
SIGNATURE

2/22/13
DATE

Entered on "STARS" Yes _X_ No ___

Commissioner Ostendorff's Comments on SECY-12-0157, "Consideration of Additional Requirements for a Containment Venting System for Boiling Water Reactors with Mark I and II Containments"

First, I commend the staff for a thoughtful and extremely detailed paper on this topic. I join Chairman Macfarlane and Commissioner Apostolakis in approving Option 2, which calls for issuance of a modified Order EA-12-050, Reliable Hardened Vents, to require a severe accident capable reliable hardened vent.

Upgrading hardened vents for post-accident operations is a pragmatic and sensible defense-in-depth measure. Severe accident capable vents will improve containment reliability and post-accident combustible gas control, which was a key lesson learned from the Fukushima Dai-ichi accident. With the containment at elevated pressure, the hydrogen leaks from the Fukushima Dai-ichi Unit 1 containment resulted in an explosion of the Unit 1 Reactor Building (secondary containment). Not only did this complicate emergency response for Unit 1, the resultant radiation release and damage complicated operators' attempts to prevent meltdowns at Units 2 and 3. Enhanced containment venting and pressure control will help to reduce this risk for these relatively small volume containments. An Order to require severe accident capable hardened vents will provide improvements to this capability in the near term, while additional enhancements can be developed in a more deliberate fashion.

Therefore, the staff should propose a modification to Order EA-12-050 requiring severe accident capability. I agree with the staff that this new requirement is not necessary for adequate protection but that it is cost-justified considering both quantitative and qualitative factors. Because the Commission reviewed and approved Order EA-12-050, any staff modifications to this Order should have Commission final review. Staff should send the Commission the final proposed revision of EA-12-050 10 business days prior to staff issuance of the Order.

I also approve development of a filtering strategies rule with drywell filtration and severe accident management of BWR Mark I and II containments (a modification of Options 3 and 4). I believe that a rulemaking, rather than an order, would best establish the expectation for a plant-specific, performance-based approach that identifies the best, cost-effective filtration and severe accident management strategies.

The staff has completed a considerable analysis to evaluate the efficacy of current filter vent technology that is available in the market place and installed in foreign reactors. In my view, the quantitative and qualitative analysis supports additional efforts to enhance containment performance for severe accidents and accident management strategies for the BWR Mark I and II containments. Defense-in-depth was one of the principal qualitative factors used to support the imposition of additional requirements. I believe this was appropriate and consistent with Agency guidance[1]. I also agree with Commissioner Apostolakis that defense-in-depth is a longstanding and important regulatory philosophy in our safety framework. And, as I noted in my vote on SECY-12-0110, "Consideration of Economic Consequences within the U.S. Nuclear Regulatory Commission's Regulatory Framework," the staff's treatment of economic consequences in this analysis illustrates that the existing regulatory structure is flexible and robust.

I am persuaded that engineered filtered vents offer a mature technological approach to enhance defense-in-depth by reducing the potential for radiological releases in the event of a severe accident. But, I do not wish to forgo additional dialogue with stakeholders on the development of a

[1] NUREG/BR-0058, Revision 4, Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission, September 2004.

performance-based approach which, as noted by the Advisory Committee on Reactor Safeguards (ACRS), "allows more scope for innovation and may result in more effective solutions." I believe that a filtering strategies rulemaking process that considers engineered filtered vents, as well as other severe accident confinement strategies, is the best way to achieve this outcome.

While I agree with the staff that additional enhancements are warranted, I believe that rulemaking, not an order, is a more appropriate course of action. In order to facilitate stakeholder input, a rulemaking is a better forum to ensure full consideration of all the pros and cons of various approaches. I agree with Commissioner Apostolakis that ". . . pursuing such requirements through the rulemaking process will give all stakeholders the opportunity to discuss candidate performance criteria and other technical issues." The Commission's severe accident policy appropriately directs generic issues of this nature into a rulemaking track which will provide for deliberate consideration of this important issue.

Further, there are other factors that reinforce my belief that this is an important, but not urgent, matter where rulemaking would be the appropriate regulatory vehicle. First, containment filtration venting was not originally identified as an issue by the Near Term Task Force (NTTF), and was not placed in Tier 1 as high-priority status because it was viewed as essential for public health and safety. Rather, placement in Tier 1 was for administrative purposes and engineering expedience to avoid potentially costly plant rework of the reliable hardened vents for the BWR Mark I and II containments. Second, the NTTF concluded that an event like Fukushima is not likely in the United States and that continued nuclear power plant operations do not pose an imminent risk to public health and safety. And, finally, there are a number of other activities currently underway in response to lessons-learned from the Fukushima Dai-ichi accident (mitigating strategies, hardened vents, seismic and flooding hazard revaluations, etc.) that are continuing to mitigate risk and are of a higher safety priority. While these assurances indicate there is no need for immediate action on filtering strategies, I believe action to provide additional defense-in-depth for potential accidents via a filtering strategies rulemaking is still appropriate.

There are significant merits to a performance-based approach. A performance-based approach is consistent with Commission policy and our past treatment of severe accidents. The Commission established nearly 25 years ago a severe accident policy statement and positions on the NRC's containment performance improvement program. In the late 1980s, the NRC embarked on a major endeavor for licensees to conduct individual plant risk assessments, specifically the individual plant examinations (IPEs) for severe accidents and the IPEs of external events (IPEEEs), so that licensees would self-identify severe accident vulnerabilities for their facilities. To achieve this objective, licensee-led multidiscipline teams systematically assessed each plant. This time-tested approach was used again after 9/11 in identifying plant-specific strategies with generic guidance to meet the B.5.b section of the 9/11 Order. Again, this approach is being used for the FLEX strategies to implement the EA-12-049 Mitigating Strategies Order. I note that our Canadian regulatory colleagues also use a risk-informed performance-based approach to containment performance issues. As stated by our Canadian participants in the Commission's January 9, 2013 meeting on Venting Systems for Mark I and Mark II Containments, the Canadian Nuclear Safety Commission instructs their licensees what to address, not how to address the requirement and that they expect the industry to address this requirement in a holistic fashion. I believe a filtering strategies rule should be implemented in this manner.

Regarding performance-based filtering strategies, I recently visited the Nine Mile Point plant with my colleague Commissioner Apostolakis to get a first-hand insight on the recent BWR Owners' Group (BWROG) tabletop[2] review. The BWROG used a multi-discipline team that comprised

[2] BWROG Report, *Plant Evaluation of Severe Accident Mitigation Strategies, Rev. 1, January 2013*

operators, engineers, and risk experts to assess the EPRI mitigating strategies approach. This was a valuable illustration of one possible approach. It is unfortunate, due to the timing of this activity, that the staff did not have the benefit of these insights when they were developing SECY-12-0157. One of the objectives of a filtering strategies rulemaking would be to blend these insights with the staff's extensive analysis of engineered filtered venting systems to provide an optimal outcome.

I recognize and commend the staff on their extensive engagement with stakeholders on this challenging issue through numerous public meetings. Subsequent to this SECY paper, there has been additional engagement, and I believe the best method to continue to foster this beneficial dialogue is through a rulemaking process on filtering strategies. Therefore, the staff should work with external stakeholders and the ACRS to fully explore various performance criteria options for drywell filtration and severe accident management of BWR Mark I and II containments in developing its recommendations for a proposed rule. There appear to be several viable approaches for performance criteria under consideration. One approach is to specify a decontamination factor based criteria. Another approach is to use a functional based set of criteria for equipment and filtering strategies, akin to what is used for 10 CFR 50.54(hh)(2). The ACRS has also offered valuable views in this area. The staff should also consider the expected testing and/or validation impacts in developing their recommendation. The staff should provide the proposed rule within two years of the final SRM on SECY-12-0157. The staff should also provide the final rule to the Commission within four years. The staff should keep the Commission periodically informed of their progress.