POLICY ISSUE
(Information)

March 31, 2016 SECY-16-0041

FOR: The Commissioners

FROM: Victor M. McCree
Executive Director for Operations

SUBJECT: CLOSURE OF FUKUSHIMA TIER 3 RECOMMENDATIONS RELATED TO CONTAINMENT VENTS, HYDROGEN CONTROL, AND ENHANCED INSTRUMENTATION

PURPOSE:

In this paper, the U.S. Nuclear Regulatory Commission (NRC) staff informs the Commission of the final assessment and closure of Fukushima-related Tier 3 recommendations regarding evaluations of reliable vents for containment types other than boiling water reactor (BWR) Mark I and Mark II containments, hydrogen control and mitigation, and reactor and containment instrumentation enhancements. This paper does not address any new commitments or resource implications.

BACKGROUND:

In SECY-15-0137, "Proposed Plans for Resolving Open Fukushima Tier 2 and 3 Recommendations," dated October 29, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15254A008), the staff supplied the Commission with a grouping of the remaining open Tier 2 and 3 recommendations developed in response to the accident at the Fukushima Dai-ichi nuclear facility. The three groups described in that paper were: (1) recommendations that could be closed, (2) recommendations that the staff's initial assessment determined could be closed, but for which stakeholder interaction was warranted before finalizing the staff's assessment, and (3) recommendations for which the staff had not completed assessments, stakeholder interactions, and documentation.

CONTACTS: Joseph M. Sebrosky, NRR/JLD
301-415-1132

William D. Reckley, NRR/JLD
301-415-7490

The Commission approved the resolution plans in the staff requirements memorandum (SRM) dated February 8, 2016 (ADAMS Accession No. ML16039A175), and directed the staff to document the final results of the evaluations after interactions with external stakeholders and the Advisory Committee on Reactor Safeguards (ACRS). This paper provides the final results for the following Group 2 recommendations from SECY-15-0137:

- evaluation of reliable vents for other than Mark I and II containments
- evaluation of hydrogen control and mitigation
- evaluation of reactor and containment instrumentation enhancements

DISCUSSION:

In SECY-15-0137, the staff described its initial assessments for the Group 2 recommendations and a basis for closing those items after finalizing the assessments and having additional interactions with the ACRS and external stakeholders. The enclosed evaluations address the observations provided by the ACRS on the staff's initial assessments in their letter dated November 16, 2015 (ADAMS Accession No. ML15320A074). The staff's evaluations also benefited from external stakeholders' insights during a public meeting on January 7, 2016 (see ADAMS Accession No. ML16013A277 for a meeting summary), and additional interactions with the ACRS, as discussed in a second letter from ACRS dated March 15, 2016 (ADAMS Accession No. ML16075A330). The two enclosures to this paper include and expand upon the initial assessments in Enclosures 4 and 5 to SECY-15-0137, based on feedback from these stakeholder interactions. These enclosures include change bars to differentiate updated information from the initial assessments (the technical content of which is unchanged from SECY-15-0137).

The focus of the staff's evaluations remains on whether the NRC can appropriately justify new regulatory requirements, as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.109, "Backfitting," and related regulations and policies. In completing its assessment of these recommendations, the staff considered the existing regulatory framework; previously completed studies; various post-Fukushima safety enhancements, such as the development of mitigating strategies for beyond-design-basis events in response to Order EA-12-049; and relevant Commission policies. In particular, the staff considered if plant or procedure changes would improve the margins between estimated plant risks and the quantitative health objectives (QHOs) defined in the NRC's Safety Goal Policy Statement and thereby provide a substantial safety improvement.

As discussed in SECY-15-0137, the staff notes that even though the agency is completing work on specific post-Fukushima recommendations, studies related to the Fukushima accident and severe accidents will continue. An example is the NRC's research activities related to improving the understanding and modeling of reactor behavior during severe accidents. The staff will perform these longer-term activities under established programs and processes, which include engaging the Commission when appropriate.

Consideration of Reliable Vents for Other than Mark I and II Containments

In Recommendation 5.2, the NRC's post-Fukushima Near-Term Task Force (NTTF) recommended that the NRC assess whether to require installation of reliable, hardened venting systems for containments of other than Mark I and II designs (i.e., BWR Mark III containments,

and pressurized-water reactor ice condenser and large dry containments). The NRC addressed recommendations for Mark I and Mark II containments through actions such as the issuance of Order EA-13-109, dated June 6, 2013 (ADAMS Accession No. ML13130A067), and related guidance documents. A draft regulatory basis document describing possible additional actions for plants with Mark I and Mark II containments was given to the Commission in SECY-15-0085, "Evaluation of the Containment Protection and Release Reduction for Mark I and Mark II Boiling Water Reactors Rulemaking Activities," dated June 25, 2015 (ADAMS Accession No. ML15022A218). In the SRM to SECY-15-0085, dated August 19, 2015 (ADAMS Accession No. ML15231A471), the Commission directed the staff to take no further actions beyond those associated with the implementation of Order EA-13-109. In its SRM for SECY-15-0085, the Commission directed staff to leverage the draft regulatory basis when evaluating other containment designs to address NTTF Recommendation 5.2.

In Enclosure 4 to SECY-15-0137, the staff documented a preliminary analysis and conclusion that regulatory actions beyond those completed for Mark I and II containments are not warranted. The assessment benefitted from many analyses and studies performed for various containment designs. Major studies referenced in the initial assessment included NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," issued December 1990, and NUREG-1935, "State-of-the-Art Reactor Consequence Analyses Report," issued November 2012. The initial assessment also considered actions taken in response to Order EA-12-049 associated with containment protection. For this final assessment, staff performed additional computer simulations of the expected performance of plants with Mark III and ice condenser containments during long-term station blackout conditions. An assessment of estimated event frequencies, plant response, the timing of barrier failures, conditional release fractions, and other factors continue to show that overall safety, as characterized by margin to the QHOs, would not be substantially improved by additional containment improvements. These findings are consistent with previous generic evaluations and plant-specific assessments performed under the Individual Plant Examination program. The staff's analyses support the conclusion that additional capabilities for containment venting or other measures to address severe accidents for Mark III, ice condenser, or large dry containments would not provide a substantial safety enhancement and therefore additional regulatory actions are not warranted. The staff's completion of this assessment, as recommended by the NTTF and described in subsequent program plans, supports closing this activity. In addition, the March 15, 2016, letter from the ACRS agreed that no further regulatory action is warranted for closure of this recommendation on containment vents.

Evaluation of Hydrogen Control and Mitigation

The NTTF recommended that the staff assess the need to strengthen requirements associated with hydrogen control and mitigation inside and outside reactor containment buildings as part of NTTF Recommendation 6. In Enclosure 4 to SECY-15-0137, the staff documented a preliminary analysis and its initial conclusion that additional regulatory actions are not warranted in response to this recommendation. The assessment relied on the analyses performed for Mark I and Mark II containments under Order EA-13-109 and the resolution of hydrogen-related issues for Mark III and ice condenser containments under Generic Safety Issue 189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion during a Severe Accident." The analysis also considered safety enhancements made in response to Order EA-12-049 in both preventing core damage and mitigating the impact of hydrogen formed during a severe accident. For this evaluation, staff performed some

additional computer simulations of the expected performance of plants with Mark III and ice condenser containments during long-term station blackout conditions. The results of these additional analyses are consistent with previous studies and support the finding that maintaining hydrogen igniter capabilities during station blackout scenarios is useful in controlling and mitigating hydrogen for plants with Mark III or ice condenser containments. An assessment of estimated event frequencies, plant response, the timing of barrier failures, conditional release fractions, and other factors show that overall safety, as characterized by margin to the QHOs, would not be substantially enhanced by hydrogen control measures beyond those already taken. The staff's analyses support the conclusion that additional capabilities for hydrogen control and mitigation inside and outside reactor containment buildings would not provide a substantial safety enhancement and therefore additional regulatory actions are not warranted. The staff's completion of this assessment, as recommended by the NTTF and described in subsequent program plans, supports closing this activity. In addition, the March 15, 2016, letter from the ACRS agreed that no further regulatory action is warranted for closure of this recommendation on hydrogen control.

Reactor and Containment Instrumentation Enhancements

As part of its response to the Fukushima accident, the staff recommended studies beyond those needed to address the recommendations in the NTTF report. One such recommendation, which resulted from interactions with the ACRS, was to assess possible regulatory requirements for reactor and containment instrumentation to be enhanced to withstand beyond-design-basis accident conditions. In Enclosure 5 to SECY-15-0137, the staff documented a preliminary analysis and conclusion that regulatory action for instrumentation enhancements to improve severe accident management is not warranted. In the evaluation provided in Enclosure 2, staff provides additional discussion to address the observations provided by the ACRS in their letters dated November 16, 2015, and March 15, 2016, and insights provided by external stakeholders. For example, information was added to the final assessment describing technical support guidance for the severe accident management guidelines and related assessments of plant parameters and the status of safety functions that would be performed by plant personnel during a severe accident. The additional staff evaluations support the conclusion that regulatory actions to require enhancements to reactor and containment instrumentation to support the response to severe accidents would not provide a substantial safety enhancement and therefore additional regulatory actions are not warranted. The staff's completion of this assessment, as described in the program plans for the recommendation, supports closing this activity. In addition, the March 15, 2016, letter from the ACRS agreed that no further regulatory action is warranted for closure of this recommendation on enhanced instrumentation.

CONCLUSIONS:

Based on the evaluations summarized above and provided in the enclosures to this paper, the staff has determined that additional regulatory actions are not warranted in response to Recommendations 5.2 and 6 or the recommendation associated with enhancements to reactor and containment instrumentation. The staff bases this finding on conservative estimates of frequency-weighted risks to public health and safety in comparison to the NRC's established safety goals, insights from evaluations and agency decisions for Mark I and Mark II containments, past studies on the performance of other containment designs in terms of plant response and the timing of possible failures during severe accidents, Commission policies, and the significant safety improvement that has and will be achieved by various post-Fukushima

enhancements strengthening the preventative and mitigative capabilities at nuclear power plants. Based on its final assessment, the staff has concluded that additional enhancements as a result of these recommendations would not be justified when evaluated under the criteria in 10 CFR 50.109. The staff has completed the recommended assessments, made the needed regulatory decisions, and has closed these recommendations.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer reviewed the resource implications provided in SECY-15-0137 and had no objections. There are no additional resource implications associated with this paper.

/RA/

Victor M. McCree
Executive Director
for Operations

Enclosures:
1. Closure of Tier 3 Recommendations 5.2 and 6.0 – Reliable Hardened Vents for Other Containments and Hydrogen Control and Mitigation Inside Containment and Other Buildings
2. Closure of Tier 3 Additional Recommendation – Enhanced Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions

enhancements strengthening the preventative and mitigative capabilities at nuclear power plants. Based on its final assessment, the staff has concluded that additional enhancements as a result of these recommendations would not be justified when evaluated under the criteria in 10 CFR 50.109, "Backfitting." The staff has completed the recommended assessments, made the needed regulatory decisions, and has closed these recommendations.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer reviewed the resource implications provided in SECY-15-0137 and had no objections. There are no additional resource implications associated with this paper.

/RA/

Victor M. McCree
Executive Director
for Operations

Enclosures:
1. Closure of Tier 3 Recommendations 5.2 and 6.0 – Reliable Hardened Vents for Other Containments and Hydrogen Control and Mitigation Inside Containment and Other Buildings
2. Closure of Tier 3 Additional Recommendation – Enhanced Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions

ADAMS Accession Nos.: Package ML16049A079;
SECY ML16049A088; Enclosure 1 ML16049A291; Enclosure 2 ML16049A295 *via email
SRM-S15-0137-1 / WITS 201200144

OFFICE	NRR/JLD/LA*	QTE*	NRR/JLD/JHMB/PM	NRR/JLD/JOMB/PM	NRR/JLD/JOMB/BC
NAME	SLent	CHsu	JSebrosky	WReckley	GBowman
DATE	02/24/16	03/11/16	02/25/16	02/25/16	02/25/16
OFFICE	NRR/DRA/D*	NRR/DIRS/D*	NRR/DSS/D*	NRR/DE/DD*	NRR/DPR/D*
NAME	JGiitter	SMorris	TMcGinty	MRoss-Lee	LKokajko
DATE	03/16/16	03/10/16	03/01/16	03/11/16	03/8/16
OFFICE	RES/DRA/D*	RES/DSA/D*	RES/DE/DD*	NRO/DSRA/D*	NRR/JLD/D
NAME	RCorreia	MCase	KBrock	JMonninger	JDavis
DATE	03/16/16	03/14/16	03/11/16	03/10/16	03/16/16
OFFICE	OGC (NLO) *	NRR/D	EDO		
NAME	SClark	WDean	VMcCree		
DATE	03/17/16	03/ 24 /16	03/31 /16		

OFFICIAL RECORD COPY