February 15, 2013

MEMORANDUM TO: Matthew A. Mitchell, Chief
Projects Management Branch
Japan Lessons-Learned Project Directorate
Office of Nuclear Reactor Regulation

FROM: David H. Jaffe, Sr. Project Manager ***/RA/***
Projects Management Branch
Japan Lessons-Learned Project Directorate
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE NOVEMBER 27, 2012, PUBLIC MEETING WITH THE BOILING WATER REACTOR OWNERS GROUP, CONCERNING THE TEMPLATE FOR THE FEBRUARY 28, 2013, RESPONSE TO SECTION IV.C.1 OF ORDER EA-12-050

On November 27, 2012, the U.S. Nuclear Regulatory Commission (NRC) staff held a public meeting[1] with the Boiling Water Reactor Owners Group (BWROG) and industry representatives to discuss Recommendation 5.1 concerning reliable hardened vents (RHV) in the *Near-Term Task Force* [NTTF] *Recommendations for Enhancing Reactor Safety in the 21st Century* report, issued July 12, 2011.[2] A meeting attendance list is shown in Enclosure 1. The specific purpose of this meeting was to discuss the implementation of Section IV.C.1 of Order EA-12-050, regarding the submittal of an overall integrated plan for an RHV at boiling-water reactor facilities with Mark I and Mark II containments. The BWROG has developed a draft template that is intended to assist licensees with preparation of the integrated plans that are to be submitted to the NRC, as required by Section IV.C.1 of Order EA-12-050, on February 28, 2013. The BWROG made a presentation and discussed the draft template with the NRC staff to determine if it serves its intended purpose and is responsive to EA-12-050. The slides from the BWROG presentation can be seen in the Agencywide Documents Access and Management System (ADAMS) Accession No. ML12333A068.

The NRC staff requested that the February 28, 2013, submittal contain a fault tree analysis of the RHV. The staff considers the fault tree methodology to be a standard industry-accepted tool

[1] The meeting notice is available via the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML12319A234.
[2] The NTTF report is available under ADAMS Accession No. ML111861807.

for addressing reliability issues. The meeting attendees agreed that the staff should provide guidance on the fault tree methodology including examples. The guidance is contained herein as Enclosure 2.[3]

The BWROG indicated that the RHV was designed to be actuated from the control room; local action could also be accomplished in the plant. Radiation shielding assumes no post-accident fuel failure. The "Flex" strategies under NTTF Recommendation 4.2 include all strategies and associated equipment including the RHV.

The BWROG inquired as to whether the NRC staff had developed prioritization for issuance of the Safety Evaluations for the RHV submittals. The BWROG offered to provide such a list based on individual plant needs.

Enclosures:
As stated

[3] In a subsequent communication from the BWROG, the BWROG proposed that a Failure Modes and Effects Analysis should be used in lieu of the fault tree methodology.

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[1] In a subsequent communication from the BWROG, the BWROG proposed that a Failure Modes and Effects Analysis should be used in lieu of the fault tree methodology

Attendance List

DATE: November 27, 2012

MEETING: Public meeting with the BWR Owners' Group to discuss a template they have developed for the February 28, 2013, submittal to respond to EA-12-050

PLEASE PRINT CLEARLY

NAME	ORGANIZATION	PHONE NUMBER or E-mail (work)
David Jaffe	NRR/DNRL	301-415-1439
Jerome Bettle	NRR/DSS	
Nagasreeta Karipineni	NRR/DSS/SCVB	301-415-1041
DAVID RAHN	NRR/DE/EICB	301-415-1315
Tom Parker	Xcel	763-807-3916
Terri Farthing	GEH	910-819-5040
GREG BRAMER	Bechtel	301-228-6081
Charles Six	Bechtel	301-228-7946
Jana Bergman	Scientech	301 471 3505
Tom Axley	TVA	423 751 3524
Randy Bunt	SNC	205-992-7475
TED SCHIFFLEY	EXELON / BWROG	630-657-3897

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Fault Tree Logic Model for the Reliable Hardened Vents

The NRC staff requests that the reliable hardened vents (RHV) submittal provide a graphical fault tree logic model for potential undesired end states of the vent system, including Fail to Vent (Open) on Demand, Fail to Stop Venting (Close) on demand, Spurious Open, Spurious Close and Automatic Isolation from Other Systems. The model should display the chain of events /conditions leading to the undesirable event using standard logic symbols for fault trees (Top Event (undesirable state), AND Gate, OR Gate, Basic Event, etc.), depicting the fault tree logic flow to the event. Individual licensees should adapt the model to their design, add plant-specific labels for equipment, and quantify the tree by providing estimates of human error probabilities, basic component independent failure rates, and common cause failure rates.

This request should not be construed as a risk-informed action, but rather a logical engineering model to make clear the functional design and operational assumptions of the system. As is well known by now, the Fukushima Dai-ichi operators had a very difficult time opening the hardened vents. When they finally got the vents opened, the vents did not stay open long. The actions being taken for the U.S. Mark I and Mark II containments by the RHV Order will address many of the challenges faced by the operators at Fukushima. However, the entire range of issues related to the hardened vents at Fukushima is still not known, neither can they be fully foreseen for all possible ranges of external events, in spite of the best efforts by the engineers and designers of the RHV. The staff believes that a fault tree logic model will provide a better understanding of the system characteristics and identify potential contributors to failure so that the designers make appropriate considerations to reduce the potential for system failure.

The Order for implementation of a “reliable” hardened vent versus the GL 89-16 suggested vent for Mark I containments, is a clear realization that the original hardened vents are not sufficiently “reliable.” The staff recognizes that the Reliable Hardened Vent Order and the ISG do not contain specific requirements for fault tree logic models. However, fault trees are the universally accepted way to model system reliability (logic and failure rates) across numerous engineering disciplines. The fault tree methodology is used routinely in the nuclear power industry. The NRC staff has to be able to make an assessment of the functional design and a sense of “reliability” to determine the acceptability of licensees’ submittals. The fault tree model will provide the NRC staff with information that can reduce the duration of the review and potential RAIs. No numeric reliability target is explicit or implicit in the review.

NASA’s “Fault Tree Handbook with Aerospace Applications” (http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf) provides suitable examples of fault tree development.

With regard to the BWROG's presentation on November 27, 2012, the staff has the following pertinent comment on the apparent disagreement between Slide 20, 3rd Bullet and Slide 29:

> The discussion provided in Slide 20, 3rd Bullet does not agree with the figure on Slide 29, which shows that the SGTS inlet and outlet valves fail open. To the best of staff's knowledge, that is what most of the industry has (fail open) SGTS valves. Slide 20 seems to be stating that the valves are air-to-open and spring to shut. Is it the intent of these slides to convey that all SGTS valves will be changed to spring to shut? The staff would like to emphasize that the SGTS interface logic with the hardened vent will receive considerable attention during the course of licensee submittal reviews.