May 14, 2013

MEMORANDUM TO: William D. Reckley, Chief
Policy and Support Branch
Japan Lessons-Learned Project Directorate
Office of Nuclear Reactor Regulation

FROM: Rajender Auluck, Senior Project Manager **/RA/**
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SUBJECT: SUMMARY OF APRIL 4, 2013, MEETING TO DISCUSS ASSOCIATED WITH IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 5.1 RELATED TO CONTAINMENT VENTING SYSTEMS

On April 4, 2013, a Category 2 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives from the Nuclear Energy Institute (NEI), Electric Power Research Institute (EPRI), and Boiling Water Owners Group (BWROG) related to industry initiatives for the Implementation of Recommendation 5.1 of the Near-Term Task Force (NTTF) Recommendations for Enhancing Reactor Safety in the 21st Century report, issued July 12, 2011, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML111861807). The specific purpose of this technical meeting was to discuss, understand, and explore differences between the analytical tools used in MELCOR and MAPP computer modeling codes in analyzing severe accident conditions in boiling-water reactor (BWR) Mark I and Mark II containments.

The NRC staff opened the meeting by reiterating the main focus of the meeting and the need to understand the assumptions used, modeling differences, and results obtained by using MELCOR and MAPP computer codes for selected accident sequences. The staff stated that it is very important to have this understanding before making any recommendations or decisions. In their opening remarks, the industry representative thanked for this opportunity and fully agreed with the main purpose and focus of this technical meeting.

In their first part of the presentation, the NRC staff described key parts of the MELCOR computer code as used for analysis of containment venting in BWR with Mark I design. Specifically, the staff discussed accident sequences, mitigation strategies, MELCOR modeling details, and potential uncertainties. For the selection of accident sequences, three BWR accidents were stylized which were informed by information from the Fukushima accident, built on the NRCs State-of- the- Art Reactor Consequence Analysis (SOARCA) and earlier probabilistic risk assessment studies. Additional cases also included low probability high consequence events.

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These cases were also informed by information available from Fukushima accident and SOARCA. In regard to mitigation actions, the analysis assumed the availability of reactor core isolation cooling (RCIC), core and drywell spray, and containment venting. The staff further stated that for base cases, the staff assumed availability of 16 hours of RCIC, 300 gallons per minute of containment spray, and wetwell venting. Sensitivity analysis was performed by varying the spray flow rate and timing, wetwell versus drywell venting, and the duration of RCIC availability. The staff mentioned that possibly, there are three areas where differences in the two approaches may exist. These are: in-vessel accident progression, ex-vessel core debris behavior, and fission product transport. Uncertainties in the analysis included mass and composition of the relocated core debris, timing and location of vessel breach, and reflooding of the degraded core. These assumptions directly relate to the amount of hydrogen generation. As regards to ex-vessel core debris behavior, the uncertainties relate to drywell temperature, non-condensable production including hydrogen, and likelihood of drywell liner melt-through. There are also uncertainties with suppression pool decontamination factors. The staff ended the first portion of the presentation by stating that the staff believes that MELCOR computer modeling is close to true scenarios and do not plan to make any changes unless some new information is received.

The industry presentation began with agreeing with the NRC staff that there are uncertainties in the analysis and it is important to understand their impact. At this time, we need to keep our focus on what is needed for modification of the Order. Many other concerns including modeling, codes, and selection of sequences should be addressed in the rulemaking activity. The main items in the presentation included a discussion of postulated Mark II bypass scenario and severe accident conditions of interest as they relate to actions directed in the Commission's Staff Requirements Memorandum for SECY-12-0157. The industry representatives described the postulated Mark II bypass scenario as failure of the reactor vessel with core debris flowing into pedestal drain line then to outside containment, and fails in reactor building resulting in containment bypass. Furthermore, Mark II designs that significantly bypass this issue may not be applicable to all Mark II reactors. The industry representative referred the relevant performed earlier at the Oak Ridge National Laboratory and EPRI. The conclusions included that presence of water in drywell may preclude drain line attack altogether and that freezing in drain line is likely, if drain line contains water. Furthermore, this failure mode is not the dominant contributor to Mark II bypass scenario. With regard to drywell venting, the industry representatives stated that wetwell addresses the majority of the containment strategies and for drywell venting to be effective, it should be included as part of the rulemaking activity. The venting system component functionality should be based on pressure, temperature, and radiation capability of the primary containment. For severe accident capable vents, one needs to reevaluate the steam conditions, amount of hydrogen generated, radionuclides, and the temperature distribution in the containment. The other important parameters which must be considered include vent pipe size, routing, and ability to allow injection, which is part of the FLEX strategy. The industry concluded by stating that most of these issues will be addressed in the rulemaking activity.

In the second part of the NRC staff's presentation, the staff provided an overview of the insights learned from the relevant MELCOR and MAPP analysis results. These analyses were done for the Peach Bottom nuclear plant. The important items of note were the RCIC operation as part of sequence evaluation, and core melt progression. The NRC staff also provided results of MELCOR calculation for several case studies. The cases used different scenarios for RCIC

operation, wetwell venting, core spray, and drywell spray. The staff also noted that many of these cases were similar to the cases used in the MAPP analyses cases. The staff also offered to respond to any questions in future meetings after industry had the opportunity to review the results. In conclusion, both the NRC staff and industry representatives agreed that it was a very useful meeting, good exchange of information, and understanding of the modeling techniques used in the MELCOR and MAPP analyses of accident sequences.

Members of the public attended in person and through the telecommunications bridge-line and webinar. At designated points during the meeting, members of the public were invited to provide any comments on the presentations. Members of the public mainly asked clarifying questions, and there were some comments similar to previous comments received by the NRC. The NRC staff responded to all questions adequately.

A list of attendees is provided in ADAMS Accession No. ML13126A233. Presentation slides may be located through ADAMS Nos. ML13126A238, and ML13126A248.

Enclosures:
1. List of attendees
2. NRC Presentation slides
3. Industry Presentation Slides

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