

Severe Accident Management Guidance Support

Background

Following the Three Mile Island Unit 2 accident, the U.S. Nuclear Regulatory Commission (NRC) developed a plan (NUREG-1050 – August 1985) to resolve the severe accident generic issue. This plan identified that utility commitment to excellence in risk management, including prevention and mitigation, is key to protection of public health and safety; it also identified the need for new severe accident research. The requirements for an Accident Management Program were outlined by the NRC in SECY 88 012, which included accident management strategies, accident management training, calculation aids, instrumentation requirements, and utility organization and decision making for severe accidents.

In 1992, the Electric Power Research Institute detailed a technical basis for severe accident management in TR 101869. Following issuance of that report, each of the three Owners Groups (Westinghouse [WOG], Combustion Engineering [CEOG] and Babcock & Wilcox [B&WOG]) developed generic severe accident management guidance (SAMG) support material that served as a framework for each utility's SAMG program. In a docketed letter to the NRC, each utility committed to implementing and maintaining a plant-specific SAMG program based on the Owners Group products. Based on implementation questions, the CEOG subsequently developed additional computational aids for its SAMG and the WOG issued a Revision 1 to its SAMG. These SAMGs are one of the bases for the International Atomic Energy Agency (IAEA) requirements in Safety Guide No. NS-G-2.15.

After the Fukushima Daiichi accident in 2011, the NRC issued a draft procedure for inspection of the utility Severe Accident Management programs. These inspections will be conducted as part of the reactor oversight process and will focus on the utility's periodic maintenance of and training on the SAMG.

In addition, the NRC and the Institute of Nuclear Power Operators are reviewing the scope and content of the current SAMG programs in the United States with respect to insights learned from the Fukushima Daiichi accident to determine the extent to which program upgrades are appropriate.

Description

Through Westinghouse's extensive SAMG experience, it is well-equipped to assist customers with preparing for NRC inspections by:

- Updating the existing utility SAMG to the latest revision of the generic SAMG – many customers have not yet updated their existing SAMG for the changes made by the WOG in 2001.
- Performing a gap assessment for existing utility training and drills.
- Developing accident scenarios for drills and exercises.
- Updating the SAMG so that it reflects the current plant design and operation, considers the availability of all appropriate plant resources, and properly interfaces with plant abnormal operating procedures and emergency procedures.

Westinghouse is also capable of conducting SAMG training through its Westinghouse Training Program as well as supporting development of SAMG scenarios for training and exercises; it can also provide assistance in developing and running drills and exercises at the plant.

Finally, regulatory requirements for changes to SAMG programs that are expected from Fukushima Daiichi lessons learned may include:

- Developing SAMG for shutdown states and spent fuel pool accidents to be consistent with IAEA recommendations.
- Extending SAMG extreme external events, including the loss of all internal power (AC and DC power).

The Pressurized Water Reactor Owners Group will likely request Westinghouse to develop a generic update of the SAMG to address the coming regulatory requirements. Following that effort, Westinghouse can support the plant-specific implementation of those generic updates as well as provide training to customers.

Benefits

Diagnosis of severe accident conditions and the appropriate responses can be a complex task since there is a wide range of potential scenarios and plant conditions. The SAMG provides an effective and efficient method for the Technical Support Center and/or control room personnel to diagnose the plant conditions through a symptom-based approach.

- This permits diagnosis of challenges and the selection of the most appropriate response to be performed in an engineering environment, where both positive and negative impacts of any action and the exact plant configuration are considered.
- This permits consideration of uncertainties due to imperfect knowledge of plant conditions and severe accident phenomena.
- This includes methods to verify instrumentation accuracy when instrumentation was not designed for severe accident conditions.
- This symptom-oriented approach minimizes the chances for confusion and human error during implementation.

The SAMG provides a clear change in primary focus for the emergency response team, from efforts

to avert core damage, to efforts to limit core damage progression and protect fission product boundaries.

Westinghouse is the foremost worldwide developer and supporter of SAMG programs and has had a strong influence on the development of accident management regulatory requirements.

Westinghouse has developed plant-specific SAMG programs, including SAMG training for Westinghouse, Combustion Engineering, Babcock & Wilcox and VVER plant designs. It has also developed and implemented SAMG for spent fuel pool accidents and plant shutdown states in some European applications. As an active participant in new plant construction and design, including the AP1000® nuclear plant and the advanced boiling water reactor, Westinghouse has developed SAMG for the next generation of reactors, extending the concept of an integrated accident-management program.

Westinghouse has had extensive interactions with the IAEA and regulators in the United States and Europe in the development of requirements for severe accident management programs.

Westinghouse and its subsidiary Fauske & Associates LLC have considerable expertise in modeling severe accident phenomena using a wide range of severe accident computer codes to provide an integrated assessment of the potential benefits of severe accident mitigation features. Westinghouse has been involved in the development and implementation of a number of these features in the United States and Europe.

Based on its extensive knowledge of severe accident management, Westinghouse is participating in a number of worldwide severe accident management projects so that the SAMG reflects lessons learned from the Fukushima Daiichi accident.

Westinghouse can also provide integrated engineering solutions for plant hardware upgrades or modifications that can resolve any weaknesses identified during the development of updated plant-specific SAMG programs.

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