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# **IAEA Workshop on the Development of Severe Accident Management Guidelines Using the IAEA's SAMG Development Toolkit**

**Lecture 23a**

**Regulatory Role in SAMG**

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## **IAEA Fukushima Accident Report – Section 2.5:**

- The National Accident Independent Investigation Commission of the Japanese Diet stated:
  - ***“The laws and regulations governing Japan’s nuclear power industry at the time of the accident were outdated relative to those of other countries and, in some cases, obsolete.”***

## **Lessons Learned:**

- The regulator should require that the operator of a facility update its safety demonstration on an ongoing basis to reflect changes in the status of the facility.
- Regulatory independence, competence, strong legislative authority and adequate resources, including qualified personnel, are essential in order to perform the required regulatory functions.
- The regulatory body needs to review and inspect the safety of a facility throughout its lifetime.

- **Regulation**

- Regulatory requirements and supporting guidance are needed for licensees to develop, implement and evaluate SAMG
- Typically provided via legislation and rule making
- IAEA provides safety requirements and safety guides that should be considered by member countries (NS-G-2.15, SRS-32)

- **Inspection & Enforcement**

- Inspections performed to assess compliance with requirements
- Inspection criteria provided to ensure a comprehensive and consistent review is performed
- Assessment of capabilities to utilize SAMG through simulated drills and exercises
- Tie to Reactor Oversight Process & SDP

- **Regulatory Incident Response**

# US Regulatory Actions

- Initial actions – two temporary NRC inspection procedures that directed power plant operators and NRC inspectors to:
  - **TI-183**: Confirm the reliability of licensees' strategies intended to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire.
  - **TI-184**: Inspect the readiness of nuclear power plant operators to implement severe accident management guidelines.

Summary of Inspection Results for TI 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"

Plant / Site	Region	03.01(a)				03.01(b)	03.01(c)	03.01(d)	03.01(f) (see footnote 2)			03.01(g)
		Does the licensee have SAMG procedures? (see footnote 1)	Are controlled copies of the SAMG located in the technical support center (TSC)? (Y/N)	Are controlled copies of the SAMG located in the emergency operations facility (EOF)? (Y/N)	Are controlled copies of the SAMG located in the control room? (Y/N)	Are SAMGs covered by the licensee's procedure control and document management system, including the requirements for periodic review and revision? (Y/N)	Does the licensee's configuration control and change management systems (e.g., 10CFR50.59 process) cause the licensee to update SAMGs to reflect design changes? (Y/N/Partially)	Are the SAMGs consistent with the owners group guidance (if any) having been incorporated? (Y/N)	Did personnel receive initial training on the SAMGs? (Y/N)	Did personnel receive periodic training on the SAMGs and how they relate to their assigned duties? (Y/N)	Can personnel articulate their responsibilities with respect to the use of SAMGs? (Y/N)	Have there been periodic exercises on the use of SAMGs by individuals who would implement them during an emergency? (Y/N)
Beaver Valley	I	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Calvert Cliffs	I	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Fitzpatrick	I	Y	Y	Y	Y	N	Y	Y	N	N	N	N
GINNA	I	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Hope Creek	I	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Indian Point 2	I	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Indian Point 3	I	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Limerick	I	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Millstone	I	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Nine Mile Point	I	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y
Oyster Creek	I	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Peach Bottom	I	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y
Pilgrim	I	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Salem	I	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Seabrook	I	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
Susquehanna	I	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N
Three Mile Island	I	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Vermont Yankee	I	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Browns Ferry	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Brunswick	II	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Catawba	II	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Crystal River	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Farley	II	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Harris	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Hatch	II	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N
McGuire	II	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
North Anna	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Oconee	II	Y	Y	N	N	N	N	Y	Y	Y	Y	Y
Robinson	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Sequoyah	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
St. Lucie	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Summer	II	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N
Surry	II	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Turkey Point	II	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N
Vogtle	II	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Watts Bar	II	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Braidwood	III	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y
Byron	III	Y	Y	N	Y	N	Y	Y	N	Y	Y	N
Clinton	III	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y
D.C. Cook	III	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N
Davis-Besse	III	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N
Dresden	III	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Duane Arnold	III	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fermi	III	Y	Y	N	Y	N	Y	Y	Y	N	N	N



# US Regulatory Actions

## Summary of Inspection Results for TI 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)"

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Kewaunee	III	Y	Y	Y	Y	N	Y	N	Y	N	Y	N
LaSalle	III	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y
Monticello	III	Y	Y	Y	Y	N	Y	Y	Y	N	N	N
Palisades	III	Y	Y	Y	N	N	Y	Y	N	N	N	N
Perry	III	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
Point Beach	III	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Prairie Island	III	Y	Y	Y	Y	N	Y	N	N	N	Y	Y
Quad Cities	III	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Arkansas Nuclear	IV	Y	Y	Y	Y	N	Partially	Y	Y	Y	Y	Y
Callaway	IV	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
Columbia	IV	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Comanche Peak	IV	Y	N	N	N	N	N	N	Y	Y	Y	N
Cooper	IV	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Diablo Canyon	IV	Y	Y	Y	Y	Y	Partially	Y	Y	Y	Y	Y
Fort Calhoun	IV	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Grand Gulf	IV	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Palo Verde	IV	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N
River Bend	IV	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
San Onofre	IV	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y
South Texas	IV	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Waterford	IV	Y	N	N	N	N	Partially	Y	Y	Y	Y	Y
Wolf Creek	IV	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

(1) See the individual plant data sheets regarding information on "when the SAMGs were last updated" as referred to in TI 2515/184 Section 03.01(a).

(2) Specific answers to training questions associated with Inspection Item 03.01(e) are not included in the matrix, however, an overview of the training program is included in the matrix under Item 03.01(f). The

# US Regulatory Actions

- On March 23, 2011, the NRC established the “Near-Term Task Force” (NTTF), to review Fukushima Daiichi events and make recommendations for potential improvements to the safety of U.S. nuclear power plants
- On July 12, 2011, the NTTF issued its report, titled, “Near-Term Report and Recommendations for Agency Actions Following the Events in Japan”
- **NRC staff prioritized the NTTF recommendations using a three-tiered approach:**
  - **Tier 1** recommendations were those actions that should be put into place without unnecessary delay.
  - **Tier 2** recommendations were those actions that needed further technical assessment or required personnel with critical skill sets who were engaged in working on the higher priority Tier 1 recommendations.
  - **Tier 3** recommendations were longer-term actions that were dependent on the completion of a shorter-term activity or needed greater study to support a regulatory action.

# US Regulatory Actions

- To support Tier 1 actions, the NRC issued three orders on March 12, 2012, with the following requirements for operators:
  - The **mitigating strategies order** requires licensees to develop strategies to maintain key safety functions for an indefinite period of time following a beyond-design-basis natural event.
    - Industry response was to develop FLEX
  - The **spent fuel pool instrumentation order** requires licensees to install reliable level instrumentation in their SFPs.
  - The **hardened containment vent order** requires licensees of certain types of reactors to have reliable hardened vents for their containments. The ability to vent these containments is needed to control temperature and pressure inside the containments and is important in preventing fuel damage, particularly during a long-term station blackout events
    - In June 2013 the NRC modified the order to ensure those vents will remain functional in the conditions following reactor core damage.



# US Regulatory Actions

- In addition to the three Orders, the NRC required issued an “**Information Request**” that directed utilities to take the following actions:
  - Conduct examinations of existing seismic and flood protection measures and report the results to the NRC
  - Reevaluate seismic and flooding hazards at each site using present day methods and inform the NRC of the results of those assessments
  - Conduct an assessment of capabilities associated with emergency preparedness communication and staffing for multi-unit and large scale events and report the results to the NRC

- **Proposed Rule on Mitigation of Beyond-Design-Basis Events - Integrated Response Capability:**
  - Beyond-design-basis external event mitigation
    - Regulation to cover Order EA-12-049 (FLEX)
  - Extensive Damage Mitigation Guidelines (EDMGs)
  - Severe Accident Management Guidelines (SAMGs)
    - Currently voluntary industry initiative
    - Regulation would require SAMGs
  - Integrate with Emergency Operating Procedures (EOPs)
  - Staffing and command and control required for Order EA-12-049 (FLEX) implementation
  - Training
    - Require Systematic Approach to Training (SAT) for EOPs and SAMG
  - Drills to provide assurance that guideline sets are integrated and can be used
- **Inspection under Reactor Oversight Process**

- **Inspection of utility implementation of NRC Orders**
  - Temporary Instruction (TI) 191 issued to provide inspection guidance for confirmation of NRC Orders
    - Mitigation strategies for beyond design basis events
    - Spent fuel pool instrumentation
    - Communications/staffing for large-scale events
  - Inspector training completed on TI
  - Pilot inspection conducted at Watts Bar in March 2015
    - Procedure adequacy gaps
    - Labeling and identification of equipment
  - Assessment panel formed to ensure consistent treatment of inspection findings
  - Inspections in progress at all US nuclear stations

# SRS-32 Draft Revision

## Insights on Regulatory Role

### Overall objectives of regulatory evaluation SAMG:

- Assess whether a licensee has developed a plant-specific SAMP in compliance with regulatory requirements and/or industry standards and has effectively integrated the SAMGs with other emergency procedures, including EOPs and other supporting guidelines.
- Assess whether the SAMP is supported by appropriate equipment and instrumentation, to ensure informed decision making during the implementation of SAMGs
- Determine that licensee personnel are effectively trained on roles and responsibilities as they relate to SAMG implementation
- Measure a licensee's capability to conduct SAMG exercises and develop corrective actions associated with exercise lessons learned
- Identify areas for improvement such that licensees can enhance NPP defense-in-depth to the extent practicable
- Although SAM verification/validation is a responsibility of a licensee, regulatory evaluation of a SAMP could provide feedback to the licensee who can use it to increase the level of SAMG verification and validation.

# SRS-32 Draft Revision

## Insights on Regulatory Role

**As part of a formal SAMP evaluation, the following activities reflect the current practices of some regulators and industry oversight organizations:**

- **Desktop review of the SAMG documentation.** The purpose of this review is to assess the comprehensiveness and adequacy of a generic or plant-specific SAMG documentation. The activity also helps the regulatory staff have a better understanding of the technical basis of the SAMG under evaluation.
- **Assessment of SAMG strategies and actions through analytical simulations.** This activity involves a limited number of numerical simulations of severe accident progression with or without crediting key strategies/actions specified in the SAMG being evaluated. The aim is to supply the evaluators with supplementary information required to understand and characterize those strategies/actions in such a way that the feasibility and efficiency of those actions under severe accident conditions can be informed or assessed.



# SRS-32 Draft Revision

## Insights on Regulatory Role

- **Evaluation of SAMG training requirements and results.** This evaluation is to assess the adequacy of the training requirements for the NPP personnel responsible for execution of SAMG. The training requirements and the scope of the personnel training are expected to be commensurate with their roles and responsibilities defined in the SAM program. This evaluation may also include a review of the organizational structures, communication and decision making protocols for SAM and emergency response.
- **Evaluation of SAM exercises.** The established plant-specific SAMG is often exercised in various ways including table-top exercises, plant walk-throughs and group discussions with postulated severe accident scenarios. This type of exercises not only demonstrate how the SAMG documents are used by staff under a simulated stressful environment, but also obtain feedback from the users' points of view and identify areas for improvement. Hence, independent evaluation of SAMG exercises is a necessary activity of assessing the usability of the SAMG documentation.
  - Observation of plant severe accident drills/exercises
  - Review of SAM exercise reports

# SRS-32 Draft Revision

## Insights on Regulatory Role

- **Interviews or discussions with plant staff responsible for SAM.** This activity may require a site visit, which provides an opportunity to discuss the important aspects identified from the SAMG desktop review and evaluation with the plant staff including the TSC staff. The question and answer mode of discussions helps the assessment of the plant staff's familiarization with the SAMG documents and their performance under severe accident conditions.
- **Integration of the above into an overall assessment of SAM effectiveness.** This is an overall evaluation in considerations of the results and feedback from all the above activities or other relevant activities related to SAMG verification and validation. Use of other measures such as those specified in Emergency Mitigating Equipment Guidelines (EMEGs) or FSGs for onsite and offsite supplementary or portable equipment and instrumentation should be considered in such an integrated assessment.



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# **End of Lecture 23a**

## **Regulatory Role in SAMG**

