SEVERE ACCIDENT MANAGEMENT GUIDELINES

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The events at Fukushima Daiichi have highlighted the importance of Severe Accident Management Guidelines (SAMGs). As the world has learned from the catastrophe and countries are considering changes to their nuclear regulatory programs, the content of SAMGs and their regulatory control are being evaluated. This presentation highlights several factors that are being addressed in the United States as rulemaking is underway pertaining to SAMGs. The question of how to be prepared for the unexpected is discussed with specific insights gleaned from Fukushima.

RADIATION PROTECTION ISSUES RAISED IN KOREA SINCE FUKUSHIMA ACCIDENT

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For the past 3 years since Fukushima accident, various issues related to nuclear safety and radiation safety were raised in Korea. This presentation focuses radiation protection (RP) issues among the various issues and has the purpose to share experiences and lessons-learned related to the RP issues.

Special safety inspections on NPPs in Korea were performed immediately after Fukushima accident and 50 follow-up measures were established in May, 2011 to improve the nuclear safety. Some of them were related to radiation protection and emergency responses. Recently, in March, 2014, additional follow-up measures were decided to be taken in additionally strengthening safety-related equipment and emergency response organization.

The 50 Fukushima-accident-follow-up measures include radiation protection for members of the public in emergency responses. Based on the follow-up measures, expansion of emergency planning zone (EPZ) is to be made according to the approval of legislation by National Assembly on May 2, 2014.

For the past 3 years, the degree of the public concerns on radiation risk has been the highest. Spontaneous activities for radiation monitoring happened in the public. Some members of the public found some contaminated paved roads in November, 2011 and a contaminated kitchen ware in January, 2012. These findings suggest the importance of the management of recycled metal scraps imported from other countries.

Fukushima accident gave much impact on Korean society all. The public gets very sensitive to issues about nuclear safety and radiation safety. Most parts of RP issues raised are related to the public. The lessons-learned are that as an issue is raised, it has a chance to be solved. However, RP issues related to radiation workers in accident conditions in NPPs are difficult to be raised enough to confirm and improve the robustness of radiation protection programs in accident conditions. It is necessary to share RP issues raised in each country as well as experiences and lessons-learned. Then, the shared information could help to enhance RP programs in each country in different conditions.

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Perspectives on Regulation of Severe Accident Mitigation

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Outline of Presentation

- Motivation
- History
- Pertinent Issues
  - Responding to the unknown
  - Technical basis
  - Periodic exercise
  - Training needs
  - Regulatory footprint
- Summary

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Motivation

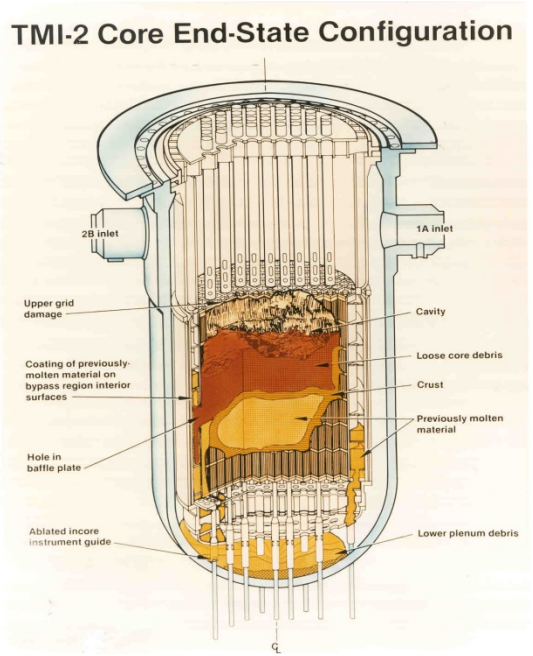
The impact of the tsunami was totally bigger than what we expected, trained, prepared for, or believed was possible—it was unimaginable. We must always be prepared for the possibility that something much bigger can happen.

Ikuo Izawa, Shift Manager Fukushima Dai-ichi Units 1 and 2

We need to be **prepared** for the **unexpected**. How do we do it?

Historical View

- 1979 Three Mile Island accident demonstrated the importance of operator actions in both contributing to accidents and also recovery
- Severe accident research programs and analytical tool development
- April 26, 1986 Chernobyl
- Symptom based SAMGs in 90's
- Attacks of September 11, 2001
  - New accident scenario
  - Use of portable equipment
- Fukushima on March 11, 2011
  - Emphasized the risk of external events
  - Highlighted the importance of site wide risk
  - Daiini actions prevented core damage



Responding to the Unknown

External events tend to dominate risk in part due to large uncertainties.

External events are highly site specific which limits the benefit of operating experience.

SAMGs should be symptom based and provide operators with the flexibility to respond to a wide variety of possible scenarios.

Plants should have readily deployable offsite assets.

Daini demonstrated the value of portable equipment and flexible strategies.

Training and Exercise

- Manual actions introduce failure modes that must be minimized by training and exercise.
- Implementation of SAMGs involves technical decision-making. Reliable communications are necessary.
- Operator actions need to consider the possible environmental factors, including radiation levels.
- Training and exercise should not be done at the expense of more probable events.

Plans are nothing. Planning is everything

President Eisenhower

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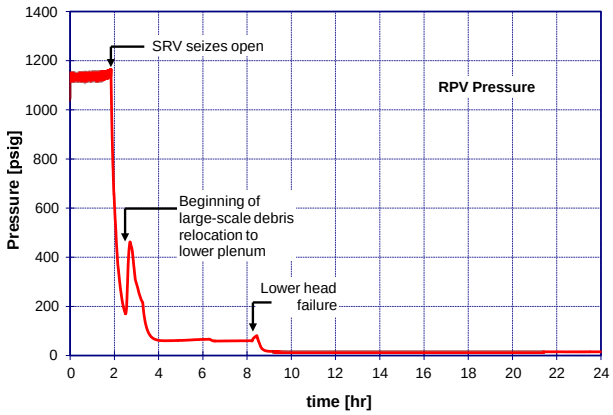
Technical Basis

Severe accident behavior is complex and validated analytical tools are of use in devising SAMGs.



Due to uncertainties in the tools as well as the plant conditions, symptom rather than scenario based SAMGs are preferred.

Best-estimate calculations can provide more accurate timelines which may allow more effective measures. There may be more time than older analyses would have indicated.
NUREG 1935, “State-of-the-Art Reactor Consequence Analysis.”

SAMG decision-makers need strong technical and leadership skills.

Regulatory Footprint

- US Experience
  - SAMGs implemented by voluntary measures
  - Inspections showed inconsistent implementation
  - Currently pursuing rulemaking
- Several issues should be considered in any requirements
  - Technical Basis
  - Training and Exercise
  - Communications, staffing and roles and responsibilities
  - Availability of equipment
  - Multi-unit specific issues
- SAMGs require adequate communication, equipment, personnel and communication to be successful.

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Summary

- SAMGs can help us respond to the unexpected
- Uncertainties in external events will always be present
- SAMGs should be based on a firm technical basis using state-of-the-art analytical tools
- SAMGs should be flexible and not scenario based
- Offsite support can help address uncertainties
- Training and exercise is vital
- SAMGs should have a regulatory footprint