Safety Principles and Guidance for SMRs

Mr. Stewart Magruder
Regulatory Activities Section
Department of Nuclear Safety and Security
General Thoughts

- SMRs should be treated as NPPs – with some exceptions
- Examples will be mostly based on U.S. NRC experience
- The international community has many ways of providing assistance
IAEA safety standards

What must be achieved
Fundamental safety objective and 10 principles “to protect people and the environment from harmful effects of ionizing radiation”

What shall be done
Requirements that must be met to ensure protection of people and environment – ’shall’

How it should be done
Recommended ways of meeting the requirements – “should”
IAEA safety standards

http://www-ns.iaea.org/standards/
FUNDAMENTAL SAFETY PRINCIPLES

1. User has responsibility for safety

2. Need an effective legal and regulatory framework

3. Strong leadership and management for safety is important

4. Must be an overall benefit from the activity considering the risk

5. Protection should be optimized to provide highest level of safety than can reasonably be achieved
6. No individual should bear unacceptable risk
7. Protect people and environment, present and future.
8. Take practical efforts to prevent and mitigate accidents
9. Emergency preparedness and response arrangements must be made
10. Protective actions to reduce radiation risks must be justified and optimized
IAEA Approach

• General and Licensing Process Standards:


IAEA Approach (cont’d.)

• Plant Design
  – Design review and approval by the regulatory body.
  – The applicant for authorization for construction should submit a basic design to the regulatory body before construction begins.
  – Regulatory control on the detailed design.
IAEA Approach (cont’d.)

• Construction
  – The applicant or licensee requires an authorization before starting construction.
  – The regulatory body reviews the following areas:
    • Management system.
    • Site evaluation.
    • Design features important to safety and security.
    • Safety analysis.
    • Organizational and financial arrangements for decommissioning, radioactive waste management and spent fuel management.
• Commissioning
  – SSR 2/2, “Safety of Nuclear Power Plants: Commissioning and Operation”
  – Two phases: non-nuclear testing and nuclear testing.
  – Review the applicant’s commissioning program/plan.
  – Establish hold points.
  – Review and approval of the commissioning test results before authorizing routine operation; this is where the regulator wants to witness particular tests.
IAEA Approach (cont’d.)

• Operation
  – Authorization for commencing routine operation.
    • Results of commissioning tests.
    • Operational limits and conditions.
    • Operating instructions and procedures and adequacy of staffing.
    • Emergency preparedness and response; and
    • Final Safety Analysis Report.
  – Oversight of safe operation.
What is different about licensing SMRs?

• More passive safety features
• Slower accident progression
• Smaller source term
• Multiple modules
• Manufactured in a factory
• Security by design
Control Room Staffing

• Issue: Appropriate number of on-site licensed operators

• Proposed Resolution (SECY-11-0098):
  – Near-term - Allow SMRs to deviate from existing regulations through exemption requests.

  • Task analysis will be critical to the staff’s review of an applicant’s human factors engineering (HFE) program.

  – Long-term – Possible Rulemaking to change staffing requirements for SMRs
Physical Security

• SMRs should have an appropriate number of security staff and corresponding size of the protected area that reflect:
  – Design and engineering features
  – Reduced reliance on human actions

• Safety and security should be designed into plants irrespective of capacity

• Applicants should have a basis for approaches that apply design features and small security forces and NRC will be ready to listen

• The staff presented positive assessment of current regulatory framework to U.S. NRC Commission in SECY-11-0184
Emergency Planning

• Issues:
  – Appropriate size of the EPZ
  – Extent of onsite and offsite emergency planning
  – Appropriate number of response staff needed
  – Alert and notification requirements

• Proposed Resolution:
  – NRC exploring possibility of generic resolutions to emergency planning requirement issues for SMRs
  – The staff proposed a new, dose-based, approach for SMRs in SECY-11-0152
Appropriate Source Term

• Longer time before release?
• Credit for more scrubbing?
• Risk-informed approach to multiple modules?
• Additional testing required
Environmental Reviews

- Potentially different scenarios for construction of multiple modules
- Consider cumulative impacts
- Reasonable alternatives to SMR
- COL/ESP-ISG-027, "Interim Staff Guidance on Specific Environmental Guidance for Light Water Small Modular Reactor"
Opportunity for Risk-Informed Reviews

- **U.S. NRC - SECY 11-0024**
  - Staff performs “Risk-Informed and Integrated” review
  - Considers both safety category and risk significance
  - Graded review approach
  - Near-term focus on iPWR licensing reviews

- **Design Specific Review Standard (DSRS)**
  - Similar to the Standard Review Plan (SRP), but adapted for a specific design
  - Engage designers, potential licensees, and stakeholders in meaningful pre-application interactions
  - Identify and resolve key technical and policy issues
  - Incorporate lessons learned from recent licensing reviews
IAEA Assistance concerning Safety

- Establishment of national, organisational strategies
  - Encompass the 4 pillars. Responsible: National governments, to which the IAEA can provide support and expertise
  - Training courses, workshops, peer-review, FSs/SVs
  - Cooperation with existing networks: RCF, TSO, ANNuR, FNRBA…
  - Competence and Knowledge Management system: sustainability, continuous improvement
‘Nuclear Safety Infrastructure is the set of:
- institutional
- organizational
- technical
elements and conditions established in a MS to provide a sound foundation for ensuring a sustainable high level of nuclear safety.’
1. Road-map to gradually apply the IAEA Safety Standards

2. Self Assessment and Safety Review Services.

3. Training framework for embarking countries.
Embarking Countries Portal

https://gnssn.iaea.org/regnet/embarking/Pages/default.aspx

WEB Link: Safety Packages based on SSG-16
The IAEA has developed Safety Packages based on INSG-16 to assist in the establishment of a nuclear safety infrastructure. The Safety Packages are a collection of the information contained in INSG-16 with Safety Standards, Peer Reviews, IAEA Assistance (Education & Training, Advisory Services, Research Publications) and knowledge networks outlined. The packages are divided into 11 Thematic Modules, following and merging the 20 elements of INSG-16. The packages give guidelines as to who is responsible (e.g., Government, Operating Organization, Regulatory Body), what the actions are, and when the actions should be taken place according to the 3-phase approach, and how the Agency can assist through appropriate peer review services, advisory services, education and training and networks and tools.

A comprehensive catalogue of workshops, including their scope and syllabus has been developed and has been included as part of the safety package for Module 1: Legal Governmental and Regulatory Framework for Safety. The workshops are offered by the IAEA targeting primarily the staff of regulatory bodies but also applicable to other governmental organizations, operating organizations and technical support organizations. The workshops address the following topics:

- **WS1**: Workshop on Developing National Infrastructure including Governmental, Legal and Regulatory Infrastructure for Safe Implementation of Nuclear Power Programmes
- **WS2**: Workshop on Regulatory Framework
- **WS3**: Workshop on Safety Regulations
- **WS4**: Workshop on Licensing Process
- **WS5**: Workshop on Safety Review and Assessment by the Regulatory Body
- **WS6**: Workshop on Regulatory Impediment and Enforcement
- **WS7**: Workshop on Interactions with the Public and Other Interested Parties in Regulatory Activities
- **WS8**: Workshop on Management Systems for the Regulatory Body
- **WS9**: Workshop on Staffing the Regulatory Body and Development of the Competencies for the Conduct of Regulatory Functions, including the Use of External Support Organizations
- **WS10**: Regulatory Activities Section - Scope of Regulations (under development)

The detailed syllabuses of the workshops are posted at:

**IEA Initiative to Strengthen Assistance Capabilities** - Development of "Exemplary Training Material" in support to Specialized Workshops to strengthen technical and managerial competence of staff of the Regulatory Bodies - emphasis on the Organizational Development
Thank you for your attention!