6th INPRO Dialogue Forum on Global Nuclear Energy Sustainability: Licensing and Safety Issues for Small and Medium-sized Nuclear Power Reactors (SMRs)

29 July - 2 August 2013
IAEA Headquarters, Vienna, Austria

Final Report of Group-1
Considerations for SMR Designs

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The group initially focused on a list of key issues provided by the team leadership. These issues include:

- Defence in depth in plant design
- Suitable DiD approach to manage international standardization
- Operational Reliability of the Integral PWR’s (iPWR) SMR designs
- I&C in SMRs and plant staffing
- Safety analyses challenges
- Fukushima lessons learned

The case studies were used to trigger the discussion
Method

- As a method for refocusing the group relative to the SMR issues of concern, the group was asked to review the content of IAEA Safety Standard SSR-2/1 - *Safety of Nuclear Power Plants: Design*
- The group reviewed all of the requirements (82) and discussed at a high level which elements required additional discussion to assure that SMR features were adequately addressed.
- The group identified a list of 19 key design requirements that may require additional consideration
- Each participant was given an opportunity to express their views considering these topics
- Detailed comments will be presented in the final report of this Dialogue Forum
Findings

Major findings and considerations:

• **Defence in Depth philosophy do not need any modification**

• The **multi-module** SMR designs require specific consideration

• **I&C** (especially remote locations) and **human factors** (operator actions and multiple reactors in common control room)

• Knowledge sharing of **new engineering features** (for safety analyses and approval of the reliability, e.g. modelling and experimental data)
Issues of interest in the SSR 2/1

- **Requirement 11**: Provision for Construction (4.19)
- **Requirement 17**: Internal and external hazards (5.16 – 5.22)
- **Requirement 23**: Reliability of items important to safety (5.37 – 5.38)
- **Requirement 35**: Nuclear power plants used for cogeneration of heat and power, heat generation or desalination
- **Requirement 53**: Heat transfer to an ultimate heat sink
- **Requirement 54 & 57**: Containment system for the reactor and Access to the containment
- **Requirements 65 & 66**: [Instrumentation and Control System] Control room (6.39 – 6.40) and Supplementary control room (6.41)
- **Requirement 68**: Emergency power supply (6.43 – 6.45)
- **Requirement 77**: Steam supply system, feedwater system and turbine generators (6.56 – 6.58)
- **Requirements 15, 16, 17, 18, 20, 24** (Safety Analyses) – Separate meeting to consider and discuss these requirements may be necessary

Recommendations

- IAEA Safety Standard SSR-2/1 (*Safety of Nuclear Power Plants: Design*) in most parts are consistent with SMR features and capabilities, however based on the group discussion we recommend that
  - The standard should be kept technology neutral
  - Our comments to facilitate the development and deployment of SMRs will be provided to the group that is responsible to revise this safety standard
- Meetings should be organized by IAEA to discuss novel aspects of multi-module plants (e.g. operational, control room, I&C, ...)
- I&C for remotely controlled SMRs, including satellite links and cyber security is recommended to be included in studies of IAEA’s *Nuclear Power Engineering section* on Instrumentation and Control Technologies

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Group 5 – Public participation

- The strong safety case offered by SMRs should be communicated to advance public acceptance.
- Newcomer countries need simple and easily understandable means to convince the public, stakeholders and decision makers that reactors under consideration will protect the health and safety of the public.
- For full public participation and acceptance of SMR technology, it is important that the regulatory process provide adequate protection of vendor and supplier intellectual property.
Cross cutting issues

- Multi-module designs, human factors, remote control, I&C - (Group 4)
- Internal versus external hazards - (Groups 2 and 4)
- Emergency planning zone (exclusion zone) - (Groups 2 and 4)
- Physical security, transportation of the fuelled nuclear power unit - (Groups 2 and 4)