Security Considerations for Small Modular Reactors (SMR)

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Presentation Outline

- SMR Considerations
- Potential Growth
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- Regulatory Framework
- Security Considerations
- Conclusion

SMR Considerations

The recent emergence of Small Modular Reactors (SMR) has significant potential to provide energy in numerous countries.

The substantial reduction in costs, maintenance, and ease of operation has unlimited potential for the use of Small Modular Reactors in a wide range of environments and geographical locations.

Security of Small Modular Reactors needs to be considered in advance to incorporate Security by Design.

SMR Potential Growth

Small Modular Reactors (SMR) are currently in the review and approval process in numerous countries.

Significant progress could be made in the next 10 to 20 years to provide nuclear energy that could not have been achieved with traditional methods.

It is crucial to consider the security implications of such facilities and the potential consequences in the event of a malicious act compared to those for traditional nuclear power plants.

The target sets associated with sabotage of this technology would be limited as well due to its smaller commercial and operational footprint.

SMRs Currently in Design Phase

Current SMR Research and Development Activities

There are currently at least 31 types of SMRs under consideration in various countries. These SMRs have unique characteristics and each present positive aspects and potential challenges that would need to be addressed. The SMRs vary by technology, size, scalability implementation, modal deployment and portability.

Type of Reactor	Number of Unique Reactors	List of Countries Currentlly Developing SMRs
Water- Cooled	22	Argentina, Canada, China, France, India, International Consortium, Italy, Japan, ROK, Russian Federation, USA
High –Temp Gas-Cooled	9	China, Japan, Russian Federation, South Africa, USA

Table 1: Types of Reactors (IAEA, 2014)

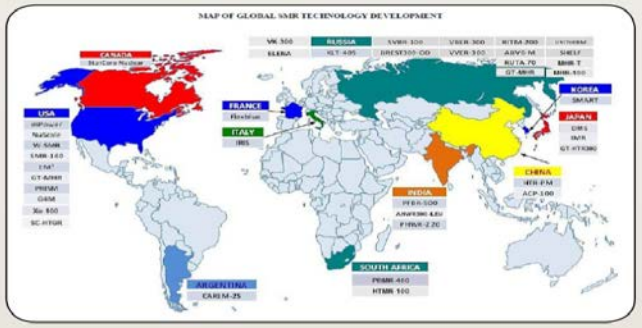

Table 1: Types of Reactors (IAEA, 2014)

https://inl.gov/article/advanced-nuclear/

NuScale plant site, aerial view.

SMR Regulatory Framework

Current IAEA nuclear material recommendations serve as a foundation for the SMRs. However, a review of local regulations may be necessary.

The performance-based approach emphasized in NSS-13 should certainly be the basis of any new country-specific regulations.

If SMRs have fewer regulatory hurdles, numerous companies may want to deploy SMR technology fairly rapidly.

This rapid approach could result in the deployment of various technologies, creating additional challenges for implementation of security elements at these reactors.

Some SMR Security Considerations

- Would additional regulations be necessary for countries to consider new technologies and utilize a graded approach?
- For government/private consortiums, who would be responsible for nuclear security implementation?
- Is there IAEA, WINS, and other international support for documents and guidelines specific to SMRs?
- Would construction of security components still require the same rigor as for traditional nuclear power plants?
- What legal considerations need to be considered for ownership of SMRs?
- How would security be considered in a graded approach as scalability increases for modular energy?
- How would local and national DBT or threat assessments (NSS-10) apply to these facilities?

Some SMR Security Considerations

- Sabotage analysis for Unacceptable (URC) or High Radiological Consequences (HRC) based on state regulations or NSS-13?
- Would it be necessary to store fresh fuel on site and per NSS-13?
- Security considerations for underground, above-ground, underwater, and portable units?
- If SMR units are being transported "turn-key," how is security implemented during transport?
- How would Nuclear Material and Accounting Control measures be implemented?
- What compensatory measures would be necessary for loading and unloading of fresh and spent fuel?

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Conclusion

The physical security of nuclear material is critical, so devising a graded approach for the security of SMRs will be necessary.

Security recommendations and requirements need to reflect the changes in technology and implementation of the SMRs.

In the past (and even for some facilities currently under construction), security has long been considered an after-thought for nuclear facilities.

We must take advantage of this opportunity as various threats around the world have changed significantly over the past few decades.

It is critical that we completely and thoroughly understand the impacts of securing these facilities around the world against various adversaries.