

APPLICABILITY OF THE IAEA SAFETY STANDARDS TO NON-WATER-COOLED REACTORS AND SMALL MODULAR REACTORS

Technical Meeting on Codes and Standards, Design Engineering and Manufacturing of Components for Small Modular Reactors

May 10-13, 2022

Vienna International Centre, Austria

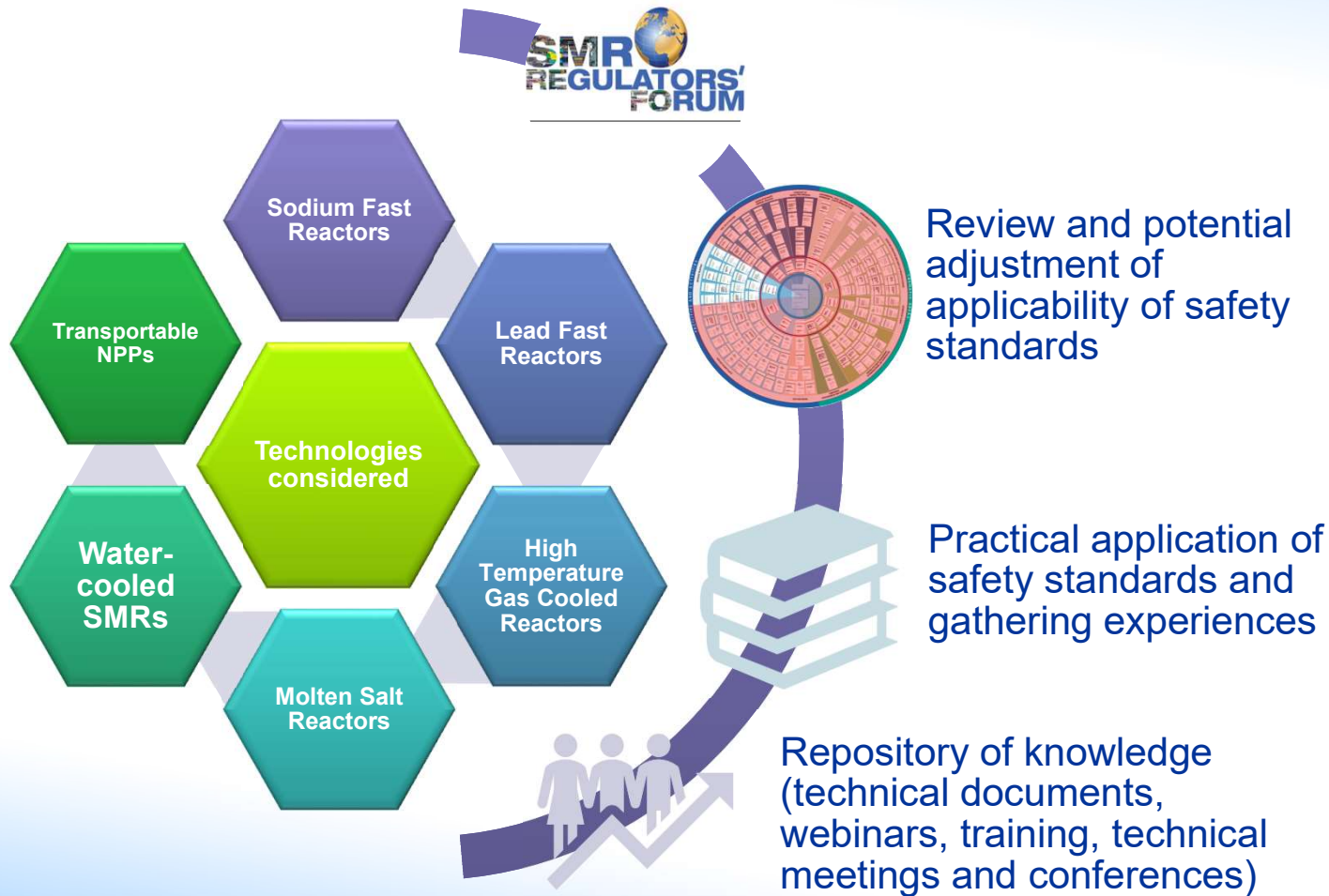
Paula Calle Vives

Safety Assessment Section (SAS)

Division of Nuclear Installation Safety (NSNI)

International Atomic Energy Agency (IAEA)

Background: IAEA Activities Related to NWCR and SMR Safety



Webinar on Safety, Security and Safeguards Interfaces and Challenges for Novel Advanced Reactors

The purpose of this webinar is to provide an overview to interested stakeholders from industry and regulatory bodies of the outcomes of the IAEA activity on safety, security and safeguards considerations for NARs, covering challenges and interfaces. Furthermore it will serve as a forum for discussions and promote the holistic approach towards safety, security and safeguards in early design stages of NARs and present an overview of other IAEA activities in this area.

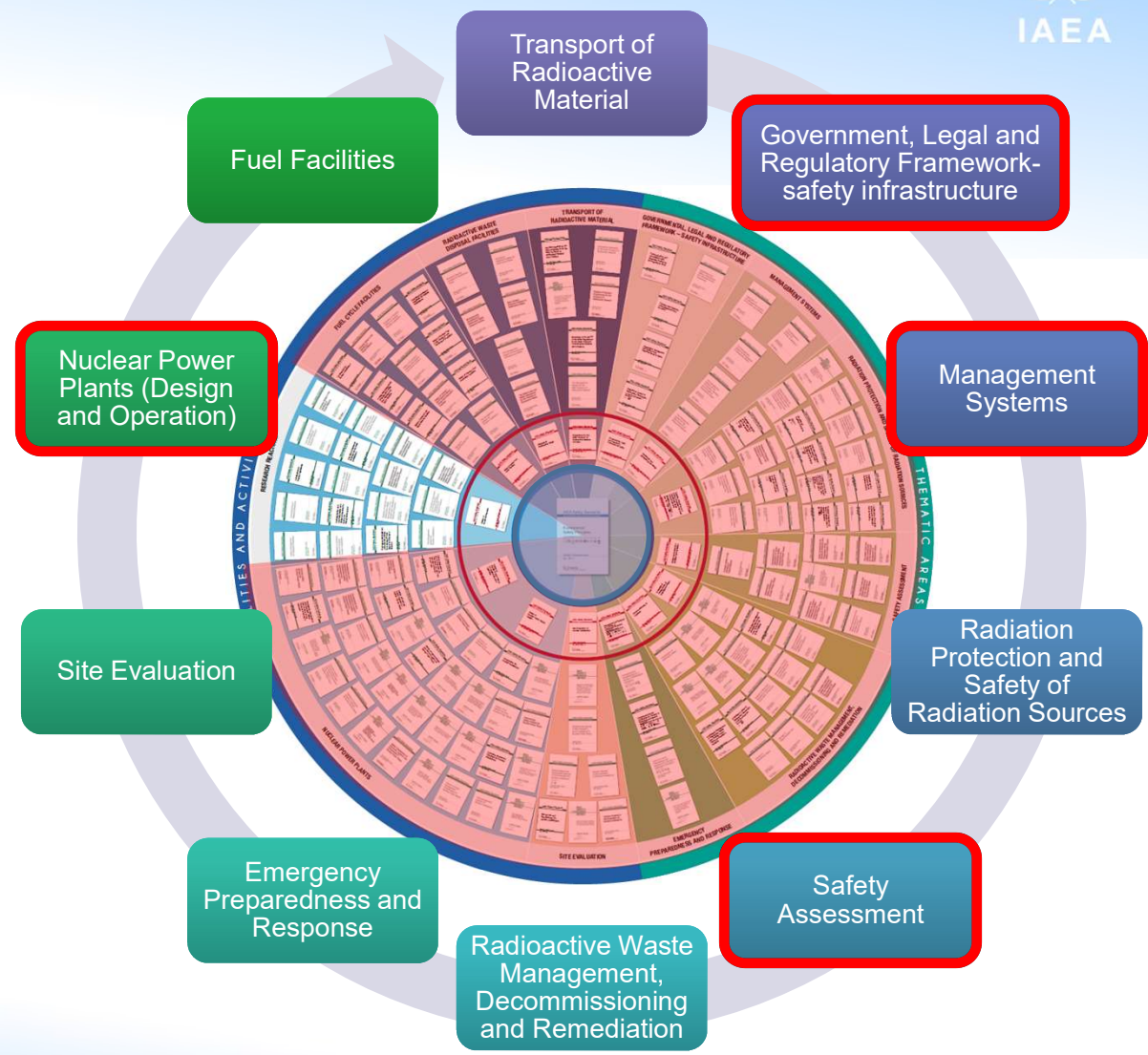
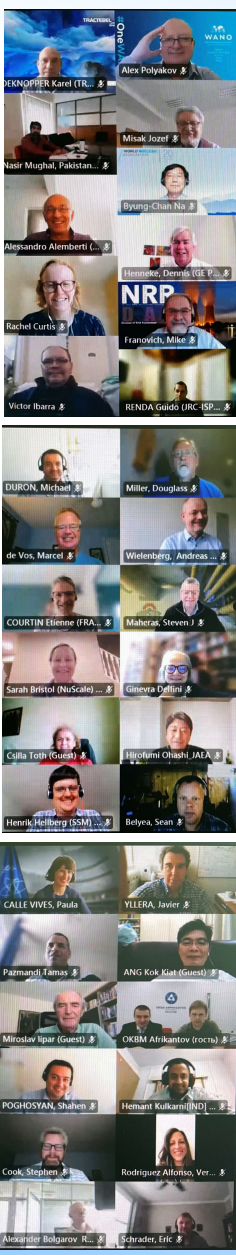
Webinar on IAEA Applicability of IAEA Safety Standards to the Design of Novel Advanced Reactors including SMRs

This webinar will provide an overview to interested stakeholders from industry and regulatory bodies of the outcomes of the review of applicability of IAEA Safety Standards to NARs, with focus on the design safety and give an insight of the activities that the IAEA has planned to address the findings of the review and produce additional guidance where needed.

Applicability of IAEA Safety Standards to SMRs

- Consideration of Non Water-Cooled Reactors and SMRs of different technologies
- Safety standards are generally applicable
 - Some areas not fully applicable or could be adapted for a better application
 - Some areas of novelty not fully covered

For most cases, issues identified may merit additional work but may not need to be reflected in the safety standards
- Review captured in a safety report



Applicability of Safety Standards to SMRs Key Findings

Design and Construction

Safety Classification of
SSCs (SSG-30)

Design Against External
Hazards (SSG-68)
Seismic Design (SSG-
67)
Equipment Qualification
(SSG-69)

Safety of Design (SSR2/1)
Internal Hazards (SSG-64)
Electrical Power System
(SSG-34)
Instrumentation and Control
System (SSG-39)
Human Factors
Engineering (SSG-51)
Auxiliary and Supporting
Systems (SSG-62)
Radiation Protection
(DS524)
Construction (SSG-38)

The Reactor Core
(SSG-52)
The Reactor Coolant
System and Associated
Systems (SSG-56)
The Containment and
Associated Systems
(SSG-53)
The Fuel Handling and
Storage Systems (SSG-
63)

No applicability considerations
(areas of non applicability, gaps,
areas for further consideration)

Small number of applicability
considerations/ very small impact
on safety standard

Some applicability
considerations/ small impact on
safety standard

Numerous applicability
considerations/ more than a third
of the safety standard impacted

Applicability of the Safety Standards to SMRs Key Findings

Commissioning and Operation

Operating Experience
Feedback (SSG-50)

Operational Limits and
Conditions (SSG-70)
Modifications (SSG-71)
Operating Organization (SSG-72)
Core & Fuel Handling (SSG-73)
Maintenance, Testing (SSG-74)
Qualification, Training (SSG-75)
Conduct of Operations (SSG-76)
Hazards in Operation (SSG-77)
Chemistry (SSG-13)
Commissioning (SSG-28)
Ageing Management (SSG-48)

**Safety of Commissioning
and Operation (SSR2/2)**
Accident Management (SSG-
54)

No applicability considerations
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Applicability of the Safety Standards to SMRs Key Findings

Legal and Regulation

LMfS

Safety Assessment

Organization,
Management
Staffing (GSG-
12)
Communication
and
Consultation
(GSG-6)

**Legal and
Regulation
(GSR-Part1)**
Licensing (SSG-
12)
Safety
Infrastructure
(SSG-16)
Functions and
Processes
(GSG-13)

**Leadership
and
Management
for Safety
(GSR- Part2)**
Management
System (GS-
G-3.5)

**Safety
Assessment
(GSR-Part4)**
Periodic
Safety
Review
(SSG-25)
Evaluation of
Seismic
Safety (NS-
G-2.13)

Deterministic
Safety
Analysis
(SSG-2)
Level 1 PSA
(SSG-3)

Level 2 PSA
(SSG-4)

**No applicability considerations
(areas of non applicability, gaps,
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Summary of Key Findings

Applicability to design and safety analysis for non-water cooled SMRs and design and transport of TNPPs

- Clarification of intent may be possible
- Direct application may lead to 'unwanted' results

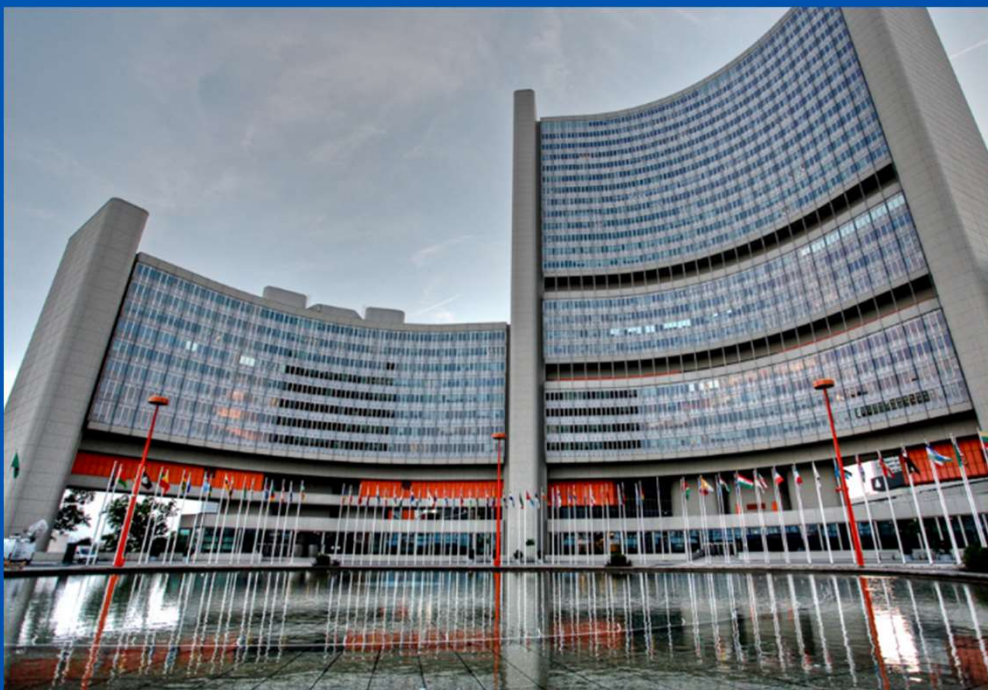
Differences with large WCRs may have safety implications not captured in safety standards

- Phenomena, failure modes, hazards, source term, waste
- Design features, manufacturing approaches
- Alternative operating models
- Deployment models (supply chain, waste management, decommissioning, regulation, transport)

How to consider designs for which there is a lack of regulatory and operating experience?

- Design
- Manufacturing
- Safety Assessment
- Interface Safety Security Safeguards

Need for increased cooperation among regulators



Thank you!
Questions?