Federal Ministry
for the Environment, Climate Action,
Nature Conservation and Nuclear Safety

Federal Office
for the Safety of
Nuclear Waste Management

Managing the safety of research reactors

Impact of the phase-out of nuclear energy on the nuclear safety regulations

22nd IGORR & IAEA TM on Integrated Management Systems
15 to 19 June 2025 in Mito, JAPAN

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Outline

Research Reactor Facilities in Germany

Current Regulatory Framework

Impact of International Regulations for RR

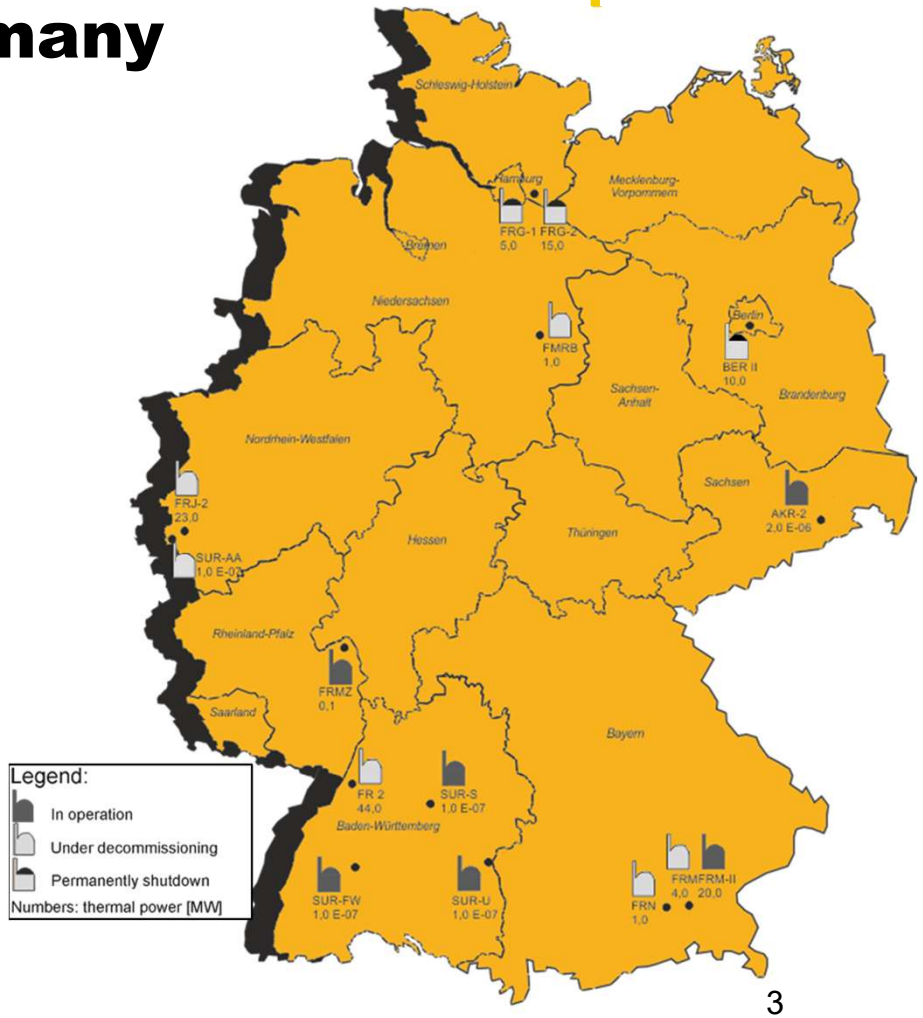
Conclusion and Outlook

Research Reactors in Germany

In total 46 RR were built

Presently

- 6 in operation
  - 2 pool reactors with P_{th} > 50 kW
  - 4 zero-power homogeneous reactors with $P_{th} \leq$ 2W
- 9 permanently shut down or in decommissioning
- 31 decommission finished and released from nuclear regulatory control

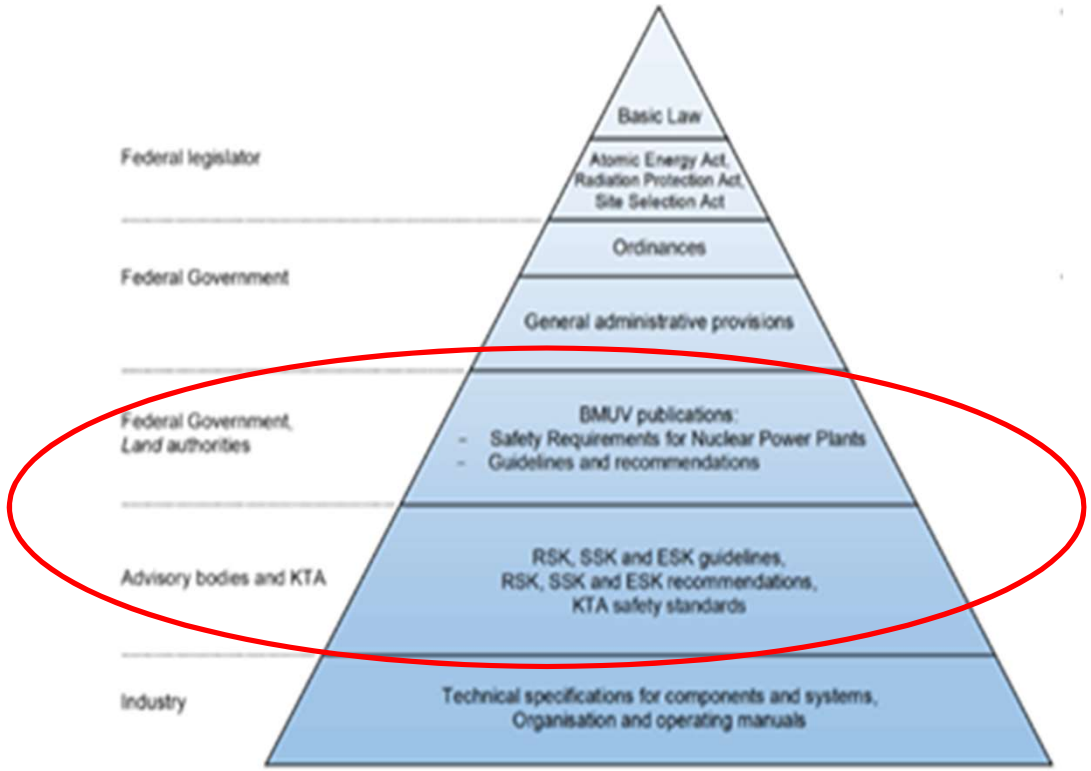


15.04.2023 final shut down of NPPs; largest reactor in operation is the FRM II (P_{th} = 20 MW)

Legislative and Regulatory Framework

- Research reactors are licensed and supervised under the Atomic Energy Act

- Most of the regulatory framework originally and intentionally developed for nuclear power plants



Regular verification and update ensuring conformity with the international state of the art; last update in 2022

Guideline on Graded Approach - Publication

Guideline for the application of the nuclear regulations for nuclear power plants to research reactors by means of a graded approach

Bundesanzeiger
Herausgegeben vom
Bundesministerium der Justiz
www.bundesanzeiger.de

Bekanntmachung
Veröffentlicht am Freitag, 19. Januar 2024
BAnz AT 19.01.2024 B4
Seite 1 von 27

Bundesministerium
für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz

Bekanntmachung
Leitfaden zur Anwendung des kerntechnischen Regelwerks
für Kernkraftwerke auf Forschungsreaktoren
mittels eines abgestuften Ansatzes

Vom 10. Oktober 2023

published on 10.10.2023

Guideline on Graded Approach - Content

Guideline on Graded Approach - Application

- All rules and regulation are assessed with regard to their applicability to research reactors (chapter 4)
- For some Announcements and Safety Standards, comments are included in addition to the categorization, e.g. for the adaptation or partial application based on the fundamental safety functions

BMI/BMU(V) Announcements

3-0.1	**Safety Requirements for Nuclear Power Plants** as amended and published on 25th February 2022 (BAnz AT 15.03.2022 B3)	2	Since the safety requirements for nuclear power plants were explicitly written for power reactors, a graduated application to research reactors is inevitable. In this context, the means for achieving the respective protection goal may deviate from the requirements, may already be fulfilled by the design of the research reactor or may not be necessary. The achievement of the protection goal on the respective safety level must always be given.

KTA Safety Standards

1507	Monitoring the Discharge of Radioactive Substances from Research Reactors, 11/17	1	
3701	General Requirements for the Electrical Power Supply in Nuclear Power Plants, 11/14	2	The general requirements for the electrical power supply of KTA 3701 can largely be applied to RR. However, extensive grading is possible, e.g. with regard to the number of required grid connections and the (non-existing) possibility of a station power supply (e.g. in Sections 3, 4.1.1, 4.2 and 5.2). Sections 6 and 7, which refer to NPPs with multiple units can be omitted completely.
(3401.1)	Steel Containment Vessels; Part 1: Materials, 09/88	3	

1 – Safety standard fully applicable for research reactors;
2 – Safety standard applicable by using graded approach;
3 – Safety standard not applicable for research reactors;

International Regulations

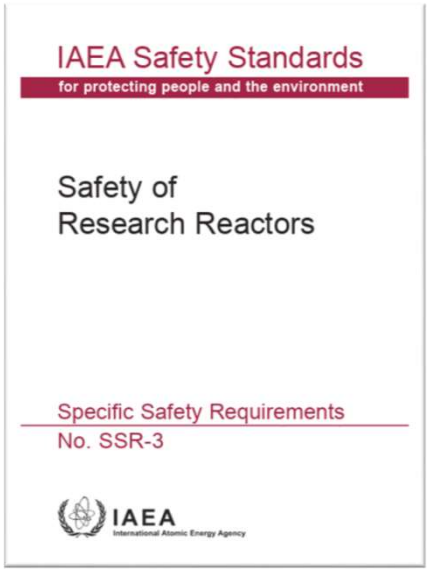
WENRA Safety Reference Levels for Research Reactors:

- Spanning 20 issues of in total 331 SRLs
- Largely based on the RHWG SRLs (version 2014), but taking into account characteristics of research reactors, e.g. Issue X on experimental devices and experiment an application of graded approach.

IAEA Safety Standards for Research Reactors:

- Safety Requirements (SSR-3) based on the IAEA-Requirements for NPPs 11 Specific Safety Guides for Research Reactors and
- other subordinate documents

(Benchmarking of national regulations against the IAEA Safety Standards is being performed by the GRS).



WGRR – SRL for RR

01
Issue A: Safety Policy

Safety area: Safety Management

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A1. Issuing and communication of a safety

A1.1 A written safety policy[1] shall be issued by the licensee.

A1.2 The safety policy shall be clear about giving safety an overriding priority in all *research reactor* activities.

A1.3 The safety policy shall include a commitment to continuously develop safety.

A1.4 The safety policy shall be communicated to all *site personnel* with tasks important to safety, in such a way that the policy is understood and applied.

A1.5 Key elements of the safety policy shall be communicated to contractors, in such a way that licensee's expectations and requirements are understood and applied in their activities.

WGRR – SRL for RR Self-Assessment

SRL No.	SRL Text	If category A is chosen provide short description how reference level is implemented in national regulations (e.g. quote text or give reference to where the text can be found, preferably in English), including an explanation/justification if grading is used. If category B is chosen provide an explanation/justification. If category C is chosen, a reference to the implementation plan is expected.	Category (self-assessment)	Category (peer-review)
A1.5	Key elements of the safety policy shall be communicated to contractors, in such a way that licensee's expectations and requirements are understood and applied in their activities.	**SiAnf: 1 (3) c** "The prime objectives of the IMS are a) the guarantee of safety, b) the continual improvement of safety, and c) the promotion of safety culture. (…)" **KTA 1402, 4.1.2 (1,g)** "Corporate policy shall include specifications regarding the orientation of the corporation. These specifications shall address, in particular, (…) g) the cooperation with external organizations and with the general public, (…)"	A	

A - SRLs fully implemented in national regulation
B - A difference, other than grading, exists, but can be justified from a safe-ty point of view
C - SRLs not implemented in national regulation

Summary

- The majority of the international requirements for research reactors is implemented in the German regulations for nuclear power plants, in particular in the “Safety Requirements for Nuclear Power Plants”(SiAnf) and in the KTA safety standards.
- Only few requirements are identified as not or not sufficiently implemented, especially those requirements that are specific to research reactors.
- In general the regulations for nuclear power plants are applicable to research reactors, as specified in the guideline on graded approach.

Regular verification and update ensuring conformity with the international state of the art; last update in 2022 (currently the KTA-Regulations are validated until the end of 2027)

Outlook

Validating regulations beyond 2027, possible approaches:

I. Proceeding with the regulatory framework for nuclear power plants as before.
II. Freezing the existing KTA safety standards and developing the “application notes”.
    - Extension of the guideline on graded approach giving in depth consideration of research reactor characteristic and allowing flexibility for application with regard to the type of installation.
III. Dedicated adaptations of the KTA safety standards allowing explicit application to research reactors
    - Full adaptation of all regulations for explicit consideration of research reactors.
IV. Replacing existing regulations and establishing a new regulatory framework based on the international requirements.

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Thank you for your attention

Guideline on Graded Approach – RR Classification

- Assessment of the facility-specific hazard potential by criteria as thermal power or achievement of fundamental safety functions “fuel cooling” or “confinement of radioactive material”.
- Based on these assessment the research reactors are classified into three classes:
  - Class 1: high flux reactors, MTR
  - Class 2: TRIGA reactors
  - Class 3: teaching reactors

Class 1: FRM II (20 MW)

Class 2: TRIGA MZ (100 kW)

Class 3: SUR (100 mW)