

Nuclear Power Plant Regulation in Indonesia: HTGR Licensing

Nur Syamsi Syam
BAPETEN

**Follow Up Training Course on
Reactor Engineering and Safety:
High-Temperature Gas-Cooled Reactor**

Yogyakarta, 18 - 22 May 2026



Biodata



**Nur Syamsi
Syam**

**Director of Regulation
Development for Nuclear
Installation and Materials
BAPETEN**

Contact

+6281317890050
n.syam@bapeten.go.id
Jalan Gajah Mada No. 8
Jakarta Indonesia

Professional Experience

- Director of Regulation Development for Nuclear Installation and Materials - BAPETEN** Jan 2025 - now
 - Directing and managing the regulation development for nuclear installations and materials safety, security, safeguards, and liability. The regulation development includes regulation for nuclear power plant.
- Coordinator of Regulation Development for Nonpower Reactor – BAPETEN** 2021 - 2025
 - Managing and coordinating the development of regulation on nuclear installation and materials (safety, security, safeguards, and liability)
 - As a person in charge in the development of amendment draft of act on nuclear energy
- Deputy Director of Licensing for Nonreactor Nuclear Installation - BAPETEN** 2014- 2016
 - Managing and Coordinating the licensing process of nonreactor nuclear installation for administration and technical aspects.
 - Conducting review and assessment of research reactor licensing application documents,
- Technical Reviewer/Licensing Staff for Nuclear Installation - BAPETEN** 2005- 2014
 - Conduct review and assessment of non reactor nuclear installation licensing application documents, including research reactors.
- On the Job Training as a Technical Reviewer for Site License Application – US NRC** Des 2011 – Jun 2012
 - Conduct review and assessment for early site permit application documents particularly for external human induced event aspect.

Education

- Bachelor Degree on Nuclear Engineering**
Gadjah Mada University - Indonesia
1998-2003
- Master Degree on Energy System and Technology**
Gadjah Mada University - Indonesia
2007 - 2010
- Doctoral Degree on Energy and Environmental Engineering**
Kyungpook National University – Republic of Korea
2017 - 2020

Trainings.:

1. Radiation Protection-BAPETEN, 2006
2. Nuclear Basic Professional Training Course, BAPETEN 2007
3. Research Reactor Systems, BAPETEN 2010
4. OJT on Human Induced Event Aspect of NPP siting, US-NRC, USA, 2012
5. MEXT Research Program, NPP Dismantling Technology, 2013
6. Training of Trainer, BAPETEN 2014

Outline



BAPETEN Regulatory Function



Regulation Framework for NPP



Licensing of NPP



Safety Requirements and Provisions for NPP



Outline



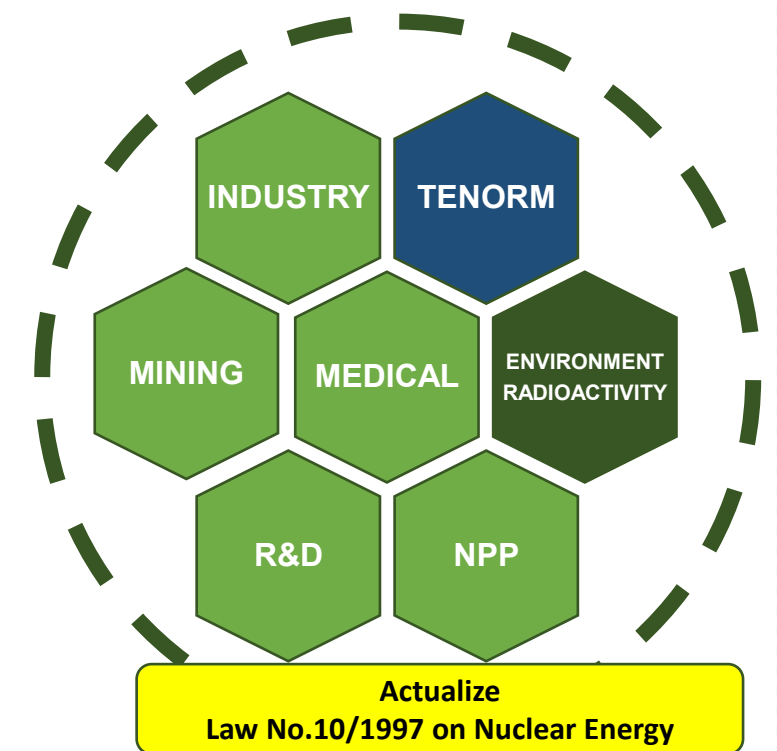
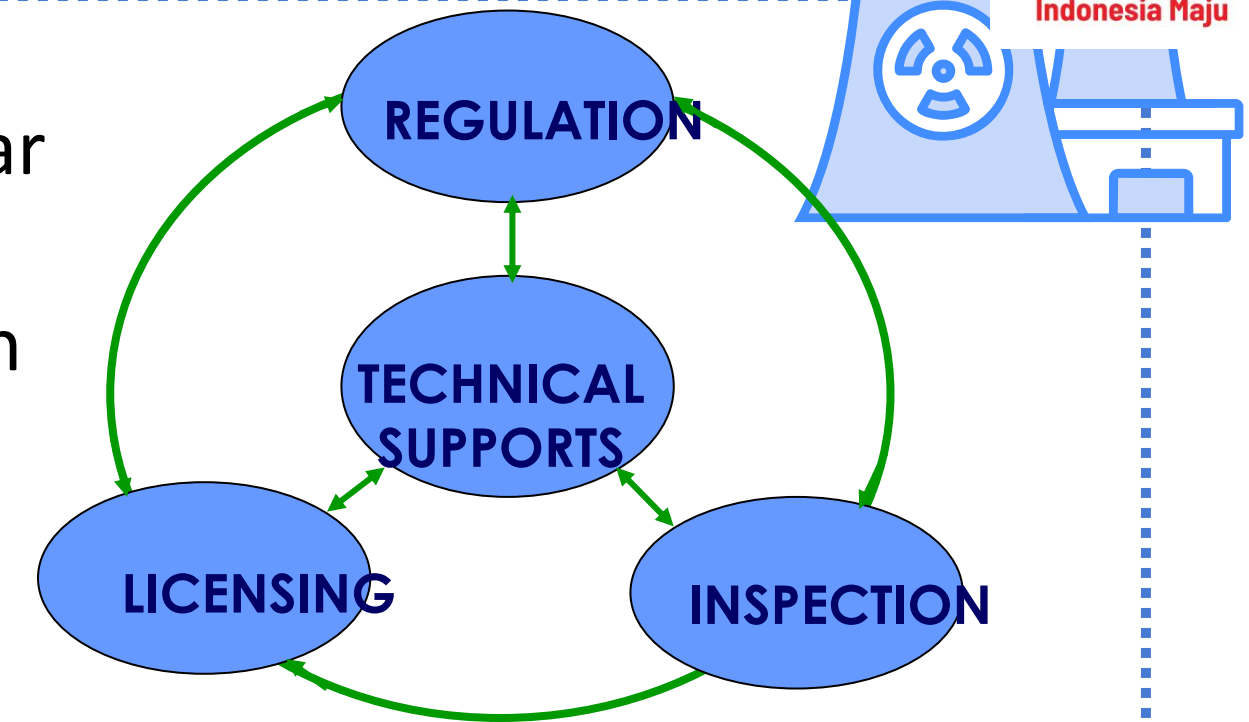
BAPETEN Regulatory Function



Indonesia Nuclear Energy Regulatory Agency (BAPETEN)

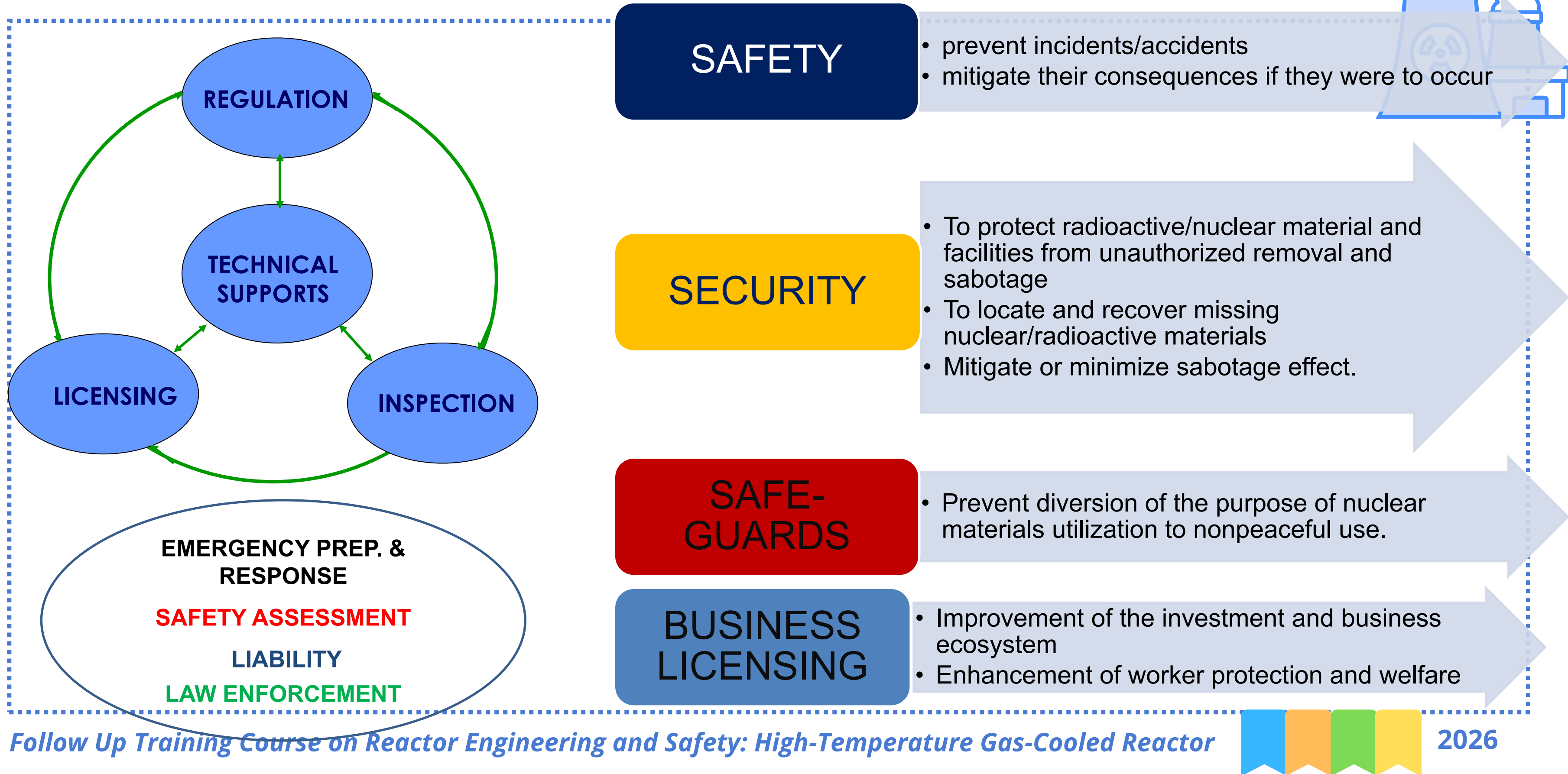


- Established in 8 May 1998 as independent regulatory body in nuclear sector (Law 10/1997)
- Responsible to the President to carry out nuclear energy supervision in Indonesia.
- The main function: establishing **regulations**, issuing license, and conducting inspections on nuclear facilities and activities.
- Mission:
 - To ensure safety, security, and safeguards in the use of nuclear energy according to international standards in order to increase competitiveness.
 - To increase organizational capability. ⁵
- Objective :
 - To realize effective regulatory control of nuclear energy to ensure safety, security, and safeguards, health of workers and public, and environmental protection.
- <http://www.bapeten.go.id>



BAPETEN Regulatory Function

(Act No. 10/1997 and Act No. 6/2023)





Regulation Framework for NPP



Nuclear Legislation and Regulation Hierarchy in Indonesia



Act No 10/1997 on Nuclear Energy
Act No 6/2023 Omnibus law on Job
Creation

ACT

GR 28/2025 Risk Based Business Licensing
GR 2/2014 Licensing of Nuclear Installation and Material
GR 54/2012 Safety and Security of Nuclear Installation
GR 42/2022 Types and Tariffs of Non-Tax State Revenue of BAPETEN
GR 46/2009 Nuclear Liability Limit

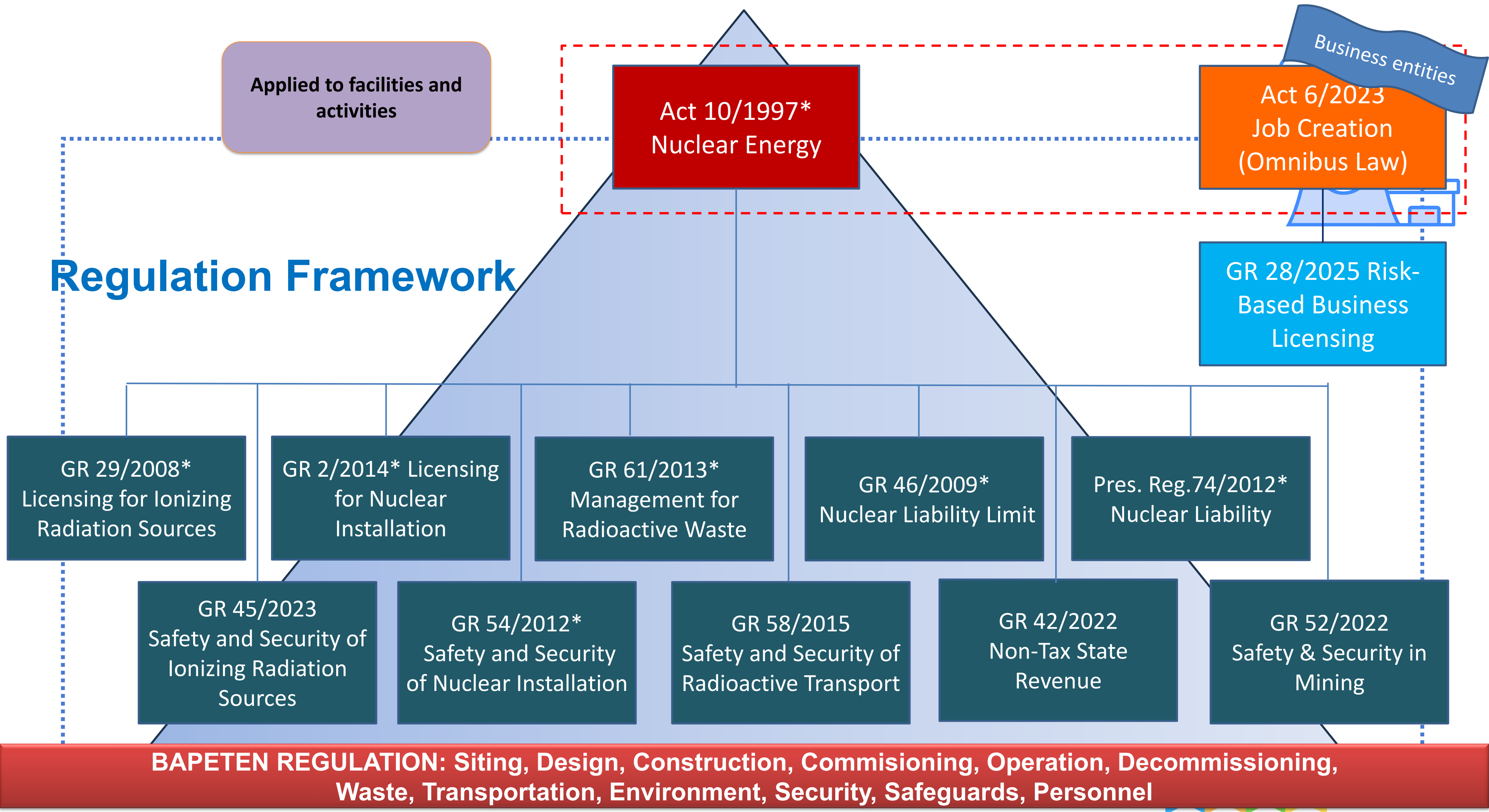
**GOVERNMENT
REGULATION**

Pres Reg 60/2019 Nuclear and Radiation Safety Nat. Strategic Plan
Pres Reg 74/2012 on Nuclear Liability

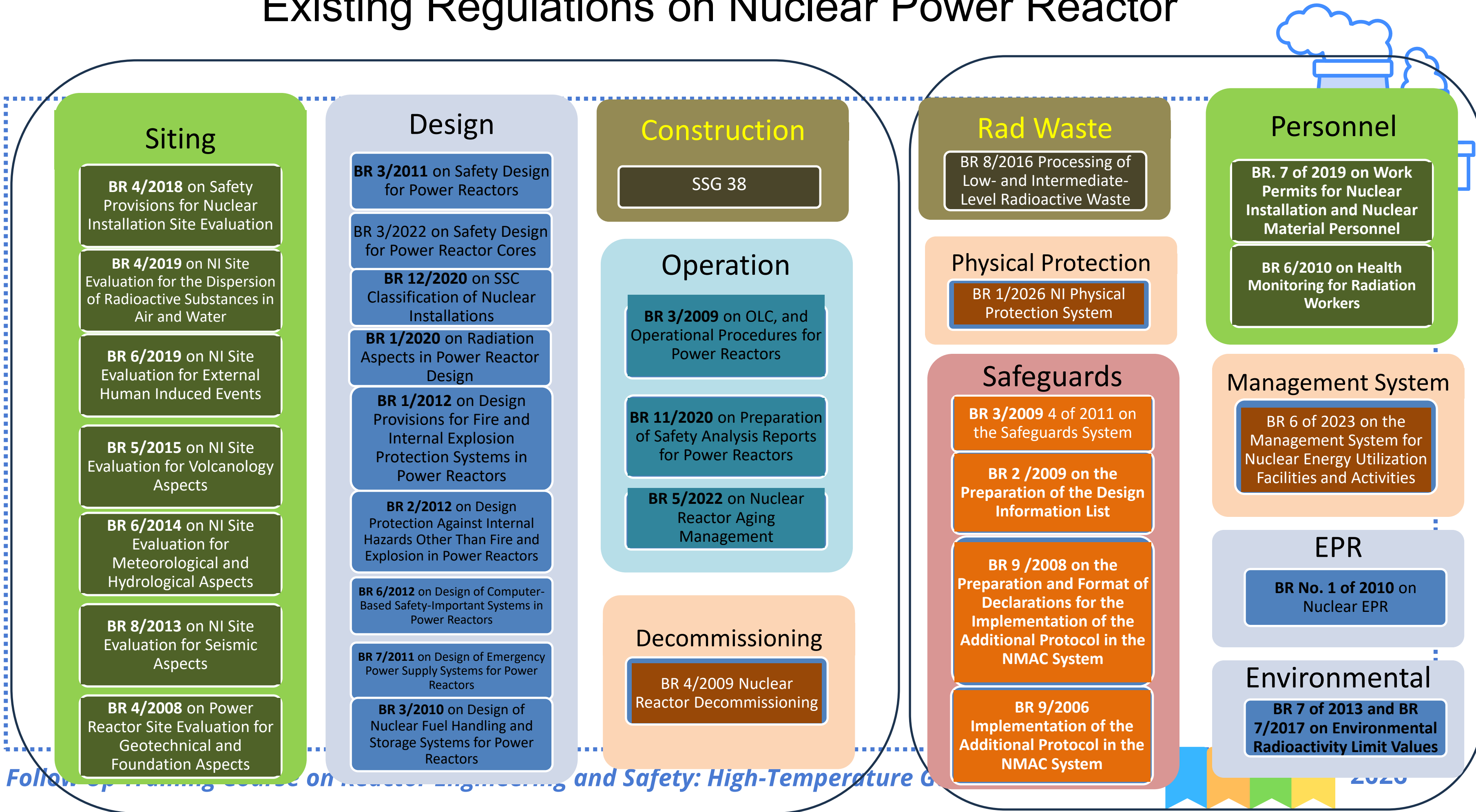
**PRESIDENTIAL
REGULATION**

- BR 4/2018 on Nuclear Installation Site Evaluation
- BR 3/2011 on the Design Safety of Power Reactor
- BR 12/2020 on the Classification of SSCs of Nuclear Installations
- BR 1/2020 on Radiation Aspects in Nuclear Power Reactor Design
- BR 3/2009 OLC and Operating Procedures for Nuclear Power Reactors
- BR 11/2020 on the Preparation of Nuclear Power Reactor Safety Analysis Reports
- BR 5/2022 concerning Ageing Management of Nuclear Reactors

BAPETEN REGULATION



Existing Regulations on Nuclear Power Reactor



Outline



Licensing of NPP



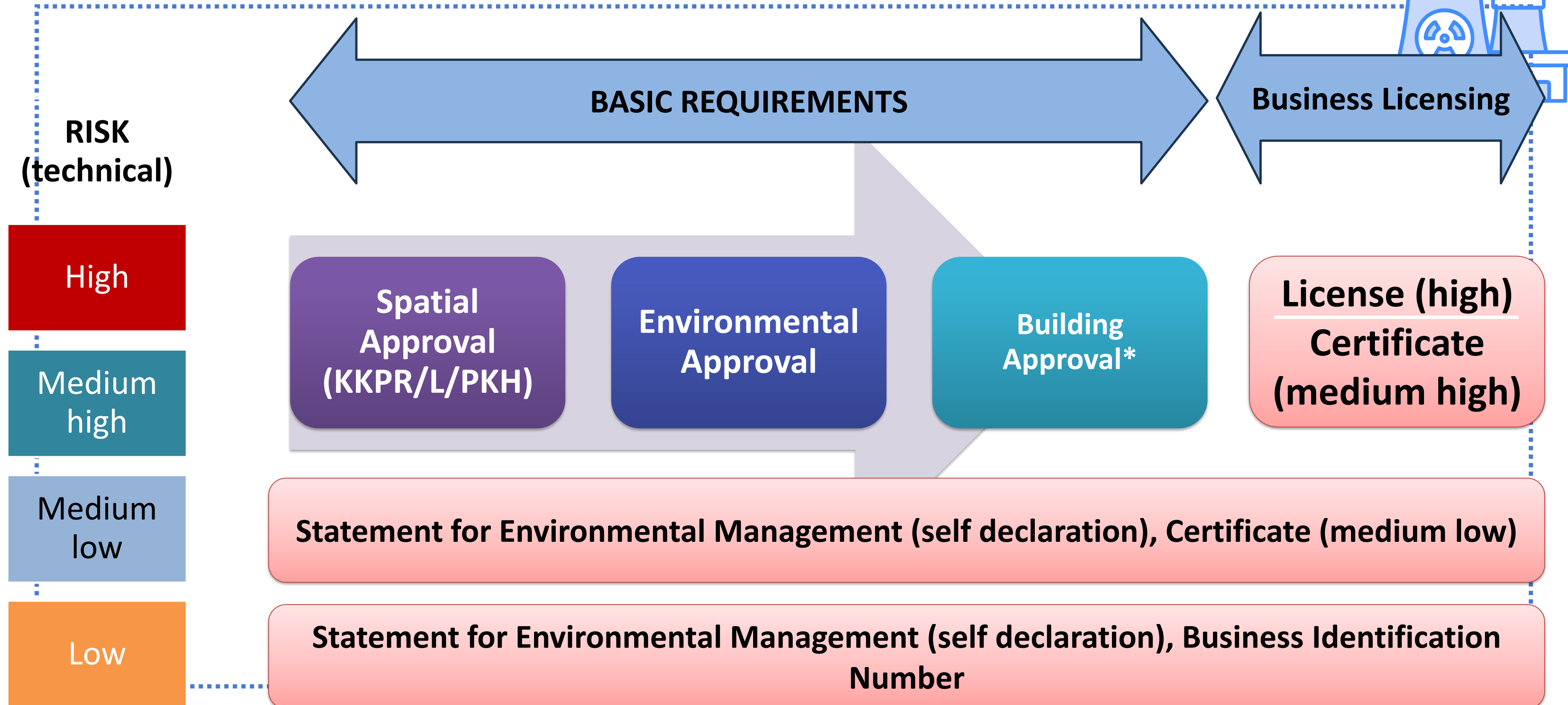
GR 28/2025 on Risk Based Business Licensing



Coordinating Ministry of Economic Affairs
Republic of Indonesia



Implementation of Risk-Based Business Licensing



PP 5/2021



KBLI IBN



43294

- Izin Reaktor (multilevel)
- Izin INNRR (multilevel)
- Izin Pemanfaatan BN



Non KBLI IBN



BELUM ADA

—



KBLI BGN



07210, 52107

- Izin Penambangan MR
- Izin Pengolahan MR
- Izin Pengolahan MIR
- Izin Penyimpanan MIR



Non KBLI BGN



BELUM ADA

—

PP 28/2025



KBLI IBN



43294, 24206, 72107, 46643

- Izin Reaktor (combined)
- Izin INNRR (combined)
- Izin Perdagangan Besar ZR & PRP (Pengalihan, Ekspor, Impor)
- Izin Fasilitas R&D/litbang



Non KBLI IBN



PB UMKU EKSPOR, IMPOR, PENGALIHAN BAHAN NUKLIR

KBLI terkait subsektor IN (penunjang 24206 dan 43294)



KBLI BGN



07210, 52107, 46642

- Izin Penambangan MR
- Izin Pengolahan MR
- Izin Pengolahan MIR
- Izin Penyimpanan MIR
- Izin Perdagangan Besar Mineral Radioaktif



Non KBLI BGN



PB UMKU MIR

(41+) KBLI terkait sektor migas minerba dan industri



KESELAMATAN & KEAMANAN UTAMA



TEKNOLOGI BERSIH

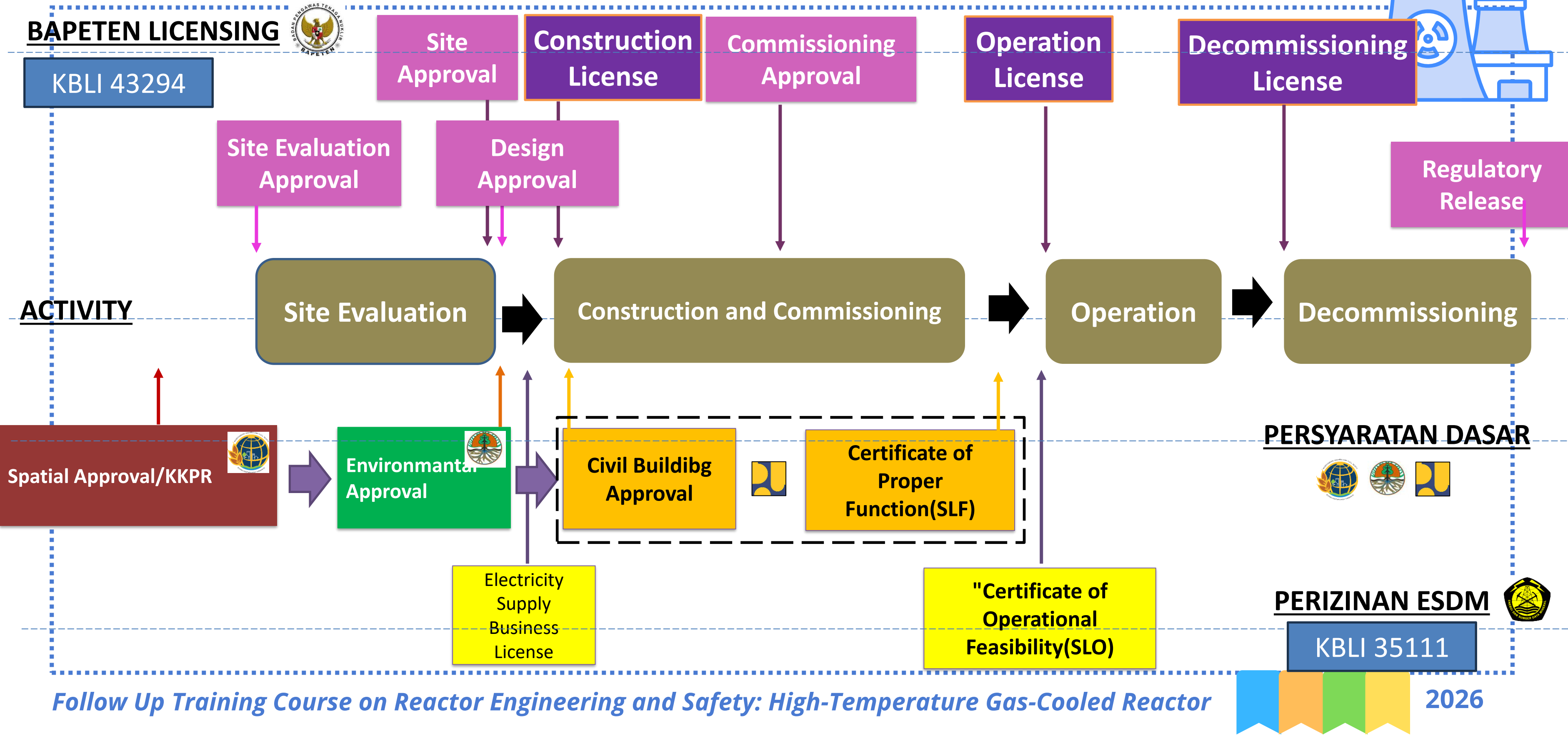


Kepatuhan & Tata Kelola

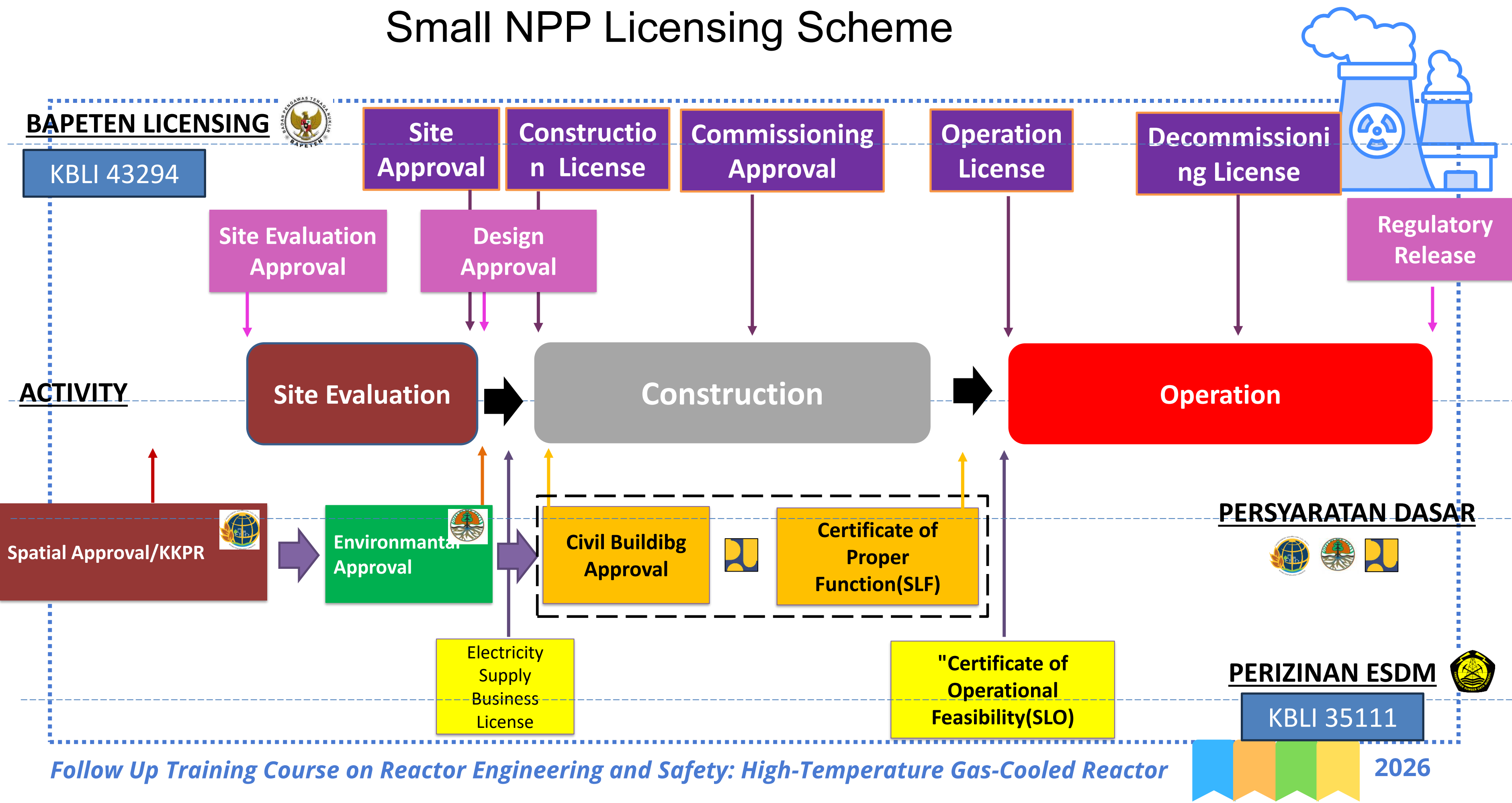


BERKELANJUTAN UNTUK MASA DEPAN

Large NPP Licensing Scheme (GR 28/2025)



Small NPP Licensing Scheme



Micro NPP Licensing Scheme



BAPETEN LICENSING



KBLI 43294

Site Approval

Operation License

Commissioning Approval

Decommissioning Approval

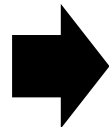
Site Evaluation Approval

Design Approval

Regulatory Release

ACTIVITY

Site Evaluation



Operation

Spatial Approval/KKPR



Environmental Approval



Civil Building Approval



Certificate of Proper Function(SLF)

PERSYARATAN DASAR



Electricity Supply Business License

"Certificate of Operational Feasibility(SLO)

PERIZINAN ESDM



KBLI 35111

Follow Up Training Course on Reactor Safety and Safety: High-Temperature Reactor

Graded Approach for NPP

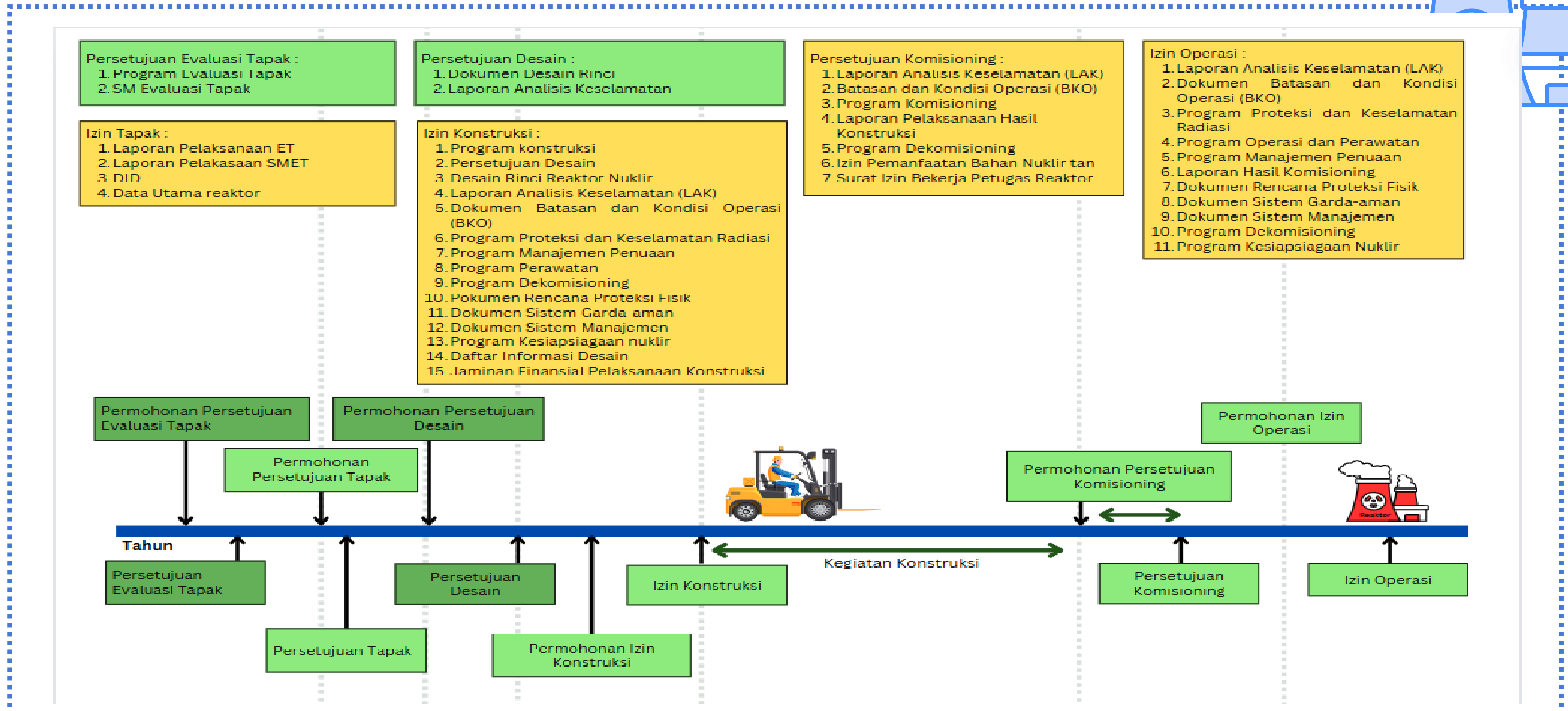
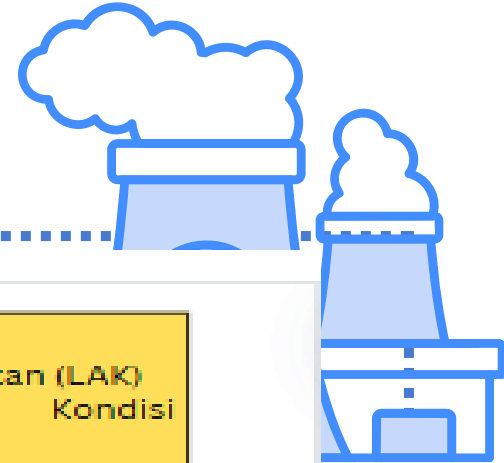
(draft revision of GR No 5 Year 2021)



	LARGE NPP	SMALL NPP	MICRO NPP
Power capacity	> 300 MWe > 1.000 MWt	$10 < P \leq 300$ MWe $30 < P \leq 1.000$ MWt	≤ 10 MWe ≤ 30 MWt
Construction license period	8 years	6 years	N/A
Operating license period	40 years (license renewal: 10 years each)		
Decommissioning license period	Based on proposal	Based on proposal	Based on proposal



NPP Licensing Application Documents



NPP Deployment Scheme



Scenario 1

**SITE APPROVAL, DESIGN APPROVAL,
CONSTRUCTION LICENSE, OPERATION
LICENSE**

Design, Construction, and
testing/commissioning in Indonesia

All requirements for each stage are
applied

Timeframe:
Preparation (including siting): 3 years,
Construction and commissioning: 4 to 5
years (licensing review process by BAPETEN
(3-5 years))

Scenario 2

**SITE APPROVAL, CONSTRUCTION
LICENSE, OPERATION LICENSE**

Design from vendor country, construction
and commissioning in Indonesia

Design review/certification from Regulatory
Body of vendor's country

Design review will refer to the result of
design review/certification from vendor's
country, Indonesia will focus on *site specific*

Scenario 3

SITE PERMIT AND OPERATION LICENSE

Design and construction in vendor
country,
(floating/micro NPP)

Licensing process by Regulatory Body in
two countries

Requires cooperation between operator in
Indonesia and in vendor country
(preparation to operation 3 years)

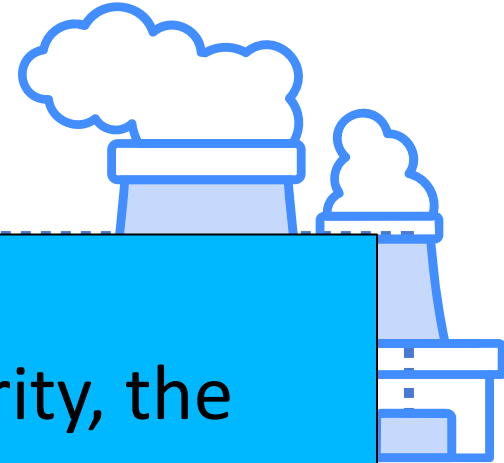




Safety Requirements and Provisions for NPP



GR No. 54 of 2012 on the Safety and Security of Nuclear Installations



Act 10/1997 Article 16

- 1) Any activity related to the utilisation of nuclear energy shall maintain the safety, the security, the peace, the health of the workers and the public, and the environmental protection.
- 2) The provisions under clause (1) will be further implemented by Government Regulation.

General Safety Objective

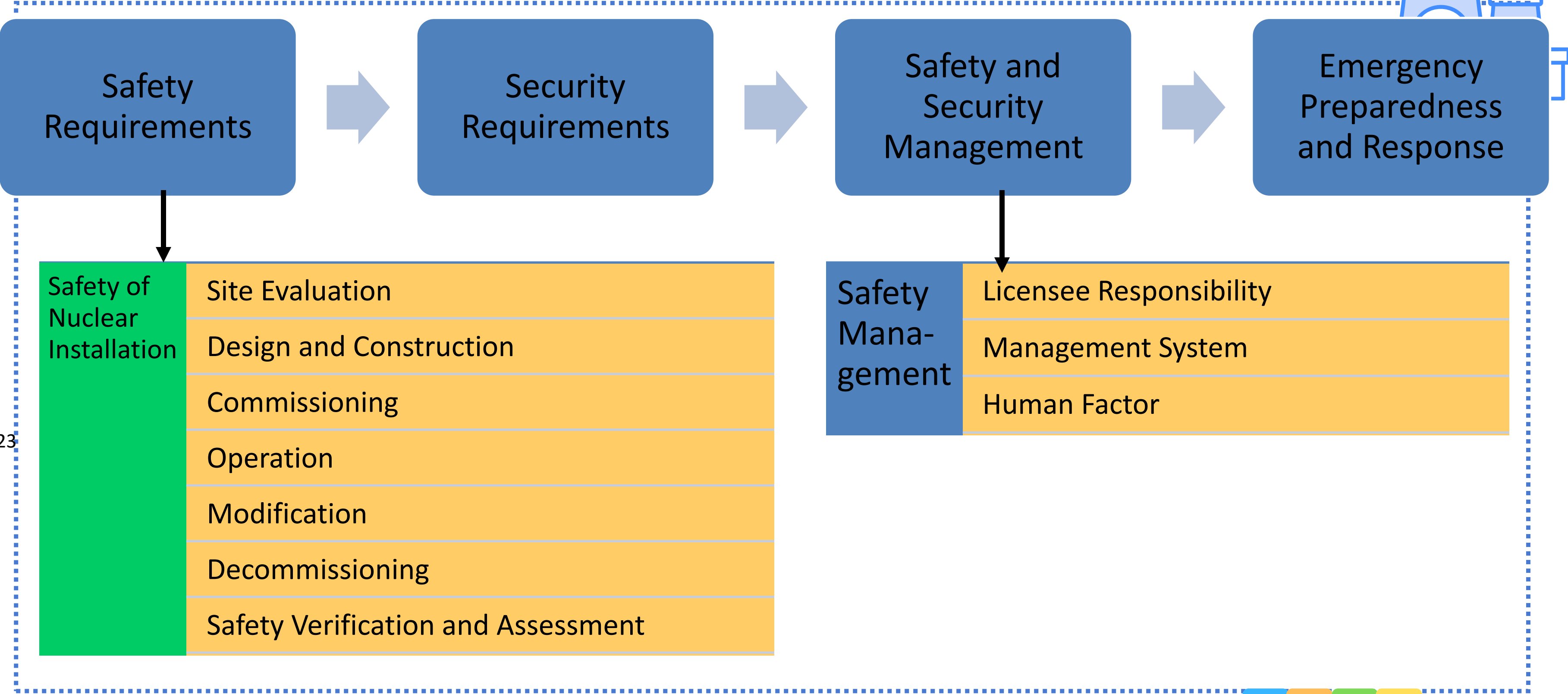
To protect workers, the public, and the environment through effective defense measures against the occurrence of radiation hazards in nuclear installations.

Security Objective

- To prevent the misuse of nuclear material for non-peaceful purposes;
- To prevent, detect, assess, delay, and respond to unauthorized removal of nuclear material and sabotage against nuclear installations.



GR No. 54 of 2012 on the Safety and Security of Nuclear Installations



23



Site Evaluation and Monitoring



When?

During the stages of:
Construction
Commissioning
Operation
Decommissioning



What?

Site Hazard Characteristics

- Natural events and human-induced events that may affect the safety of nuclear installations at the site
- Site characteristics that may affect the transfer of radioactive substances from the nuclear installation to humans and the environment
- Population demographics and other characteristics of the site and surrounding areas relevant to public risk evaluation and the feasibility of implementing emergency preparedness programs



How?

- Implement engineering solutions if significant hazards are identified, such as:
 - Structural reinforcement
 - Addition of SSCs
 - Provision of protective equipment
- In accordance with the RKL/RPL
- Assessment is also conducted on the site's capability to receive heat discharge during operation



RPL dan RKL

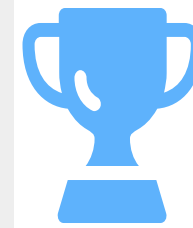
- Significant impacts and their sources
- Impact assessment benchmarks
- Objectives of environmental management plans
- Environmental management measures
- Location of environmental management implementation
- Period of environmental management
- Environmental management funding
- Environmental management institutions

Further regulated in detail under BAPETEN Regulations on site evaluation and Environmental Impact Assessment (AMDAL)

Design and Construction

GENERAL PROVISION

- The licensee shall carry out construction based on a design that complies with the fundamental principles of nuclear safety.
- The licensee shall comply with general and specific design requirements from the construction stage through decommissioning.
- The licensee may make design **modifications** during construction after obtaining approval from BAPETEN (if affecting safety) or by submitting notification to BAPETEN (if not affecting safety)
- The licensee shall establish SSC classification: quality class, seismic class, and safety class.



GENERAL DESIGN REQUIREMENT

- Reliability of SSCs
- Ease of operation, inspection, maintenance, and testing
- Nuclear emergency preparedness and response
- Ease of decommissioning
- Radiation protection
- Human factors considerations
- Measures to minimize ageing effects



BASIC PRINCIPLE OF NUCLEAR SAFETY

- Inherent safety
- Diversity
- Multiple barriers
- Independency
- Safety margins
- Fail-safe design
- Redundancy
- Equipment qualification



SPECIFIC DESIGN REQUIREMENT

- Reactor Core
- Heat Removal System
- Shutdown system
- Reactor Protection System
- technical safety features
- containment system
- instrumentation and control system
- nuclear fuel handling and storage system
- radioactive waste management system; and
- auxiliary system



Design and Construction



Construction

Carried out based on a construction program that includes:

1. Construction implementation procedures and schedule
2. Functional testing procedures
3. Hold points
4. Design acceptance criteria;
5. Documentation and reporting

Design modifications

Design modifications may be carried out to:

1. Improve the safety of nuclear installations
2. Prevent failures identified during nuclear installation construction; and/or
3. Improve maintainability of nuclear installations

SSCs Important to Safety

1. SSCs that prevent radiation exposure to workers, the public, and the environment
2. SSCs that prevent anticipated operational occurrences from escalating into accident conditions; and
3. Features provided to mitigate the consequences of functional deviations or failures of SSCs

Design modifications that:

1. Affect SSCs important to safety shall obtain approval from BAPETEN
2. Do not affect SSCs important to safety shall be notified to BAPETEN

Commissioning



Commissioning Program

- ensuring that the installed SSCs for NI can function according to design
 - incorporating integrated design testing for all systems with nuclear material

Ageing Detection Plan

The Aging Detection Plan for SSCs is established prior to commissioning.

Ageing Detection

The Ageing Detection Plan is implemented through data collection & analysis related to SSC aging since commissioning activities began.

Operational Limits and Conditions

During testing, the Licensee conducts verification to establish operational limits and conditions in accordance with general requirements and specific design requirements.

Operation

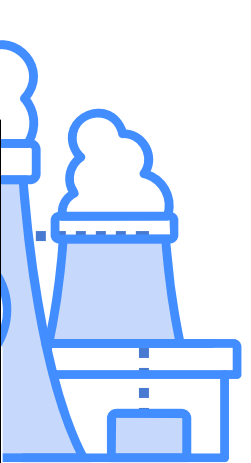
In the Operation Stage, Licensee must establish:

Operational Limits and Conditions

Operating Procedures

Maintenance,
Surveillance, & Inspection
Prog.

Aging Management
Program



OPERATIONAL LIMITS AND CONDITIONS

- Safety limits
- Safety system settings;
- Limiting conditions for normal operation;
- Surveillance requirements;
- Administrative requirements.

OPERATING PROCEDURES

- Established for all NI Conditions:
- normal operation
 - AOO
 - DBA and BDBA.

MAINTENANCE PROGRAM

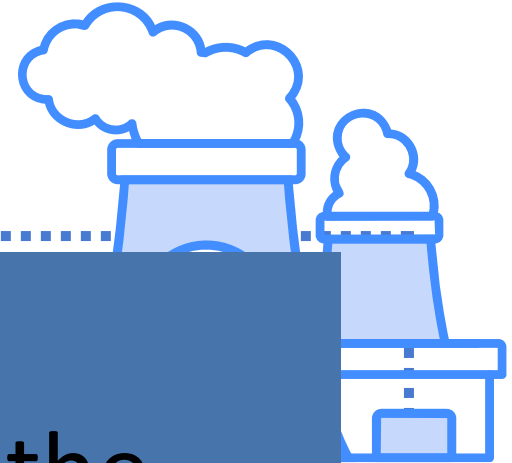
- The Licensee must establish and implement a maintenance, surveillance, and inspection program for every SSC important to safety.

AGING MANAGEMENT PROGRAM

- The Licensee must establish an AMP for critical SSCs.
- The Licensee must conduct periodic evaluations of the AMP implementation.

Operation, maintenance, surveillance, and inspection of NI are carried out by trained and/or qualified personnel in accordance with laws and regulations.

Decommissioning



The licensee must implement a decommissioning program during the decommissioning phase, from characterization to the final radiation survey

(1) The decommissioning program must be periodically reviewed and updated during the commissioning, operation, and decommissioning phases.

(2) In reviewing and updating the decommissioning program, the licensee must consider at least:

- a. changes to SSCs during the operation of the NI;
- b. AOO and/or accidents that occurred during the commissioning and operation of NI;
- c. decommissioning costs; and
- d. the latest technology related to decommissioning.



BR No. 3 Year 2011 on the Design Safety of Power Reactor



Article 2: This regulation contains provisions regarding general design requirements and specific design requirements for all plant states.

Plant States: Normal Operation, AOO, DBA, and BDBA

Article 3: This BAPETEN Regulation applies to **land-based water-cooled power reactors**.



BR 3/2011: Nuclear Safety Objectives



Nuclear Safety Objectives

General safety Objective

to protect workers, the public, and the environment through effective defense efforts against radiation hazards in power reactors.

Specific safety Objective

radiation protection objective

technical safety objective.

Radiation protection objectives:

- ensuring that radiation exposure under any plant states or any anticipated release of radioactive substances from the installation is kept as low as reasonably achievable and below the established dose constraints;
- ensuring the mitigation of radiological impacts from an accident caused during the operation of a power reactor.

Technical safety objectives:

- preventing accidents during the operation of a power reactor and mitigating radiological impacts should an accident still occur;
- ensuring with a high level of confidence that all accidents considered in the power reactor design present the lowest possible risk; and
- ensuring that accidents with serious radiological impacts have an extremely low probability.

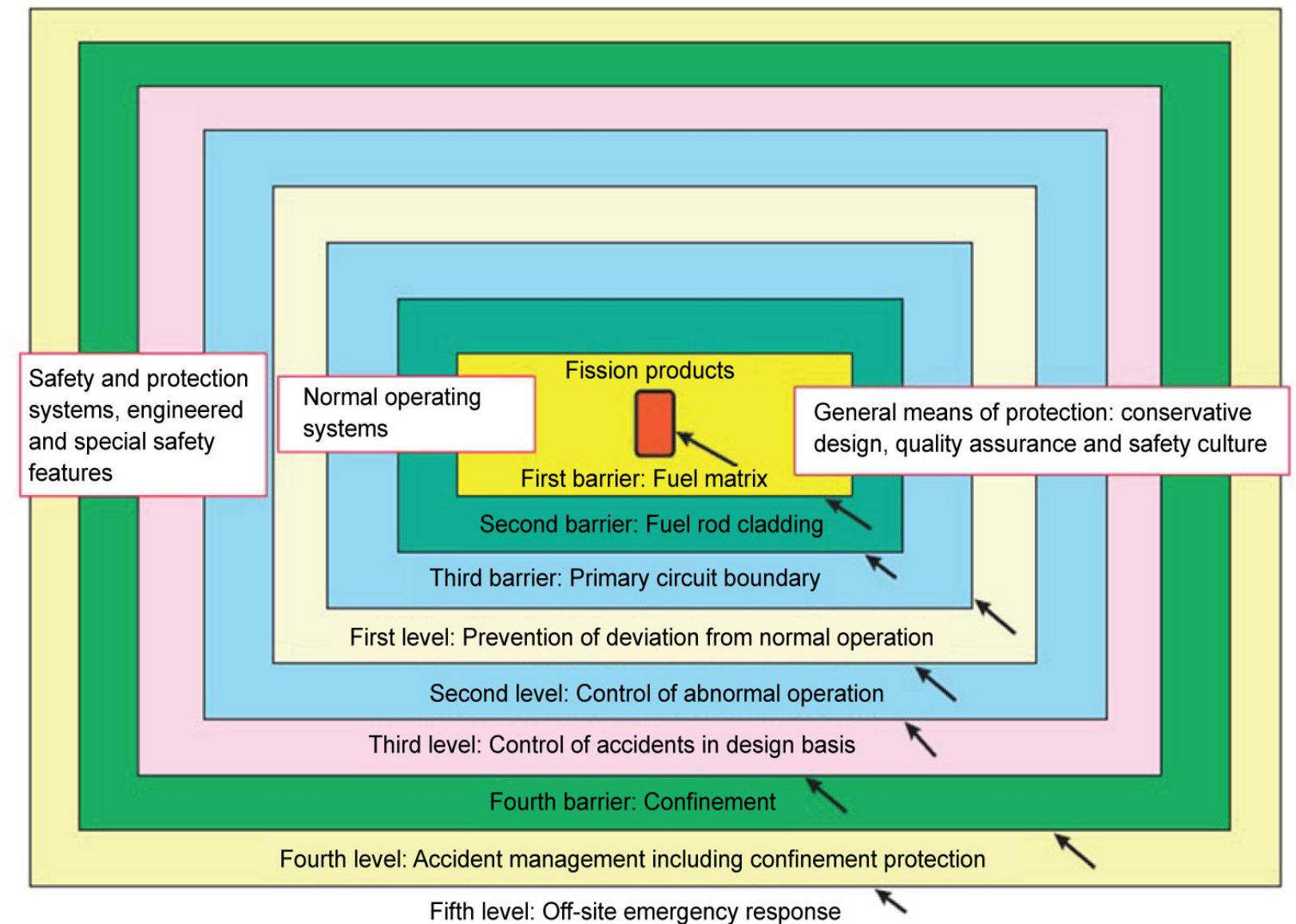


Article 6 BR 3/2011: Defense in Depth



Defense in depth includes:

- **level 1**, prevention of failures and AOO carried out through conservative design, and high-quality construction and operation;
- **level 2**, prevention of AOO from developing into accidents through the control of AOO and detection of failures carried out with control, limitation, and protection systems, as well as other surveillance features;
- **level 3**, control of design basis accidents to bring the reactor condition to a controlled state and maintain the containment of radioactive substances using engineering safety features and accident procedures;
- **level 4**, control of severe conditions to keep the release of radioactive substances as low as possible, including the prevention of accident progression and mitigation of severe accidents carried out through complementary measures and accident management; and/or
- **level 5**, mitigation of radiological consequences for significant releases of radioactive substances, carried out through nuclear emergency response measures both on-site and off-site.



BR 3/2011: Fundamental Safety Function and Other Provision



- **The fundamental safety functions of the reactor as referred to in Article 6 include:**
 - a. controlling reactivity;**
 - b. removing heat from the reactor core; and**
 - c. confining radioactive substances and shielding radiation.**
- **Detil Provisions on Postulated Initiating Event, General Design Requirements, Specific Design Requirements.**



Content of Safety Analysis Report (BR 11/2020)



- Introduction
- Site characteristics
- Safety objectives and design requirements
- Reactor
- Reactor cooling system and related systems
- Technical safety features
- Instrumentation and control system
- Electrical power supply system
- Support systems
- Buildings and structures
- Energy conversion system
- Radioactive waste management
- Radiation protection and safety
- Conduct of Operational
- Commissioning
- Safety analysis
- Operational limits and conditions
- Management system
- Human factors engineering
- Nuclear emergency preparedness and response
- Environmental management and monitoring plan
- Decommissioning



Terima kasih

