KINS REGULATORY PRACTICES FOR RESEARCH REACTOR

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□ Nuclear reactors at a glance

In operation
24 units
1 P. Shutdown
(23GW)

Under
Const.
5 units
(7 GW)

Radioactive Waste
Disposal Facility

Hanul 6 units
Shin-Hanul
2 units

Wolsong 4 units
Shin-Wolseong
2 units

Kori 4 units
Shin-Kori 4 units

Hanbit
6 units

HANARO

KJRR

In operation
Under construction

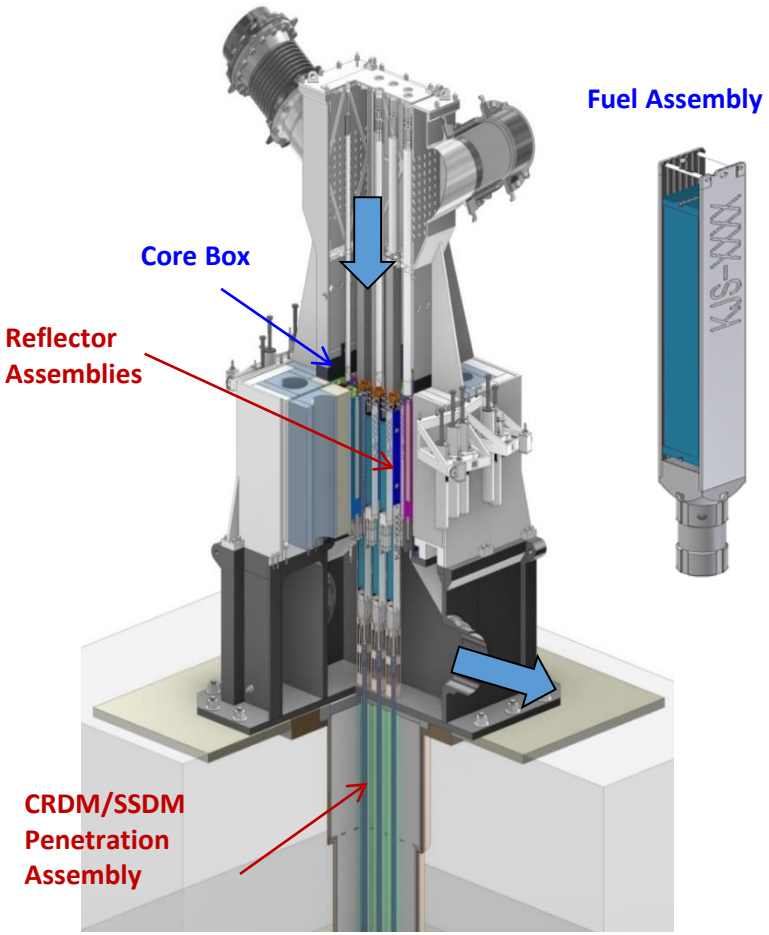
□ Research Reactors

	KJRR	HANARO	AGN-201	KRR-1	KRR-2
Location	Kijang (KAERI)	Daejeon (KAERI)	Kyunghee University	Seoul (KAERI)	Seoul (KAERI)
Status	**Review for CP**	Operating	Operating	Decomm.	Decomm.
1st Criticality	(2023 ?)	1995.2	1982.12	1962.3	1972.5
Power(th)	15 MW	30 MW	10 W	250kW	2MW
Supplier	KAERI	KAERI/AECL	AGN	GA	GA
Utilization	•RI/NTD •Material Irradiation •Mo-99 Production	•Neutron Beam research •RI/NTD •Material test	•Education •Physics Experiment	•Basic Research •Education/ Training •RI production	•Basic Research •Application of Beam & NAA •Education/ Training •RI production

□ Ki-Jang Research Reactor (KJRR)

Owner & supplier	KAERI	**Location**	• In Ki-Jang, Busan • Near Kori NPPs site
Scope of works	•Rx & BLDGs •RI production facility •Neutron irradiation facility	**Project period**	• April 2012 ~ 2023

□ Characteristics

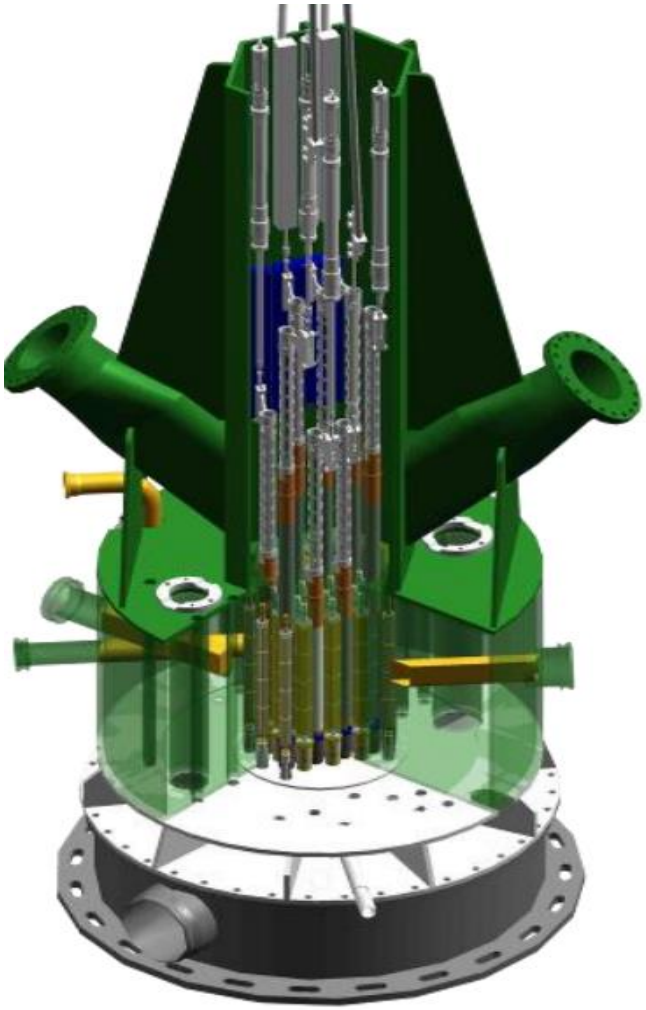


- Open-tank-in-pool type
- 15 MWt of power capacity
- Plate type fuel assembly, LEU of 19.75 % or less, 16+6 U-Mo fuel assemblies
- Light water cooling, forced convection flow downward
- Reflector of Beryllium
- Utilization
  - RI production
  - Material irradiation
  - Neutron transmutation doping

□ **H**igh-flux **A**dvanced **N**eutron **A**pplication **R**eact**O**r (HANARO)

- Multi-purpose research reactor

□ Characteristics



- Open-tank-in-pool type
- 30 MWt of power capacity
- Rod type fuel, LEU of 19.75% or less, 32 U_3Si fuel assemblies
- Light water, forced convection cooling upward
- Reflector of heavy water
- Utilization
  - About 20 horizontal or vertical beam ports and irradiation holes
  - Irradiation tests with capsules
  - Fuel test loop facilities
  - RI production facility
  - Neutron transmutation doping
  - Beam utilization facilities

Cold neutron research facility in 2008

Reactor hall in 1995

Reactor hall in 2015

□ Licensing of HANARO

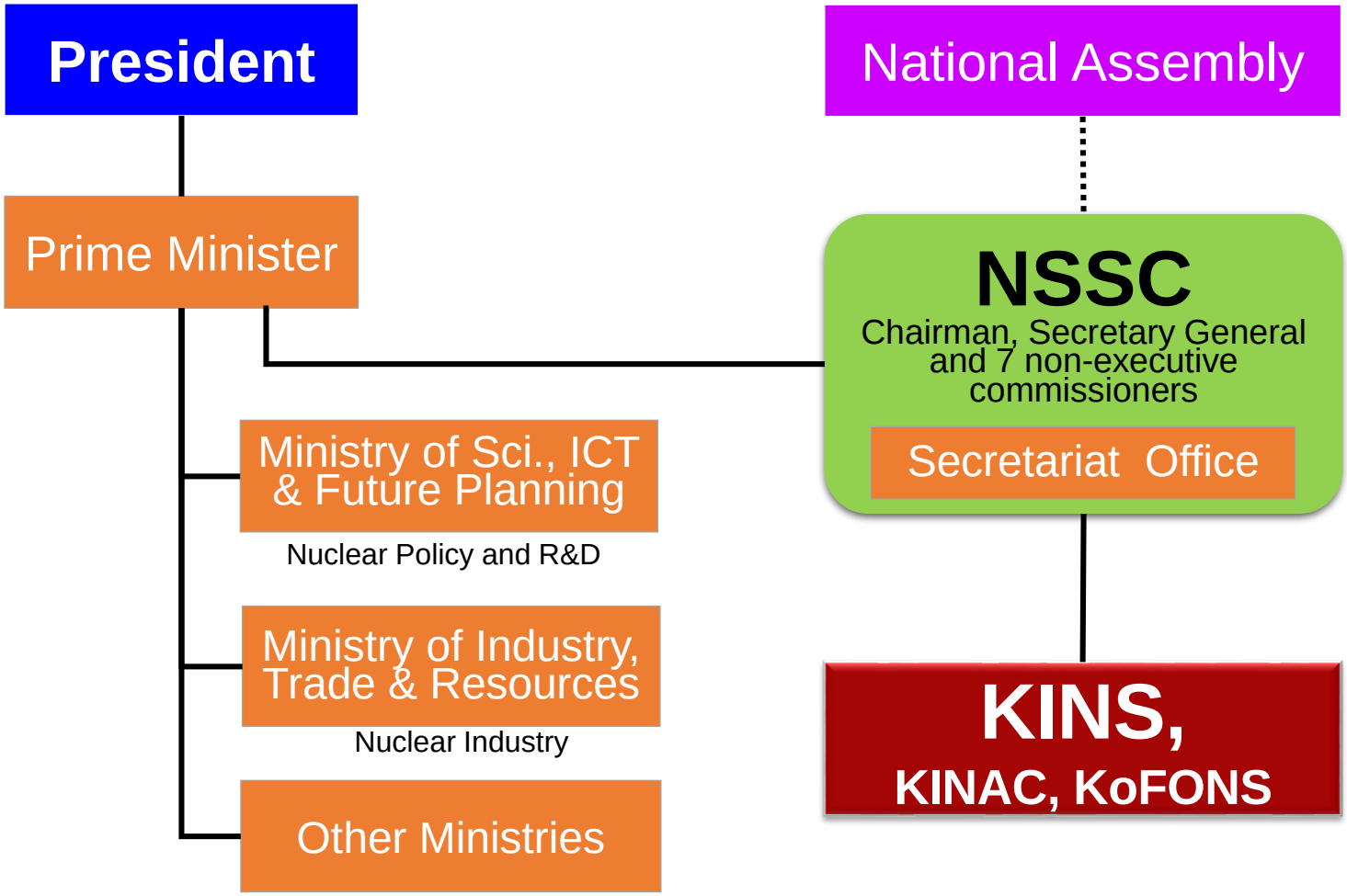
- 1985.01 Start of HANARO project
- 1986.12 Pre-application review on SAR/ER
- 1987.07 Application for CP/OL (1-step licensing)
- 1987.12 Issuance of CP/OL with 4 conditional items
- 1989.01 Start of HANARO construction
- 1993.05 Submission of revised SAR (system design)
- 1993.08 Installation of HANARO reactor structure
- 1993.12 Submission of revised SAR (core design & safety analysis)
- 1994.02 Response to the 4 conditional items
- 1994.03 Submission of the revised ER
- 1995.01 Permit for zero power operation
- 1995.02 Fuel loading and achievement of initial criticality
- 2004.11 Start full power operation (30MW)
- 2006.04 Start of cold neutron laboratory construction (completed in 2008)

CONTENTS

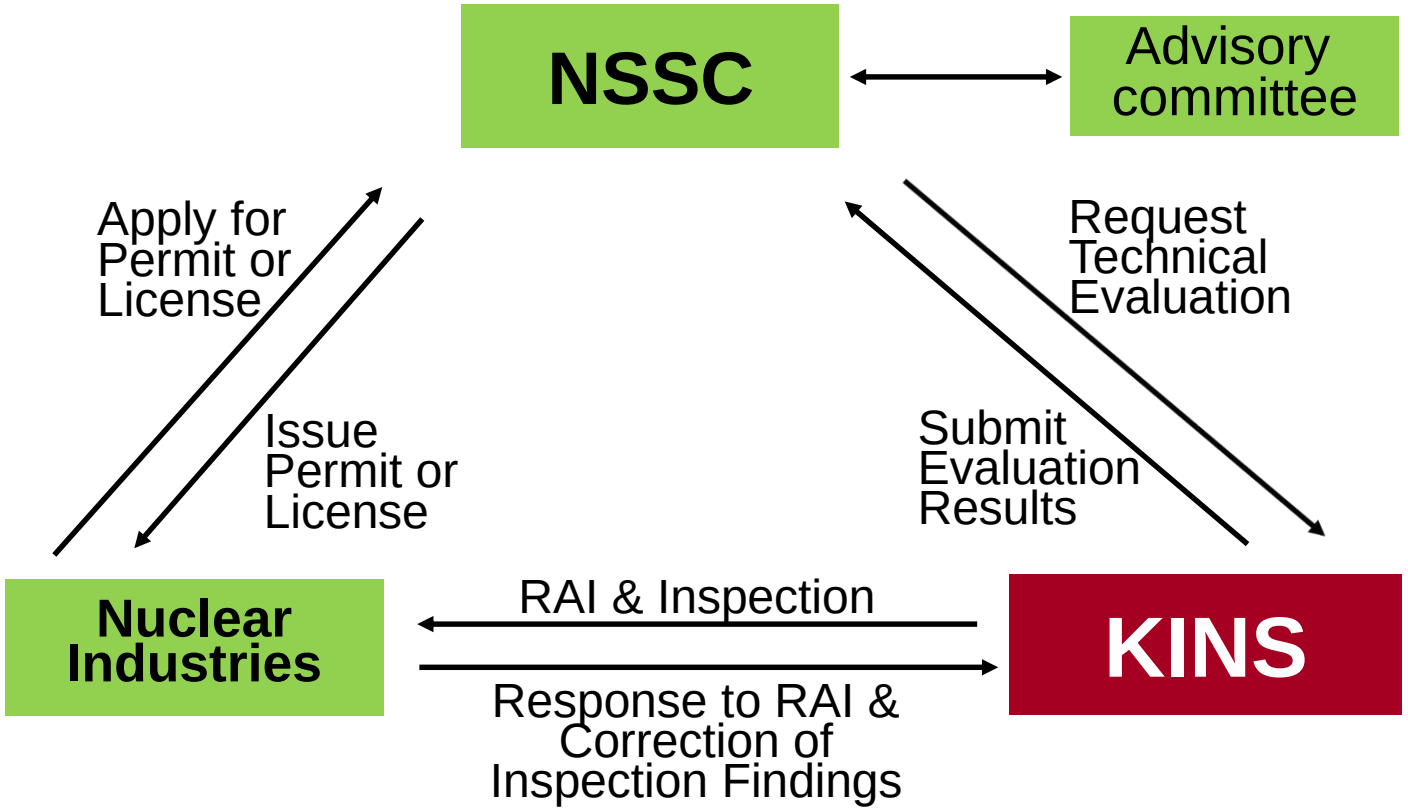
□ Fundamentals of nuclear regulation

- Protect the public health and safety from radiation hazards
- Preserve the environment from any subsequent harmful effects
- The scope for nuclear facilities covers;
  - Site selection, Design, Manufacturing, Construction, Operation, Decommissioning
- Core values for nuclear regulation
  - **Excellence**: expertise & experience toward public confidence
  - **Independence**: safety and security in the eyes of the people
  - **Transparency**: no doubt in the process of decision making
  - **Impartiality**: objective approach in policy & decision making
  - **Reliability**: conformity of principles, and clarity & consistency

□ Regulatory framework



□ Working mechanism



- Nuclear Safety & Security Commission (NSSC)
  - Regulatory authority of about 140 officials
  - Policy making, authorization, administration and enforcement actions for nuclear safety and security

- **Korea Institute of Nuclear Safety (KINS)**
  - Nuclear safety expert organization, having **600**$^{+}$ staff members
  - Safety review and inspection, and development of policies, rules, regulations and guidelines
  - ✓ Established in 1990 by the special KINS Act

- Korea Institute of Nuclear non-proliferation & Control (KINAC)
  - Safeguards and security expert organization from 2006

- Korea Foundation of Nuclear Safety (KoFONS)
  - Supporting organization in managing government funds for nuclear safety regulations and the relevant R&D projects

- Overview of nuclear regulation

Safety Policy

Safety Standards

Safety Review

Safety Management

Safety Inspection

Incidents Investigation

Regulatory Research

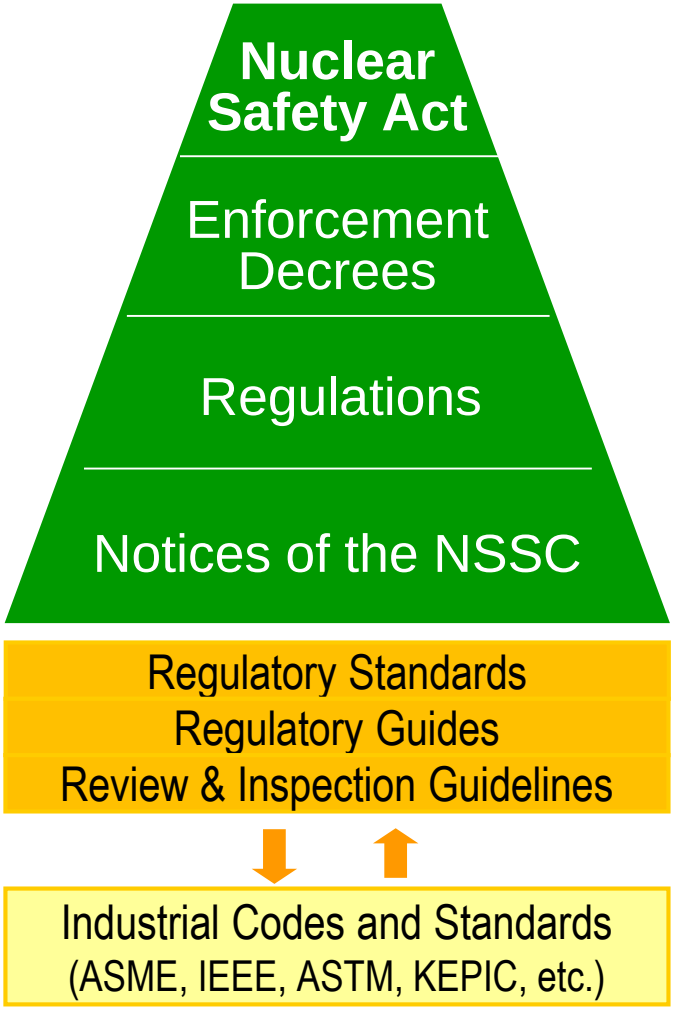
Human Res. Develop.

International Co-op.

Infra. Improvement

□ Legal and policy frameworks

- Legal framework



- Bases and fundamental matters regarding safety regulations
- Particulars entrusted by the Act and necessary for the enforcement of the Act
- Technical standards and particulars entrusted by the Act and the Decree
- Details on technical standards, procedures or formats as designated by the Act and relevant regulations
- Interpretation, detailed criteria, acceptable methods, conditions, and specifications of the technical standards
- Staff guidance for regulations

- Nuclear Safety Act (NSA), and the subsidiary regulations
  - Enforcement Decree of the Act
    - Address the methods to put the philosophy prescribed in the acts into action
  - Enforcement Regulation of the Act
    - Prescribe the procedural approaches in general
  - Regulations on Technical Standards for Nuclear Facilities
  - Notices of the NSSC
    - Notices provide the specific technical standards

✓ Supplemented by the "*Act on Physical Protection and Radiological Emergency*," and the subsidiary regulations

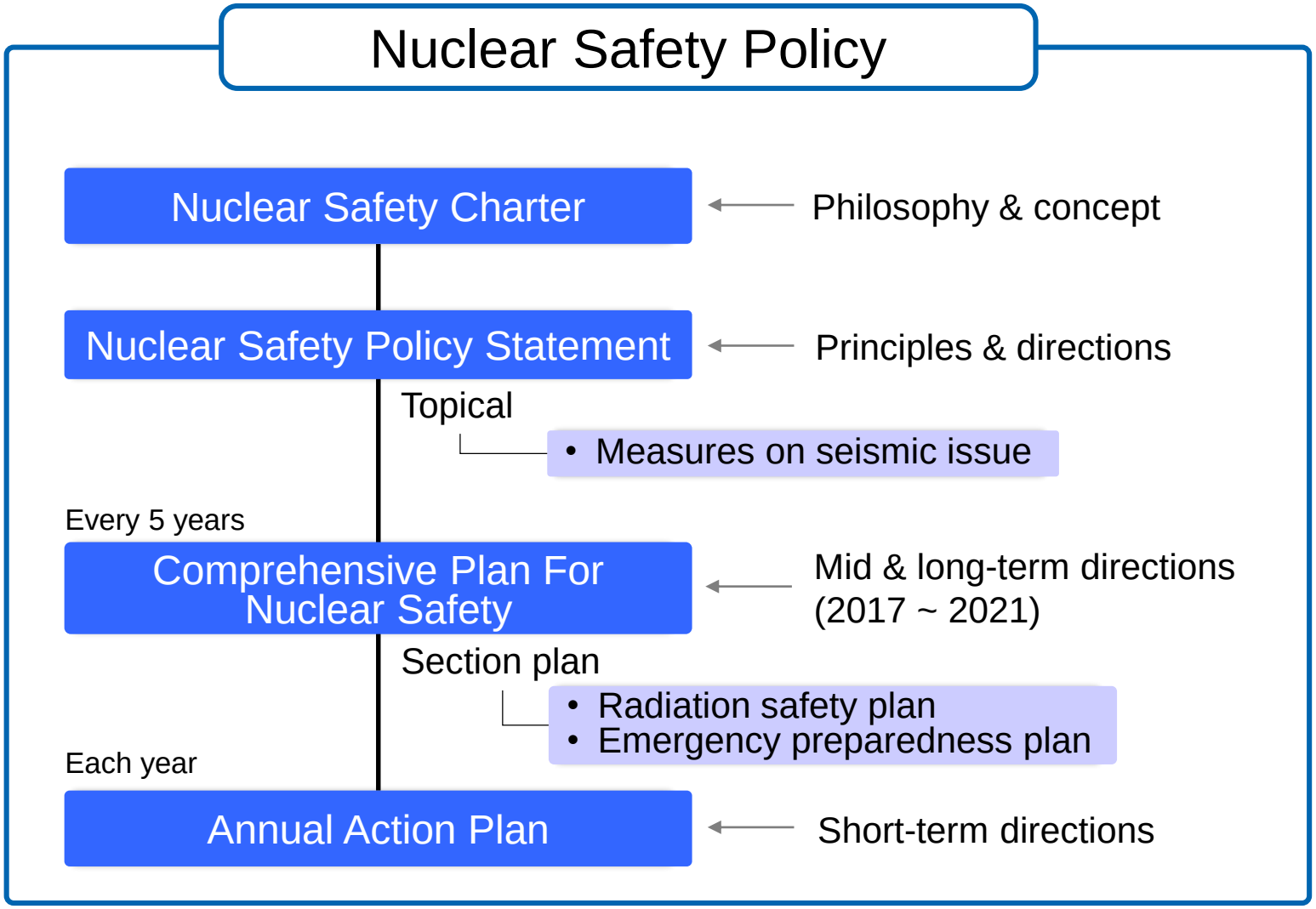
- KINS guides and examples
  - Developed for the detailed regulations of licensing review, inspection, and radiation protection
    - Safety Review Guide for Research and/or Educational Nuclear Facilities (KINS/GE-N010)
    - Review Guide of Environmental Report for Nuclear Facilities (KINS/GE-N004)
    - Review Guide of Radiological Emergency Preparedness (KINS/GE-R10)
    - Periodic Inspection Guide of HANARO (KINS/GI-N019)

  ✓ Not legally binding, but used by KINS staff as references

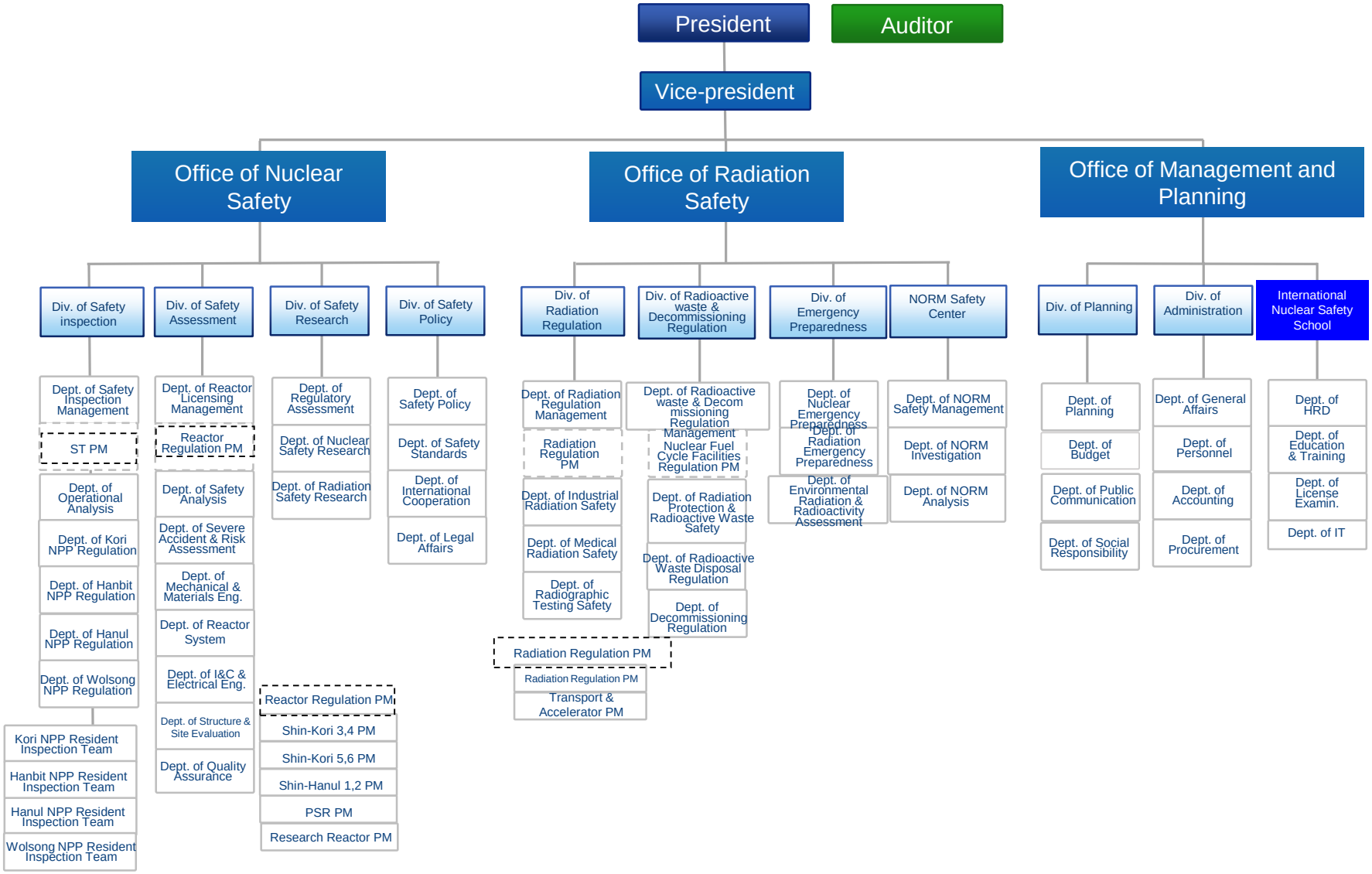
  ✓ Review guide prescribes review area, acceptance criteria, review process, and evaluation results

  ✓ Inspection guide prescribes the items, method, and acceptance criteria

- Policy framework

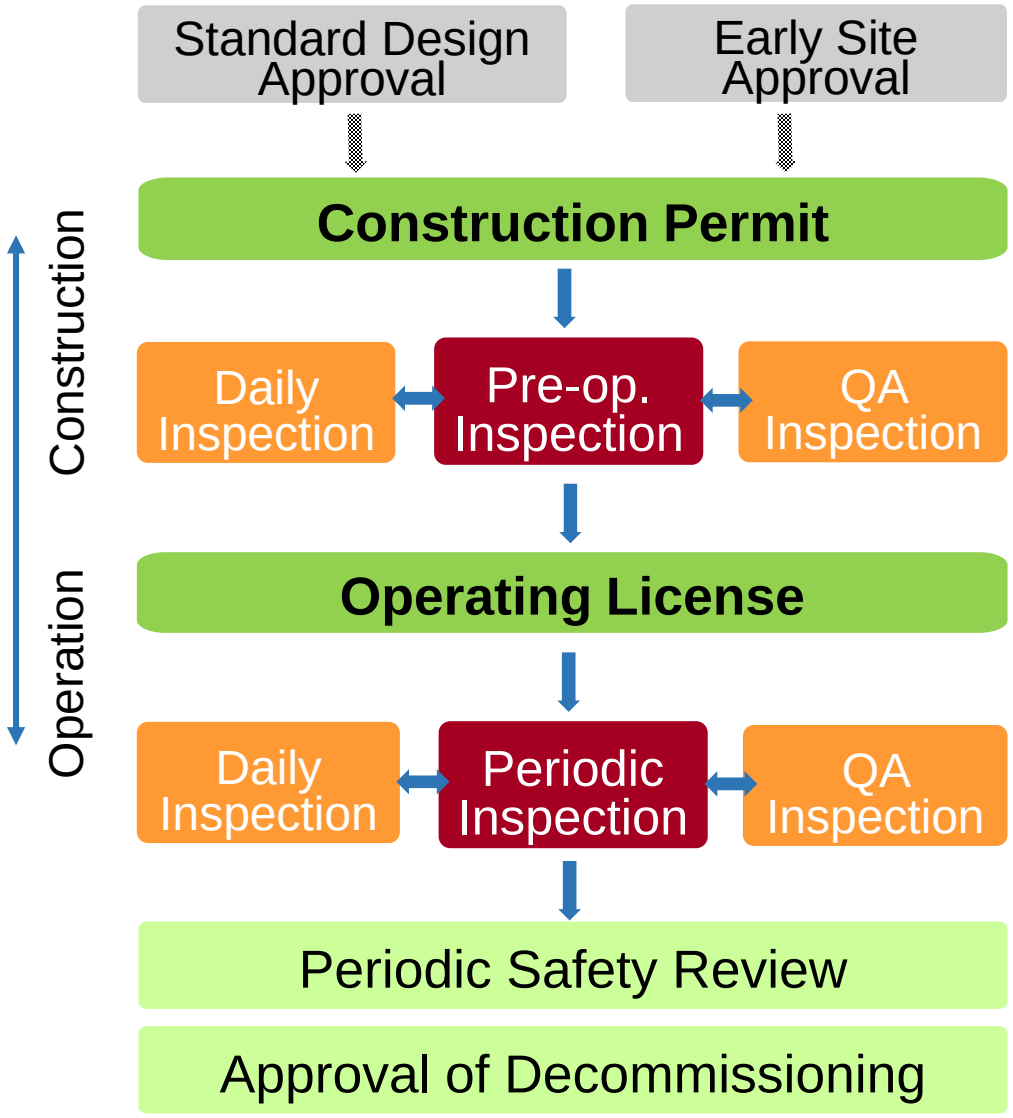


• KINS organization



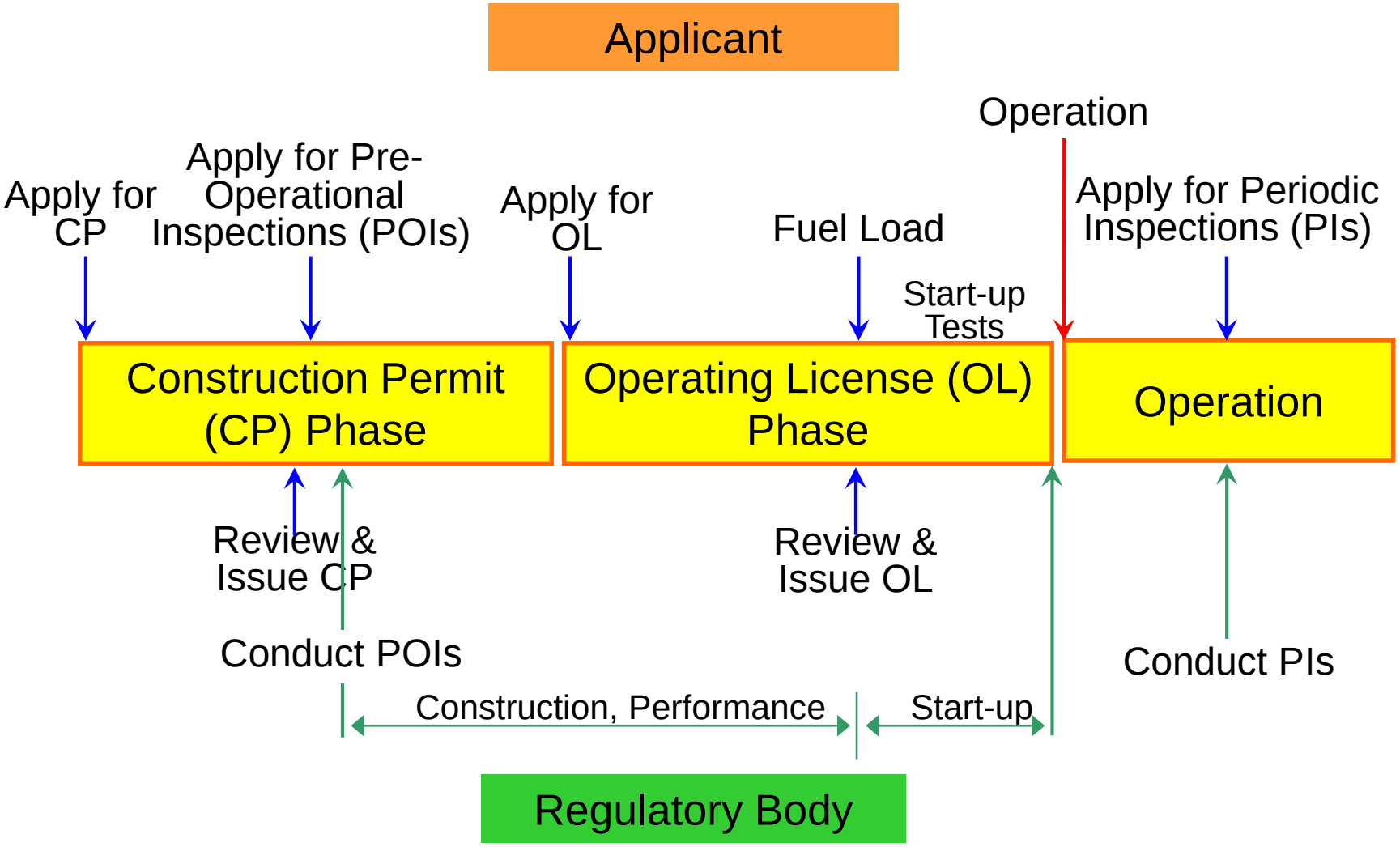
CONTENTS

□ 2-step licensing process



- SAR for standard design and preparation plan of EOP
- Site survey report with geologic survey results
- PSAR, QAP for construction, ER
- Confirm the construction, considering project milestone
- FSAR, QAP for operation, Radiological emergency plan
- Confirm the plant as licensed and/or commissioned
- Re-evaluate each NPP safety with a 10 year interval

□ Process and activities



□ Safety review

- Construction Permit (CP)
  - To ensure the adequacy of plant location and design, and construction approaches in accordance with the rules & regulations, prior to the commencement of construction
  - Major application documents
    - Preliminary Safety Analysis Report (PSAR)
    - Quality assurance program for design and construction
    - Environmental Report (ER)

✓ Early Site Approval (ESA)

- To allow the applicant to perform a limited civil engineering work of site preparation and power block excavation, before CP
- Site Survey Report
- Detailed Geological Survey Report

- Operating License (OL)
  - To confirm the final adequacy of plant design and operational approaches
  - Perform safety review in the same manner as that for CP
    - With some additional reviews of the operating capability and accident response ability of the applicant
  - Major application documents
    - Final Safety Analysis Report (FSAR)
    - QAP for operation
    - Technical Specifications for Operation
    - Radiological Emergency Plan

✓ Nuclear fuel loading and commissioning tests upon the issuance of OL

- Standard Design Approval (SDA) for NPP
  - Prior authorization of a standard NPP design for the repeated construction; *effective for 10 years*
    - Safety analysis report on the standard design
    - Preparation plan of emergency operating procedures
  - Issued for the designs of APR-1400 and APR^{+}, and SMART NPP in 2001, 2014 and 2012, respectively
- Amendment of Permit or License, or SDA
  - Modification of the contents of approved documents after permit, license or approval
  - Supplementary documents to verify the adequacy
- Periodic Safety Review (PSR)
  - Comprehensive re-evaluation for the safety of each operating NPP or research reactor with a 10 year interval after the OL
  - Physical conditions, safety analysis, equipment verification, aged deterioration, safety performance, experience feedback, operating procedures

□ Safety inspection

<table>
<tr><th>Category</th><th colspan="2">Construction</th><th>Operation</th><th>Type</th></tr>
<tr><td rowspan="3">Planned</td><td colspan="3">Quality Assurance (QA) Inspection</td><td rowspan="3">Regular and announced</td></tr>
<tr><td colspan="2">Pre-operational Inspection</td><td>Periodic Inspection</td></tr>
<tr><td colspan="3" rowspan="2">Resident Inspection</td></tr>
<tr><td rowspan="2">Reactive</td><td rowspan="2">Irregular and unannounced</td></tr>
<tr><td colspan="3">Special Inspection</td></tr>
</table>

- QA inspection
  - Confirm the quality achievement of organization involved in the design, manufacturing, construction, and operation of facilities
  - Verify the effectiveness of QA Program (QAP) and the appropriateness of applicant's QA activities
  - Performed in reference to the QAP approved by the regulatory body, in a programmatic manner, annually planned for each organization

- Pre-operational inspection
  - Confirm the adequacy of materials, components, systems and structures, as well as construction related activities, processes, procedures and personnel competence
  - Performed in compliance with safety assessment results and Safety Analysis Reports, and in reference to the project's milestones

- Periodic inspection
  - Ensure the performance of reactor facility for re-criticality after plant overhaul
  - Performed during the NPP outage period
  - For research reactor, conducted every 24 months in accordance with the standard inspection items and re-started with the approval of regulatory body

- Resident inspection
  - Monitor daily construction and operation status, and identify and respond to any activities adverse to safety
  - Operate, both NSSC and KINS, resident inspection office at each NPP site

- Special inspection
  - Initiated in response to any unexpected, unplanned or unusual situations or events, as necessary

□ Authorization

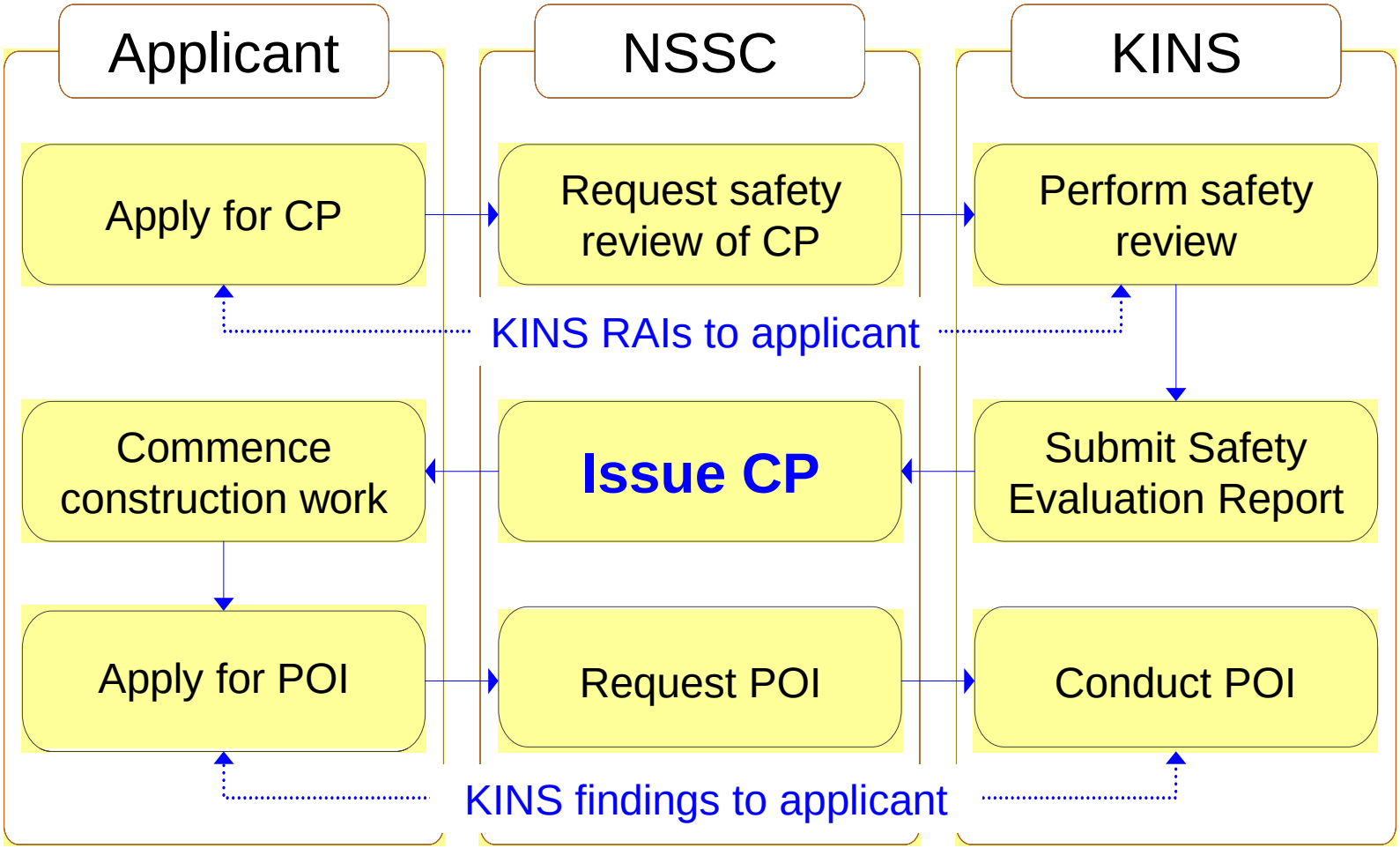
✓ 2-step licensing process for RRx since 2014

- NSA, Article 30 (Permit for the construction of RRx)
  - Require a permit for the construction of reactor for research or educational purposes, and for the change of any permitted
  - Documents to be submitted:
    - Preliminary Safety Analysis Report (PSAR)
    - Radiation environmental impact assessment report (RER)
    - Quality Assurance Plan (QAP) for construction
    - Description of the purpose for the use of reactor
    - Description of the technical capabilities regarding installation of reactor facilities
    - Preliminary decommissioning plans
  - Establish standards for permit, so as to apply mutatis mutandis those for NPP

- Standards for permit
  - Availability of the technical capabilities of applicant, necessary for construction
  - Adequacy of the location, structures and equipment to protect human and physical resources, and the public
  - Adequacy of the construction to prevent any harm to the public and the environment, caused by radioactive materials
  - Adequacy of Quality Assurance Plan
  - Adequacy of Decommissioning Plan

  ✓ Article 11 of the Act

- Process for CP

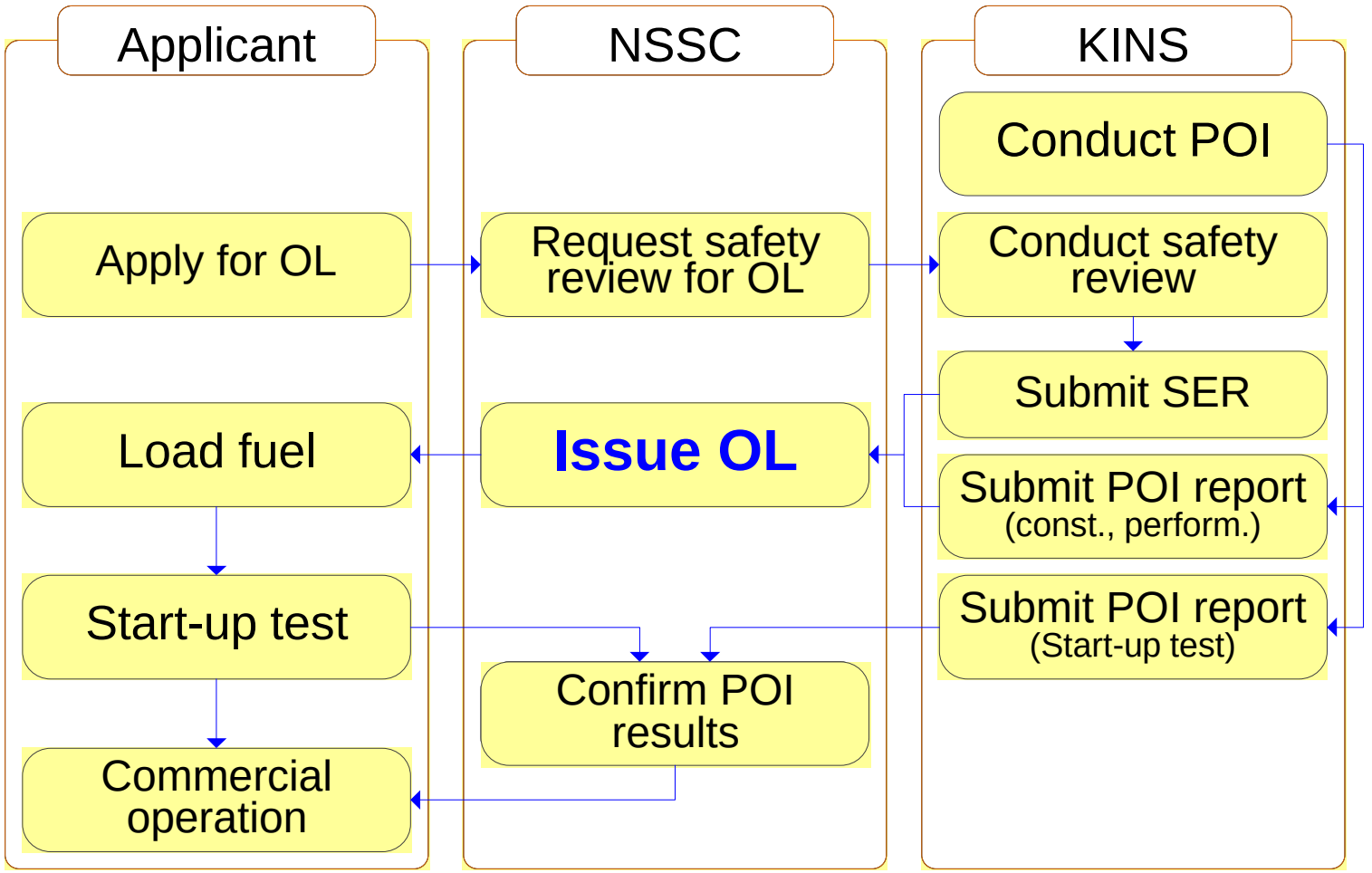


- NSA, Article 30-2 (License to operate RRx)
  - Require a license to operate reactor for research or educational purposes, and to change any permitted
  - Documents to be submitted:
    - Final Safety Analysis Report (FSAR)
    - Technical specifications for operation of reactor & facilities
    - Accident management programme
    - Quality Assurance Plan (QAP) for operation
    - Radiation environment impact assessment report (RER, modified part)
    - Description of the technical capabilities of applicant regarding operation of reactor facilities
    - Description on fuel loading plan
    - Descriptions of technical rationale and verification method to be used for emergency operating procedures
    - Final decommissioning plan
  - Stipulate standards for license, allowing to apply those for NPP mutatis mutandis

- Standards for license
  - Availability of the technical capabilities of applicant, necessary for operation
  - Adequacy of the performance of nuclear facilities to protect human and physical resources, and the public
  - Adequacy of the operation to prevent any harm to the public and the environment, caused by radioactive materials
  - Adequacy of Quality Assurance Plan
  - Adequacy of Decommissioning Plan
  - Adequacy of Accident Management Program

  ✓ Article 21 of the Act

□ Process for OL



CONTENTS

1. General practices for RRx regulation

□ Regard RRx as a kind of nuclear facilities, which rules and regulations (R&Rs) cover inclusively

□ Apply, *mutatis mutandis,* the same R&Rs as those for NPPs

- "Mutatis mutandis" allows modifications of R&Rs as necessary

□ Manage regulatory activities under the same project system of KINS as that for NPPs

- By a dedicated Project Manager(s)

□ Review and inspection by the same technical departments of KINS as those for NPPs

2. Graded approach

□ The NSA for RRx

- Article 30 (Construction permit)
  - No prior approval of construction site for RRx
- Article 30-2 (License for the operation of RRx)
  - Apply mutatis mutandis to RRx
- Article 11 (Standards for permit) and 21 (Standards for license)
  - Apply mutatis mutandis to RRx
- Article 34 (Other mutatis mutandis applications)
  - Pre-operational inspection, periodic inspection, decommission plan

- Article 104 (Preservation of environment)
  - Survey and evaluation of radiation impact on the environment by operator
  - ✓ Applicable to RRx, generating thermal power of not less than 100kw
- Article 103 (Gathering of residents opinion)
  - Public hearing for compiling radiation environment report
  - ✓ Only for NPPs, nuclear waste disposal facility and spent fuel storage facility
- Enforcement regulation Article 19 (Periodic inspection)
  - Regular inspection within 20 months for NPPs, and within 24 months for RRx

- ✓ Enforcement decree, Article 129 (Establishment of exclusion area)
  - No exclusion area for RRx with thermal output of not more than 10 MWt
- ✓ NSSC Notice 2014-82 (Regulation on radiological emergency preparedness for nuclear licensee), Article 3 (Areas of emergency planning zone)
  - PAZ (Preventive Action Zone) and EPZ (Zones for planned Emergency Protective actions)

	NPP	RRx	
PAZ	3 ~ 5 km	-	
EPZ	20 ~ 30 km	2 ~ 10 MWt	0.5 km
		10 ~ 50 MWt	1.5 km
		50 ~ 100 MWt	5 km

□ Legal basis for graded approach

✓ Regulations on Technical Standards for Nuclear Facilities

- Section 1 (Article 3 to 10),Location
- Section 2 (Article 11 to 49), SSCs and performance
- Section 3 (Article 50 to 66), Operation
- Section 4 (Article 67 ~ 85), Quality assurance regarding construction and operation

✓ Apply mutatis mutandis to all the nuclear facilities

- Article 3 (Scope of application)
  - **Admit exceptions of application for the cases**
    - Such standards are not directly applicable to the facilities due to the differences
      - Purpose, fundamental concept, or design features of such facilities
    - Safety is not affected even if such standards are not applied

□ Engineering practices for a graded approach

✓ Standard of judgement for *mutatis mutandis*

- Severity of hazard, and potential impact (risks) on the safety and health of people and the environment
- Safety analysis and the related engineering judgement
- Significance and complexity of the activity involved
- Experiences of the staff involved
- Possible consequences in case of failure
- Maturity of the technology and operating experience associated with the activities

3. Review and assessment

① Review of safety management

✓ Description of Technical Capabilities of Applicant concerning Installation and Operation of Nuclear Facilities (NSSC Notice 2014-33)

- Article 2 (CP of nuclear facilities)
  - Items to describe technical capabilities for construction
    - Organization and departments for construction, and the assignment of responsibilities and rights for duties
    - Engineering and technical support organization to review safety matters that may arise during construction
    - Description of qualification and experiences of employees involved in construction
    - Systems to analyze construction cases and operating experiences to reflect into design and construction
    - Plans for test and inspect of the safety-related structures, systems, and components

✓ *Article 3 (OL): refer to the Regulation of Tech. Stds. followed*

✓ Regulation on Technical Standards for Nuclear Facilities

- Article 54 (Operating organization)
  - Establish an organizational structure for the safe operation of reactor facilities, and provide with authority and responsibilities
  - Employ qualified personnel, including licensees of supervisory reactor operator, reactor operator, supervisory fuel material handler, and fuel material handler
  - Clarify functional responsibilities and authority for assuring correct response to emergency situations, and establish the lines of internal and external communication
  - Establish an engineering and technical support organization for the review of operational safety

- Article 55 (Qualifications and training)
  - Appoint plant personnel with knowledge and experience required for the performance of duties
  - Assure that qualified personnel conduct reactor operations, fuel materials handling, and radioisotopes handling
  - Establish training program for the plant personnel to assure they perform their duties successfully in normal operations and accident conditions
  - Examine the reactor operators annually to ensure their medical fitness is appropriate to the duties and responsibilities
- Article 56 (Operating procedures)
  - Prepare in writing the procedures for administration, operation, testing, and maintenance before commencement of operation
  - Consist of normal, abnormal, and emergency operating procedures, and include operating staff actions for normal operations, anticipated operational occurrences and DBAs
  - Include all the measures to prevent severe accidents and mitigate the results in accident management program

- Article 63 (Testing, monitoring, inspection and maintenance)
  - Establish a testing, monitoring, inspection and maintenance program for structures, systems, and components (SSCs), in order to maintain safety functions and performance
  - Monitor and evaluate the following items:
    - Degree of degradation in materials and performance of safety-related SSCs due to ageing
    - Performance and degree of degradation due to ageing, for the pumps and valves necessary for safe shutdown, core cooling, and mitigation of accident consequences
    - Degree of degradation in material and performance due to neutron irradiation for reactor pressure vessel
    - Verification and calibration of instrumentation and radiation detector directly related with the preservation of reactor facilities at the specified period
  - Perform testing, monitoring, and maintenance activities by qualified personnel

② Review of design

✓ Regulations on Technical Standards for Nuclear Reactor Facilities

- **Design philosophy of safety-related SSCs**
  - Article 12 (Safety classes and standards)
    - Apply the safety classes and standards for SSCs, commensurate with the importance of safety functions
  - Article 13 (External events design bases)
    - Protect from the consequences of:
      - Potential natural phenomena including earthquake, hurricane, flood or tsunami
      - Potential man-induced external event including airplane crash or explosion
  - Article 14 (Design bases for fire protection)
    - Design and locate to minimize the possibility and consequence of fire and explosion

- Article 15 (Design bases for environmental effects)
  - Prevent any damage caused by environmental or dynamic effect
- Article 40 (Use of qualified equipment)
  - Use the equipment qualified by operating experiences, analysis, tests, or a combination of them
- Article 41 (Test, monitoring, inspection and maintenance):
  - Design the safety-related SSCs so that they can be tested, monitored, inspected and maintained
- Article 44 (Reliability)
  - Ensure high reliability commensurate with the importance of the safety function
  - The principles of redundancy, diversity, independency, physical separation and single failure assumption
- Article 45 (Human factor)
  - Consider human factors systematically in the design of man-machine interface, and minimize the possibility of human errors

- **Design bases for major safety-related systems**
  - Engineered safety features to mitigate the results of abnormal occurrences and DBAs
    - Article 23 (Reactor containment)
      - Provide leak tight protective barrier in order to minimize uncontrolled release of radioactive materials to the environment for all accident conditions
    - Article 30 (Emergency core cooling system)
      - Maintain the safety following loss of residual heat removal capability or loss of reactor coolant accidents
  - Other safety-related systems addressed by the REGULATION
    - Reactor power control system, reactor cooling system, power supply system, reactor protection system, reactivity control system, residual heat removal system, facilities for treatment of radioactive waste, fuel handling and storage facilities, radiation protection facilities

– Perform safety analyses

  - Demonstrate that the consequence of any DBA is within the regulatory limit

    - Ensure that radiation dose to workers and the public is maintained within the acceptable limits for a set of DBAs including internal and external events

  - Perform safety analyses for the DBAs, based on the deterministic methodology with the application of conservative codes and standards

  - Confirm the performance of engineered safety features to mitigate the results of DBAs

③ Review of operation

- Verify the performance of nuclear facilities and the capability of applicant for safe operation

✓ Regulations on Technical Standards for Nuclear Reactor Facilities, Article 69 (Quality assurance program)

  – Require to establish the QAP, including the education and training of the personnel who perform activities that affect quality

✓ NSSC Notice 2015-01 (Standard format and content of technical specifications for operation), Article 15 (Reporting requirements)

  – Environmental radiation report (biannually and annually)

  – Operation history report (quarterly)

  – Radiation management report (quarterly)

  – Incident or failure report if occurs

- ✓ NSSC Notice 2014-17 (Regulation on reporting and public announcement of accidents and incidents for nuclear power utilization facilities)
  - Stipulate the types of incident or failure which shall be reported and published to the public
  - The relevant procedures and evaluations regarding the incident or failure

- ✓ NSSC Notice 2014-12 (Regulation on survey and evaluation of environmental radiation in vicinity of nuclear power utilization facilities)
  - Stipulate the items of radiological environment survey to be reported biannually and those to be reported annually
  - Any abnormality identified by the survey to NSSC within one week

- ✓ Act on Physical Protection and Radiological Emergency, Article 20 (Radiological emergency plan of a nuclear licensee)
  - Stipulate preparation of radiological emergency plan and NSSC approval prior to the commencement of the use of nuclear facilities

- ✓ NSSC Notice 2014-82 (Standards for radiological emergency plan of nuclear related enterprisers)
  - Stipulates the contents of radiological emergency plan
    - Descriptions regarding emergency organizations and their responsibilities
    - Radiological emergency declaration criteria
    - Radiological disaster response facilities
    - Emergency response activities
    - Radiological emergency training and exercises

④ Review on decommission

- ✓ Enforcement Regulation of the Act, Article 4 (Application of Construction Permit)
  - – Stipulate the contents of documents for the application of CP
    - Apply mutatis mutandis to RRx
  - – Contents of decommissioning plan for nuclear facilities
    - Organization, and human and budgetary resources
    - Strategies and milestones
    - Design features and steps to be taken during the construction or operation to facilitate decommissioning
    - Steps to prevent any potential hazard that might be caused by radiation
    - Methods to remove radioactive materials and the contamination caused
    - Strategies of the treatment, storage and disposal of radioactive waste
    - Evaluation of the impact of radioactive materials on the environment and the countermeasures

4. Inspection and enforcement

□ Safety inspections

✓ Nuclear Safety Act, Article 16 and 22 (Inspection)
- Inspection for construction and operation of nuclear facilities, respectively

✓ Enforcement decree of the NSA

- Article 29 (Time of pre-operational inspection)
  - When the construction of important structures has started
  - When any strength test for major process may be available
  - When the construction has been completed and any performance test of each system may be available
  - When a cold hydro test and hot functional test may be available
  - When nuclear fuel loading and commissioning test may be available

✓ The facilities and items to be inspected are to be adjusted in consideration of the design characteristics of RRx

- Article 31 (Quality assurance inspection)
  - Inspections of construction or operating activities to verify the conformity with the technical standards of quality assurance in the Regulation on Technical Standards for Nuclear Reactor Facilities
- Article 35 (Periodic inspection)
  - Regular inspection for the operational performance
  - Conformity of the performance of major facilities and the operation with the relevant technical standards
  - Maintainability of the performance confirmed at the pre-operational inspection

  ✓ Re-criticality of reactor depends on the results of periodic inspection

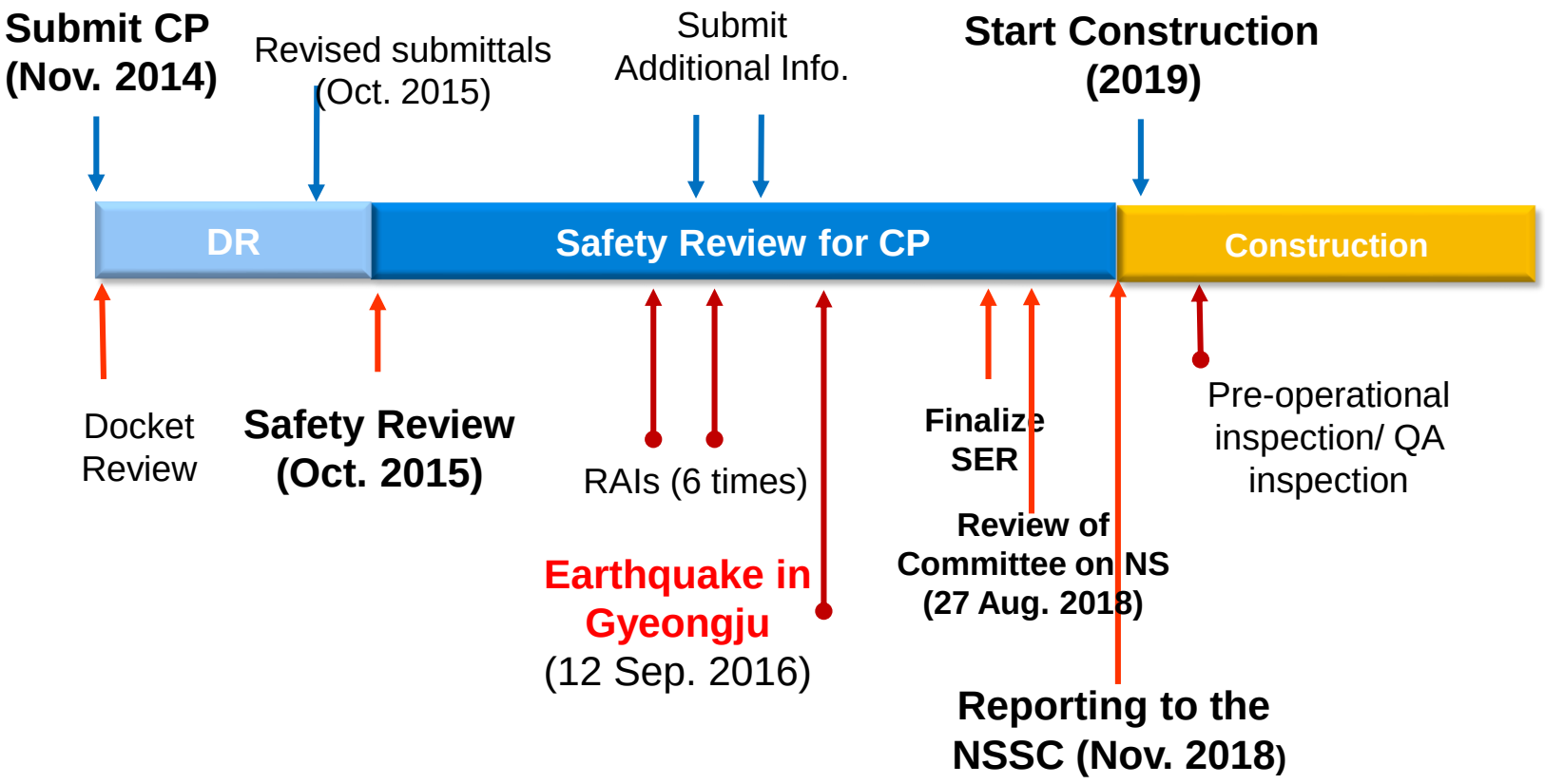
- Nuclear Safety Act, Art. 28 (Decommissioning of nuclear facilities)
  - Inspection of the decommissioning status of the nuclear facilities before and after the completion of decommissioning
  - Verify the conformity of activities with the decommissioning plan approved
    - Method to decommission the facilities
    - Method to remove the contamination of radioactive materials
    - Management of radioactive wastes
    - Management of radiation protection
    - Consistency of decommissioning completion report with the actual state
    - Site condition after decommissioning

□ Enforcement

- Nuclear Safety Act, Article 16 and 22 (Inspection)
  - Order the licensee to take corrective or complementary measures for any noncompliance to the licensing standards or to the descriptions of licensing basis documents
- Article 32 (Revocation of permits for construction or operation)
  - Order the revocation of permit or the suspension of business within one year for the cases:
    - Permit by fraud or by any other illegitimate means
    - Failure to commence the business within the specified period *(3 yrs after the authorization)*
    - Continuous suspension of the business for not less than one (1) year without justifiable reasons
    - Failure to meet the standards for the permit
- NSSC Notice 2015-07 (Regulation on management of inspection findings)
  - Corrective action plan by the licensee to respond to findings

5. Safety review of KJRR

□ Milestone



□ Review approach

- Apply regulatory requirements and guides for RRx as well as those for NPPs, as necessary
- Utilize graded review in consideration of the reactor characteristics
- Identify any potential safety issues as early as possible, and focus on the efforts of review
- Feedback the experience and information related to the operation and licensing of RRx, domestic and overseas
- Implement the action items of Fukushima D. accident
- Utilize consultations of outside experts and perform audit calculations, if necessary

□ Review focus

- Site characteristics including the effects of Gyeongju earthquake and geological/hydrological characteristics
- Classification of SSCs, its general/specific design requirements and equipment qualification
- Design of plate type U-Mo nuclear fuel
- Thermal hydraulic design of plate type fuel and fission moly (Mo-99) target
- Evaluation of credibility of Primary Cooling System (PSC) and Safe-Residual-Heat Removal System (SRHRS)
- Categorization of transients and accidents
- Comprehensive safety review on fission-moly production facility including defense-in-depth approach for protection of radioactive material leakage
- Radioactive waste management

□ Technical issues resolved

- Geotechnical stability of the foundation material of the site
- Atmospheric dispersion factor using site meteorological data
- Use of core internal materials, not registered in KEPIC (Korea Electric Power Industry Code)
- Fire protection for safety related system

CONTENTS

✓ Applicability of licensing technologies of RRx to NPP

- Refer to the practices of KOREA, applying those for NPPs mutatis mutandis

✓ International cooperation to utilize the experiences available globally

Always we keep watching our Atomic Power

Thank You

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