



The Abdus Salam
**International Centre
for Theoretical Physics**



2473-35

Joint ICTP-IAEA School on Nuclear Energy Management

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Siting and Environmental Aspects

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SITING FOR A NEW NPP

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IAEA

International Atomic Energy Agency

NPP SITING

- ✓ The selection and the evaluation of the site for a Nuclear Power Plant are crucial parts of establishing a nuclear power program and can be significantly affected by costs, public acceptance and safety considerations.
- ✓ Main task: identify a **cost-effective, safe and secured** site for the first NPP.

Nuclear power option
included within the
national energy strategy

MILESTONE 1
Ready to make a knowledgeable
commitment to a nuclear programme

MILESTONE 2

Ready to invite bids
for the first NPP

MILESTONE 3

Ready to commission and
operate the first NPP

**Preparation of
Infrastructure
(planning)**

Site survey

**Nuclear infrastructure implementation
NPP Project Decision Making**

- Feasibility Study
- Environment Impact Analysis(EIA)
- Site Evaluation and selection
- Bid information Specification and Bidding and Evaluation
- EPC contractor selection
- Construction activities will start
- Public information and understanding

**Commissioning and
Operation of the first
NPP**

Pre-project

Project decision making

Construction

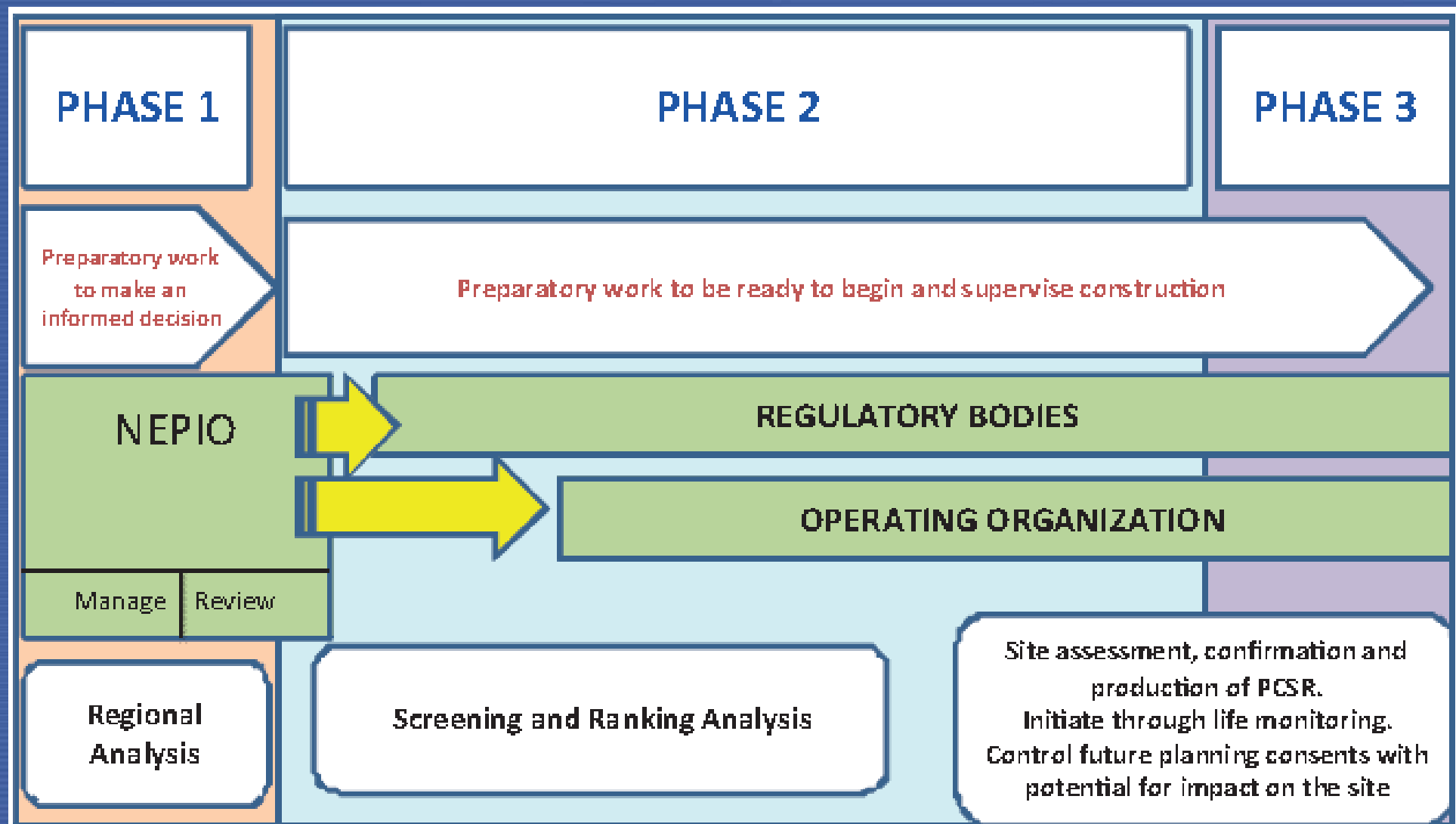
Operation /
Decommissioning

Bidding process

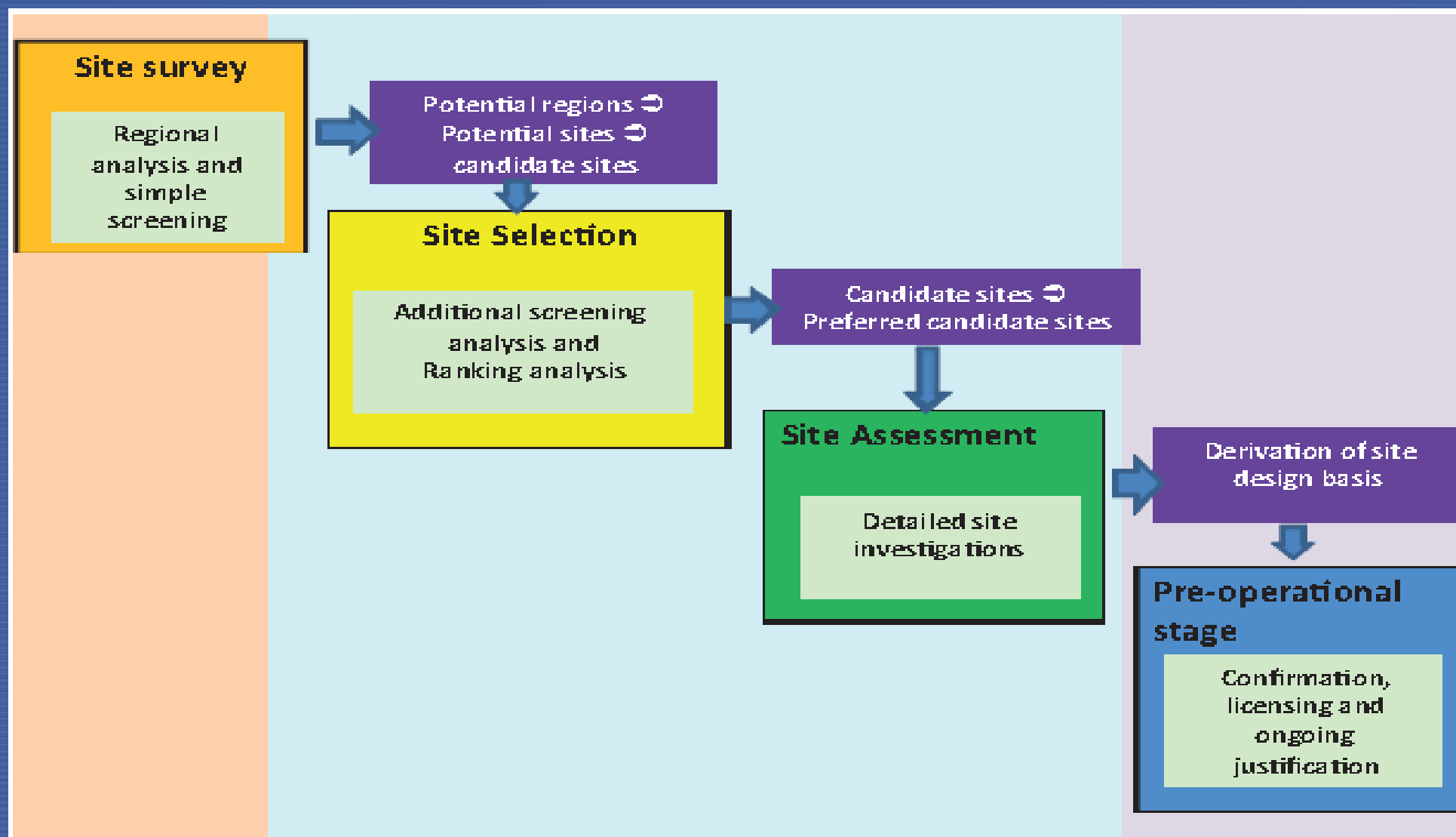
Commissioning

~ 10 – 15 years

RESPONSIBILITIES IN NPP SITING



NPP SITING PROCESS



MILESTONES AND NPP SITING

PHASE 1 - Milestone 1: ready to make decision on introducing a nuclear power programme

- General survey to identify potential sites
- Selection of potential “candidate” sites

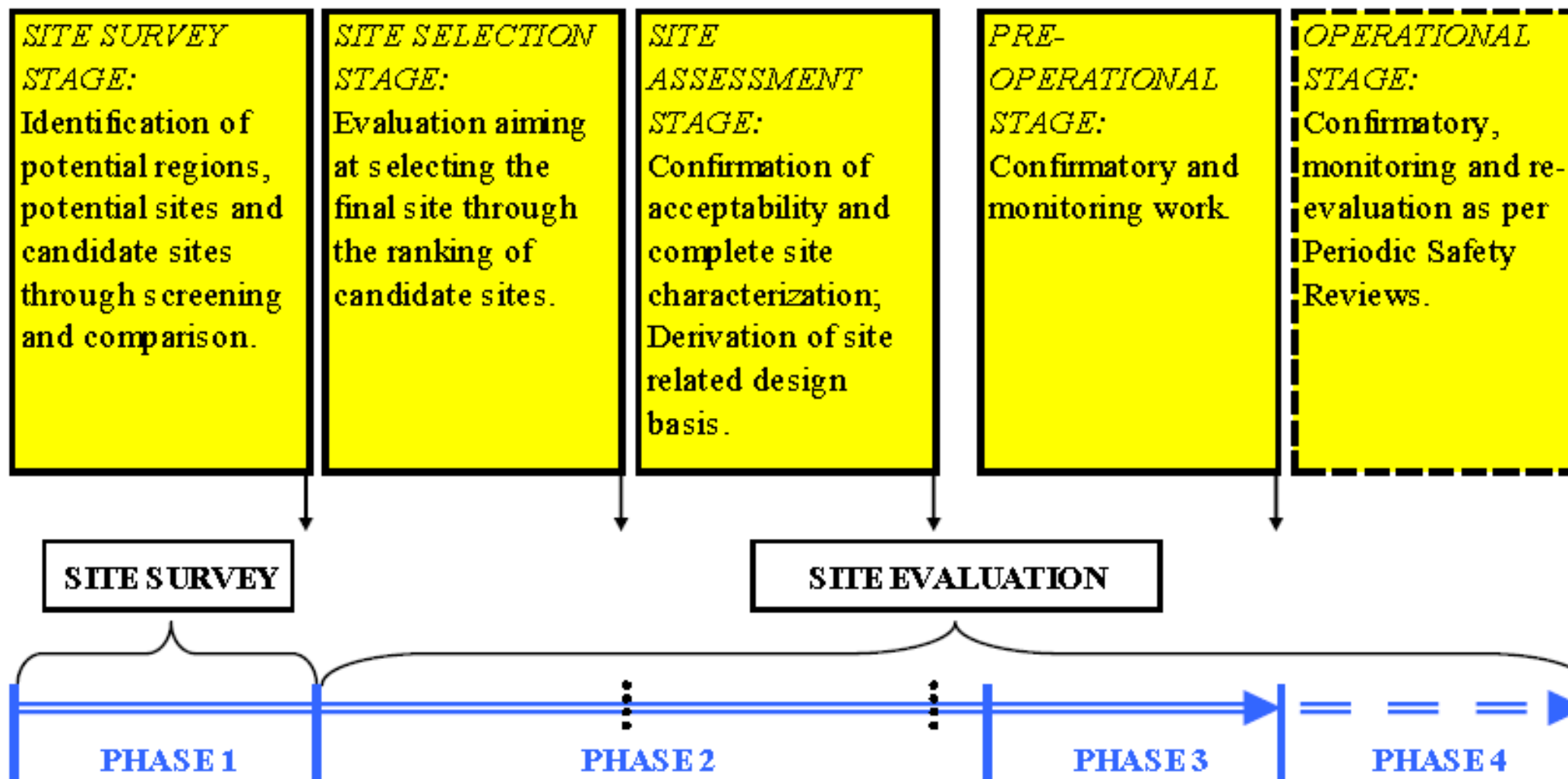
PHASE 2 - Milestone 2: ready for inviting bids

- Evaluation of “candidate” sites
- A suitable site is selected
- Full characterization of the selected site: confirmation of acceptability and derivation of Site related Design Bases.

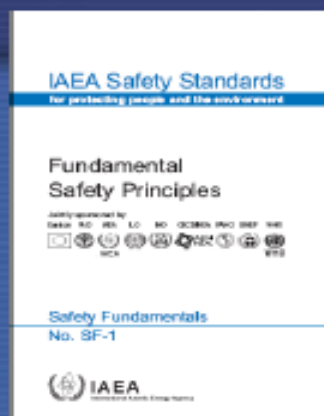
PHASE 3 - Milestone 3: ready for commissioning and operation

- All site services and provisions in place and functional

SSG-16 SITE SELECTION AND EVALUATION STAGES



INTEGRATED SITE EVALUATION REVIEW



SITE EVALUATION

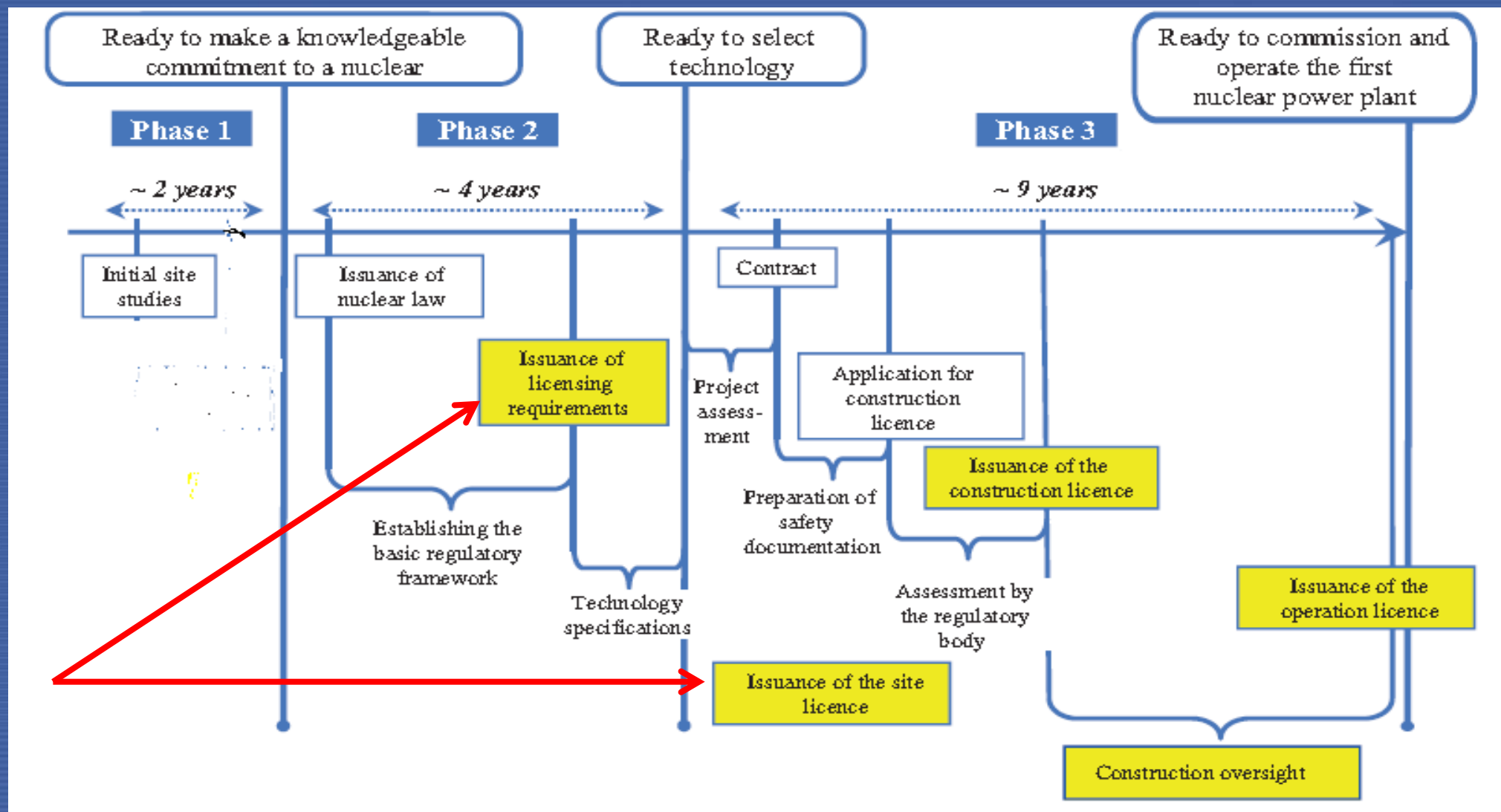


REQUIREMENTS

SAFETY GUIDES

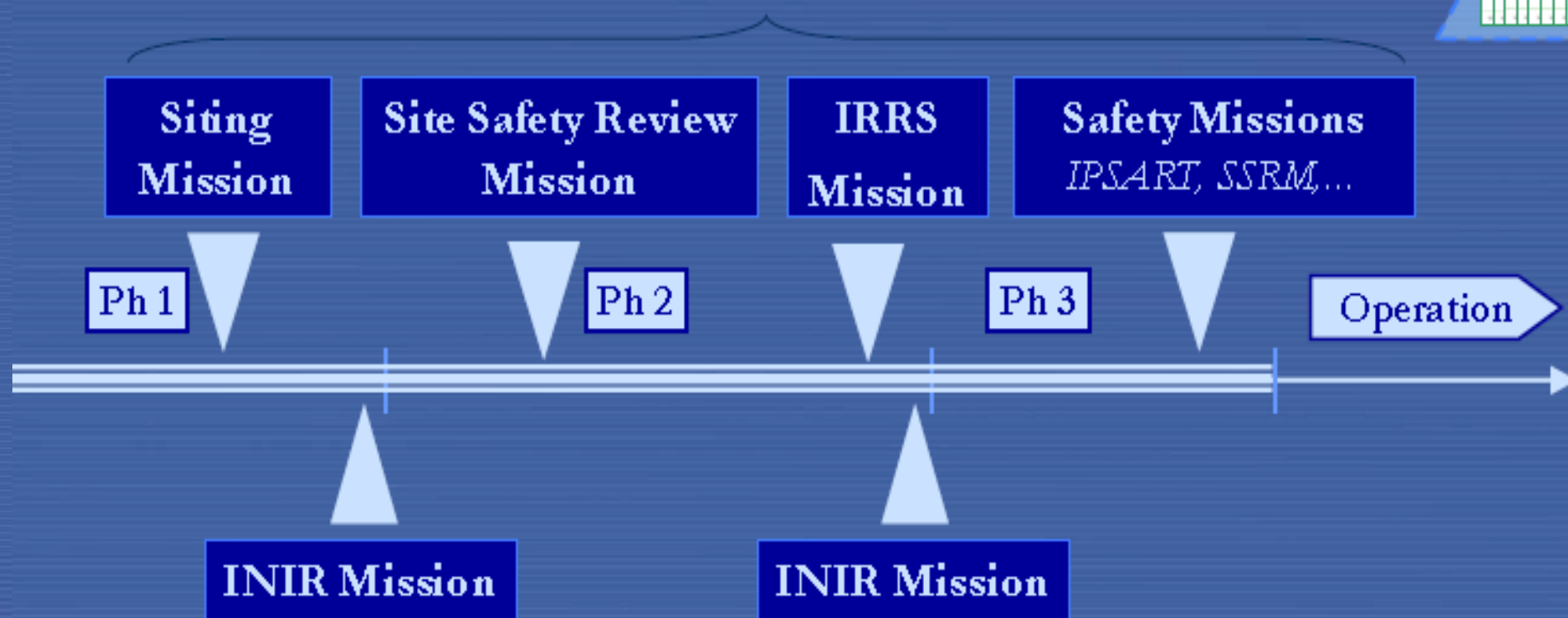


STEPS OF THE LICENSING PROCESS



IAEA SAFETY REVIEW MISSIONS

Safety peer reviews against the Safety Standards
(to address the safety-related infrastructure)



MAJOR AREAS CONSIDERED IN NPP SITING

Major area considered in NPP siting:

- ✓ Health, Safety and Security (Elaborated in the Safety Standard Series)
- ✓ Socio-economic
- ✓ Environmental
- ✓ Engineering and Cost

Specific area:

- ✓ Effects of external events (natural and human induced)
- ✓ Site characteristics influencing transfer of radioactive material to persons and environment
- ✓ Feasibility of emergency measures
- ✓ Ensure that the site–installation combination does not constitute an unacceptable risk to individuals, the population or the environment over its lifetime

TECHNICAL DISCIPLINES IN NPP SITING

GRID INFRASTRUCTURE
LAND USE
DEMOGRAPHY, POPULATION DISTRIBUTION
FEASIBILITY OF EMERGENCY PLANNING
ENVIRONMENTAL IMPACT ASSESSMENT
ENVIRONMENTAL MONITORING
VOLCANIC HAZARD
SECURITY
SEISMOLOGY
GEOLOGY
HYDROLOGY & HYDROGEOLOGY
METEOROLOGY
OCEANOGRAPHY
HUMAN INDUCED EVENTS ASSESSMENT
EXTERNAL NATURAL HAZARDS OTHER THAN EARTHQUAKES
GEOTECHNICAL, EARTHWORK & FOUNDATION

NUCLEAR POWER PLANT PARAMETER ENVELOPE

- ✓ At the beginning of the siting project, the type of NPP that will be deployed is not usually determined
- ✓ In order to select an appropriate NPP site without knowing the actual NPP parameters, it is necessary to establish a Plant Parameter Envelope (PPE) for the Nuclear Power Plant.
- ✓ PPE gives the potential **range of values** for the basic NPP parameters that impact the proposed site.
- ✓ Documents such as the Utility Requirements Document (URD) or the European Utility Requirements (EUR) that present a clear, complete statement of utility requirements for the next generation of nuclear plants, could be used as generic design basis considerations for NPP siting.

NPP SITING CRITERIA

1. Exclusion criteria.

- ✓ Exclusion criteria are used early in the siting process to eliminate areas based on consideration of go/no-go situations and are generally based on regulatory and/or plant design requirements.

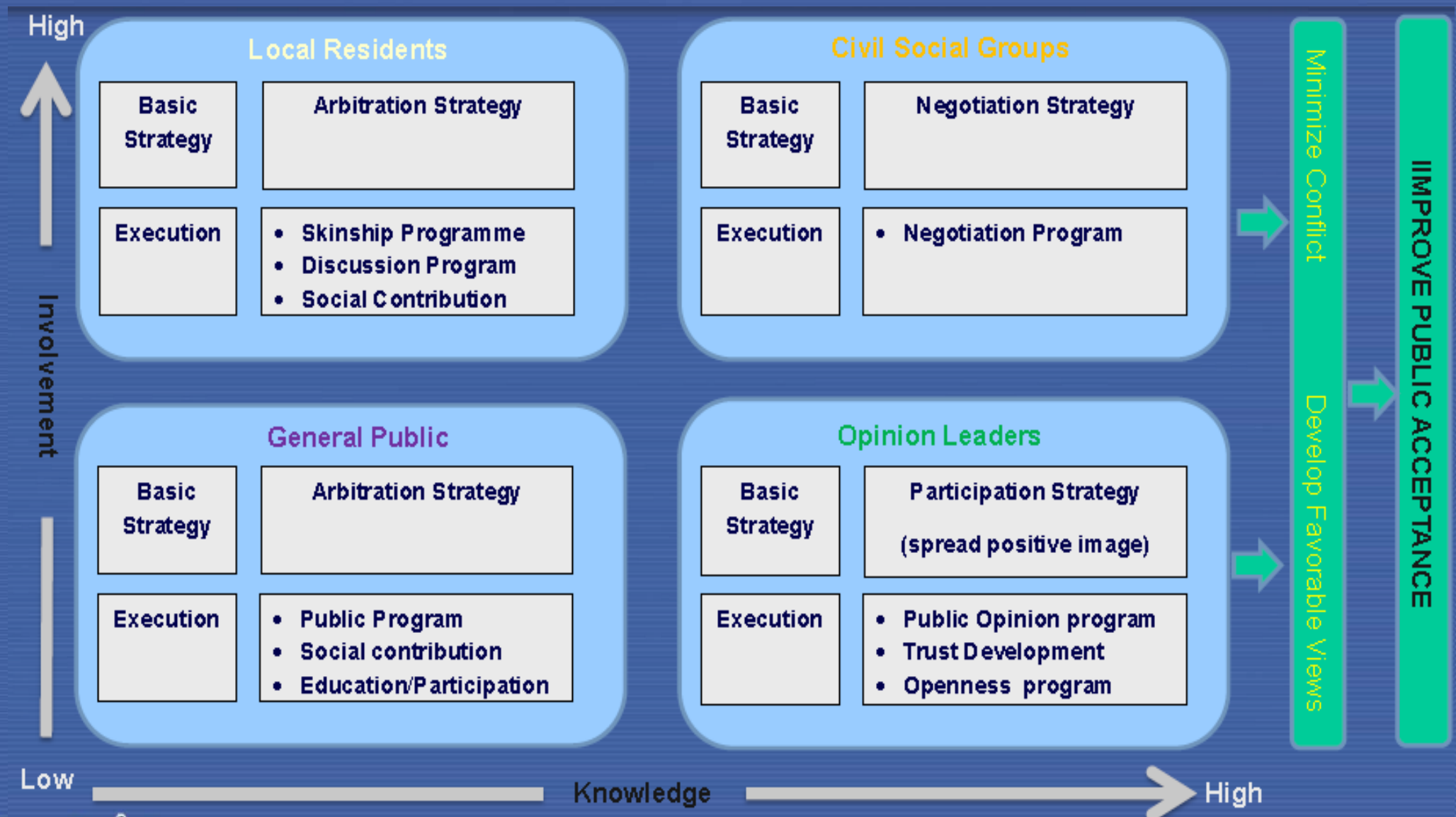
2. Avoidance criteria.

- ✓ Avoidance criteria are not strictly go/no go criteria but are utilized to identify broad areas with more favorable than unfavorable conditions. Application of avoidance criteria helps ensure that the siting approach is manageable but still effective in identifying the most suitable sites.

3. Suitability criteria.

- ✓ These factors are used in the latter stages of the siting process, once the exclusion and avoidance criteria have been used to reduce the number of sites being considered.

STAKEHOLDERS IN NPP SITING



MAJOR ISSUES IN NPP SITING

Assurance of the supporting disciplines in site investigations
(**beginning of the NP program**) :

- ✓ **Technical Activities**
- ✓ Program/Project Management
- ✓ Management system
- ✓ Data Management
- ✓ Procurement / Consulting in Siting
- ✓ Regulatory & Legislative Issues (utilization of the IAEA standards and guides)
- ✓ Resources (Human, Financial, Logistic, etc.) .

SOME LESSONS LEARNED (1)

- 1) Nuclear installations – complex systems - are sited, designed, constructed and operated taken into account the potential occurrence of extreme events. The high consequences of low probability events shall be properly considered.
- 2) Lessons to be learned after the multi-unit nuclear accident induced by external hazards in Fukushima shall enhanced safety measures in relation to Site Safety aspects and protection against External Hazards
- 3) No complacency, continuous safety improvement is required.

SOME LESSONS LEARNED (2)

- 4) Careful attention should be paid from the very beginning since mistakes, wrong approaches and simplistic criteria, may seriously impact safety and economic aspects of the program.
- 5) Validated methodology for safety assessment against external hazards should be used to assess and maintain adequate safety margin (consistent with the safety goal). The IAEA's methodology for assessing the safety vulnerabilities of a nuclear power plant, which meets the IAEA Safety Standards, was provided to Member States in November 2011. It is now being used by Member States, of which Japan is the first to implement it.
- 6) Periodic Safety Re-evaluation in respect to external hazards should be conducted including hazard re-assessment and safety evaluation against safety significant external hazards.

SOME LESSONS LEARNED (3)

- 7) One of the key lessons learned from the Fukushima accident is the crucial importance of protection of the critical safety systems against extreme events such as tsunami, floods, hurricanes and earthquakes.
- 8) Adequate defense in depth capability should be maintained for beyond design base accidents considering external hazards.
- 9) The credited emergency measures should be assessed against external hazards for their feasibility with appropriate consideration of the human errors.

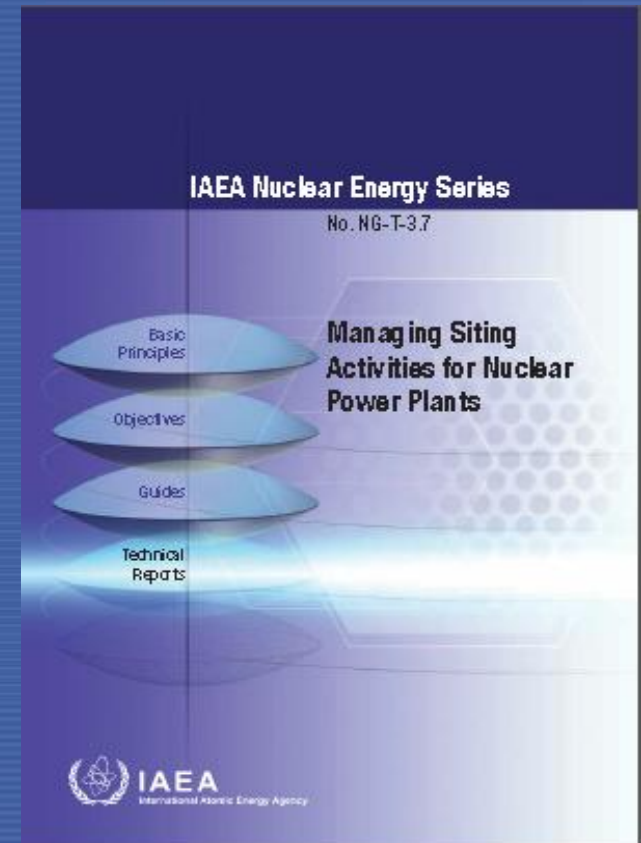
IAEA GUIDANCE DOCUMENT

IAEA Nuclear Energy Series Technical Reports

Managing Siting Activities for Nuclear Power Plants No. NG-T-3.7/2012

Content:

- ✓ MANAGEMENT OF SITING ACTIVITIES
- ✓ CRITERIA FOR SELECTION AND ASSESSMENT OF NPP SITE
- ✓ METHODOLOGY FOR SITING STUDIES
- ✓ STAKEHOLDER INVOLVEMENT.





Thanks !