vuje

EVERYTHING UNDER ONE ROOF

1977 vuje 45 YEARS

2023

Nuclear Power Industry

STUDY

Pre-design analyses, feasibility studies

DESIGN

Construction proceeding, safety documentation and regulations, project management

CONSTRUCTION

Design, delivery, assembly, initialization, physical & power start-up, assessment of the equipment

OPERATION

Operation safety & reliability, personnel training, diagnostics, NDT inspections, development of manipulators

DECOMMISSIONING

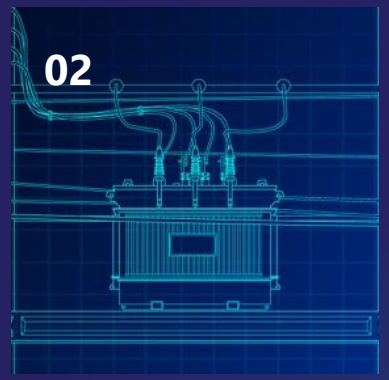
NPP decommissioning
RAW management,
On-site works

1977 vuje 45 YEARS

High Voltage Grid

STUDY

Pre-design analyses, feasibility studies



DESIGN

Construction proceeding, design elaboration, project management

CONSTRUCTION

Management of implementation services, evaluation of transmission & load efficiency

OPERATION

Personnel training, diagnostics, operation of power stations

UPGRADE

Modernization of distribution plants, replacement of power lines

1977 vuje 45 YEARS

Organization Structure

Shared Services

- Financial & Treasury
- Strategic Development and International Operations
- Procurement & Contracting
- Information Technologies
- Source and Asset Management

0200 Nuclear Safety Research and Development

0300 Diagnostic of Nuclear Power Components

0500 Engineering Services and Implementation

0600 NPPs Personnel Training Centre

0700 Radiation Safety, Decommissioning and Radioactive Waste Management

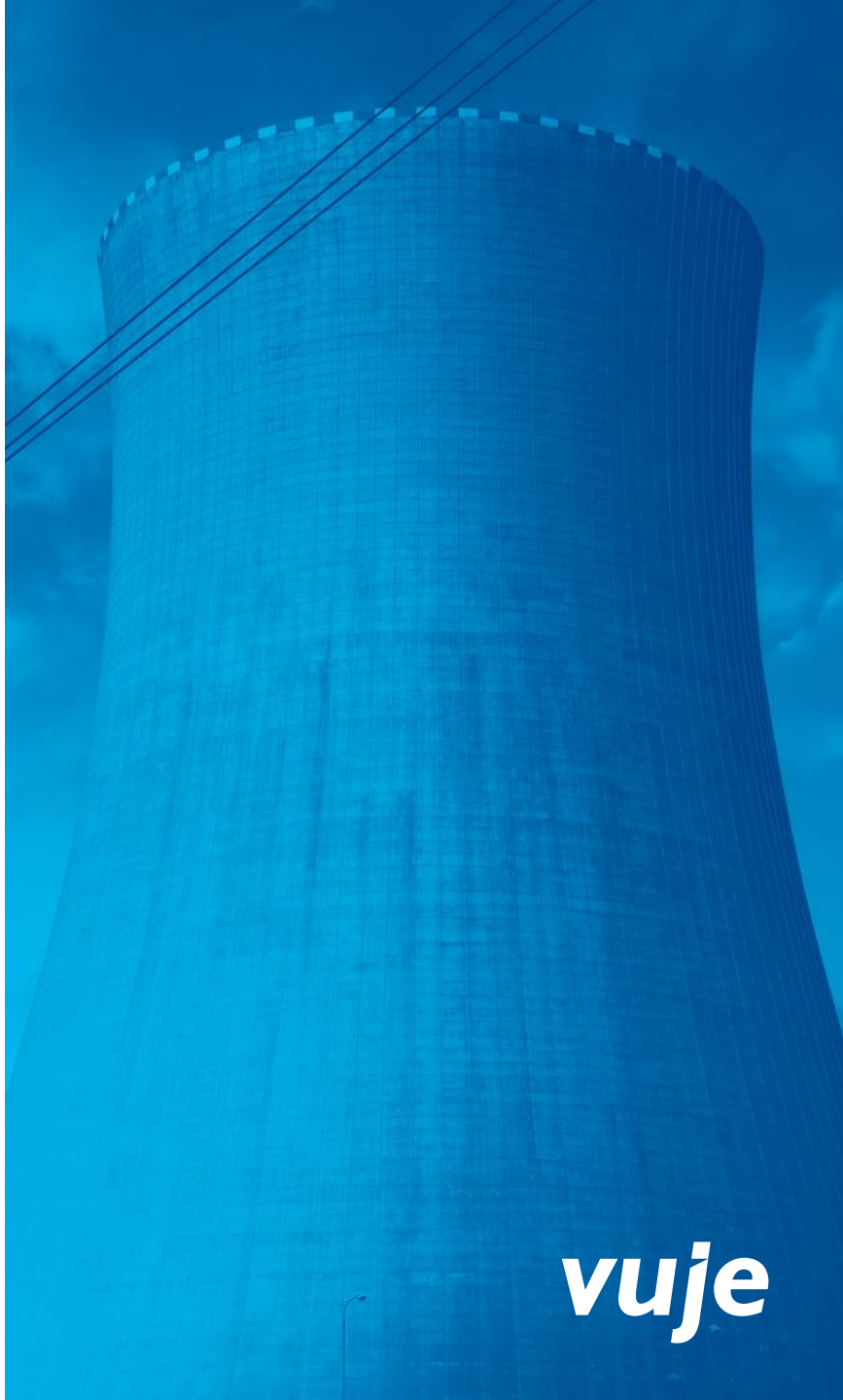
1200 Electric Grid Control and Operation Support

1700 New Build NPPs Preparation and Construction

1977 vuje 45 YEARS

0200 Nuclear Safety and R&D

- Comprehensive safety assessments of nuclear installations,
- Safety enhancement of nuclear units,
- Deterministic and probabilistic analyses of Nuclear Power Plants,
- Development of Emergency Planning and Preparedness,
- Commissioning of Nuclear Power Plants,
- Development of safety regulation and guideline for operators of nuclear installations,
- Research and development of generation IV. Gas-cooled Fast Reactor demonstrator ALLEGRO.



Some Significant Projects of VUJE with Participation of the Regulatory Body in Different Ways or Stage

- ✓ Siting of new NPP
- ✓ Completion of NPP Mochovce, Unit 3, 4
- ✓ Commissioning of the 3rd unit of NPP Mochovce MO34

1977 45 vuje YEARS

Completion of NPP Mochovce, Unit 3, 4

- Design, delivery, installation, functional tests and commissioning of systems
- Qualification of components and equipment to inside containment and outside containment environmental conditions (LOCA conditions, seismic bed tests, thermal and radiation ageing, wear ageing, EMC)
- Documentation for Nuclear authority (classified equipment quality plans, qualification documents, support for manufacturing and installation documentation)
- Procurement management, delivery of individual equipment

Brief List of Done Steps for Building New Power Plant up to now - Siting

Site selection

identification by screening, comparing based on established safety and suitability criteria (the best candidate was selected locality with existing nuclear facilities)

Management Summary and Feasibility Study

detailed financial and time analysis, inspection of technical solutions of realization, selection of applicable technologies of NPP

finished in 2012

Environmental Impact Assessment

Detailed environmental study of impacted areas

finished in 2015

Documentation defined by Atomic law for Regulatory Body to Gain permission to Facility Site

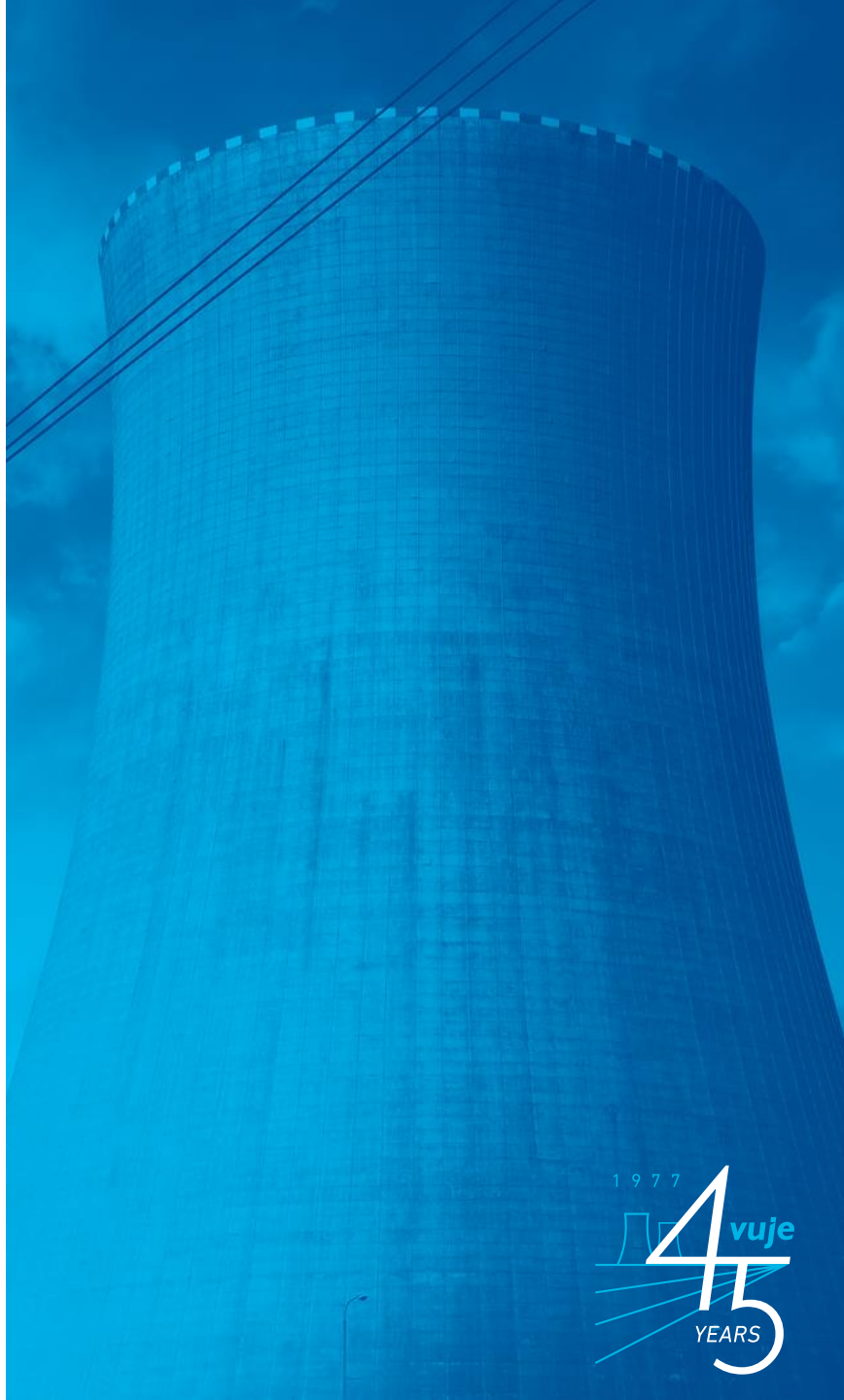
Initial Safety Analysis Report –the chapter „Site Characteristics“ was elaborated in as the greatest details as possible. The others should be prepared in reasonable rate. Technology is not defined – envelope approach was chosen to make possible transparent tender

finished in beginning of 2023

Siting of New NPP

All required documents had been completed
for obtaining a Permission from UJD SR to site new nuclear facility

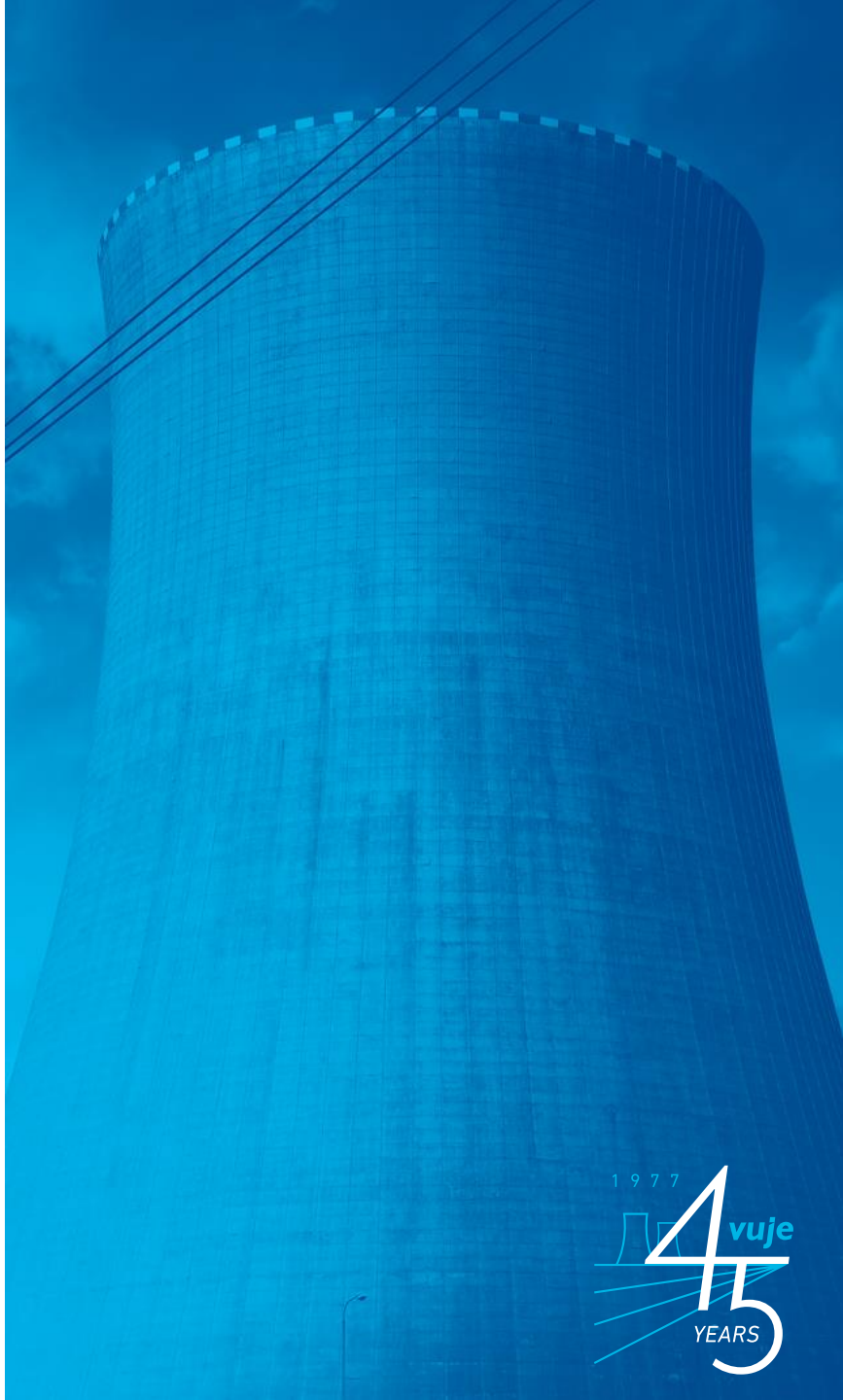
- Initial Safety Analysis Report (considering IAEA SSG-61)
- Initial Report about Decommissioning Plan (considering IAEA SRS No. 77)
- Initial Report about Treatment with Radioactive Waste and Spent Nuclear Fuel
- Project Intention for Physical and Technical Solution of Nuclear Installation
  – Design Development Project Level
- Requirements on the Quality of the Nuclear Installation
- Proposed Boundaries of the Nuclear Installation
- Proposed Size of the Emergency Planning Zone
- Environmental Impact Assessment of the Nuclear Installation
  as well as Potential Impact Assessment of the Environment on the Nuclear Installation



Siting of New NPP

- Initial Safety Analysis Report (considering IAEA SSG-61)

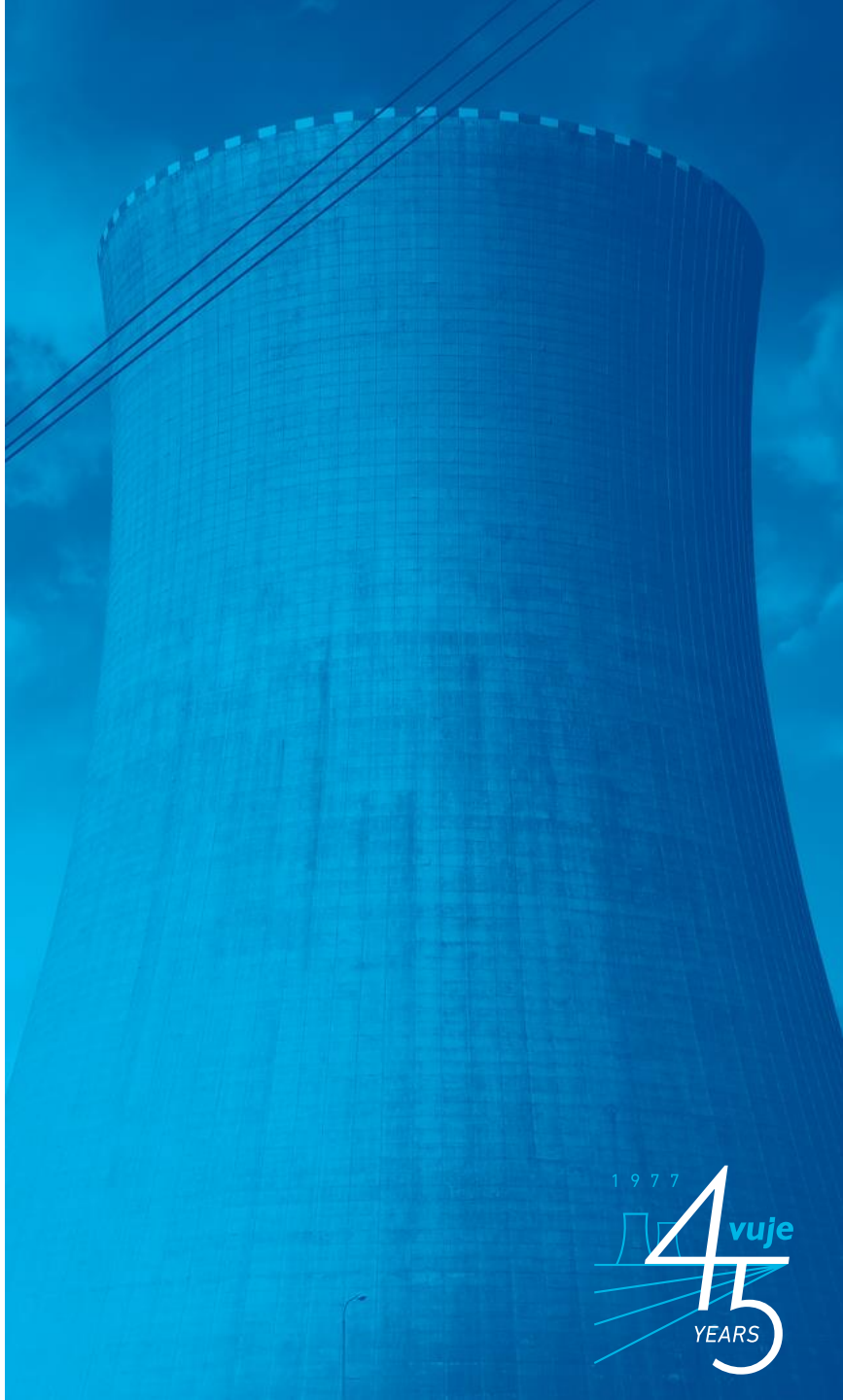
Chapter 1: Introduction and general considerations
Chapter 2: Site characteristics
Chapter 3: Safety objectives and design rules for SSC
Chapter 4: Reactor
Chapter 5: Reactor coolant system and associated systems
Chapter 6: Engineered safety features
Chapter 7: Instrumentation and control
Chapter 8: Electrical power
Chapter 9: Auxiliary systems and civil structures
Chapter 9A: Auxiliary systems
Chapter 9B: Civil engineering works and structures
Chapter 10: Steam and power conversion systems
Chapter 11: Management of radioactive waste
Chapter 12: Radiation protection
Chapter 13: Conduct of operations
Chapter 14: Plant construction and commissioning
Chapter 15: Safety analysis
Chapter 16: Operational limits and conditions for safe operation
Chapter 17: Management for safety
Chapter 18: Human factors engineering
Chapter 19. Emergency preparedness and response
Chapter 20: Environmental aspects
Chapter 21: Decommissioning and end of life aspects



Siting of New NPP

- Initial Report about Decommissioning Plan
  (considering IAEA SRS No. 77)

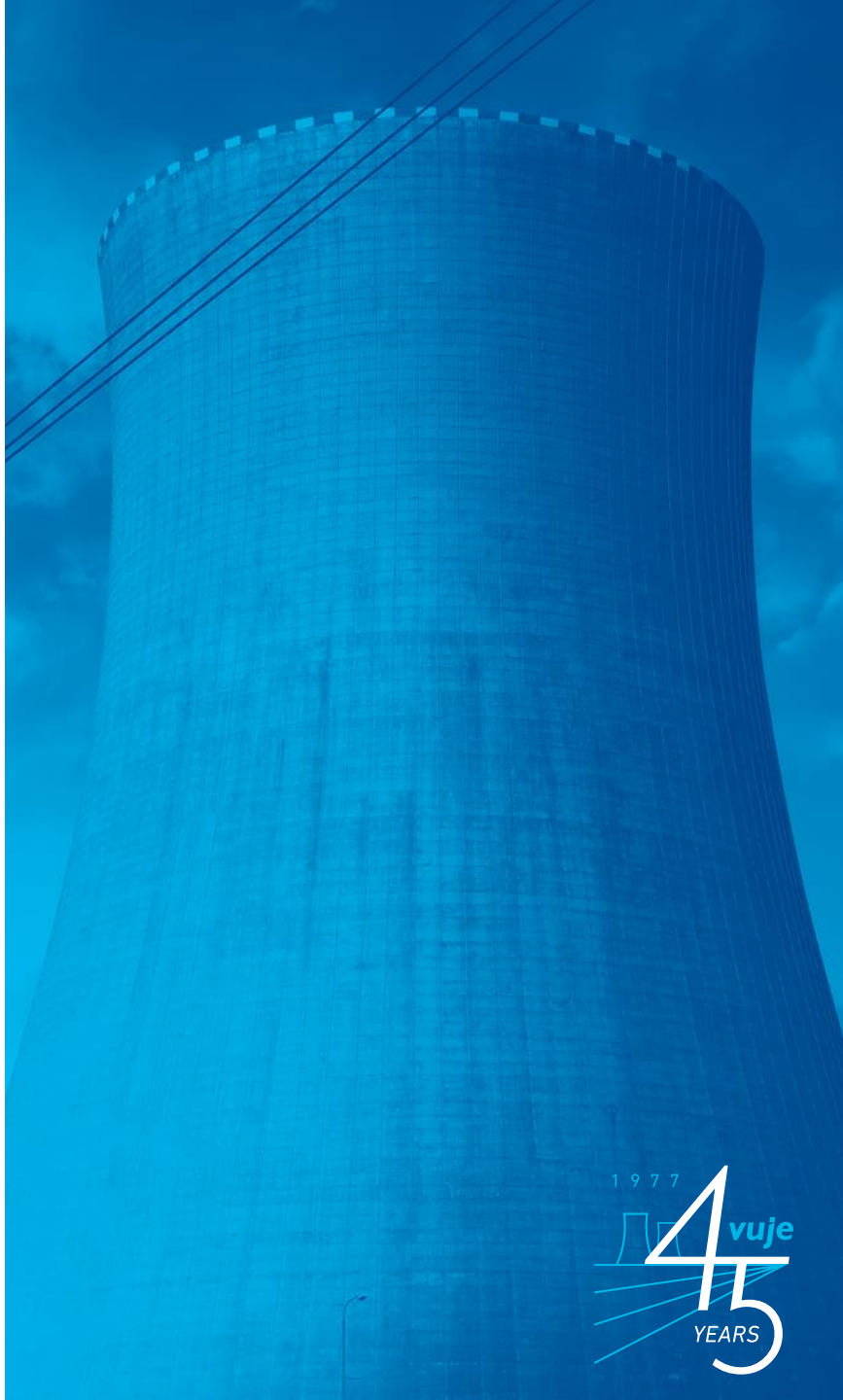
The report on the method of decommissioning
takes into account the goals, strategic plans and schedule
as well as other information stated
in the National Policy and the National Program
for the Management of Spent Nuclear Fuel and Radioactive Waste
in the Slovak Republic.



Siting of New NPP

- Initial Report about Treatment with Radioactive Waste and Spent Nuclear Fuel

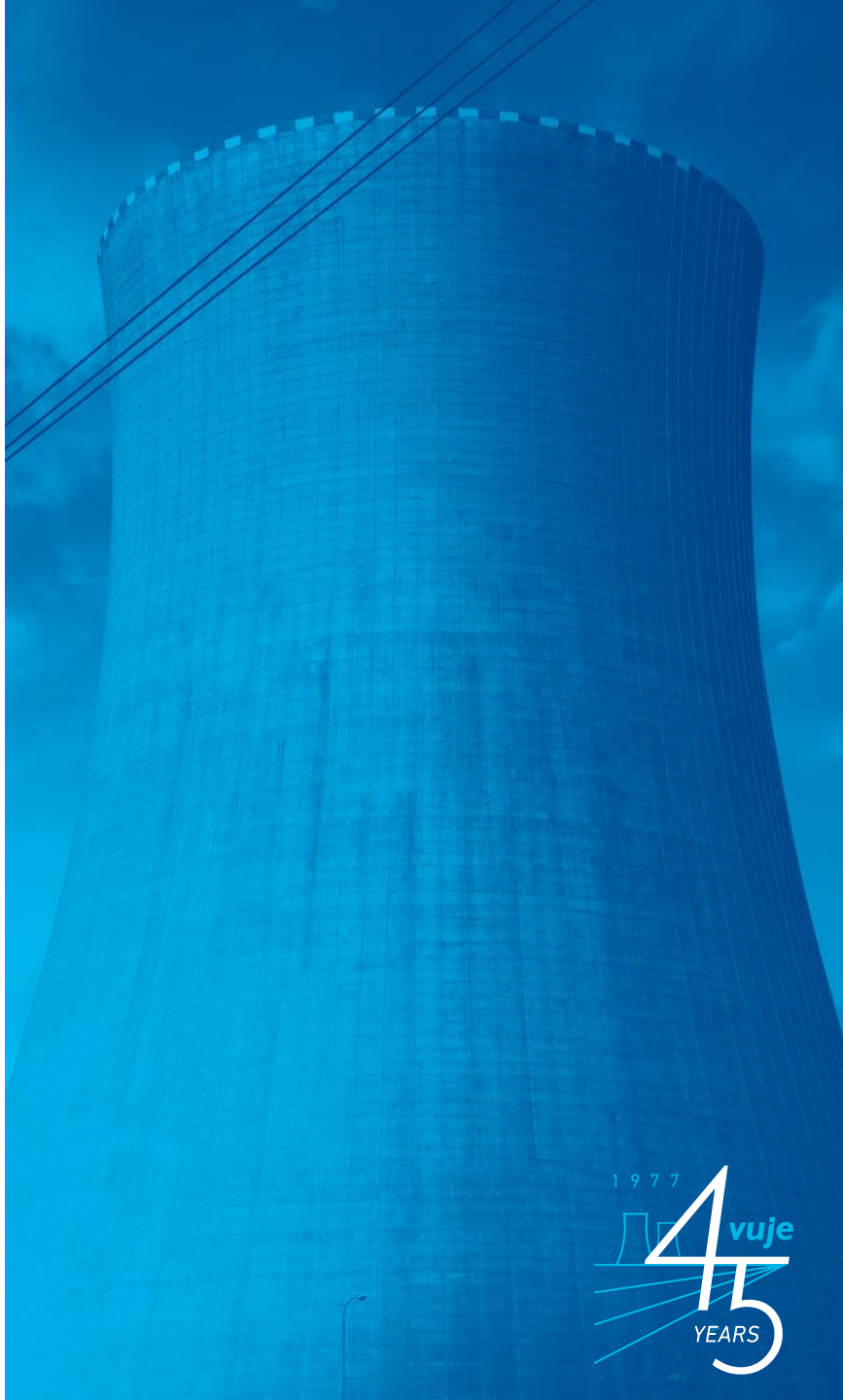
  Description of the radioactive waste management activities
  in the nuclear facility, covering all radioactive waste management activities,
  up to the actual storage of radioactive waste
  or the storage of spent nuclear fuel
  until the NPP decommissioning stage.



Siting of New NPP

- Project Intention for Physical and Technical Solution of Nuclear Installation
  – Design Development Project Level

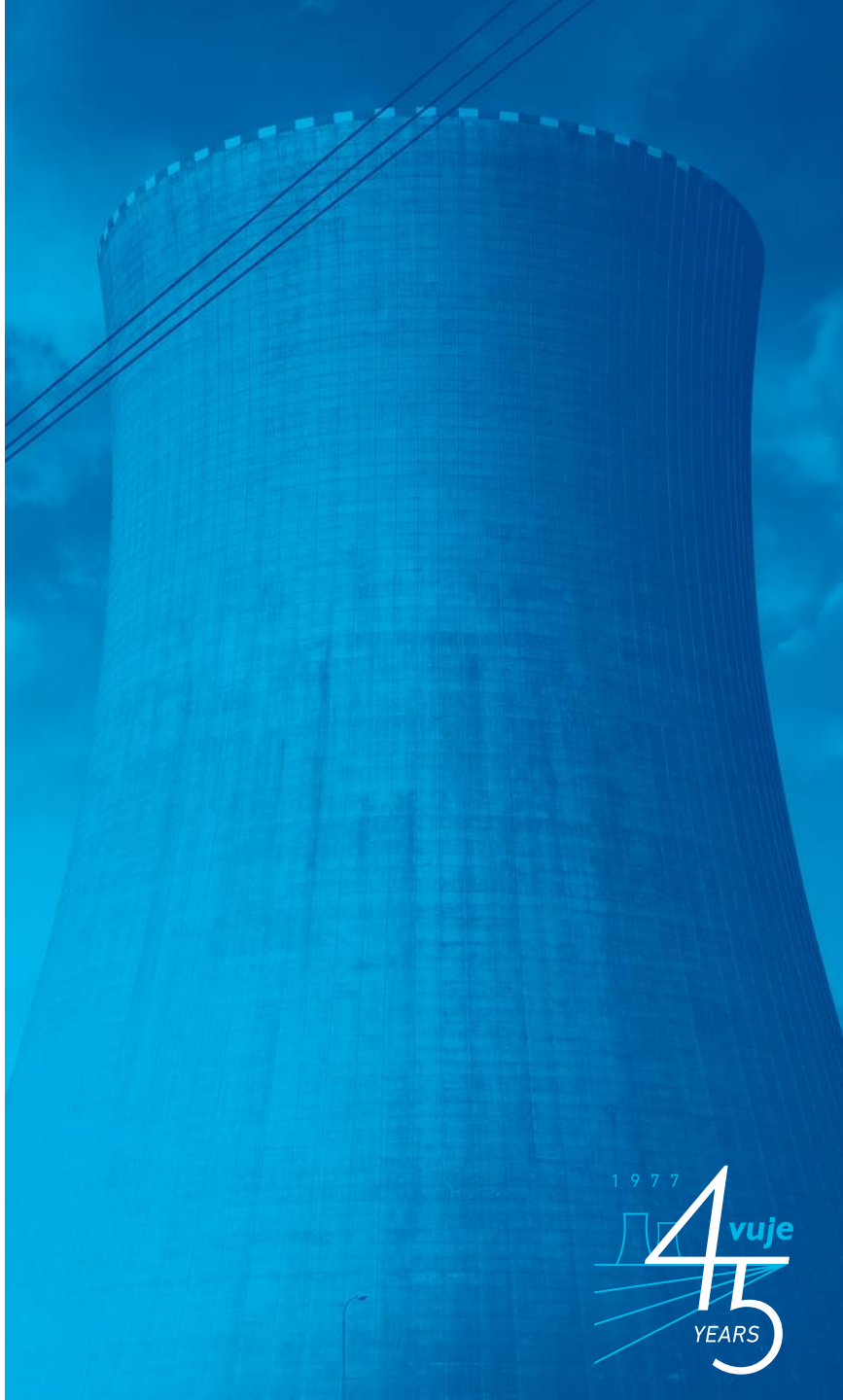
The subject of this Project Intetion Plan is to document
the conditions that were established as a starting point
for the preparation of the new NPP build
in order to ensure the fulfillment of all requirements of Slovak legislation
as well as relevant generally accepted recommendations
of international institutions in the field of nuclear facility operation safety.



Siting of New NPP

- Requirements on the Quality of the Nuclear Installation

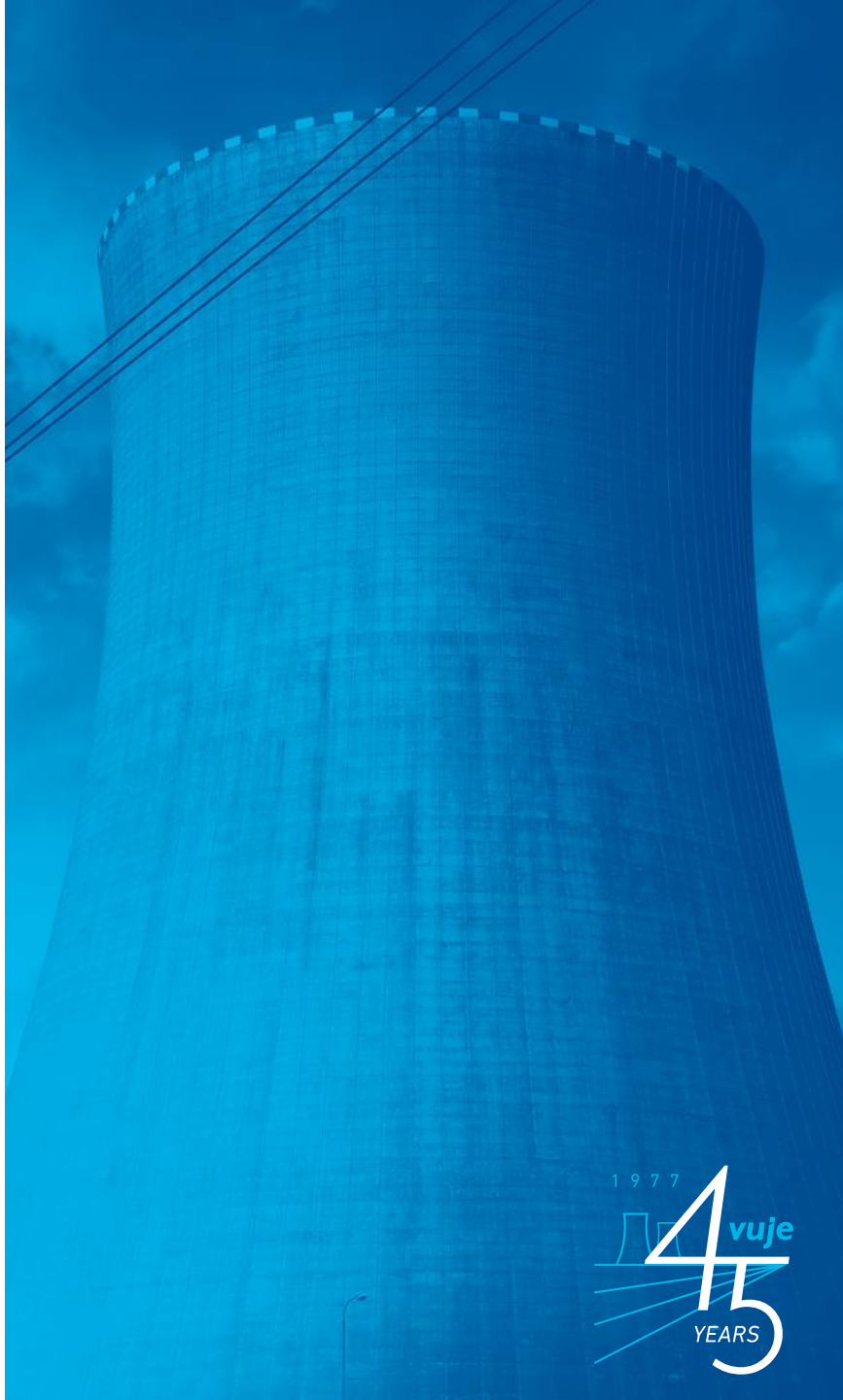
The document contains references to valid Slovak legislation
and also describes specific requirements
for the quality of nuclear equipment



Siting of New NPP

- Proposed Boundaries of the Nuclear Installation

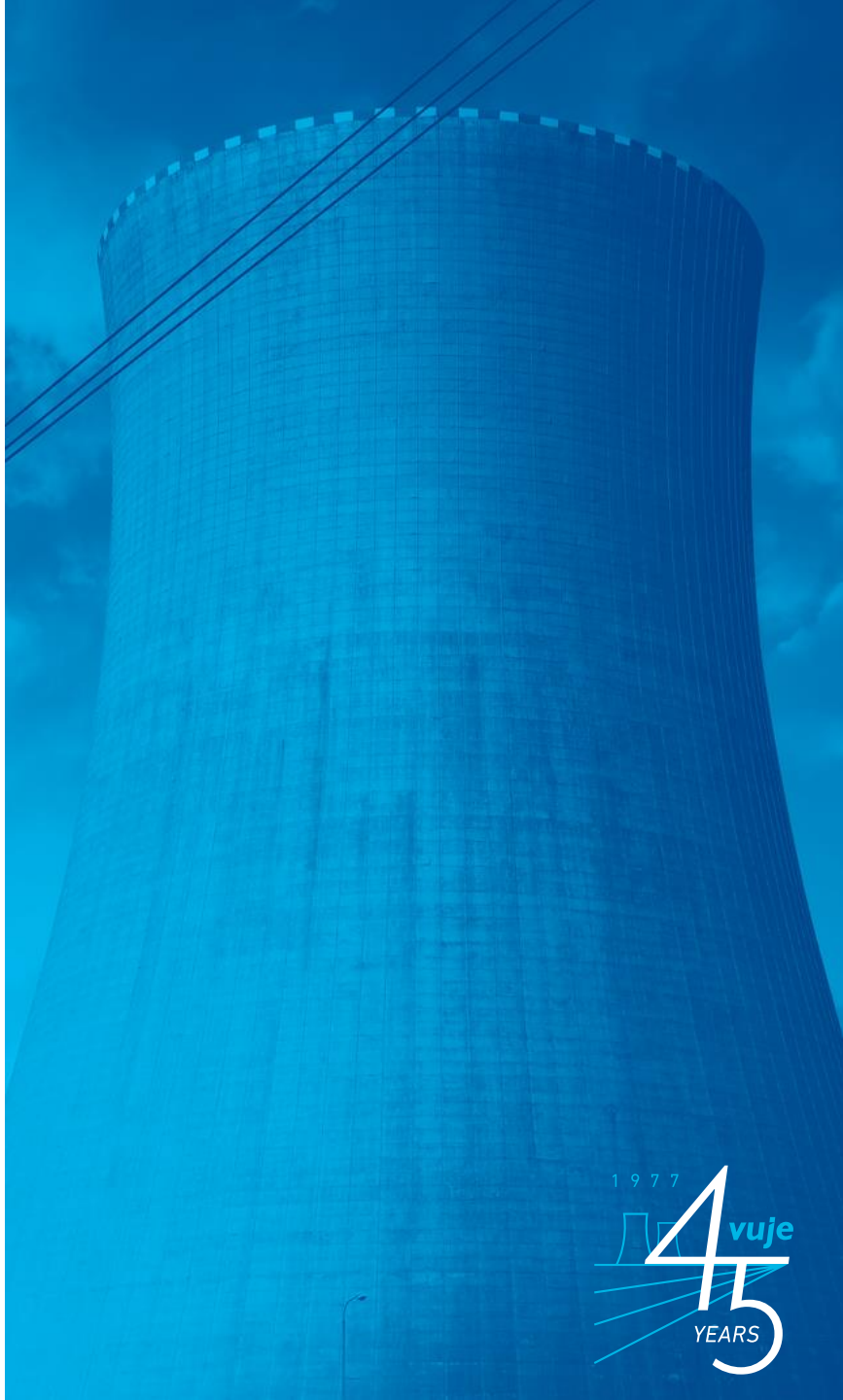
The purpose of the document is to establish and describe the boundaries of the nuclear facility in relation to other systems, structures and components and legal entities.



Siting of New NPP

- Proposed Size of the Emergency Planning Zone

The threat area is defined as the area around the NPP,
for which a set of measures is planned for detecting, mitigating and eliminating the consequences of the release of radioactive substances into the environment as a result of accidents



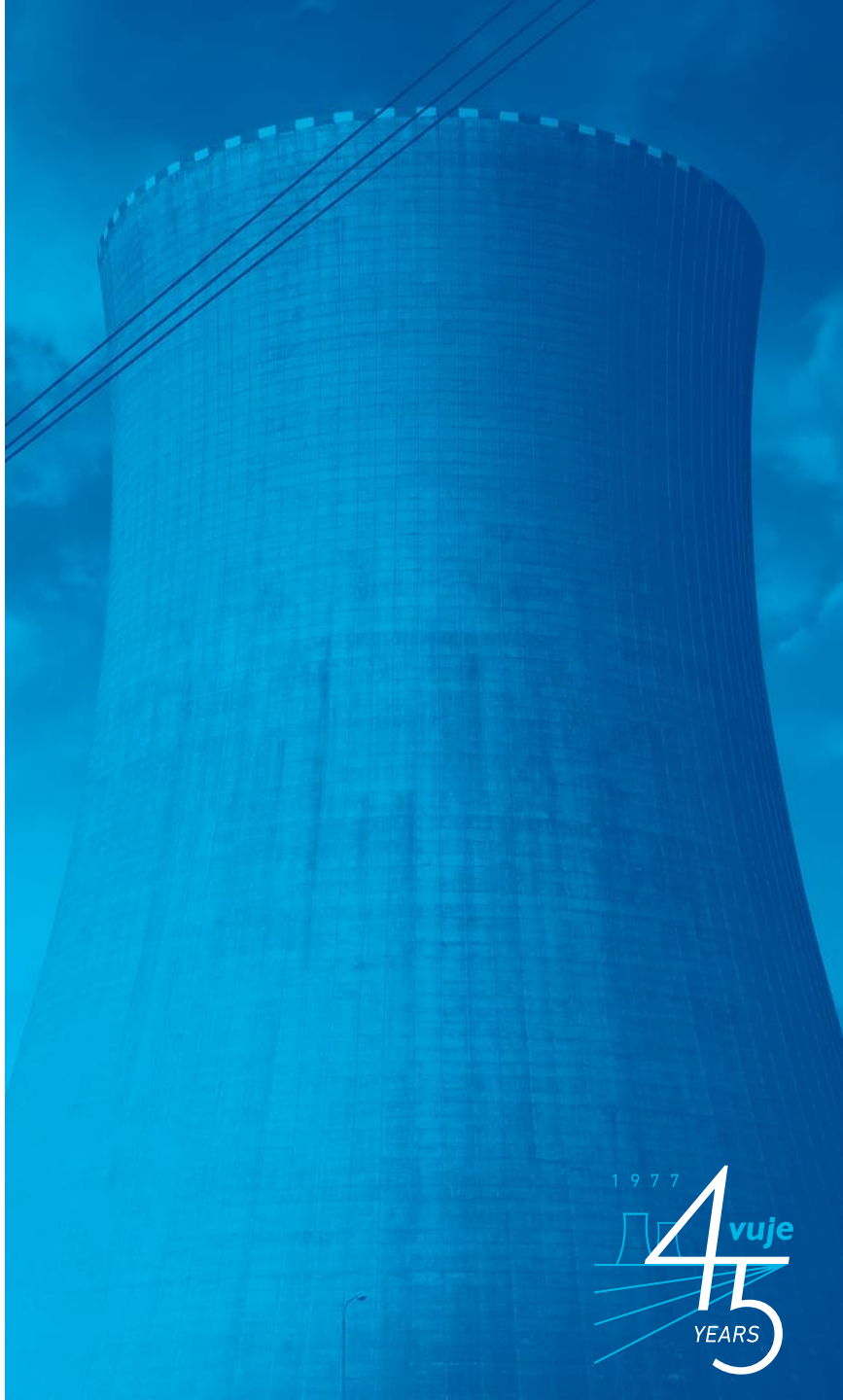
Siting of New NPP

- Environmental Impact Assessment of the Nuclear Installation as well as Potential Impact Assessment of the Environment on the Nuclear Installation

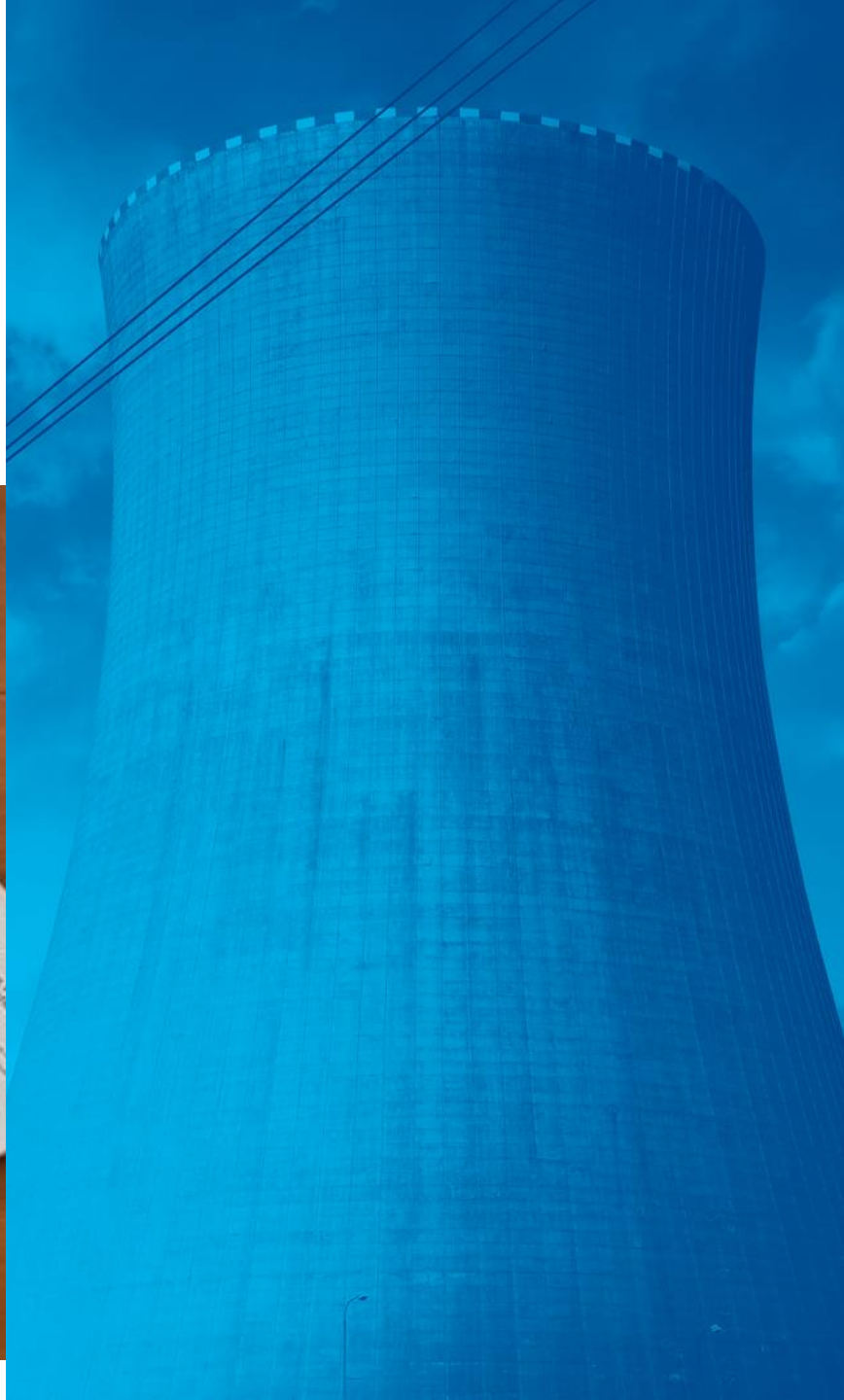
The document summarising information on the impact of new NPP on the environment, based on the EIA process, in particular on the Report on the Assessment of the Effects of the Proposed Activity on the Environment (EIA Report), and supplemented by information with regard to the current procedure of new bild.

The assessment of the impact of the surrounding environment on the New nuclear instalation in the location

Compliance of the current solution of new NPP with the NPP proposal that was the subject of the EIA process

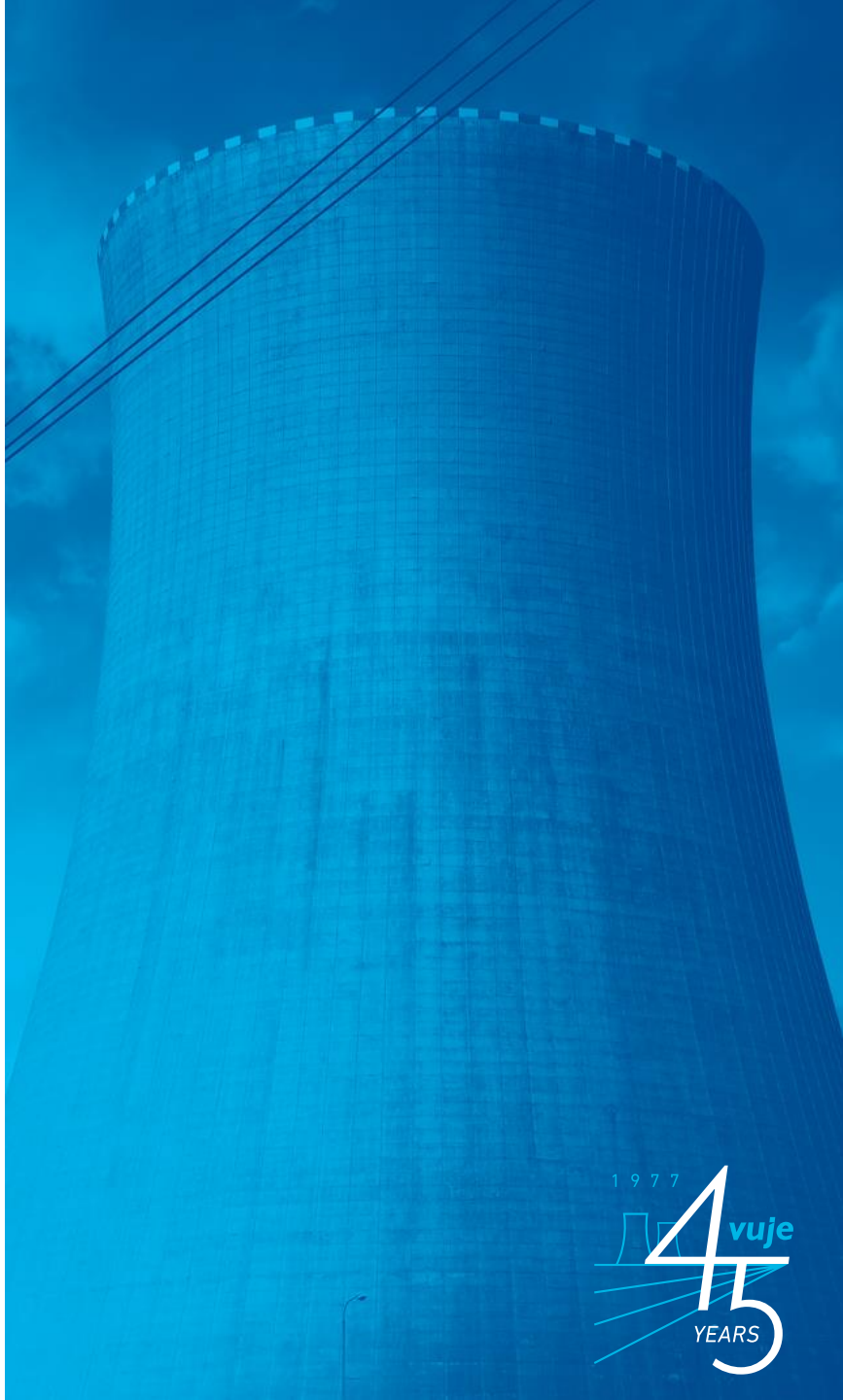


Siting of New NPP



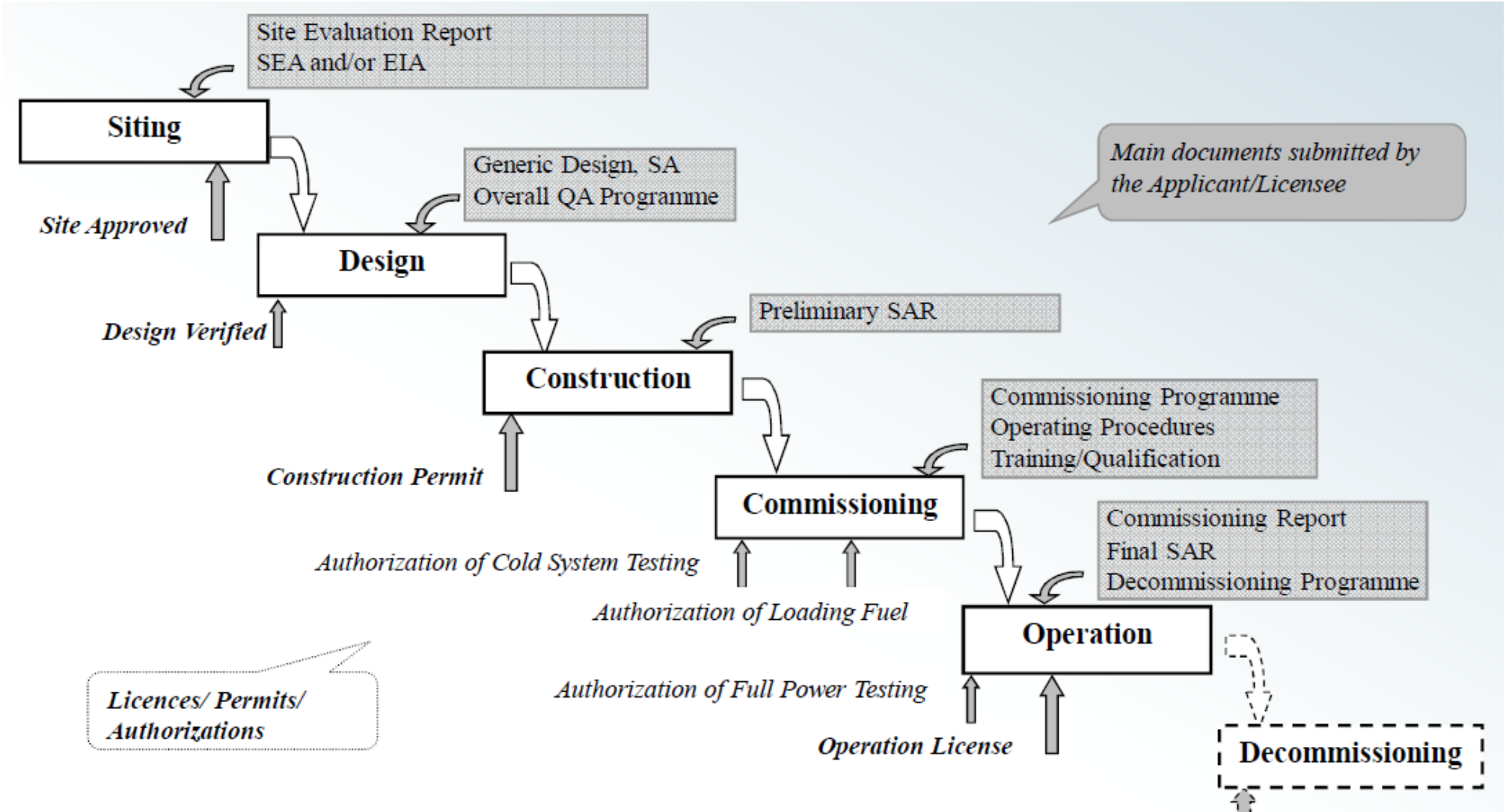
Siting of New NPP

IAEA Safety Standards

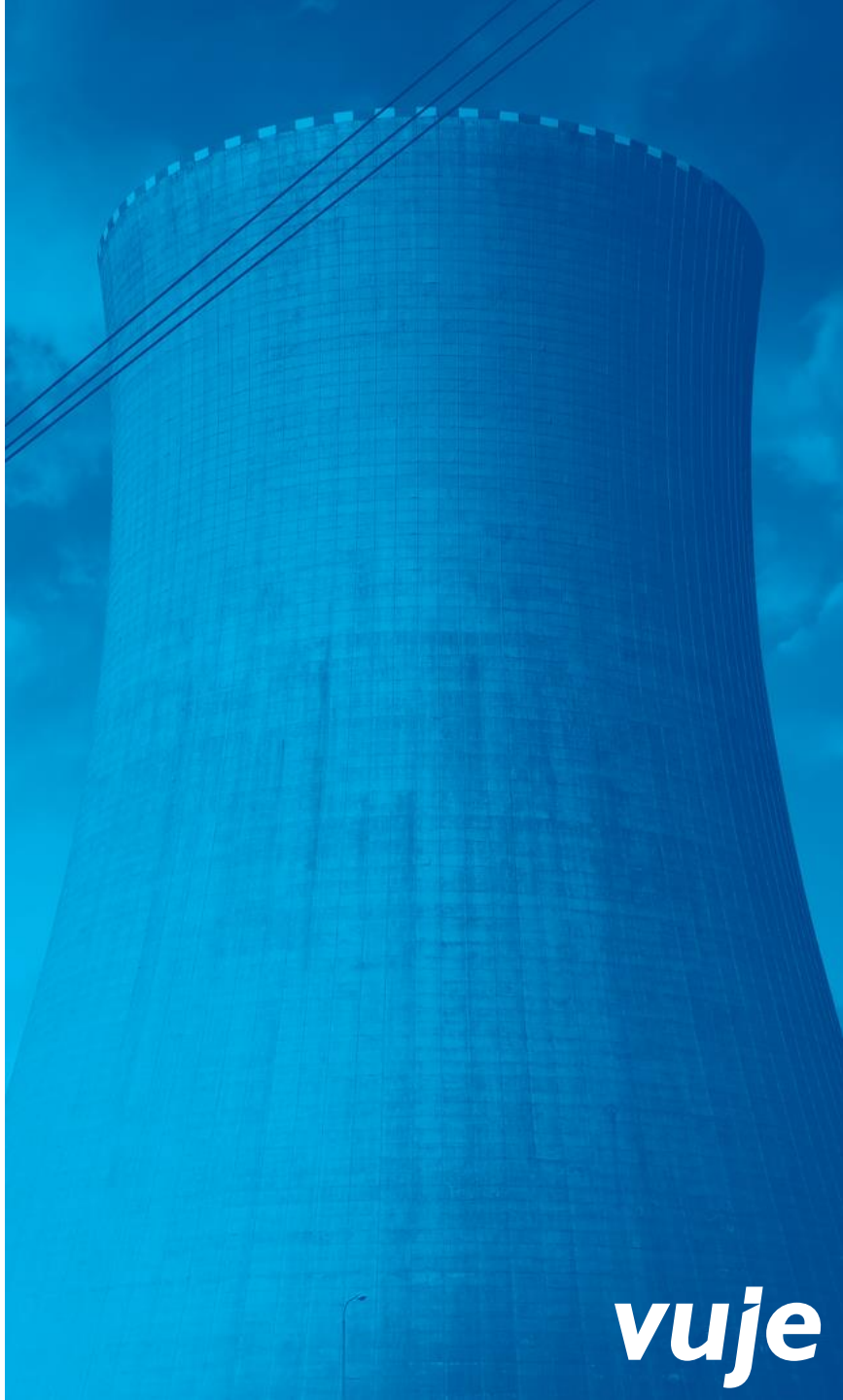


Example of Licensing Process

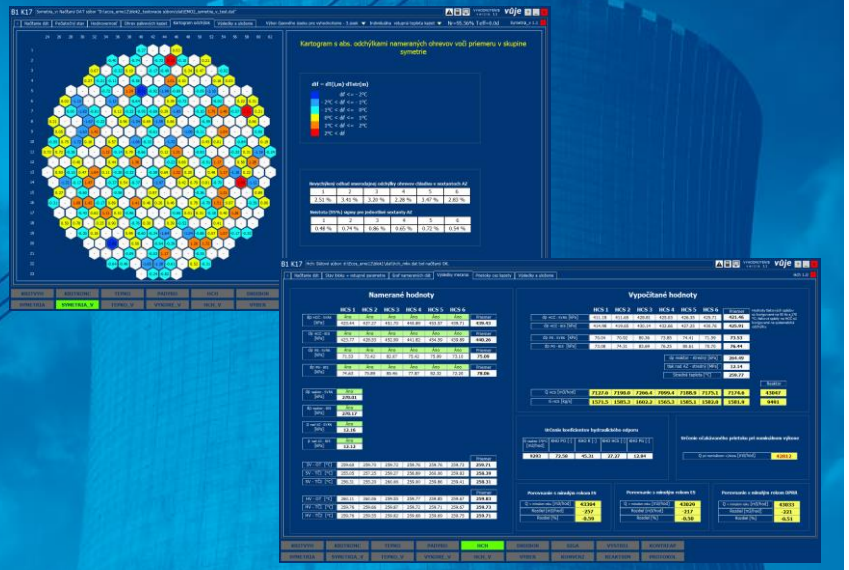
- depends on regional nuclear regulatory authority requirements

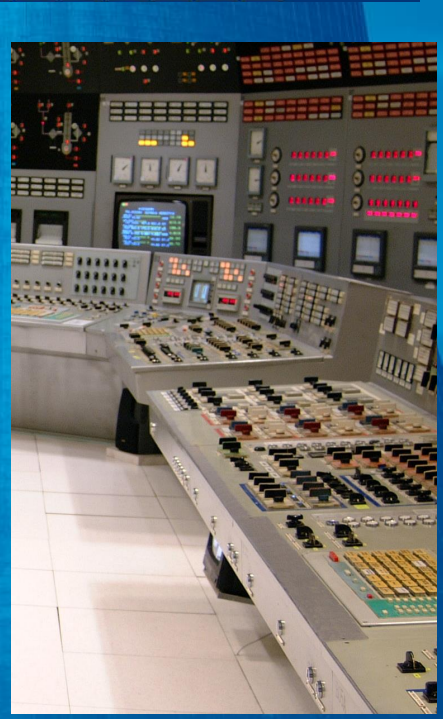


NPP Commissioning



vuje





NPP Commissioning

- **Preparation of commissioning documentation**

  Creation of commissioning group
  Planning the commissioning programmes well in advance
  Creation of test procedures
  Theoretical data preparation (neutron-physical, thermal, hydraulic, technological, etc.)
  Determination of the commissioning tests success criteria
  Development and implementation of non-standard measurement systems for the required signals sensing
  Development and verification of control and evaluation programmes

- **Performance of inactive and active commissioning tests**

  Physics commissioning tests (reactor power ≤ 2 % Nnom)
  Power commissioning test (reactor power > 2 % Nnom)

- **Evaluation of the individual commissioning tests**

  Preliminary evaluation – up to 24 hours after test completion
  Final evaluation – up to 2 months after commissioning completion

- **Scientific leaders of commissioning**

  The scientific commissioning leaders provide independent support to the operator in ensuring nuclear safety in the process of preparation and implementation of a nuclear power plant unit commissioning.

- **Technical support and consultancy**

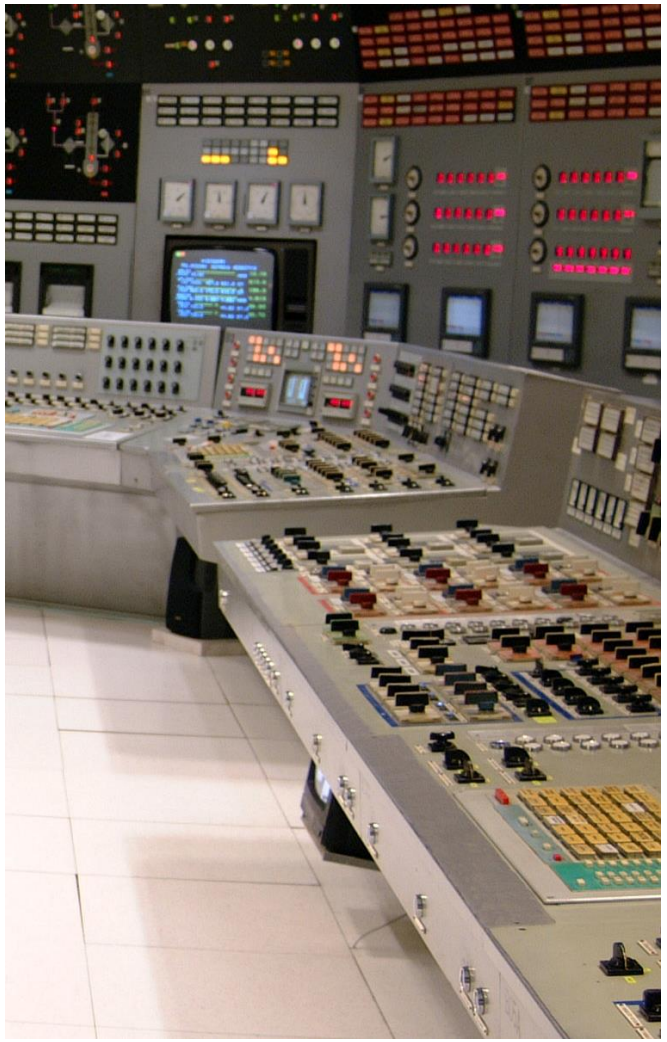
vuje

Performance of commissioning tests

- Physics commissioning tests (reactor power ≤ 2 % Nnom)
- Power commissioning test (reactor power > 2 % Nnom)

Evaluation of commissioning tests

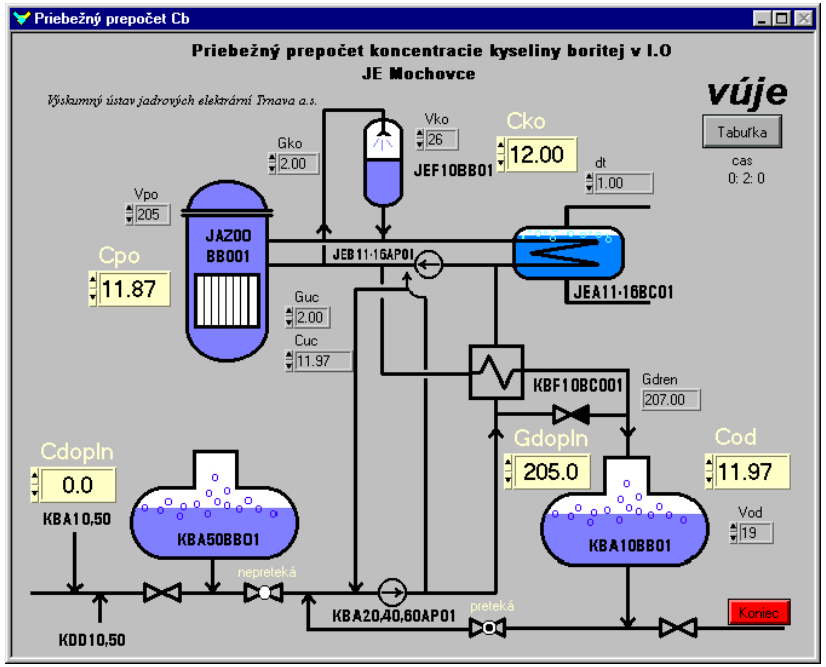
- Preliminary evaluation – up to 24 hours after test completion
- Final evaluation – up to 2 months after commissioning completion



vuje

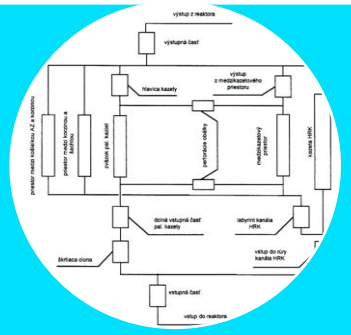
Physics commissioning tests

- Reactor core loading
- Reaching the reactor first criticality
- Control rod – Motor coupling test
- Determination of maximal reactor power for physics commissioning tests
- Reactivity computer checkout
- Reactor core load symmetry checkout
- Control rods efficiency measurement
- Measurement of thermal, pressure and power coefficient of reactivity
- Measurement of boric acid critical concentrations
- Determination of thermocouples data corrections during isothermal condition
- Boric acid efficiency measurement
- Measurement of "ejected" control rod efficiency
- Measurement of the primary circuit thermal loss and thermal capacity
- Neutron flux measurement system calibration
- Radiation situation monitoring
- Noise characteristics measurement

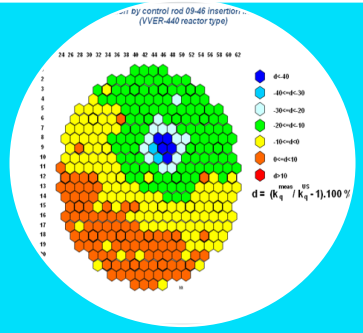


Power commissioning tests

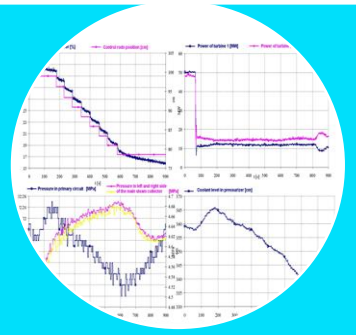
The task of the power commissioning is to demonstrate the capability of NPP to work safely and in compliance with the design in normal conditions and after anticipated operation events.



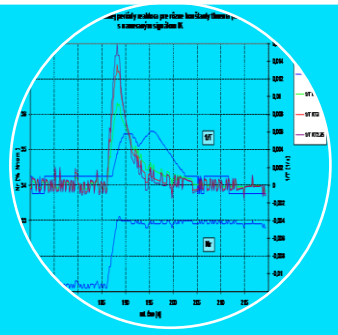
thermo-hydraulic tests



physics tests



dynamic tests



inspection and calibration measurements

Scientific commissioning leaders

The scientific commissioning leaders provide independent support to the operator in ensuring nuclear safety in the process of preparation and implementation of a nuclear power plant unit commissioning.

- professional and expert works focused on the method and inspection of compliance with nuclear safety
- assessment of selected operational, safety and commissioning documentation
- inspection of the NPP unit equipment and documentation readiness for the individual commissioning stages.

- independent unit inspection, assessment of the course and evaluation of the functional capability tests of equipment and systems related to nuclear safety in the stage of inactive tests.

- continuous inspection of the course of commissioning and tests results during physics and power commissioning by shift scientific leaders of commissioning
- recommendations for moving to the next stage of commissioning
- summary evaluation of the commissioning including recommendations for operation of the commissioned NPP unit

References

Units commissioning:

- Bohunice NPP (4 units of VVER-440 type), from 1978 to 1985
- Dukovany NPP (4 units of VVER-440 type), from 1985 to 1987
- Mochovce NPP, Units 1&2 (2 units of VVER-440 type), from 1998 to 2000
- Temelín NPP (2 units of VVER-1000 type), from 2000 to 2002
- Mochovce NPP, Units 3&4 (Unit 3, 2022-2023)
- Bohunice NPP, Units 3&4 after modernisation from 2007 to 2008
- Mochovce NPP, Units 1&2 during power uprate of units in 2008
- Bohunice NPP, Units 3&4 during power uprate of units from 2008 to 2010

References

	Name	Reactor Type	Put in to Operation	Note
1	NPP Bohunice A1	KS-150	December, 1972	Shutdown May 1979
2	NPP Bohunice V1 Unit 1	VVER440/230	December, 1978	Shutdown December 2006
3	NPP Bohunice V1 Unit2	VVER440/230	March, 1980	Shutdown December 2008
4	NPP Bohunice V2 Unit3	VVER440/213	August, 1984	Modernization + Power Up-rate 107% Electric output 500 MW
5	NPP Bohunice V2 Unit4	VVER440/213	August, 1985	Modernization + Power Up-rate 107% Electric output 500 MW
6	NPP Mochovce Unit 1	VVER440/213	Jul 1998	Power Up-rate 107% Electric output 500 MW
7	NPP Mochovce Unit 2	VVER440/213	December, 1999	Power Up-rate 107% Electric output 500 MW
8	NPP Mochovce Unit 3	VVER440/213	Commissioning	Project Finalization + licensing
9	NPP Mochovce Unit 4	VVER440/213	Under Construction	Project Finalization + licensing

vuje

vuje

Contacts:

VUJE, a. s.
Okružná 5
918 64 Trnava
Slovak Republic

Phone: + 421 33 599 1111
Fax: + 421 33 599 1200
E-mail: vuje@vuje.sk
Web: www.vuje.sk