Akkuyu NPP

PROGRESS & DEVELOPMENT

KOCAELI, APRIL 22, 2014

- **Brief of Akkuyu NPP Project**
- **3 Years Age Project**
- **Current Status and Development**
- **The Way forward**

About Akkuyu NPP Project

Project History

12 May 2010

Intergovernmental Agreement (IGA)signed

21 July 2010

Ratification of IGA in Turkey

3 December 2010

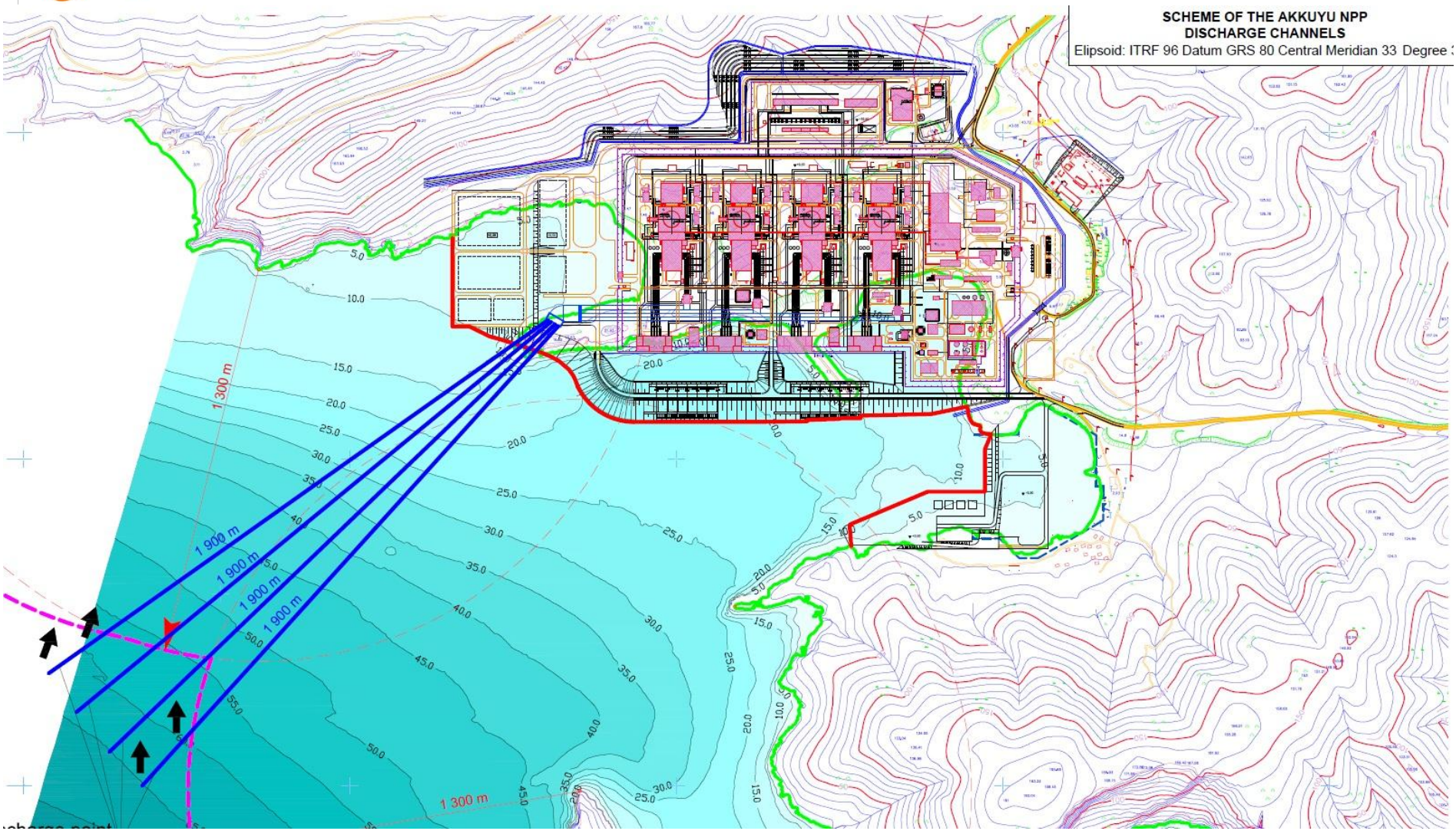
Ratification of IGA in Russian Federation

13 December 2010

Project Management Company “Electricity Generation JSC AKKUYU NPP” was established in Turkey

Turkey, Akkuyu NPP

General Plan of the Akkuyu NPP



Akkuyu Project Features

- First Nuclear Power Plant in Turkey
- Design: AES-2006 series (VVER – 1200), 4 Units
- Total capacity: 4800 MW (Gross output)
- Construction period: 2011 – 2023
- Total Project cost: ~ $ 20 B
- Generation output: ~ 35 B kWh/year
- Opportunity for foreign investors participation: up to 49% shares
- BOO Model (Build-Own-Operate)

Russian Technology
is
in FOCUS

Akkuyu NPP Safety Features

Main Technical and Economic Characteristics of the Akkuyu NPP Unit:

▪ Power Unit electric capacity, least	1200 MW
▪ Power Unit heat capacity	3300 MW
▪ Power Unit service lifetime	60 Years
▪ Availability factor of power unit	93 %
▪ Power Unit gross efficiency under average annual conditions	37,2 %
▪ Auxiliary power consumption	7 %
▪ Time of the plant self-contained operation in case of BDBA	72 Hours

Akkuyu NPP Safety Features

- Akkuyu NPP consists of four units of standard design configuration of AES-2006
- The plant unit is of two-circuit design
  - The primary circuit is radioactive entailed by Reactor Coolant Piping System
  - The secondary circuit is non-radioactive consisting the steam generating part

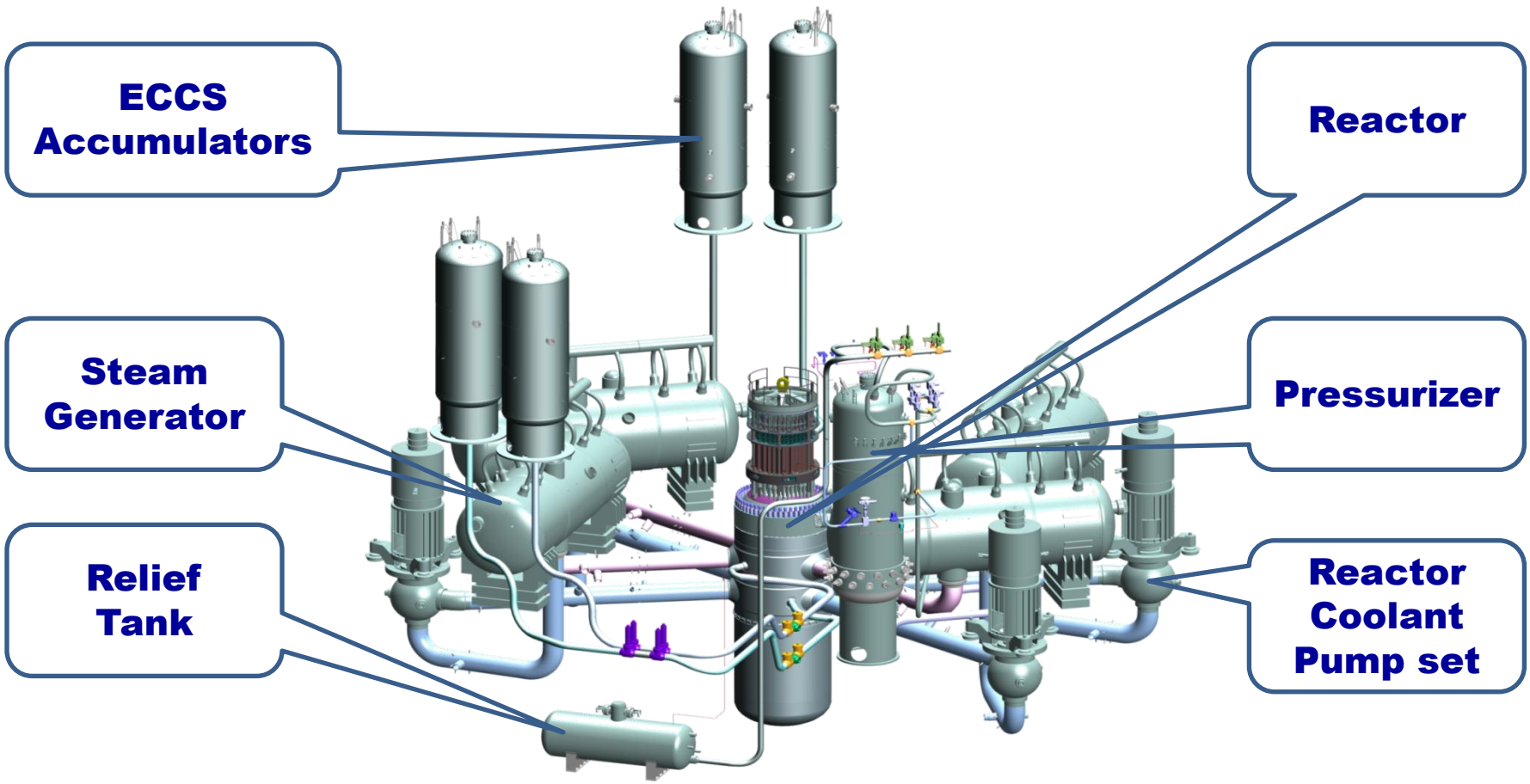
Novovoronezh NPP-2 design (AES-2006) with VVER-1200 reactor has been selected as a reference plant for Akkuyu NPP design.

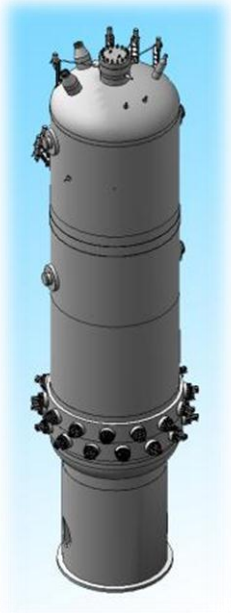
Akkuyu NPP Safety Features

- The Akkuyu NPP is based on the most recent achievements of the Russian nuclear industry in terms of both efficiency and safety
- The Akkuyu NPP each unit consists of reactor VVER-1200 which is based on the substantial experience of operation and evolutionary development of VVER-1000 reactors
- The Akkuyu NPP is the **Generation 3+** reactor meeting advanced safety requirements
- The Akkuyu NPP's design complies with the Russian norms, regulations and standards and developed in accordance with the IAEA recommendations and the European Utility Requirements (EUR)

Akkuyu NPP Safety Features

The primary circuit includes:



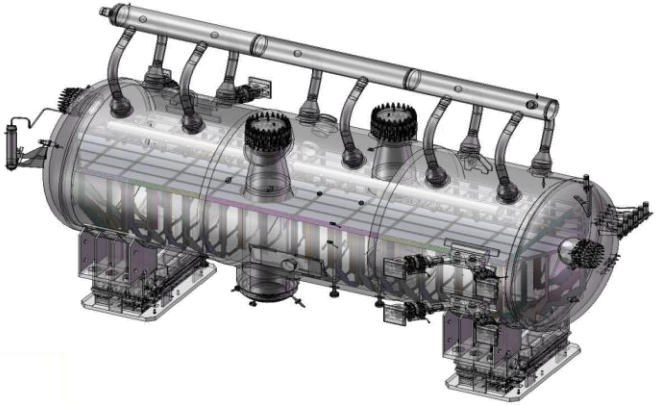


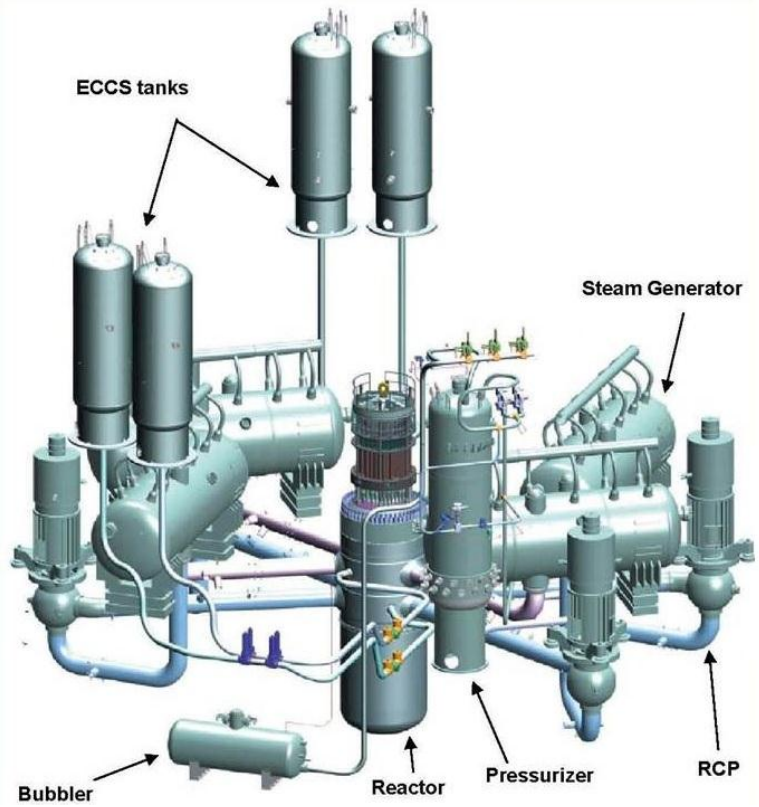
Coolant pressure: 17,6 MPa

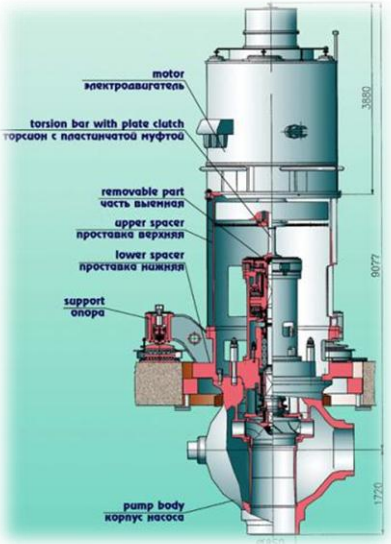
Coolant inlet temperature: 298 °C

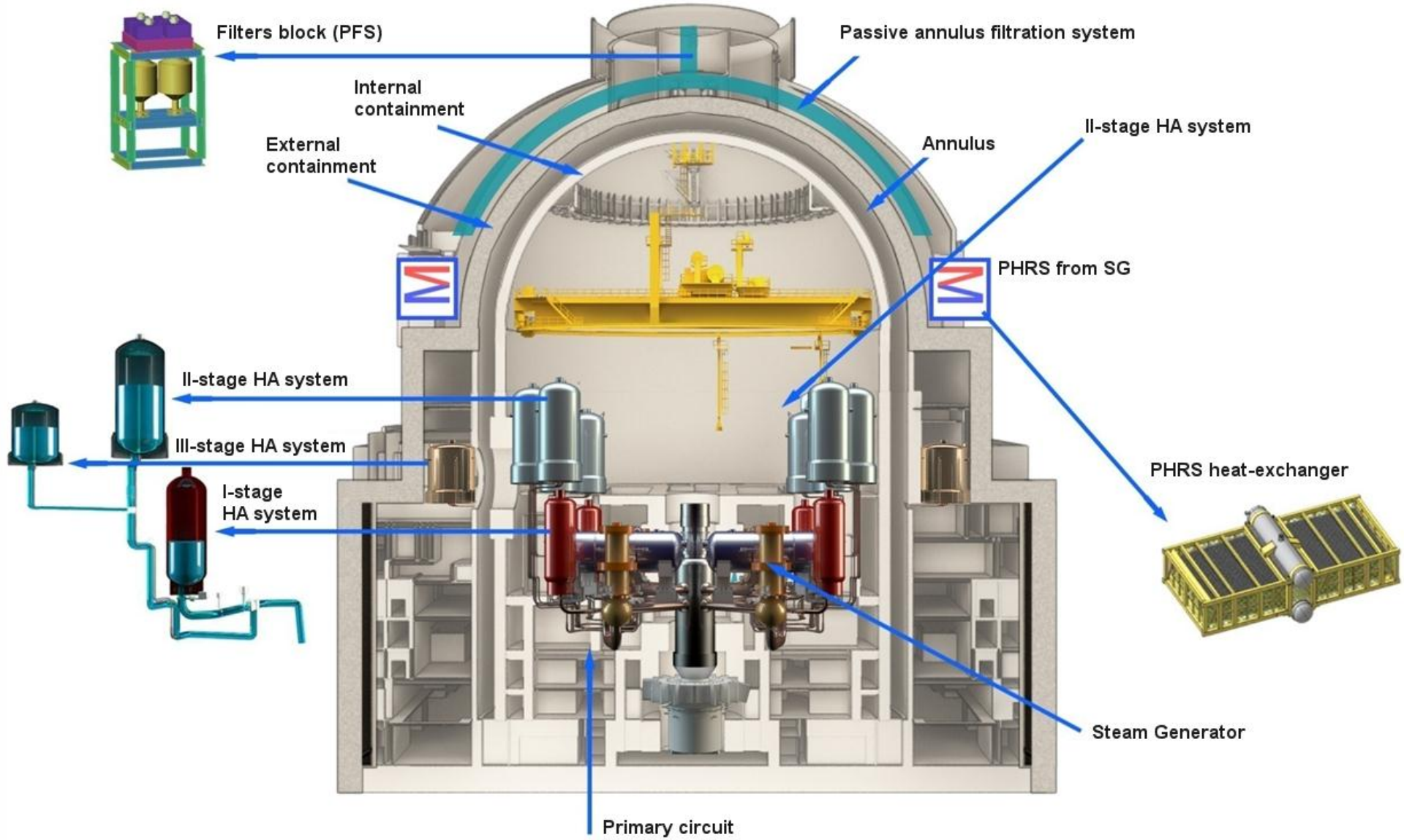
Coolant outlet temperature: 329 °C

Reactor coolant flow: 86000 m3/h







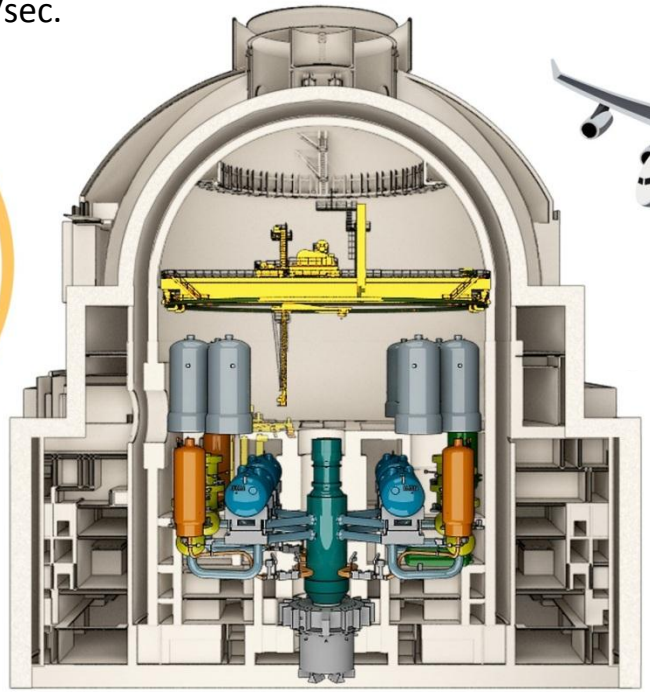

Filters block (PFS)
Passive annulus filtration system
Internal containment
External containment
Annulus
II-stage HA system
PHRS from SG
II-stage HA system
III-stage HA system
I-stage HA system
PHRS heat-exchanger
Steam Generator
Primary circuit

Akkuyu NPP Safety Features

Hurricanes, tornados
Design maximum wind speed is 56 m/sec.

Aircraft crash
Crash of the heavy 400 t aircraft falling at a velocity of 200 m/s

Explosions
Pressure at shock wave front 30 kPa



Floods, storms and Tsunami
Protection

Earthquake Load
Maximum earthquake magnitude is **up to 9 as per MSK 64** (Comprehensive Intensity Scale)

Build Own & Operate
is
in FOCUS

BOO Model

- Long Project duration period (generation of electricity during 60 years)
- Potential stable profit from power sales
- Forecast for growth of power consumption and capacity deficit
- Electricity market liberalization and electricity price growth in Turkey
- Turkish power market investment attractiveness
- Availability of grid infrastructure and possibility to export power to Europe and the Middle East
- Government support of the project in Turkey and Russia

BOO Model

Advantages

- Profit from electricity sales after pay back period
- Revenue guarantee for Project investors – PPA
- Usage of Proven technology
- Operational experience
- Sustainable operation and availability of fuel; spare parts and maintenance services
- Involvement of Turkish industry and Turkish personnel in construction and operation of NPP
- Decommissioning

Disadvantages

- Need to forecast long-term electricity price
- The Project Company bears all risks
- Possibility of unpredictable growth of the construction costs due to economic and political force majeure
- Difficulty to find investors

BOO Model

Involvement of Turkish industry and Turkish personnel in construction and operation of NPP

IGA Parties Responsibilities

Russian Party responsibilities

- NPP engineering and design supervision
- Construction management/ supervision
- Issuing project documentation
- Construction and assembly work
- Nuclear Fuel management
- Personnel training
- Startup and Commissioning
- Operation, maintenance and upgrade
- Decommissioning
- Rad waste management

Both Parties responsibilities

- Nuclear energy regulation and legislation development
- Infrastructure development
- Operation and maintenance
- Physical protection
- Emergency planning
- Public relations
- Research & Development

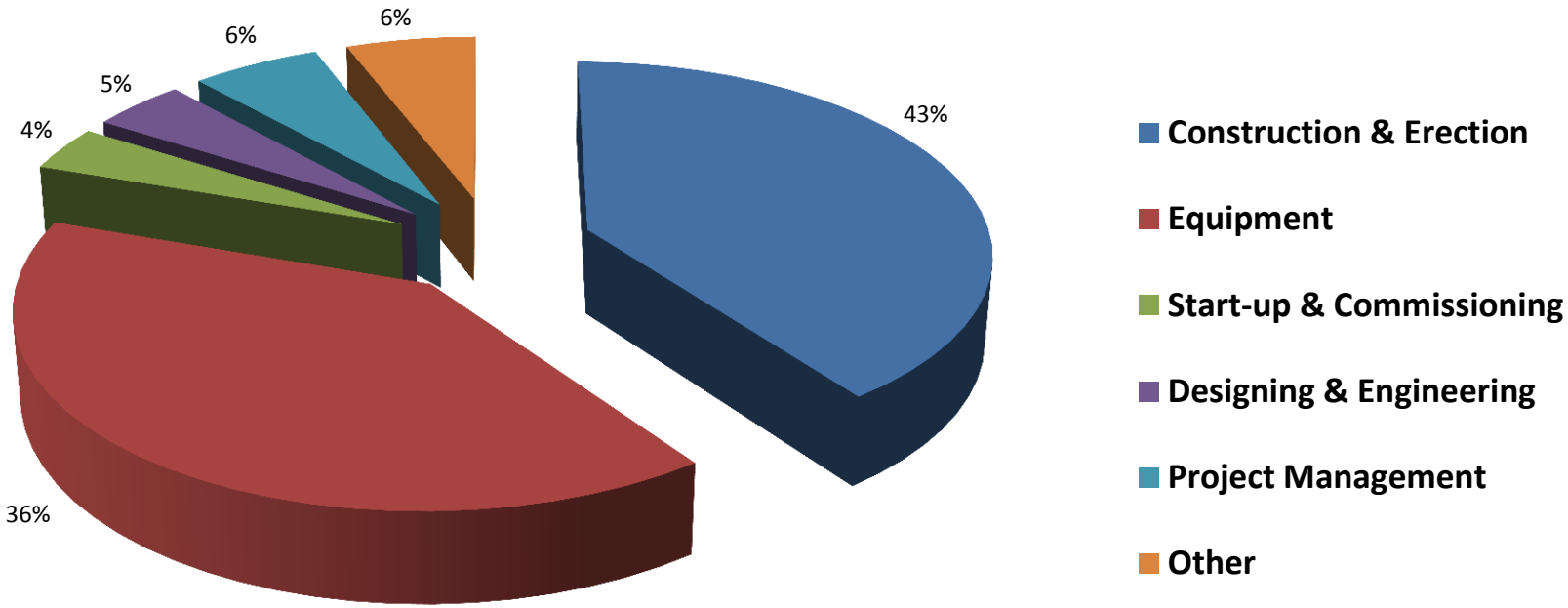
Turkish Party responsibilities

- Site allocation
- Site infrastructure
- Grid connection
- Provision of materials and equipment
- Participation in O&M
- Construction and assembly work

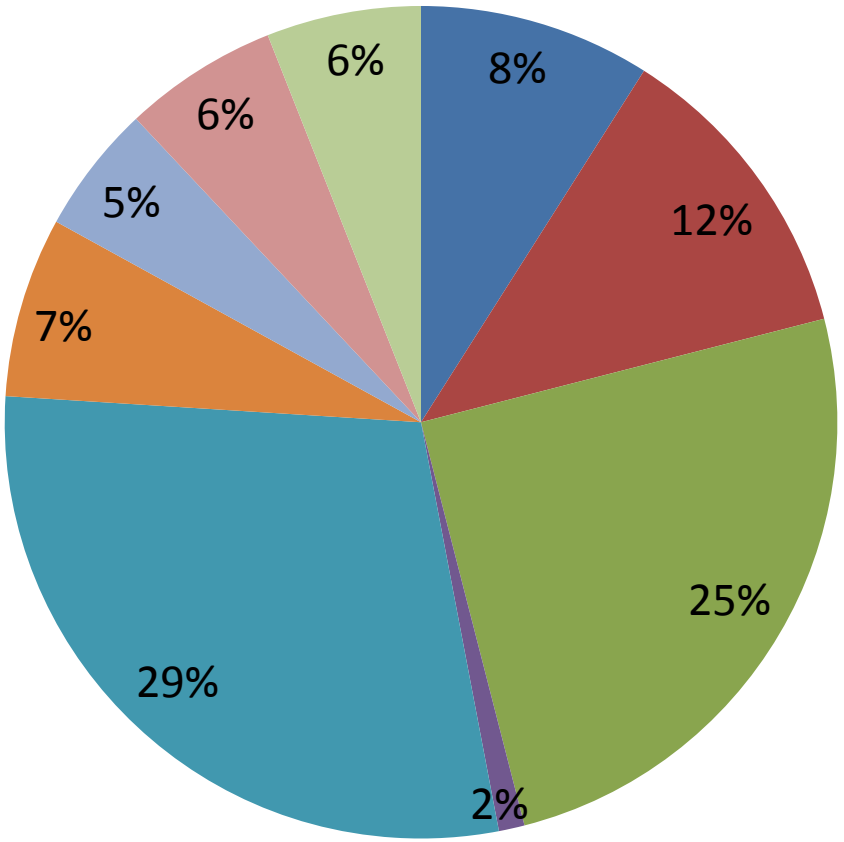
Turkish Industry Supply Chain

Project CAPEX

Project Cost Breakdown by Activities



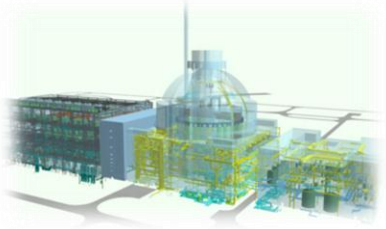
Equipment and services estimated cost breakdown



- Assembly Work (Turkey and other states)
- Assembly work (Russia)
- Construction (Turkey and other states)
- Construction (Russia)
- Equipment (Russia and other states)
- Equipment (Turkey and other states)
- Design and Engineering
- Project management

Three Years Age Project

What have been done?



GENERAL

- The Project Company (APC) has received the NPP construction site with effective site license and renewed licensing conditions.
- The Updated “Site Report” has been prepared by PC and approved by TAEK

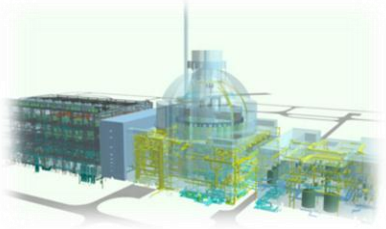
ENGINEERING SURVEYS

- Preliminary stage priority engineering surveys for preparation of the TDD have been completed
- SOW for Working Design Development stage engineering surveys have been completed and now surveys are being implemented

DESIGNING

- Design documentation has been developed by the Designer and currently is under revision by the Project Company
- Akkuyu NPP Layout General Plan has been developed
- Design works for the priority construction facilities of the preliminary period are underway. Technical Specifications and estimate documentation for modular erection facilities of the preliminary period have been developed

What have been done?



DESIGNING (cont.)

- Design work is undergoing for five packages of the preliminary construction period priority facilities:
  - Water supply pipeline (P01),
  - Site road infrastructure (P02),
  - Construction Assembly Base facilities (P03),
  - Temporary housing area for construction period (P04),
  - Temporary West sea Per (P05)

CONSTRUCTION PREPARATION

- Construction organization plan for preliminary stage has been developed
- Organizational Structure (Directorate of the NPP) under NPP construction has been established and in process of development
- Works on infrastructure maintenance and modernization are underway with the participation of Turkish companies. Contract for the maintenance of pioneer base facilities has been signed and implementation started
- Fire-protection roads and zones at the Site were built and are under implementation
- Tender for long-lead equipment procurement was announced

What have been done?

CONSTRUCTION PREPARATION (cont.)

- Mining lime stone quarry development works were arranged and are underway within the framework of granted licenses and permits (app 3 mln m3 of stone soil was excavated and replaced)
- Stone Crashing Facility is being assembled

LICENSING

- NPP Project Licensing Base of applicable regulations, Guides and Standards was approved by TAEK
- The Application for Power Generation License has been made
- Reference NPP Selection Justification Report was prepared by PC and the Novovoronezh NPP - 2 was approved by TAEK as the referenced plant
- The EIAR has been prepared and submitted to MoEU for approval
- The Construction License package is being prepared
- PC Quality Management System Documents (General Quality Plan and General Guidance on Quality Management System) were approved by TAEK (requirements for NPP Owner)

Current Status and Development

Recent Key Licensing Events

DONE

- Approved by TAEK the Updated Site Report
- EIAR completed and submitted for approval
- Mining Excavation License obtained for lime stone quarry development at the Site

IN PROCESS NOW

- Construction License Application preparation
- EIAR and Zoning plans approval
- Permissions for Infrastructure preparation activities
- LLI equipment procurement and local supply chain development

Licensing Activities are in FOCUS

Akkuyu NPP Project Program of Performance

We are here

Commissioning

1 stage | 2 stage | 3 stage | 4 stage

PREPARATION | CONSTRUCTION | OPERATION & MAINTENANCE | DECOMM

1 2 YEARS | 60 YEARS

12.2010 — Akkuyu JSC registered

03.2011 — Site Survey started

2012 — Site Survey completed

2014 — EIAR approval

2016 — First concrete

2016 — NPP Construction license

2020 — 1 UNIT

2021 — 2 UNIT

2022 — 3 UNIT

2023 — 4 UNIT

2080

TURKISH SUPPLY CHAIN

Akkuyu NPP Project Program of Performance

We are here

Commissioning of the First Unit

1 stage

2 stage

3 stage

PREPARATION

1 UNIT

2 UNIT

3 UNIT

4 UNIT

4 YEARS

5 YEARS

1 Y 1 Y 1 Y

Site License

Construction License

Operating License

Approval of Site Param.

Limited Work Permit

Commissioning Permit

Fuel Loading and Test Operations Permit

TAEK Licenser

Owner's Initial Appl'n

Notification of Initial Site Inves.

Appl'n for Site License

Appl'n for Approval of Site Param.

Appl'n for Construction License (PSAR)

Appl'n for Commissioning Permit

Appl'n for Fuel Loading and Test Operations Permit (FSAR)

Appl'n for Operating License

Akkuyu NPP Licensee

Conventional infrastructure

Non-safety related buildings

All NPP buildings and Installations

AKKUYU NPP LICENSING PROGRAMME

Licensing management

Licensing Management

- **APC-TAEK working within 10 working groups**
  - engineering surveys (WG01),
  - rules, standards and regulations (WG02),
  - quality management systems (WG03),
  - long-lead items (WG04),
  - construction license application (WG05),
  - physical protection (WG06),
  - emergency preparedness,
  - radiation protection and wastes management (WG07),
  - system engineering (WG08),
  - EIAR (WG09)
  - Nuclear Materials Safeguards (WG10)

Licensing management

Licensing Management

- **APC-TAEK working within 10 working groups**
  - engineering surveys (WG01),
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  - radiation protection and wastes management (WG07),
  - system engineering (WG08),
  - EIAR (WG09)
  - Nuclear Materials Safeguards (WG10)

Licensing management

Licensing Management

- APC-TAEK working within 10 working groups
- APC-TAEK Regular coordination meetings
- APC - MENR Regular coordination meetings
- Negotiations with TETAS on Power Purchase Agreement (PPA)
- Negotiations with TEIAS on power distribution scheme and NPP grid connection to Turkey energy system
- Regular communications with the TR regulatory and governmental authorities

Licensing cooperation

Cooperation APC - TAEK

- TAEK personnel NV NPP-2 Site visits
- TAEK personnel visits to Russian manufacturer factories, designers institutes, main equipment suppliers
- Arranged 4 training courses for TAEK personnel (each 1 week duration) at the NV NPP-2 Site

Cooperation APC - International

- **May 2013** Evaluation work completed within the framework of IAEA INIR mission on TR preparedness for NPP construction, Vienna
- **June 2013** participation in the development of TR National Report on Nuclear Safety, Ankara,
- **October 2013** Akkuyu NPP design stress test studies results were presented in EU commission, Brussels
- **November 2013** IAEA mission for the INIR report preparation, Ankara
- **November 2013** Akkuyu NPP JSC hosted the IAEA training seminar on inspections and quality management during NPP construction, held in Ankara

EIAR
is
in FOCUS

EIAR in Focus

EIA process history

- **December 02, 2011** APC submitted an EIA Dossier according to general format to the MoEU
- **March 29, 2012** – Public hearings started in Buyukeceli of Mersin province
- **May 21, 2012** – The MoEU officially issued the special EIAR format to the APC, EIAR preparation started
- **July 5, 2013** APC submitted EIAR to MoEU
- **October 1, 2913** The first meeting of the EIA Evaluation Commission
- **31 March, 2014** APC submitted revised EIAR to MoEU

EIAR in Focus

EIA process features

- **58** Evaluation Committee Members
- **More than 800** Comments received
- **By June 2014** the EIAR positive decision is expected

Infrastructure Activities are in FOCUS

Activities at the Site

Infrastructure activities

- 3800 m fire-protection roads were constructed
- 2100 m fire-break lines were cleaned and constructed
- 1840 m road for local inhabitants was constructed
- Existing site infrastructure rehabilitation in progress

Local Supply Chain
is
in FOCUS

Akkuyu NPP equipment to supply

- In accordance with the IGA between the Russian Federation and the Republic of Turkey, the both parties agreed to widely attract Turkish companies to supply of products, delivery of services and performance of works in connection with the construction stage of the Project.

- In order attract Turkish Market to the Akkuyu NPP Project realization, the Turkish Suppliers and Manufacturers should be informed about the planned scope of works, requirements to suppliers and requirements to the their products, such as equipment, materials and services.

- Suppliers of equipment, materials and services for the Akkuyu NPP construction will be selected on a competitive basis

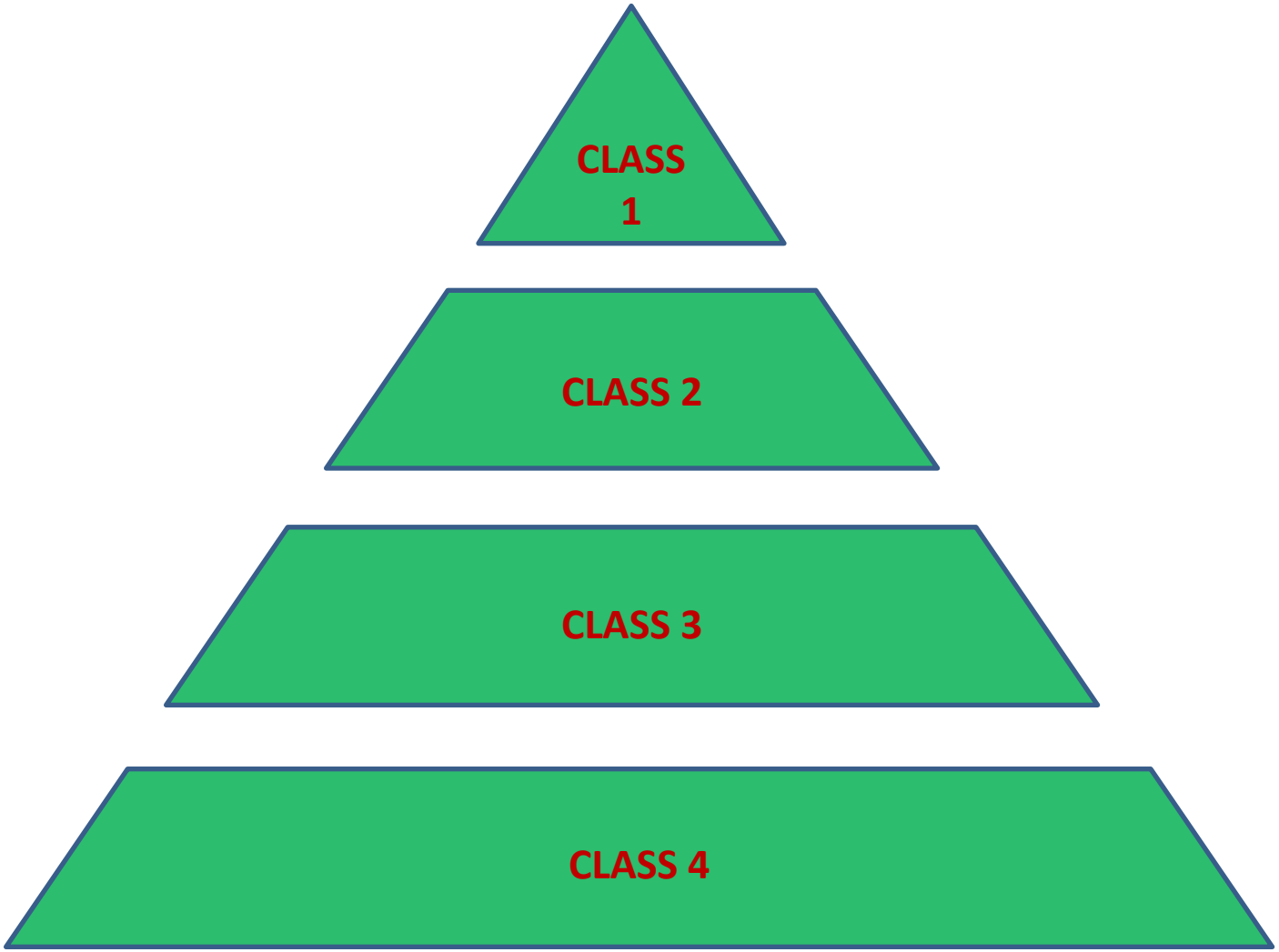
Akkuyu NPP equipment to supply

Procurement for Akkuyu NPP includes:

- **provision of services during construction and installation works,**
- **supply of construction materials,**
- **thermal engineering,**
- **supply of pumping, hoisting, electrical, cabling and other equipment,**
- **O&M equipment supply and provision of maintenance services,**
- **etc.**

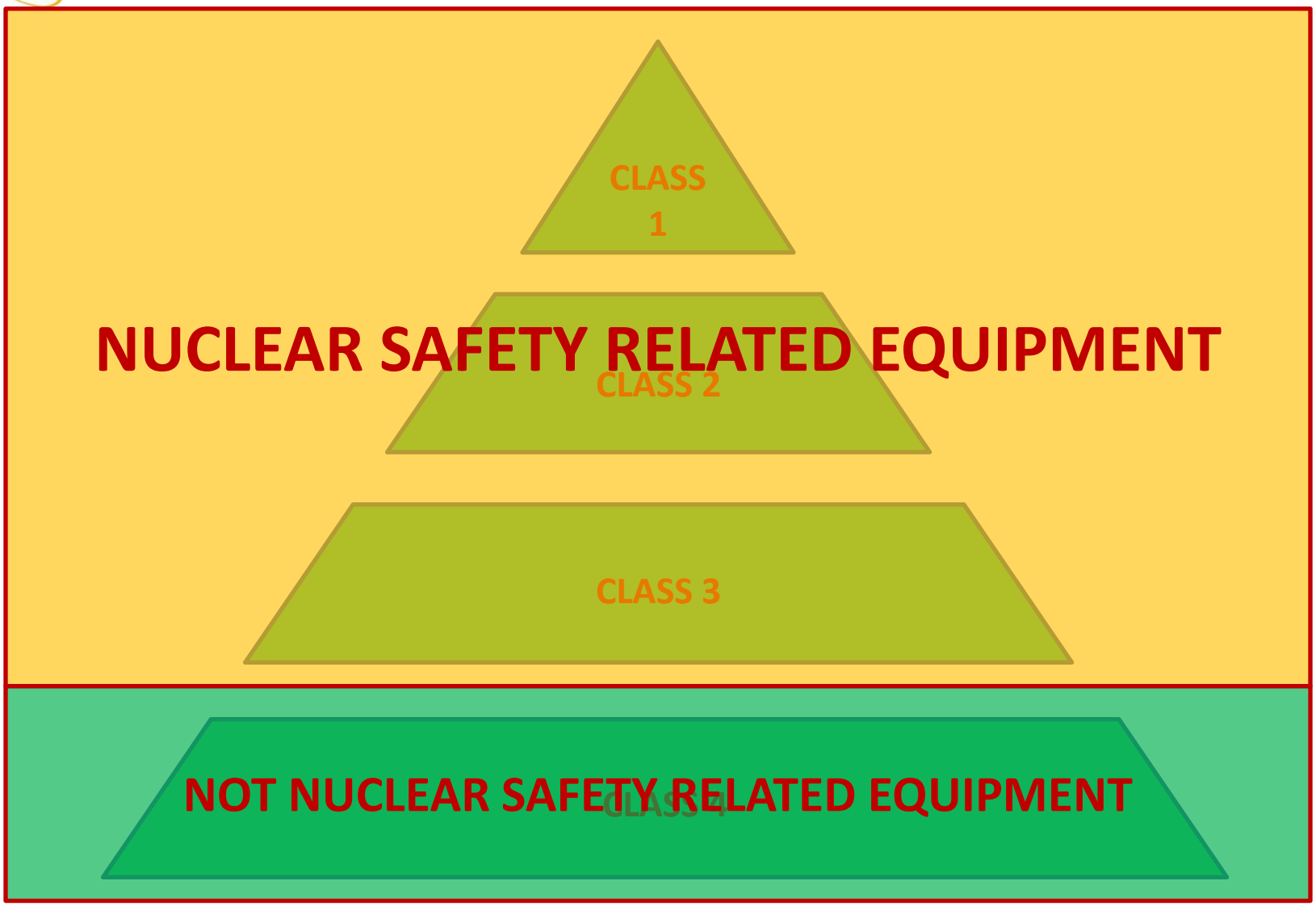
It is particularly to be stressed the necessity to take into account specific requirements to the NPP safety at all the stages of the NPP life cycle

Classification of the Akkuyu NPP Equipment



Safety classification under the Russian Rules and Norms for Safety of Nuclear Power Plants (ПНАЭ Г-01-011)

Classification of the Akkuyu NPP Equipment



Safety classification under the Russian Rules and Norms for Safety of Nuclear Power Plants (ПНАЭ Г-01-011)

Classification of the Akkuyu NPP Equipment

CLASS 1

Equipment, failure of which serves as an initiating event of beyond design-basis accidents resulting in fuel element damages and exceeding the limits established for design-basis accidents

Fuel elements, reactor vessel, main joint seal, lid of upper unit, steam generators, pressurizer, primary coolant pumps

CLASS 2

Equipment, failure of which serves as an initiating event resulting in nuclear fuel element damages within design-basis accidents

Supporting ring and thrust ring of the reactor vessel, vessel internals, equipment of the reactor well, accumulators of emergency core cooling system, main circulation pipeline, equipment of refueling system, locks, fittings and elements of the pipelines of the reactor building's systems

CLASS 3

- **Equipment of safety-important systems and not covered by safety classes 1 and 2**
- **Systems containing radioactive substances emission of which into the environment exceeds standard values**
- **Equipment implementing controlling function for the radiation protection of personnel and public**

Guard of nozzle area, embedded parts and fastening elements of the reactor building's equipment, ventilation equipment, pumps, pressure vessels, heat exchange equipment

Classification of the Akkuyu NPP Equipment

CLASS 4

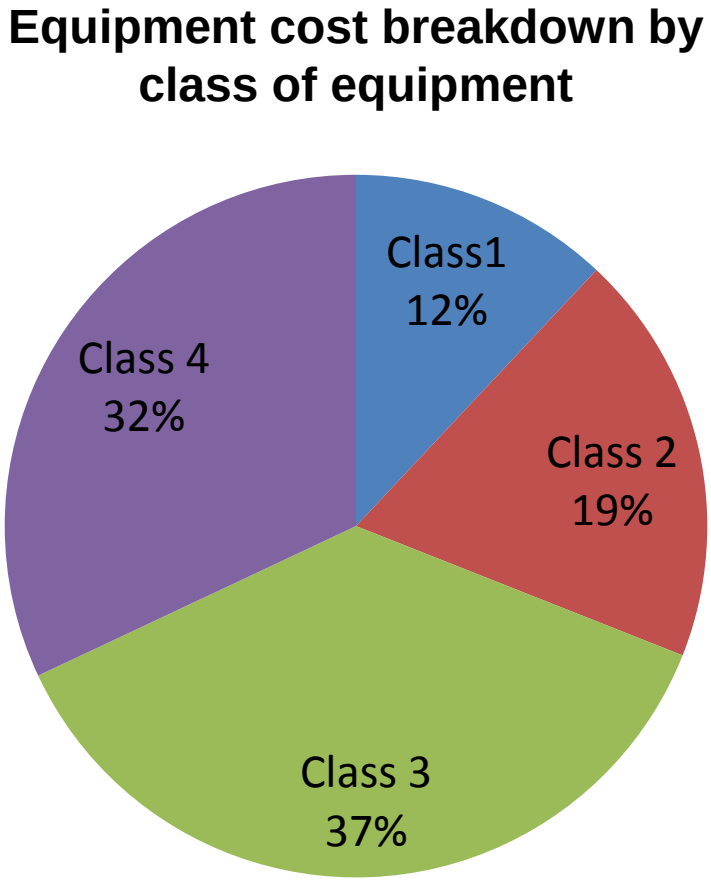
Equipment of the systems of the NPP normal operation not impacting nuclear safety and not covered by safety classes 1, 2 and 3

Turbine Island supporting equipment, ventilation equipment, pumps, pressure vessels, heat exchangers, valves, cables, pipes etc.

Preliminary equipment cost Breakdown for Akkuyu NPP

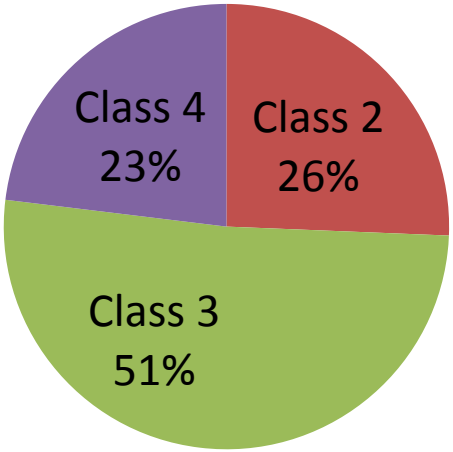
CLASS 4

32 %



Preliminary equipment cost Breakdown for Akkuyu NPP

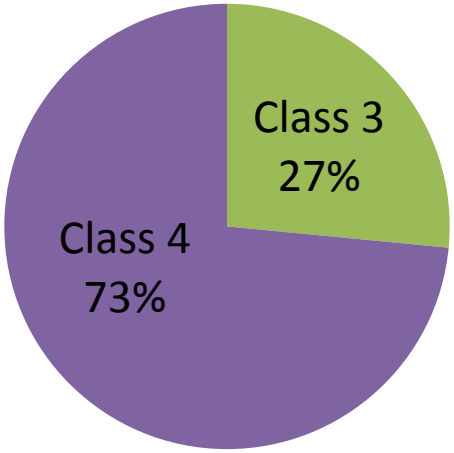
Electrical equipment
cost breakdown by class of equipment



CLASS 4

23 %

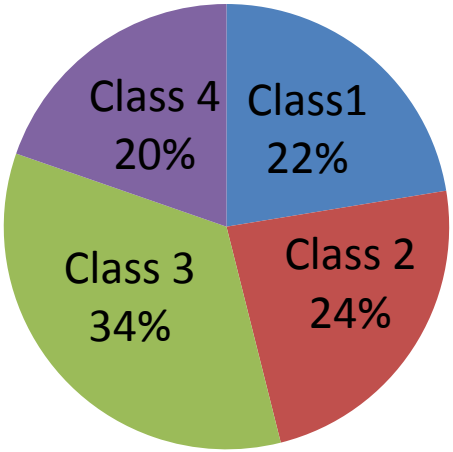
Construction equipment
cost breakdown by class of equipment



CLASS 4

73 %

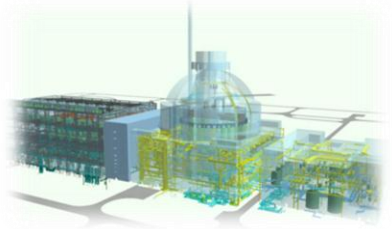
Mechanical equipment
cost breakdown by class of equipment



CLASS 4

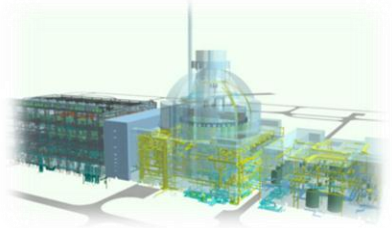
20 %

Types of necessary equipment CLASS 4 (based on 4 Units)



Equipment description, units of measurement	Quantity
Cabling and wiring products, thous. km	15.2
Nonstandard equipment (tanks, vessels, doors, gates, steel access doors), thous. t /thous. pcs.	11.4 / 28.9
Ventilation equipment, including air supply units, fans, electric air heaters, split system AC units, thous. pcs.	19.4
Air ducts, thous. m^2	773.0
Pipelines and pipeline shaped parts of carbon and stainless steel, thous. t	32.6
Low pressure pipeline and sanitary fittings, thous. pcs	91.2
Hoisting and transport and handling equipment, thous. pcs.	2.29
Pumping equipment, thous. pcs.	2.59
Cable ducts, t	43.2
Control boards (local control boards), pcs.	604
Light fixtures, wiring accessories and accessory electrical fittings	as per the design
Electric motors	to complete ventilation and pumping equipment
Transformers, pcs.	660
Firefighting equipment and fire engines	as per the design
Laboratory equipment and materials	as per the design
Machinery, pcs	98

Scope of Main Construction Works (based on 4 Units)



Work description, unit of measurement	Quantity
Cast-in-situ concrete and reinforced concrete, thous. m^3	1308.9
Precast concrete and reinforced concrete, thous. m^3	526.2
Brickwork, thous. m^3	10.5
Steel structures, thous. t	63.8
Carbon steel liner, thous. t	3.4
Corrosion-resistant steel liner, thous. t	1.3
Roof, thous. m^2	157.5
Waterproofing	
membrane, thous. m^2	393.3
surface covering, thous. m^2	450.2
Heat insulation, thous. m^3	37.6
Floors, thous. m^2	533.0
Finishing work, thous. m^2	1456.5
Special paint coating, thous. m^2	1763.0
Arrangement of air ducts of flat steel, thous.m^2	64.0
Installation of equipment, thous. t	127.0
Electric power supply, radiation monitoring system and communications	
cables, km	7251.0
wires, km	71.0
On-site roads and sites, thous. m^2	125.0
On-site utilities, km	92.0
Water pipeline and sewage in buildings, km	49.0
Heating and ventilation in buildings, km	41.0

Main Construction Materials needs (based on 4 Units)

Material description, unit of measurement	Quantity
Ready-mixed concrete, thous. m^3	**1500.0**
Precast concrete and reinforced concrete, thous. m^3	**526.2**
Precast concrete stones, thous.m^3	488.0
Enclosing structures, thous. m^3	17.5
other, thous. m^3	20.7
Brick, thous. pcs.	**4200.0**
Reinforcement, thous. t	**200.0**
Mineral wool products, thous. m^3	**53.9**
Rolled materials, thous. m^2	**1077.0**
Grout, thous. m^3	**37.4**
Cement, normalized to M400, thous. t	**482.0**
Sand, thous. m^3	**911.0**
Aggregate, thous. m^3	**1260.0**
Paint materials, thous. t	**2.6**
Bitumen,asphalt mastic, thous. t	**2.1**

Scope of installation works (based on 4 Units)

Equipment Total, including:	TOTAL : 127,0 thousands ton
- Technological equipment	55,2 thousands ton
- Technological pipelines	39,6 thousands ton
- Water supply and canalization	0,4 thousands ton
- Heating and Ventilation	9,6 thousands ton
- Electrical	22,2 thousands ton

Requirements for equipment and suppliers

Materials, Equipment and Services Supply

Suppliers of equipment, materials and services for the Akkuyu NPP construction will be selected on a competitive basis

SAFETY CLASS 4
Not Nuclear Safety Related

Materials	Equipment	Services
SUPPLIERS FROM TR, RF, third countries based on competitive bidding		SUPPLIERS FROM TR, RF based on competitive bidding

Technical Requirements to Equipment and Materials

- Technical requirements for equipment and materials are specified in design documents as specifications and initial technical requirements (ITR)

- Specifications of materials and equipment, as well as ITR will be available after elaboration of Akkuyu NPP design documentation.

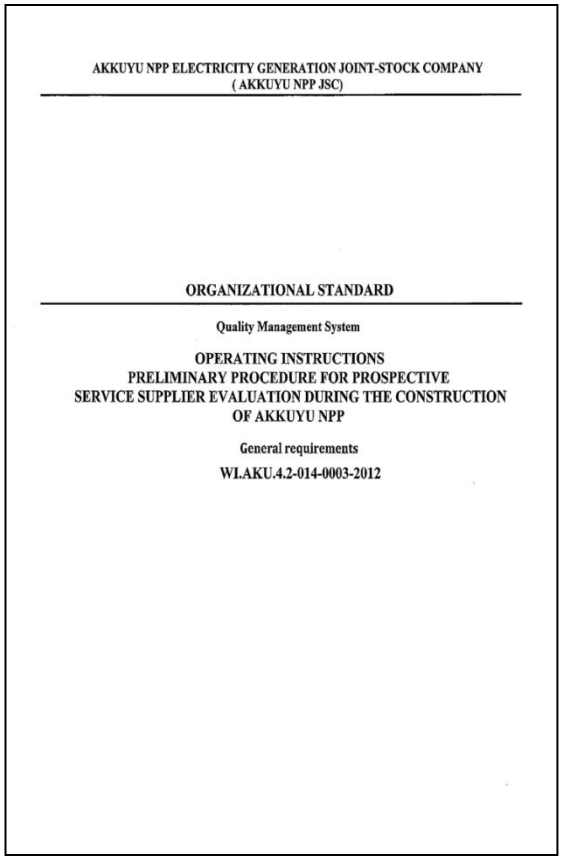
- Akkuyu NPP design documentation delivery time – mid 2014.

Suppliers and Manufacturers Requirements

- Necessity of the certified QMS according to the ISO requirements
- Direct supply of Akkuyu NPP equipment and materials from manufacturers to the Customer
- Capability to satisfy to all technical requirements of the Technical Design Documentation
- Compulsory requirement – certification of all the equipment and construction materials for the safety related systems

Suppliers and Manufacturers Requirements

- Qualification requirements for suppliers will be indicated in the tender documentation
- Potential suppliers are evaluated in accordance with the Akkuyu NPP JSC QMS *Procedure for the prospective service supplier evaluation during the construction of the Akkuyu NPP*



AKKUYU NPP ELECTRICITY GENERATION JOINT-STOCK COMPANY
(AKKUYU NPP JSC)

ORGANIZATIONAL STANDARD

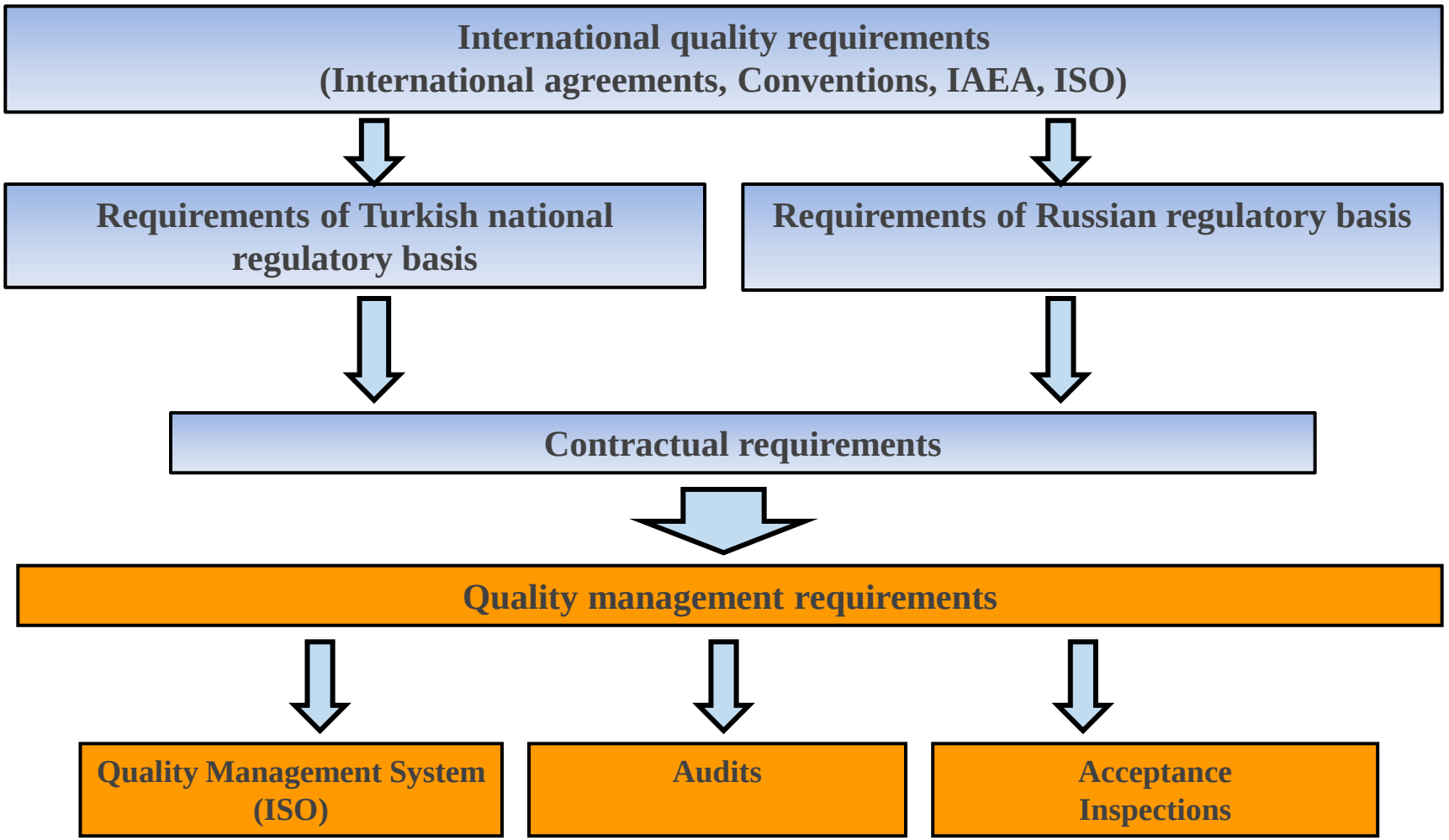
Quality Management System

OPERATING INSTRUCTIONS
PRELIMINARY PROCEDURE FOR PROSPECTIVE
SERVICE SUPPLIER EVALUATION DURING THE CONSTRUCTION
OF AKKUYU NPP

General requirements

WI.AKU.4.2-014-0003-2012

Quality Management Requirements

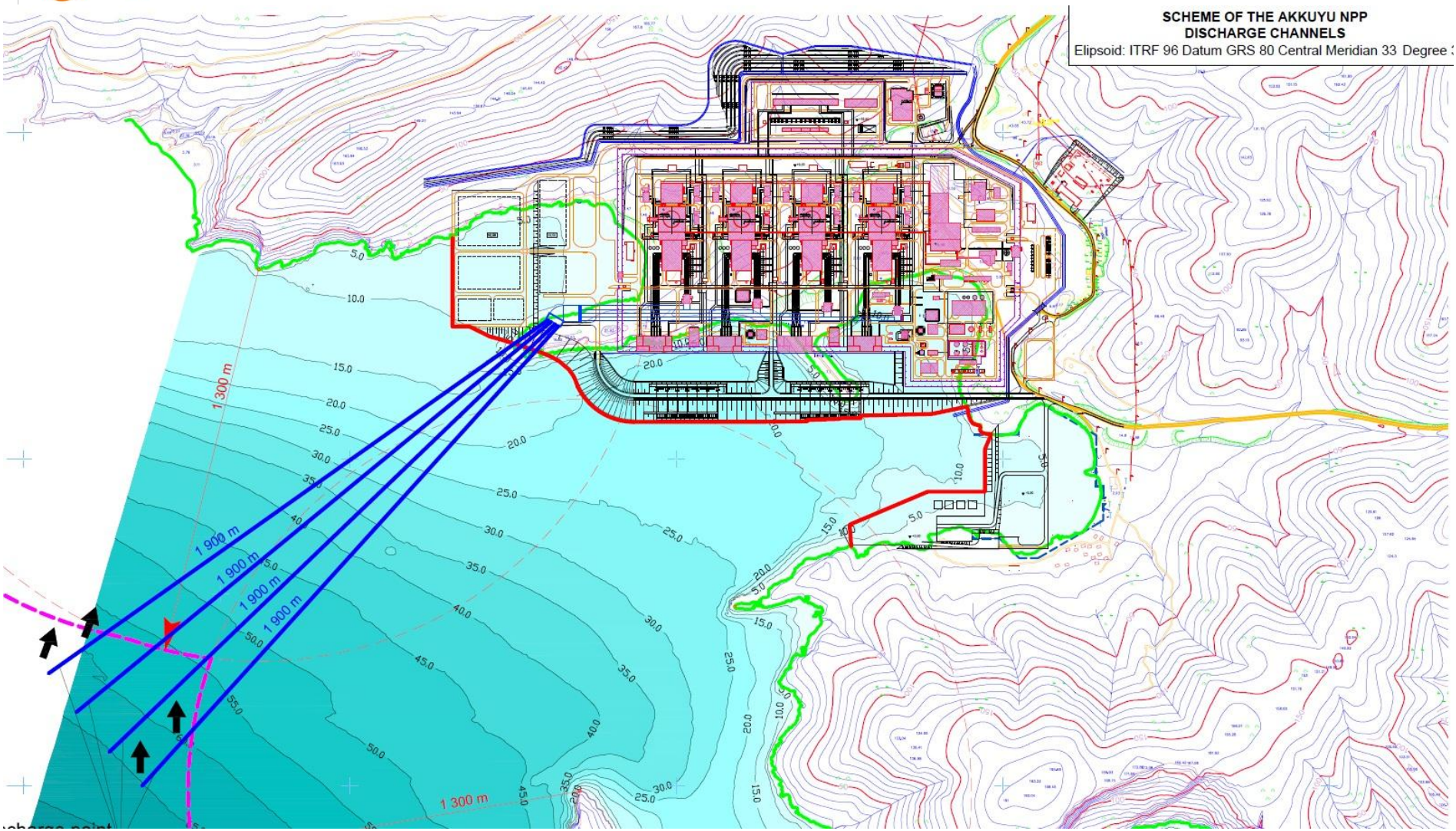


Requirements to procurement procedures

- Requirements to services, materials and equipment suppliers will be set forth in tender documentation to be elaborated by the General Contractor ASE and published on the website of State Atomic Energy Corporation “Rosatom” (http://zakupki.rosatom.ru)

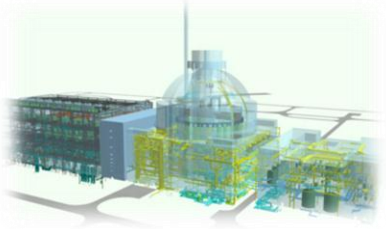
- Procurement procedure will be followed according to the Common Industry Procurement Standard (Procurement Regulations) of “Rosatom” requirements.

General Plan of the Akkuyu NPP



Following steps

Plans for the near future



LICENSING

- “Site Parameters Report” to be completed, submitted to TAEK for approval and approved by TAEK
- EIA Report Approval by MoEU
- Completion of negotiations with TETAS on Power Purchase Agreement (PPA)
- Submittal of application package for the Construction License to TAEK
- Approval of power distribution scheme and NPP grid connection to Turkey energy system
- Obtaining temporary generation license (potentially, subject to EMRA decision)
- Converting of the temporary permits of the Ministry of Forestry and water Resources and Ministry of Finance for land use into permanent
- Work with TAEK’s Working Groups in order to organize Project related licensing and permitting activities basis

Plans for the near future

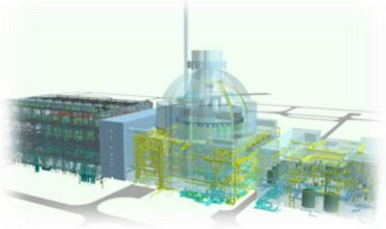
Designing Works

- Engineering surveys for detailed design phase completion
- Completion of the Akkuyu NPP Technical Design review and approval
- Completion and Approval of the zoning plan (after approval of EIAR): residential camp, NPP site land allocation, Changing sea coastal line
- Completion of design for five design work packages for the preliminary construction period
- Completion of specifications for equipment, and long-lead equipment orders/ procurement

Construction Preparation

- Renovation of existing site infrastructure
- Completing designing of the five preliminary stage priority construction and assembly facilities

Plans for the near future



Construction Preparation (Cont.)

- Renovation of existing site infrastructure
- Completing designing of the five preliminary stage priority construction and assembly facilities

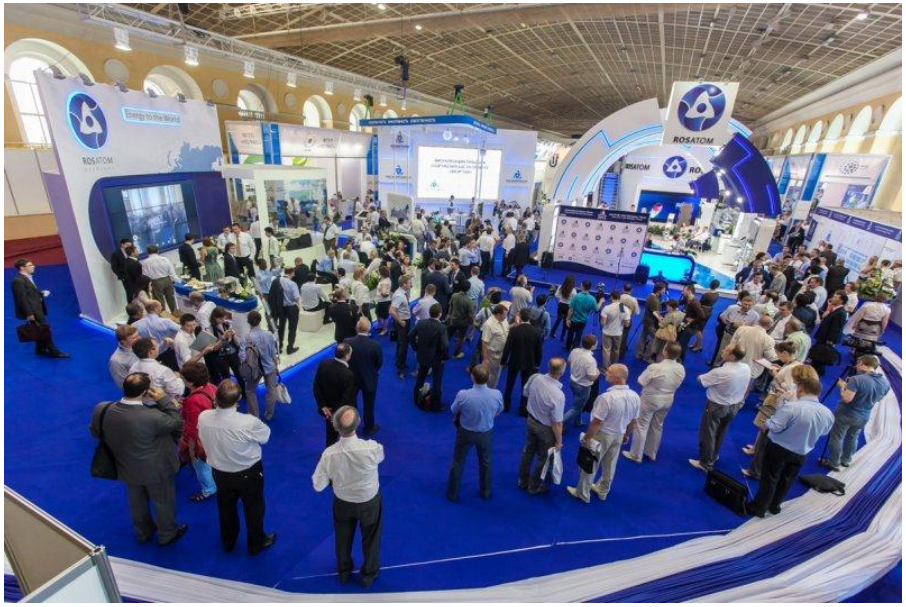
Manufacturing equipment for Akkuyu NPP

- Tendering process for fabrication of long-lead equipment to be followed
- Quality control during long-lead equipment start-up production and manufacturing with participation of Designated Authority and TAEK

Akkuyu NPP Management

- Owner - Operator functions development
- Finalization of establishing Directorate for NPP construction at Akkuyu site
- Selecting of an independent consultant for the PC - Owner's Engineer

ATOMEXPO 2014



ATOMEXPO – 2014

Tarih : 9-11 Haziran
Yer: Moskova

The Forum will include an international specialized exhibition and congress to be attended by the representatives of international, governmental and non-profit organizations, Russian and foreign companies; as well as leading nuclear industry experts.

Thank you for your attention