New VVERs in Russia and Abroad

Sergey Svetlov , Dr.Sc. (Tech.)
Chief Expert for Design
ASE Group (ROSATOM Corporation)

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DEVELOPMENT OF VVER DESIGN

Kudankulam NPP

Bushehr-2 NPP
NPP in Jordan

NV-2 NPP
Rooppur NPP
Akkuy

VVER.1000 (V-320)

VVER.1000 (AES-92)

VVER.1000 (AES-91)

VVER.1200

VVER.TOI

VVER.1200

Kursk-2 NPP

VVER.640

Tianwan NPP

LNPP–2, Bel NPP
Baltic NPP

MIR-1200

Hanhikivi NPP,
Paks-II NPP
El-Dabaa NPP

VVER.1200 Design

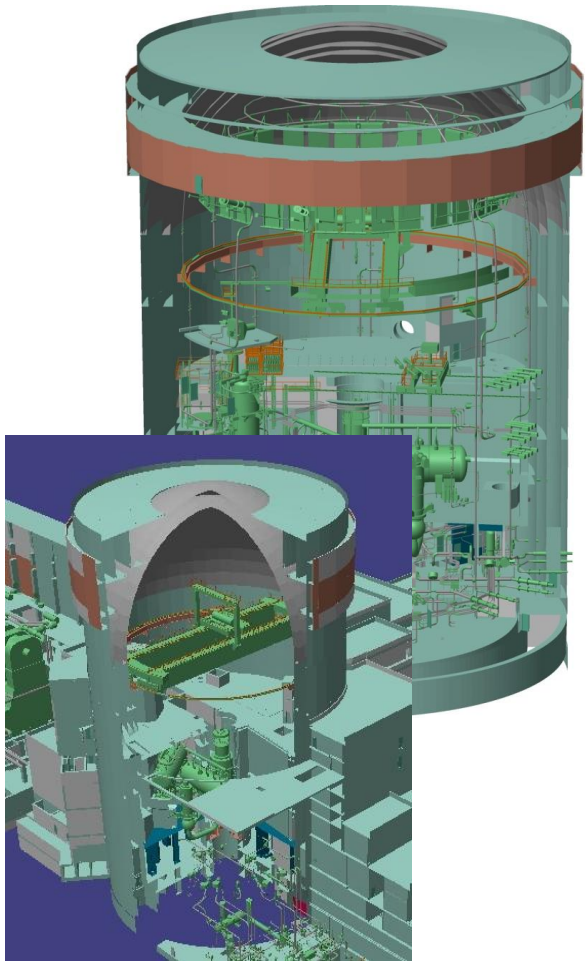
- VVER.1200 is an export name of the Russian design of the nuclear power plant known as AES-2006. It is an evolving NPP design developed on the basis of a Russian design VVER.1000.
- The VVER.1200 design belongs to Generation III+ . It meets all up-to-date Russian, European and international requirements for new NPP.
- The first units of this design are the unit #1 of Leningrad NPP-2 (LNPP-2) and the unit #1 of Novovoronezh NPP-2 in Russia. The unit #1 of Novovoronezh NPP-2 with the reactor VVER-1200 was put into operation in 2016. It is the first unit of Generation III+ under operation in the World.

VVER.1200 Design

- The VVER.1200 design is to be developed as a serial design both in Russia and abroad.
- There are two modifications of the design: VVER.1200M and VVER.1200E which differ in structure and layout of safety systems. The basic characteristics are same.
- VVER.1200M design is implemented at Novovoronezh NPP-2 and being implemented at NPP Rooppur in Bangladesh.
- VVER.1200E design is being implemented at LNPP-2, at Ostrovets NPP in Belorussia, at Hanhikivi-1 NPP in Finland, at Paks-II NPP in Hungary.
- The EPC-Contract is being prepared for El-Dabaa NPP in Egypt now, Contract negotiations start for new units in China.
- This design has also been submitted in the bid in Czech Republic (as MIR-1200).

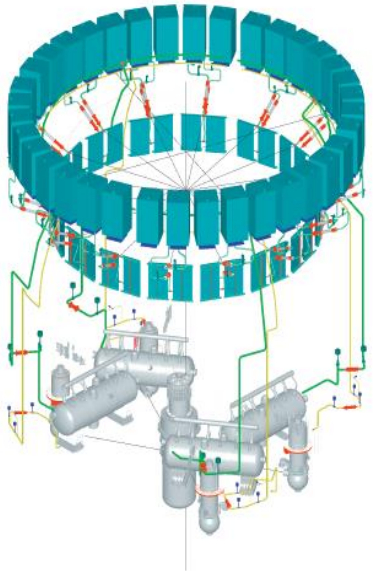
Main Technical Features of the VVER.1200E design

- Double containment (Inner containment is a cylindrical structure of prestressed reinforced concrete with hemispherical dome and reinforced concrete foundation plate)
- Four trains of active safety systems (4x100%, 4x50%)
- Maximum use of well-proven solutions and equipment
- BDBA management engineering measures (core catcher, H2 PARs, PHRS) based mainly on passive principles.

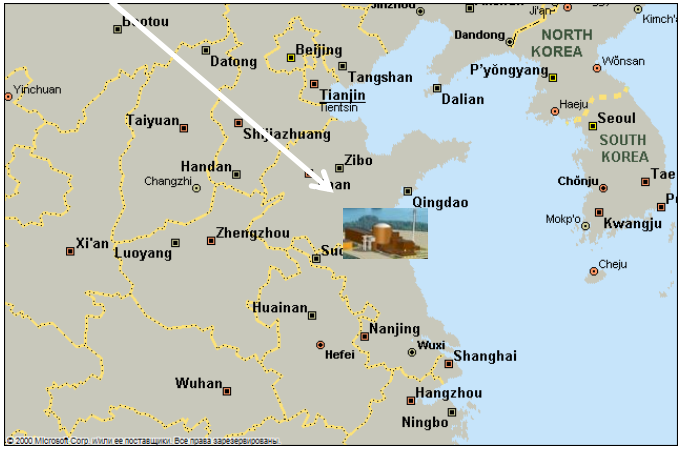


DEC Management Systems

- Core Catcher;
- Hydrogen Removal System (with passive recombiners);
- System of primary loop overpressure protection;
- Passive Heat Removal System via Steam Generators;
- Passive Heat Removal System from Containment.



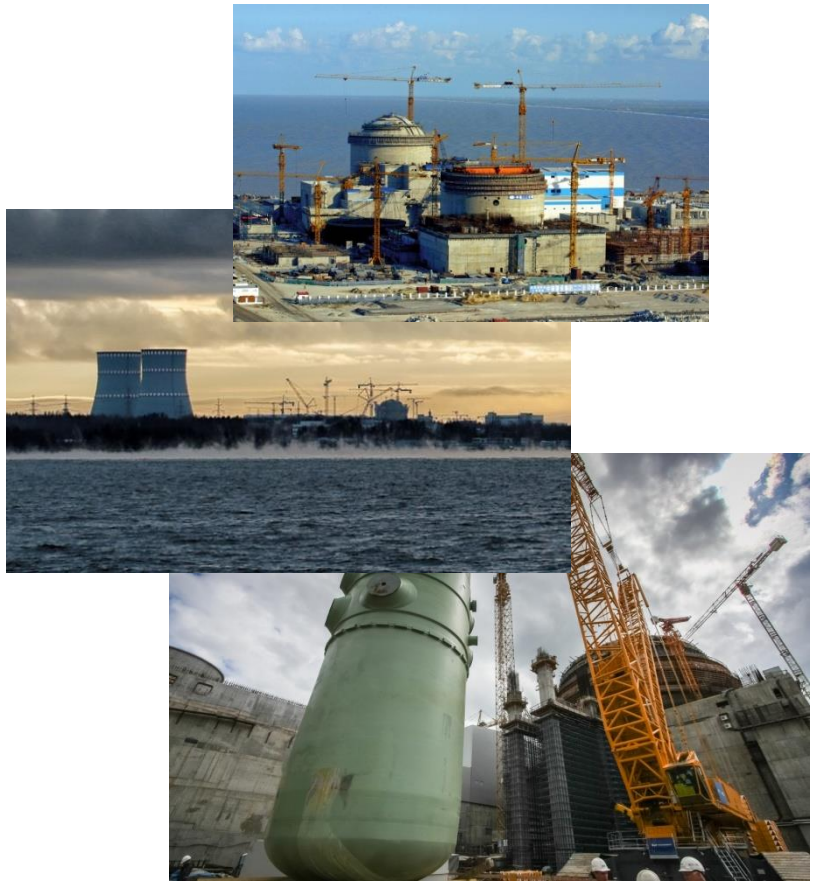
VVER.1200E. Current and Prospective



VVER.1200M and VVER.TOI. Current and Prospective

Leningrad NPP-2 (Russia)

- The first units of this design (VVER.1200E);
- Two units are under construction; two units – siting;
- The Construction Licenses for Units 1,2 are obtained; the Operating Licenses for Unit 1 is intended in 2017;
- Russian Codes and Standards are used; all up-to-date Russian, European and international requirements are met;
- Location near a large town with existent infrastructure; industrial surroundings; 80 km from a large city (St-Petersburg);
- North location of NPP with strong temperature, snow and wind loads;
- Water supply with cooling towers.



Hanhikivi NPP (Finland)

- One Unit with 1250 MWe Electrical Output;
- The Construction Licenses is intended in 2018;
- North location of NPP with strong temperature, snow and wind loads (for example, momentary outside temperature range is min -47, max +36);
- Cooling water supply from Gulf of Bothnic (without cooling towers);
- No existent infrastructure at the site;
- Strong safety requirements based on Finnish (STUK) and European (EUR, WENRA) requirements;
- Technology requirements based on STUK, Fingrid requirements and Eurocodes.

Paks II (Hungary)

- Two units with 1200 MWe each, the expansion of the existing NPP;
- Danube river location with cooling water supply from the river (without cooling towers);
- Location near a large town with existent infrastructure at the site;
- Strong safety requirements based on European (EUR, WENRA) requirements;
- Strong seismic parameters (0.35 g).

El-Dabaa NPP (Egypt)

- Two + two units with 1190 MWe each;
- Mediterranean Sea shore location with cooling water supply from the sea (without cooling towers);
- Location in a desert without existent infrastructure at the site;
- Hard soil conditions;
- Strong seismic parameters (0.1/0.35 g);
- Russian Codes and Standards are used; all up-to-date Russian, European and international requirements are met
- Taking into account heavy commercial aircraft crash

License Process for New VVERs

- New units have undergone the process of licensing in full scope only in Russia, China, India and Iran.
- The first interactions with regulatory authorities take place in Europe within the frameworks of Feasibility Study and Construction License Application.
- All new designs can be conventionally divided into:
  - Design with application of mainly Russian standards;
  - Design with application of local and European standards and norms;
- Harmonization of norms – necessary condition for successful (and profitable) adaptation of design at new sites.

MDEP Activity for New VVERs

❑ VVER working group was established in December of 2013 and lead by Russia (SEC NRS)

The VVER WG includes 4 expert subgroups:

- Consideration of lessons learnt from NPP Fukushima Daiichi disaster in new designs;
- Strength of reactor vessel and primary circuit components;
- Analysis and management of the severe accidents;
- Transient and accident analysis.

❑ Technical visits to Leningrad NPP-2, Novovoronezh NPP-2, Tianwan NPP were organized within the framework of supporting activities for MDEP.

❑ Possible directions of cooperation between MDEP VVER WG and Design Institutes:

- Provision of the required information on design (upon request) to VVER WG, participation in meetings of WG;
- Evaluation of new design solutions;
- Consideration of new topic on heavy aircraft crash impact on NPP (if necessary, to create separate working subgroup).

Thank you for your attention!

Sergey Svetlov, Dr.Sc. (Tech.)
Chief Expert for Design Engineering
ASE Group (ROSATOM Corporation)

SVSvetlov@atomproekt.com