**Some features of V-92 (466) and V-392 (AES 2006) WWER reactor types:**

1. **V-92 (466):**
* WWER-1000/V466 being built at the Kudamkulam NPP,India(first unit in operation, second in final stage of construction) and Belene NPP, Bulgaria (design - approved, construction – interrupted)
* Belene NPP design:
	+ combination of proven WWER-1000/V-320 design, new systems and components, 4x100% redundancy of active safety systems instead of 3x100% in previous design
	+ Safety systems (SS): protective, localizing, supporting and control; protective systems perform functions of emergency cooling and residual heat removal from the reactor core and have active and passive parts; each safety system has four independent trains (4x100%) which efficiency is chosen based on the single failure principle, trains are physically separated.
	+ Main safety functions are performed by active and full set passive systems, which are able to ensure safety independently. A specific feature is the combination of the function of systems for normal operation and of safety systems, which increases their functional reliability.
	+ In addition to the big water reserves in the secondary circuit, there are 8 additional stage 2 hydro-accumulators with water volume of 120m3 each.
	+ The containment external shell withstands external impact loads as large commercial and military aircraft crash and seismic impact; the internal shell withstands deign basis accidents and simultaneous seismic impact, ass SS and equipment are accordingly qualified.
	+ Hydrogen explosion hazard is excluded by the use of passive autocatalytic re-combiners
	+ Seismic hazard and seismic design: Beyond Design Basis Earthquake (BDBE) is taken into account. The Design Basis Earthquake (DBE) was set up at 0.24g, and it was required additionally (European Utility Requirements) that the safety is proven for seismic excitation 40% higher than the DBE, which provides for significant robustness against earthquakes.
	+ Equipment qualification – there are components that are subject to qualification by test both for aircraft crash and earthquake excitation.
	+ Belene BNNP design provides significant technical solutions to cope with the whole variety of accidents to be considered for Generation III+ NPPs.
1. **V-392 (AES 2006):**
* Evolutionary Generation III+ reactor design based on the V-92 - under construction at Novovoronezh (NVNPP-2) in Russia- first unit expected to be commissioned early 2015.
* Design changes include in particular:
	+ Optimization from a four train active safety systems to a two train active SS with redundant main components, and supplemented by redundant passive safety features,
	+ Increase of reactor power(core and vessel dimensions, operating parameters),
	+ Increased burn-up (70 MW-days/kg, 5% enrichment, U-Gd, 4 refuelling cycles)
	+ Extension of the life time to 60 years (reduction of fast neutron flux)
	+ Automatic accident control algorithm for coping with (multiple) SGTR
	+ Use of innovative safety features (PHRS, PRS, passive filtration system of the intershell space, core melt trap)
* Internal and external hazards:
	+ Internal and external hazards are deeply considered in the design. The SS design is based on following principles: each SS has two trains, use of passive cooling systems, use of combination of normal operation and safety systems, etc.
	+ The seismic design shall provide sufficient safety margin to protect against seismic events. For multiple unit plan site, the design shall take due account of the potential for specific hazards giving rise to simultaneous impacts on several units at the site.
	+ Equipment is designed to 0.25g. Please note that the similar (0.24g) value was set up for Belene NPP design (on the basis of DBE), but in addition it was required (on the basis of European Utility Requirements to take into account BDBE) to be excited by 40% higher than the BDE.