Status Report - AP300 (United States of America)

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1. Overview

- ☐ **In Operation**
- ☐ **Under Construction**
- ☐ **Described in**

Link to PRIS	--

- ☑ **New Concept**

Number of Units	--
Year	--

Reference Plant

Name of Site	Sanmen Units 1 & 2, Haiyang Units 1 & 2, Vogtle Units 3 & 4 (Link to PRIS)
Net Power Output (MWe)	330
Gross Power Output (MWe)	--

1.1 Introduction

Westinghouse AP300 SMR is a 300 MWe class (990 MWth core thermal power), Generation III+, one-loop light water Pressurized Water Reactor (PWR) based on the licensed AP1000 plant technology which has demonstrated industry leading reliability. There are 6 AP1000 PWR units operating in the world (China and the United States) with another 8 units currently under construction. The reference plants for the AP1000 are Sanmen Units 1 & 2 (PRIS - Reactor Details (iaea.org)), Haiyang Units 1 & 2 (PRIS - Reactor Details (iaea.org)), and Vogtle Units 3 & 4 (PRIS - Reactor Details (iaea.org)).

AP300 is the only SMR utilizing deployed, operating, and advanced reactor technology.

The plant design includes passive safety systems and extensive plant simplifications to enhance the safety, construction, operation, and maintenance of the plant. Safety systems use natural driving forces such as pressure, gravity, natural circulation, and convection. Active components such as pumps, fans, or diesel generators are not required, and the plant is designed to function without safety-grade support systems such as AC power, component cooling water system, service water system, or HVAC.

Plant operability and maintainability is a key focus for the SMR design, which improves operation while reducing the number of components and associated maintenance requirements. In particular, simplified

safety systems reduce surveillance requirements by enabling significantly simplified technical specifications.

Selection of proven components ensures a high degree of reliability with low maintenance requirements. Additionally component standardization reduces spare parts, minimizes maintenance, reduces training requirements, and allows shorter maintenance durations.

The plant has a well-defined design basis backed by extensive engineering analyses and testing performed as part of the AP1000 plant reactor development. High-level design characteristics of the plant are:

- Leveraged AP1000 reactor design and licensing experience to achieve deployment by early 2030's;
- Maximized use of demonstrated solutions to reduce cost and risk with no plant prototype needed since passive plant systems and power generating system components are based on proven Westinghouse technology;
- Westinghouse 17x17 RFA fuel product that has demonstrated excellent performance in its extensive operating experience in the United States and in more than 50 plants worldwide;
- Proven Westinghouse-supplied fuel and core design solutions capable of extended operating cycle up to 4 years;
- Based on licensed & operating AP1000 technology, the only GEN III+ technology to be fully licensed by the U.S. NRC;
- Outside the US, the proven technology also received a Design Acceptance Confirmation (DAC) from the ONR and a Statement of Design Acceptance (SoDA) from the Environment Agency;
- Simplified plant design and world class outage performance resulting in short refueling outages;
- Availability, minus planned outages, is expected to be in excess of 97%;
- Enveloping site parameters are defined to ensure the standard plant design is suitable for a wide range of site locations;
- In the extremely unlikely event of a core melt, in-vessel retention of core debris provides high confidence that containment failure and radioactive release to the environment will not occur due to ex-vessel severe accident phenomena.

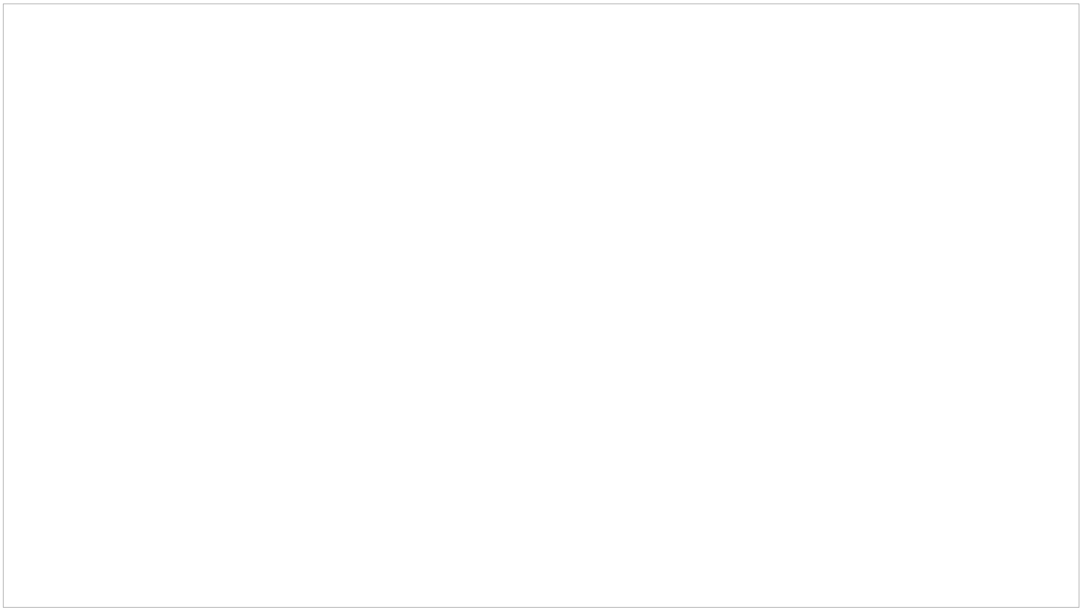


Figure 1. AP300 SMR site rendering.

Figure 2. AP300 SMR containment vessel peel-away.

1.2 Development Milestones

2023	Conceptual Design complete

2024	Start of Basic Design; Pre-licensing NRC interactions with white paper and topical report submittals; Submit UK Generic Design Assessment (GDA) Entry Application to DESNZ
2025	Design Certification Application (DCA) Submittal to US NRC; Initiate and Conclude GDA Step 1 (Initiation) with UK ONR
2026 - 2027	Detailed Design completion, initiate and conclude GDA Step 2 (Fundamental Assessment) with UK ONR, NRC issues Final Safety Evaluation for Design Certification & Standard Plant Ready to Deploy
2027 – 2030	Target long lead item procurement, site specific design & licensing, ready for construction
2033 - 2034	Target SMR commercial operation

1.3 Design organization or vendor company

kurascmv@westinghouse.com

1.4 Links to designer/vendor website

https://westinghousenuclear.com/energy-systems/ap300-smr;

1.5 Design Description

1.6 Licensing Application Support Documents

The AP300 SMR is currently in basic design with DCA and GDA submittals to the US NRC and UK ONR slated for end of 2025.

1.7 Reactor Unit in PRIS

2. Category Fields

Table 1: ARIS Category Fields

ARIS Category	Value	Units of Examples
Current/Intended Purpose	Commercial – Electric/Non-Electric	e.g. Commercial – Electric/Non-electric, Prototype/FOAK, Demonstration, Experimental
Main Intended Application (once commercial)	Baseload, Dispatchable, Non-electric (Various)	e.g. Baseload, Dispatchable, Off-grid/Remote, Mobile/Propulsion, Non-electric (specify)

Reference Location	On Coast, Inland	e.g. On Coast, Inland, Below-Ground, Floating-Fixed, Marine-Mobile, Submerged-Fixed (Other-specify)
Reference Site Design (reactor units per site)	Single Unit	e.g. Single Unit, Dual Unit, Multiple Unit (# units)
Core Coolant	H2O	H2O, D2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify)
Reactor Core Size (1 core)	30 MWth <= Thermal power < 1000 MWth	e.g. Thermal Power < 30 MWth, 30 MWth ≤ Thermal power < 1000 MWth, 1000 MWth ≤ Thermal power ≤ 3000 MWth, Thermal power > 3000 MWth
Reactor Type	PWR	e.g. PWR, BWR, HWR, SCWR, GCR, GFR, SFR, LFR, MSR, ADS
Reactor Size	SMR	e.g. PWR, SMR
Neutron Moderator	H2O	e.g. H2O, D2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify)
NSSS Layout	Loop-type (1 loop(s))	e.g. Loop-type (# loops), Direct-cycle, Semi-integral, Integral, Pool-type
Primary Circulation	Forced (2 pumps)	e.g. Forced (# pumps), Natural
Thermodynamic Cycle	Rankine	e.g. Rankine, Brayton, Combined-Cycle (direct/indirect)
Secondary Side Fluid	H2O	e.g. H2O, He, CO2, Na, Pb, PbBi, Molten Salts, (Other-specify)
Fuel Form	Fuel Assembly/Bundle	e.g. Fuel Assembly/Bundle, Coated Sphere, Plate, Prismatic, Contained Liquid, Liquid Fuel/Coolant
Fuel Lattice Shape	Square	e.g. Square, Hexagonal, Triangular, Cylindrical, Spherical, Other, n/a
Rods/Pins per Fuel Assembly/Bundle	264	e.g. #, n/a
Fuel Material Type	Oxide	e.g. Oxide, Nitride, Carbide, Metal, Molten Salt, (Other-specify)

Design Status	Basic Design	e.g. Conceptual, Detailed, Final (with secure suppliers)
Licensing Status		e.g. DCR, GDR, PSAR, FSAR, Design Licensed (in Country), Under Construction (# units), In Operation (# units)
Neutron Spectrum	Thermal	e.g. Fast, Thermal

3. Parameter Fields

Table 2: ARIS Parameter Fields

ARIS Parameter	Value	Units of Examples
Plant Infrastructure		
Design Life	80	Years
Lifetime Capacity Factor	> 97%	%, defined as Lifetime MWe-yrs delivered / (MWe capacity * Design Life), incl. outages
Major Planned Outages	TBD	# days every # months (specify purpose, including refuelling)
Operation / Maintenance Human Resources	TBD	# Staff in Operation / Maintenance Crew during Normal Operation
Reference Site Design	Single Unit Design	n Units/Modules
Capacity to Electric Grid	330	MWe (net to grid)
Non-electric Capacity	990 (Core Power)	e.g. MW(th) heat at x °C, m3/day desalinated water, kg/day hydrogen, etc.
In-House Plant Consumption	~25	MWe
Plant Footprint	Power Block Buildings: 8300 m2 (bounding value)	m2 (rectangular building envelope)
Site Footprint	58,000 m²	m2 (fenced area)
Emergency Planning Zone	within site boundary	km (radius)
Releases during Normal Operation		TBq/yr (Noble Gases / Tritium Gas / Liquids)
Load Following Range and Speed	25-100%, 5% per minute	x – 100%, % per minute
Seismic Design (SSE)	0.3g	g (Safe-Shutdown Earthquake)

NSSS Operating Pressure (primary side)	15.4	MPa(abs), i.e. MPa(g)+0.1, at core outlet
NSSS Operating Pressure (secondary side)	7.35	MPa(abs), i.e. MPa(g)+0.1, at secondary side outlet
Primary Coolant Inventory (incl. pressurizer)		kg
Nominal Coolant Flow Rate (primary)	6879	kg/s
Nominal Coolant Flow Rate (secondary)	557	kg/s
Core Inlet Coolant Temperature	302	ºC
Core Outlet Coolant Temperature	325	ºC
Available Tempeature as Process Heat Source	287 Max (Flexible)	ºC
NSSS Largest Component	SG	e.g. RPV (empty), SG, Core Module (empty/fuelled), etc.
- NSSS Largest Component Length	21000	mm
- NSSS Largest Component Diameter	3500-4500	mm
- NSSS Largest Component Thickness		mm
- NSSS Largest Component Weight	410	tonne
Reactor Vessel Material	SA-508	e.g. SS304, SS316, SA508, 800H, Hastelloy N
Steam Generator Design	Vertical U-Tube	e.g. Vertical/Horizontal, U-Tube/ Straight/Helical, cross/counter flow
Secondary Coolant Inventory	47,000	kg
Pressurizer Design	Separate Vessel	e.g. separate vessel, integral, steam or gas pressurised, etc.
Pressurizer Volume	59 m3 / 28 m3 liquid	m3 / m3 (total / liquid)
Containment Type	Dry free standing steel containment + Concrete containment	Dry (single/double), Dry/Wet Well, Inerted, etc.
Containment Volume	30000	m3

Spent Fuel Pool Capacity and Total Volume	3 fuel cycles (326 Fuel Assemblies)	Years of full-power operation / m3
Non Electric Application		-
Core Delta Temperature		ºC
Fuel/Core		
Single Core Thermal Power	990	MW(th)
Refuelling Cycle	36 Months (Up to 48 months)	months or “continuous”
Fuel Material	UO2	e.g. UO2, MOX, UF4, UCO
Enrichment (avg./max.)	Less than 5%	%
Average Neutron Energy		eV
Fuel Cladding Material	Zr-Alloy	e.g. Zr-4, SS, TRISO, E-110, none
Number of Fuel “Units”	121 assemblies	Specify as Assembly, Bundle, Plate, Sphere, or n/a
Weight of one Fuel Unit	658-680	kg
Total Fissile Loading (initial)	~57,000 kg U	kg fissile material (specify isotopic and chemical composition)
% of fuel outside core during normal operation		Applicable to online refuelling and molten salt reactors
Fraction of fresh-fuel fissile material used up at discharge		%
Core Discharge Burnup		MWd/kgHM (heavy metal, eg U, Pu, Th)
Pin Burnup (max.)	~48,000 MWD/MTU	MWd/kgHM
Breeding/Conversion Ratio	N/A	Fraction of fissile material bred in-situ over one fuel cycle or at equilibrium core
Reprocessing	N/A	e.g. None, Batch, Continuous (FP polishing/actinide removal), etc.
Main Reactivity Control	Rods, soluble boron	e.g. Rods, Boron Solution, Fuel Load, Temperature, Flow Rate, Reflectors
Solid Burnable Absorber	Gd2O3	e.g. Gd2O3
Core Volume (active)	20.8	m3 (used to calculate power density)

Fast Neutron Flux at Core Pressure Boundary		n/(cm²*s)
Max. Fast Neutron Flux		n/(cm²*s)
Core Control Rod Absorber		-
Core Soluble Neutron Absorber		-
Safety Systems		
Number of Safety Trains	Active / Passive	% capacity of each train to fulfil safety function
- reactor shutdown	Passive	- / - / -
- core injection	Passive	- / - / -
- decay heat removal	Active/Passive	- /- / -
- containment isolation and cooling	Passive	- / - / -
- emergency AC supply (e.g. diesels)	N/A	- / - / -
DC Power Capacity (e.g. batteries)	72	Hours
Events in which Immediate Operator Action is required	None	e.g. any internal/external initiating events, none
Limiting (shortest) Subsequent Operator Action Time	72	Hours (that are assumed when following EOPs)
Severe Accident Core Provisions	No core melt	e.g. no core melt, IVMR, Core Catcher, Core Dump Tank, MCCI
Core Damage Frequency (CDF)	<1E-5	x/reactor-year (based on reference site and location)
Severe Accident Containment Provisions	PARs, H2 Ignitors	e.g., H2 ignitors, PARs, filtered venting etc.
Large Release Frequency (LRF)	<1E-6	x/reactor-year (based on reference site and location)
Overall Build Project Costs Estimate or Range (excluding Licensing, based on the Reference Design Site and Location)		
Construction Time (nth of a kind)	36 Months	Months from first concrete to criticality
Design, Project Mgmt. and Procurement Effort	TBD	Person-years (PY) [DP&P]

Construction and Commissioning Effort	TBD	PY [C&C]
Material and Equipment Overnight Capital Cost	TBD	Million US$(2015) [M&E], if built in USA
Cost Breakdown	%[C&C]/%[M&E]	
- Site Development before first concrete	TBD	(e.g. 25/10) (30/40) (20/25) (20/10) (5/15) (----------) (to add up to 100/100)
- Nuclear Island (NSSS)	TBD	
- Conventional Island (Turbine and Cooling)	TBD	
- Balance of Plant (BOP)	TBD	
- Commissioning and First Fuel Loading	TBD	
Factory / On-Site split in [C&C] effort	TBD	%/% of total [C&C] effort in PY (e.g., 60/40)
Nuclear System		
System Steam Flow Rate		kg/s
System Steam Pressure		MPa
System Steam Temperature		ºC
System Feedwater Flow Rate		kg/s
System Feedwater Temperature		ºC
Reactor Core		
Active Core Height		m
Equivalent Core Diameter		m
Average Linear Heat Rate		kW/m
Average Fuel Power Density		kW/kgU
Average Core Power Density	47.6	MW/m3
Outer Diameter Of Fuel Rods		mm

4. Plant Layout, Site Environment and Grid Integration

SUMMARY FOR BOOKLET

The AP300 SMR overall plant arrangement utilizes building configurations and structural designs to minimize the building volumes and quantities of bulk materials (concrete, structural steel, rebar) consistent with safety, operational, maintenance, and structural needs.

The plant arrangement provides separation between safety-related and non-safety-related systems to preclude adverse interaction between safety-related and non-safety-related equipment. Separation between redundant safety-related equipment and systems provides confidence that the safety design functions can be performed.

Minimizing the overall plant footprint with focus on the Nuclear Island (NI), the AP300 SMR locates all the safety-related structures, systems and components in the Nuclear Island. Structures located off the Nuclear Island are neither safety-related nor seismic Category I.

The AP300 SMR buildings are grouped as shown below:

- Nuclear Island

o Containment and Shield Building
o Auxiliary Building

- Nuclear Island Supporting Buildings and Structures

o Annex Building
o Diesel Generator Building

- Turbine Island

o Turbine Building First Bay
o Turbine Building

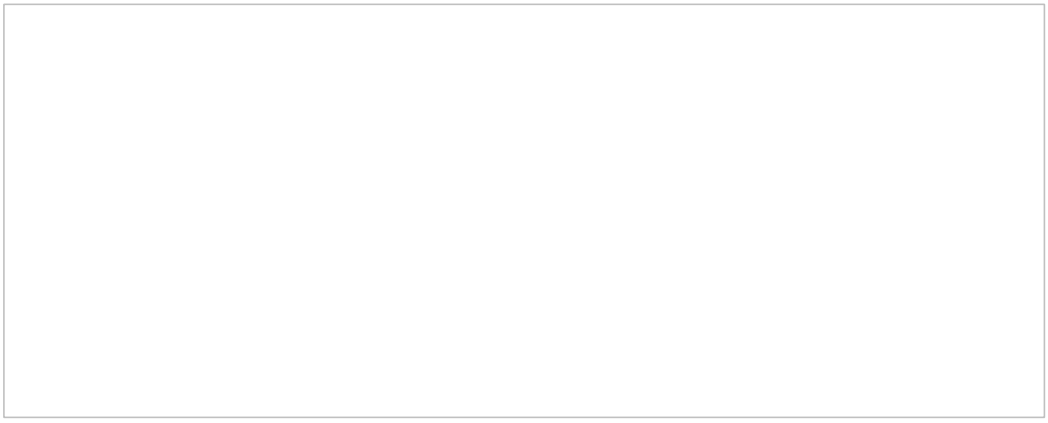


Figure 3. AP300 SMR site overview.

Making full practical use of concurrent fabrication schemes to reduce construction time and reduce deployment costs, the AP300 SMR employs open-top, bottom-up construction. Structural systems as well as system functional systems (mechanical, electrical, instrumentation, and piping) are modularized and shop fabricated to support an overall deployment schema. This schema is used to capitalize on the benefits of concurrent manufacturing, schedule compression, and standardization made possible by this methodology. Where full factory fabrication is not practical, factory fabrication is used concurrent with site outfitting to minimize in-situ labor requirements. On location fabrication is reserved

for specific tie-in applications and aspects of the design that cannot be shop or shop/site prefabricated.

Additionally, plant reliability and flexible operation are important considerations in the AP300 SMR, including load follow. The design can accept a step load increase or decrease of 5% between 25% and 100% power without reactor trip, steam dump system actuation, or turbine trip.

4.1 Site Requirements during Construction

The AP300 can accommodate an inland or on-coast site.

The Westinghouse AP300 SMR is being designed to an enveloping set of site conditions to ensure the best suitability for a wide range of sites. Westinghouse can perform site-specific analysis on a case-by-case basis to assess suitability of sites with values outside the enveloping values.

Where possible the AP300 SMR has been designed to minimize on-site fabrication with the modularization approach. The AP300 SMR will take full advantage of structural modules and operating experience from AP1000 deployments and supply chain. To achieve rapid, reliable construction, AP300 SMR is focused on the elimination of typical cast-in-place reinforced concrete. Rather, the AP300 SMR will use structural modules that are fabricated offsite and filled with concrete after being set.

The AP300 SMR will incorporate full room modules that include Mechanical, Electrical, Piping, and Instrumentation (MEPI) equipment. This building block design approach integrates with structural systems for a bottom-up installation.

As a result, constructability is “designed in” using extensive modularization. It promotes greater standardization and the ability to incorporate lessons learned from previous builds. It provides for a more predictable site construction with less field deviations. In summary, it provides confidence in achieving the lowest construction risk for the lowest overall price in the shortest possible construction schedule.

The Westinghouse AP300 SMR containment building is the containment vessel and all structures contained within the containment vessel. The containment building is an integral part of the overall containment system with the functions of containing the release of airborne radioactivity following postulated design basis accidents and providing shielding for the reactor core and the reactor coolant system during normal operations.

The containment vessel is an integral part of the passive containment cooling system (PCS). The containment vessel and the PCS are designed to remove sufficient energy from the containment to prevent the containment from exceeding its design pressure following postulated design basis accidents. The principal systems located within the containment building are the reactor coolant system (RCS) and passive core cooling system (PXS).

The Westinghouse AP300 SMR stores spent fuel temporarily in the In-containment Refuelling Water Storage Tank (IRWST). The IRWST is a large, stainless-steel lined tank located underneath the operating deck inside the containment. The PCS provides a safety-related flow path from the Passive Containment Cooling Water Storage System Tank to the IRWST to provide a water supply to continue IRWST boiling for core and spent fuel cooling, and ensures the fuel remains covered.

4.2 Site Considerations during Operation

Water usage needs for all plant systems

The AP300 is being designed, similar to the AP1000, to be flexible to site conditions for optimal water utilization. The passive safety systems do not require large ponds or reservoirs for emergency cooling. The sources for the 72 hours or safety-related cooling are self-contained within the Nuclear Island. The AP300 SMR offers an optimal performance or water conservation mode, where the AP300 SMR could be deployed in extremely dry climates with adjustments to water consumption and potential power output.

Maximum acceptable ambient air temperature, humidity, and heat sink temperature for full-power operation

The configuration of the AP300 SMR Circulating Water System (CWS) (including piping design pressure, the cooling tower or other site-specific heat sink, such as once-through cooling) is a site-specific design, dependent on location, environmental requirements, and economic optimization. The plant performance (electrical output) varies based on these factors as they affect Main Condenser backpressure and required CWS pumping power. Different plant cooling water (heat rejection) designs/options are available, from the once-through (sea water cooled) cooling to the conventional surface condenser (wet) and the dry cooling methods. A plant cooling design optimization study is typically part of site-specific early works activities.

The HVAC and support systems provide proper temperature and humidity within environmental qualification conditions for equipment and structures, as well as maintain the spaces at personnel comfort level.

The maximum ambient air temperature (dry bulb) for the AP300 SMR is 46.1°C (115°F).

The maximum ambient air temperature (wet bulb) for the AP300 SMR is 30.1 °C (86.1°F).

Cooling options / requirements; effect of heat sink temperature

The Westinghouse AP300 SMR is currently using a mechanical draft cooling tower as its design basis, but the design is flexible and can incorporate a variety of cooling systems depending on site conditions such as: Wet Closed Loop Cooling, Dual System Hybrid Cooling, Direct Dry Cooling, a conventional cooling tower or a Once-Through Cooling Water System.

Manpower during operation

The AP300 SMR provides a simplification to the refueling process by limiting irradiated fuel movement during core offload and core reload and enhancing the overall safety case of storing fuel within the containment structure. Westinghouse is able to discuss specifics upon request on a case-by-case basis.

Normal and abnormal emissions

Westinghouse can provide a full list of normal and abnormal emissions upon request.

Thermal discharges

Thermal discharge requirements are dictated by local (site specific) environmental regulations where acceptable limits for thermal discharge are specified based on effects on hydrology, deterioration of sea or fresh water quality, deaths of sea animals that are sensitive to high temperature, and an increase in the frequency of red tides. The AP300 SMR design will meet the requirements of the site specific needs and regulations.

Required infrastructure and support systems during operation and maintenance, special equipment/tooling needs

AP300 is based on the well-established AP1000 technology with its required infrastructure and support systems, neither additional equipment nor special AP300 tools are required for AP300 technology.

4.3 Grid Integration

Grid interface/code requirements

The net output of the electrical grid is 330MWe, at either 50 or 60Hz frequency depending on the local grid operator requirements.

By default, there are two grid connections – one for the Main Step Up (MSU) Transformer and one for the Reserve Auxiliary Transformers (RATs). These connections can be to the same grid/source as the design supports a partial NRC GDC 17 exemption for two physically independent offsite circuits. Additionally, two grid connections supports fast bus transfer capabilities.

Load following capability, experience, and effect on waste generation

Plant reliability and flexible operation are important considerations in the AP300 SMR, including load follow. The design can accept a step load increase or decrease of 5 percent between 25- and 100-percent power without reactor trip, steam dump system actuation, or turbine trip.

The design can accept a 100-percent load rejection from full power without reactor trip or operation of the pressurizer or steam generator relief valves. The turbine is capable of continued stable operation at the minimum house loads.

The design can accept ramp load changes of 5 percent per minute while operating in the range of 25 to 100 percent of full power without reactor trip or steam dump actuation subject to core power distribution limits.

Additional details are available and can be provided as requested.

Extend of electrical systems reliance on grid Class IV power

The AP300 SMR plant design supports a partial exemption to US NRC GDC-17 requirement for two physically independent offsite circuits by providing safety-related passive systems for core cooling and containment integrity, and multiple non-safety related onsite and offsite electric power sources for other functions. Offsite power has no safety-related function due to the passive design of the AP300 SMR. Therefore, redundant offsite power supplies are not required. The design provides a reliable offsite power system.

Plant needs from the grid (availability, stability, etc.) during normal and off-normal operation

Grid power through the Reserve Auxiliary Transformers (RATs) is required for plant startup. Grid power is not required during normal operation (island mode capable) nor for abnormal operation (shutdown). Grid availability/stability values:

1. The utility grid system steady state operating voltage range (when the generator is off-line) of:

a) System Nominal Voltage other than 60 Hz Plants, 500 kV (50 Hz Plants, 400 kV): 0.95 to 1.05 per unit.

b) System Nominal Voltage of 60 Hz Plants, 500 kV (50 Hz Plants, 400 kV): 1.00 to 1.10 per unit.

2. The main generator operating voltage range of 0.95 to 1.05 per unit (50/60Hz).

3. The isophase bus operating voltage range of 0.95 to 1.05 per unit (50/60Hz) when the generator is on-line (the grid operator shall maintain the switchyard voltage such that steady state voltage on the isophase bus is within the 0.95 to 1.05 per unit range).

5. Technical NSSS/Power Conversion System Designn

SUMMARY FOR BOOKLET

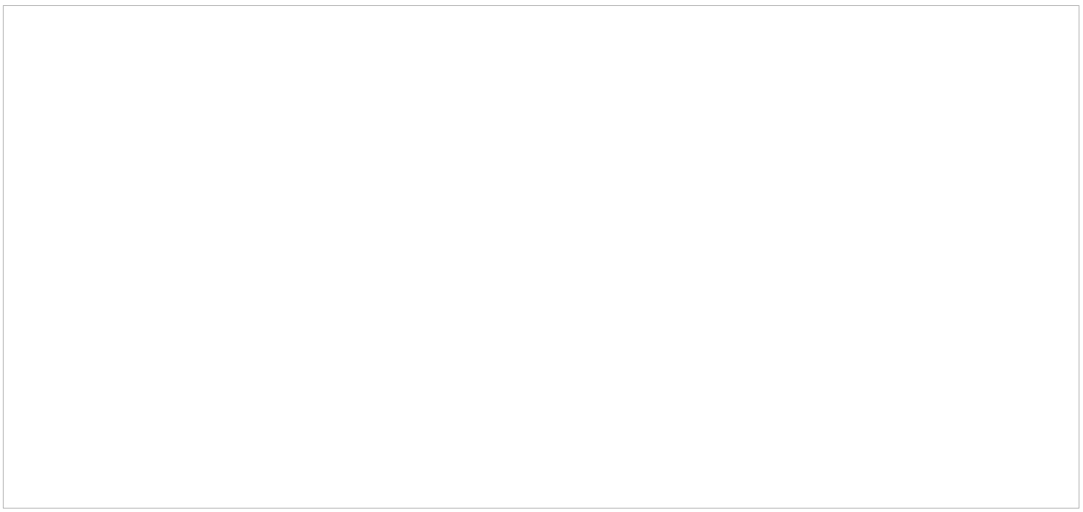


Figure 4. AP300 SMR applications.

Nuclear Steam Supply System: The NSSS for the AP300 SMR is a Westinghouse-designed pressurized water reactor. The AP300 SMR is designed around a conventional 1 loop, 1 steam generator primary system configuration with 1 hot leg, 2 reactor coolant pumps directly mounted to the steam generator lower head, and two cold legs. The system also includes a pressurizer, interconnecting piping, and the valves and instrumentation necessary for operational control and the actuation of safeguards.

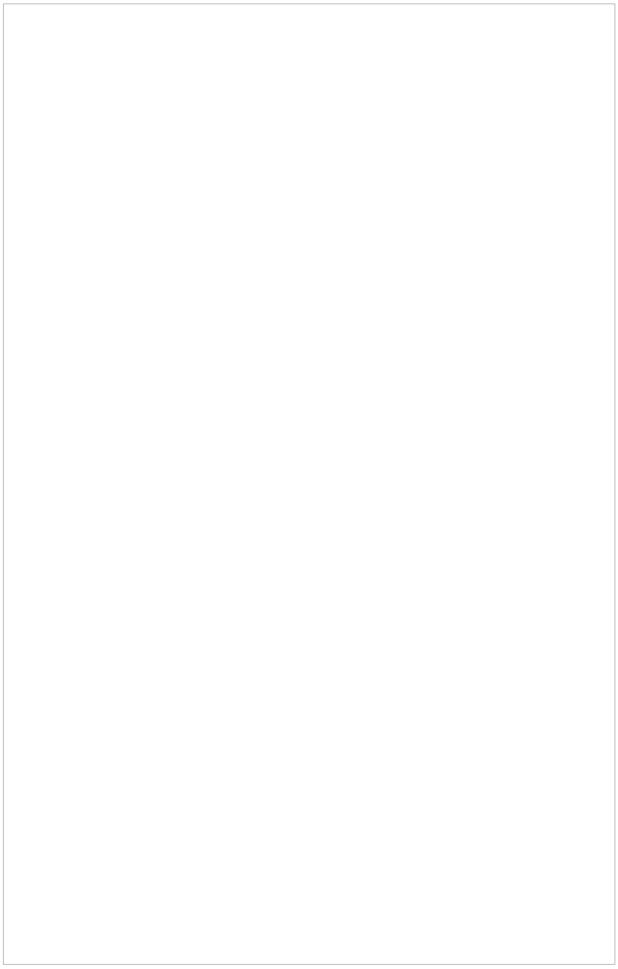


Figure 5. AP300 SMR reactor coolant system.

Reactor Core: The AP300 SMR core design consists of 121 17x17 Robust Fuel Assembly (RFA) fuel assemblies, laid out in a typical PWR core configuration. The core fuel stack height is 12 feet, consistent with the majority of today's operating PWRs.

Reactivity Control: The AP300 SMR has 45 Control Rod Drive Mechanisms (CRDM) and incorporates both Gray Rod Cluster Assemblies (GRCA) and black Rod Cluster Control Assemblies (RCCAs) to implement the mechanical shim (MSHIMTM) operational strategy. The MSHIM operation and control strategy, adopted from and proven in the AP1000 PWR, greatly simplifies reactor operations by automatically moving the certain banks to maintain the coolant average outlet temperature within the normal operation deadband compensating reactivity changes as the core depletes throughout the cycle, thereby requiring the operator to make changes to the soluble boron concentration only every few weeks instead of multiple times a day. Additionally, the MSHIM strategy allows the performance of load following manoeuvres without having to change boron concentration during the manoeuvre (except for changes required to account for fuel depletion), which extends load following capabilities and reduces CVCS requirements and related effluents.

Instrumentation and Controls (I&C) Systems: The 4-division AP300 SMR safety system utilizes the Common QTM platform. The Common QTM platform is the standard Westinghouse safety system platform previously approved by the NRC with over 20 years of operating experience. The plant uses a proven Distributed Control System (DCIS) platform with improvements in supporting server technology using a high availability virtualized system that reduces the volume of independent servers and increases reliability.

The Diverse Actuation System (DAS) also applies the non-safety platform from the DCIS using

separate network segments and different applications. The non-safety platform is diverse from the Common Q safety platform, and DAS uses independent and dedicated sensors diverse from the Common Q safety system.

5.1 Primary Circuit

Primary circuit component description and layout

The RCS design meets the performance requirements set for the plant while minimizing changes to proven AP1000 plant NSSS components and configuration. In particular, the AP300 SMR utilizes a one-loop design with similar equipment used in the proven AP1000 design. The reactor coolant loop piping configuration includes a single hot leg pipe aligned with the reactor – steam generator axis, flanked by two cold leg pipes. The RCS has two Reactor Coolant Pumps (RCPs) attached to the bottom of the Steam Generator, similar to the AP1000 design. The AP300 SMR design uses the same, proven, state-of-the-art RCPs as in the AP1000 plant. RCS piping includes the same connection and shapes of the AP1000 design.

Reactor Vessel (RV)

The reactor vessel is part of the high-pressure boundary that contains the reactor coolant system, specifically the portion that encloses the reactor core. The vessel is cylindrical, with a hemispherical bottom head and removable flanged hemispherical upper head. Surfaces, which can become wet during operation and refueling, are clad with stainless steel welded overlay. As a safety enhancement, there are no reactor vessel penetrations below the top of the core. This eliminates the possibility of a loss of coolant accident caused by leakage from the reactor vessel, which could lead to uncovering of the core. The core is positioned low in the vessel to limit reflood time in accident situations and to support in-vessel retention of core debris following an extremely unlikely core melt scenario.

Steam Generator (SG)

One SG is used in the AP300 SMR. This SG is a Delta 76 SG updated to be compatible with the AP300 SMR loop configuration. The AP300 SMR SG design has high reliability since it is based on mature designs with additional design enhancements. These enhancements include full-depth hydraulic expansion of the tubes in the tubesheet, nickel-chromium-iron Alloy 690 thermally treated tubes on a triangular pitch, broached tube support plates, and a primary-side channel head design that allows easy access and maintenance by robotic tooling. All tubes in the SG are accessible for sleeving, if necessary.

Pressurizer

The AP300 SMR pressurizer is of conventional design, based on proven technology. The large pressurizer minimizes challenges to the plant and operator during transients by providing increased operating margins resulting in a more reliable plant with fewer reactor trips. The large pressurizer size also eliminates the need for fast-acting power-operated relief valves, which are a possible source of RCS leakage and maintenance.

Reactor Coolant Pumps (RCPs)

The RCPs are high-inertia, highly-reliable, low-maintenance, hermetically-sealed motor pumps that circulate the reactor coolant through the reactor core, loop piping, and steam generator.

Two pumps are mounted directly on the channel head of the SG. This configuration eliminates the crossover

leg of coolant loop piping; reduces the loop pressure drop; simplifies the foundation and support system for the SG, pumps, and piping; and reduces the potential for uncovering of the core by eliminating the need to clear the loop seal during a small loss of coolant accident. The reactor coolant pumps have no seals, eliminating the potential for a seal failure-induced loss of coolant accident, which significantly enhances safety and reduces pump maintenance needs. The pumps use a flywheel to increase the pump-rotating inertia. The increased inertia provides a slower rate of flow coastdown, which improves core thermal margins following loss of electric power.

Main Coolant Lines

Reactor coolant system piping is configured with a single hot leg pipe that transports reactor coolant to a SG. The two reactor coolant pump suction nozzles are welded directly to the outlet nozzles on the bottom of the SG channel head. Two cold leg pipes (one per pump) transport reactor coolant back to the RV to complete the circuit.

Operating modes

AP300 has five operating modes: startup, power ascension, normal operation, shutdown and refuelling.

5.2 Reactor Core and Fuel

Reactor System (RXS)

The reactor system (RXS) of the AP300 plant generates heat from controlled nuclear reactions in the fuel and transfers the heat generated to the reactor coolant, while providing a barrier that prevents the release of fission products to the atmosphere and a means to insert negative reactivity into the reactor core and to shutdown the reactor core. The components of the RXS are integrated in a manner which will assure safe and economical operation of the system and equipment.

Reactor Fuel

The reference fuel assembly design for the AP300 SMR is the Westinghouse 17x17 Robust Fuel Assembly-2 (RFA-2, referred to as “RFA” throughout), which has been utilized extensively in more than 50 plants worldwide, exhibiting excellent performance in over 20 years of reliable and cost-effective operation. Based on a long history of experience gained from earlier Westinghouse fuel designs, the RFA fuel design was first introduced in 1997. Since then, it has undergone numerous design enhancements and evolutions to further improve fuel and plant performance and reliability. In addition, the AP300 SMR is designed with flexibility to incorporate Accident Tolerant Fuel (ATF) products into the core reload design as they are developed over the plant lifecycle.

Core Design

The AP300 SMR core consists of 121 fuel assemblies laid out in a typical 2-loop core configuration of 13 rows and columns in a square pitch. The active core height is 12 feet, consistent with the majority of today’s operating PWRs. The core thermal power rating is 990 MWth resulting in a relatively low core power density that supports extended operating cycle lengths, up to 4 years, with efficient fuel management solutions.

The Rod Cluster Control Assemblies (RCCA) and Gray Rod Cluster Assemblies (GRCA) provide reactivity control for the reactor. The purpose of RCCAs is to provide effective reactivity and power distribution control

capability during operation and a rapid shutdown capability for the reactor core. The RCCAs contain a strong neutron absorber and can insert enough negative reactivity into the core to achieve the required shutdown margin (SDM). The GRCAs contain a lighter (and slow depleting) neutron absorber. This allows their insertion during full power operation with minimal perturbation to power distribution and loss in negative reactivity worth from absorber depletion, thereby best supporting the MSHIM operational strategy, as already demonstrated in the operational AP1000 reactors.

Fuel suppliers or supply chain

Westinghouse is among the largest suppliers of commercial nuclear fuel worldwide, with extensive experience in fuel manufacturing, design and analysis and three world-class fuel manufacturing facilities. As a global nuclear fuel supplier, Westinghouse provides security and diversity of supply through its robust supply chain and three strategically-located fuel manufacturing sites currently supporting 145 nuclear plants worldwide. A benefit of operating a global manufacturing system is the resiliency it provides. Cross-qualification of manufacturing fuel designs at multiple facilities adds to the depth of manufacturing experience and broadens the ability for sites to support one other (including the ability to shift load from one Westinghouse plant to the next to navigate market fluctuations and preclude potential interruptions in the supply). This reliable, robust, redundant network is a key strategic factor in Westinghouse's ability to guarantee a secure supply of state-of-the-art fuel products for LWRs, and AP300, customers worldwide.

5.3 Fuel Handling

In the AP300 SMR, spent fuel is stored in a portion of the IRWST inside the seismic Category I Containment Building. By limiting irradiated fuel movement during core offload and core reload and enhancing the overall safety case of storing fuel within the containment structure, the AP300 offers a simplified fuel handling approach. The spent fuel storage area in the IRWST is designed to store the spent fuel assemblies until they have cooled sufficiently to allow transfer to dry cask storage during a refuelling outage. With the fuel inside containment, casking is required and will be performed within the Fuel Handling Area (FHA) of the Auxiliary Building. Design features have been incorporated to minimize impact to outage duration.

Fuel movement from fresh to spent fuel bay

Although the spent fuel is located inside Containment, the Auxiliary Building contains a fuel handling area. This FHA has storage space for new fuel, a cask loading pit, and cask washdown pit to support the cask loading operations and fuel receipt. The cask loading pit is connected with the inside of the Containment building with a fuel transfer canal. To maintain storage space in the spent fuel pool, casking operations will be performed during a refueling outage. Once a cask is loaded, it will be brought to an interim spent fuel storage installation (ISFSI) located on or off site for longer term storage. The AP300 SMR standard plant site provides provisions for an ISFSI.

Fuel cycle and refuelling outage lengths

The AP300 SMR expected outage timeline is expected to be lower than typical PWR refueling outages and align with the AP1000 plant outages, well less than 20 days for a refueling and maintenance outage. This shorter expected timeframe is due to the following attributes:

- Transfer of spent fuel outside containment and of new fuel inside Containment can start at Mode 5,

before the RCS is cooled down and depressurized, unlike standard PWRs that require the head removed and refueling cavity flooded.
- Both core offload and reload will offer significant time saving opportunities by performing all fuel movement activities within containment. Each fuel assembly does not need to be removed outside and back into containment for offload and reload operations.

The AP300 SMR maintains a base fuel cycle length of 36 months and is designed to extend the fuel cycle to 48 months as fuel operating experience improves. However, the current ASME Operation and Maintenance (OM) code applicable to AP300 SMR plant supports fuel cycles of 24 months.

The overall AP300 SMR approach to maintenance will be to design with extended fuel cycle lengths while meeting the current industry and regulatory endorsed ASME OM code. As a result, availability calculations for the AP300 SMR assume a required inspection and maintenance only outage aligned with the current version of the ASME OM code. More novel approaches on Inservice Inspection Testing (IST) are being evaluated by the ASME OM code subcommittee as far as what is and is not included in a plants Inservice Testing (IST) program and how often the components should be tested. As ASME OM-2 develops, the AP300 SMR will leverage this justification for greater than 24 months in the IST program as required.

5.4 Reactor Protection

Similar to the AP1000 plant design, the AP300 SMR has a Passive Core Cooling System (PXS) and Passive Containment Cooling System (PCS). These passive safety-related systems use natural driving forces such as pressure, gravity, natural circulation, and convection and are designed to operate without the use of active equipment such as pumps and AC power sources. Like the AP1000 plant, these passive features do require a one-time alignment of valves upon actuation of the specific components from the plant protection system, when setpoints on key process parameters are reached.

The AP300 SMR passive safety features rely on extensive testing performed as part of the AP1000 reactor development program which ensures the safety features will perform as designed and analyzed. Performance has been further demonstrated through extensive full-scale testing as part of commissioning the lead AP1000 reactors.

Tests were conducted during the AP600 and AP1000 Design Program to provide input for plant design and to demonstrate the feasibility of unique design features. Tests for the AP600/AP1000 design certification and design program were devised to provide input for the final safety analyses, to verify the safety analysis models (computer codes), and to provide data for final design and verification of plant components.

No fewer than fifteen different test facilities for design basis accident testing were used to demonstrate passive core and containment cooling and to collect data for code validation for the Westinghouse passive plant technology. Further, the U.S. NRC has conducted extensive, independent testing of the technology in five test facilities. The U.S. NRC tests confirmed design basis accident results obtained by Westinghouse as well as a significant number of beyond design basis accidents.

The Westinghouse passive plant technology was tested at multiple facility scales to study important phenomena at multiple hierarchical scales for passive containment cooling, passive core cooling, and in-vessel retention after a postulated severe accident.

To support the startup and operation of the first wave of AP1000 plants, several tests were performed of the

passive safety systems. The results of these tests agree well with the scale model testing performed during the AP1000 plant development effort.

Passive Core Cooling (PXS)

The primary function of the Passive Core Cooling System (PXS) is to provide emergency core cooling following postulated design basis events. To accomplish this primary function, the passive core cooling system is designed to perform the following functions:

- Emergency core decay heat removal
- Reactor coolant system emergency makeup and boration
- Safety injection
- Containment pH control

The passive core cooling system is designed to operate without the use of active equipment such as pumps and AC power sources. The passive core cooling system depends on reliable passive components and processes such as gravity injection and expansion of compressed gases. The passive core cooling system requires a one-time alignment of valves upon actuation of specific components.

In-Containment Refueling Water Storage Tank (IRWST)

The IRWST is a large, stainless-steel lined tank located underneath the operating deck inside the containment. The tank is constructed as an integral part of the containment internal structures and is isolated from the steel containment vessel. Water stored in the IRWST is used during refueling to fill the reactor cavity. Refueling water can drain by gravity into the RCS after it is sufficiently depressurized. The IRWST is connected to the RCS through both direct vessel injection lines. The IRWST contains water at the existing temperature and pressure in containment.

For the AP300 SMR, the fuel storage area is located with fuel racks located in the lowest area of the IRWST. As a result, the AP300 SMR does not have a spent fuel pool located outside of containment. The normal residual heat removal system (RNS) provides cooling and purification of the IRWST including the fuel pool.

The IRWST contains the passive residual heat removal heat exchanger (PRHR HX) and one depressurization sparger. The top of the PRHR HX tubes are located underwater and extend down into the IRWST. The sparger is also submerged in the IRWST. The sparger is oriented and configured to not interact with the spent fuel area to not impact the fuel during actuation of safety systems.

The IRWST is sized to provide the flooding of the refueling cavity for normal refueling, for post-loss of coolant accident flooding of the containment for RCS long-term cooling, and to support PRHR HX operation. Flow out of the IRWST during the injection mode includes conservative allowances for spill flow during a direct vessel injection line break. The IRWST provides sufficient injection until the containment sump floods up high enough to initiate recirculation flow.

Passive Residual Heat Removal (PRHR) Heat Exchanger

The PRHR HX consists of inlet and outlet channel heads connected together by vertical tubes. The tubes are supported inside the IRWST. The top of the tubes is several feet below the IRWST water surface. The PRHR HX is Safety Class A and is designed to meet seismic Category I requirements.

The PRHR HX is designed to remove sufficient heat so that its operation, in conjunction with available

inventory in the steam generator, provides RCS cooling and prevents water relief through the pressurizer safety valves during loss of main feedwater or main feedline break events.

Accumulators

The accumulators are cylindrical tanks located inside containment and function the same as the AP1000 plant accumulators. The accumulators are designed to deliver water to the reactor vessel at a high flow rate in the event of the large Loss of Coolant Accident (LOCA). The accumulators also help provide adequate core cooling during smaller LOCA events and automatic RCS depressurization events. During small LOCAs, the accumulators assist in keeping the core covered with water.

The two accumulators are tanks made of carbon steel and clad on the internal surfaces with stainless steel. Accumulator pressure is provided by a supply of nitrogen gas and can be adjusted as required during normal plant operation.

The AP300 SMR accumulator is isolated from the RCS by two check valves in series. When the RCS pressure falls below the accumulator pressure, the check valves open and water is forced into the reactor coolant system by the gas pressure. Mechanical operation of the check valves is the only action required to open the injection path from the accumulators to the core.

Core Makeup Tank

The AP300 SMR contains two core makeup tanks (CMTs). The CMTs stores cold borated water under system pressure for high pressure reactor coolant makeup. During normal operation, the CMTs are completely full of cold, borated water. The boration capability of these tanks provides adequate core shutdown margin following a steam line break. The balance line from the cold leg is normally open to maintain the CMTs at RCS pressure, which prevents water hammer upon initiation of CMT injection.

Passive Containment Cooling System (PCS)

The role of the Passive Containment Cooling System is to provide enhanced cooling in the event that a design basis accident results in a large release of energy into the containment. In this event, the outer surface of the containment vessel transfers heat to the air within the Shield Building. This heated and thus, lower density air, flows upward and out through exhaust paths in the Shield Building and cooler, higher density air is drawn into the Shield Building through the air inlets. The containment vessel is free-standing and surrounded by a separate Shield Building so the “chimney effect” can occur. Containment isolation provisions are designed so that fluid lines penetrating the primary containment boundary are isolated in the event of an accident. This minimizes the release of radioactivity to the environment.

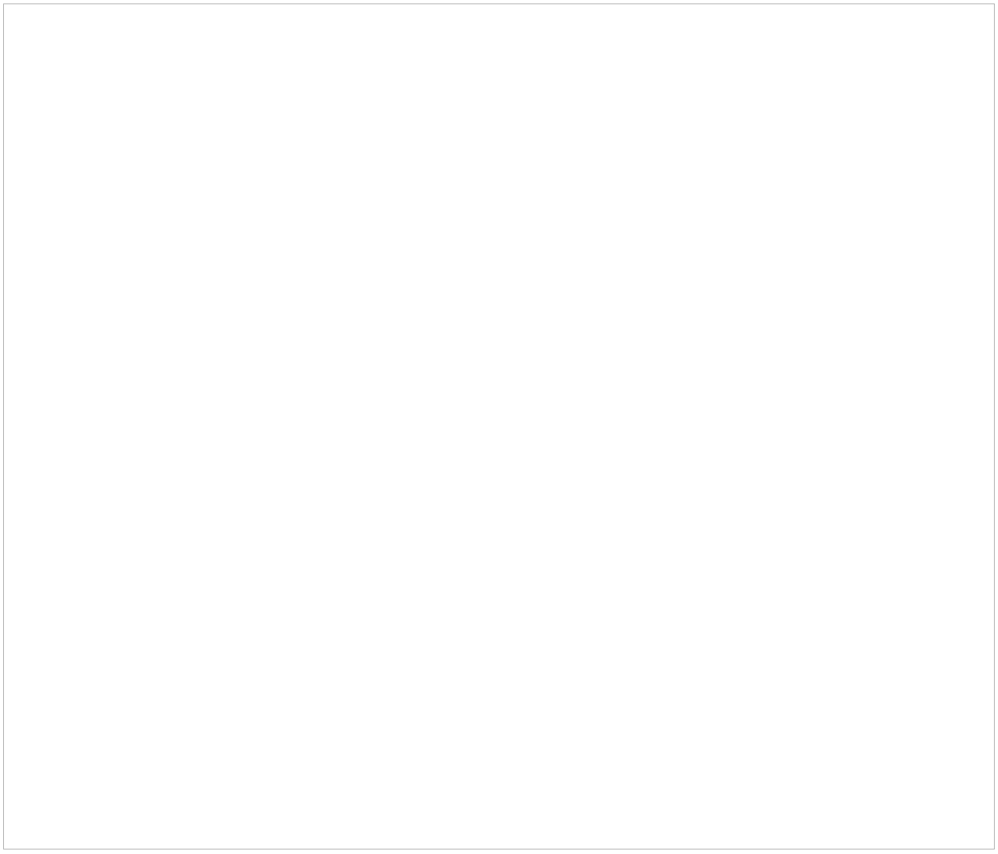


Figure 6. AP300 SMR passive containment cooling system.

5.5 Secondary Side

Turbine generator description

The steam and power conversion systems are designed to remove heat energy from the Reactor Coolant System (RCS) via the Steam Generator and to convert it to electrical power in the Main Turbine-Generator.

The steam generated in the Steam Generator (SG) is supplied to the HP Turbine by the Main Steam System (MSS). After expansion through the HP Turbine, the steam passes through the Moisture Separator Reheater (MSR) and is then admitted to the LP Turbine. A portion of the steam is extracted from the HP and LP Turbines for feedwater heating. Exhaust steam from the LP Turbine is condensed in the Main Condenser. The heat rejected in the Main Condenser is removed by the Circulating Water System (CWS).

Feed water systems

The Condensate Pumps take suction from the Main Condenser hotwell and deliver the condensate through the condensate polishers, turbine Gland Steam Condenser, and low-pressure closed feedwater heaters to the Main Feedwater Pumps. The Main Feedwater Pumps discharge the feedwater through a high-pressure feedwater heater to the Steam Generator. Instrumentation systems are designed for the normal operating conditions of the steam and power conversion systems. The systems are designed for safe and reliable control and incorporate requirements from performance calculations and heat balances. Continuous sampling instrumentation and grab sample points are provided so that water chemistry in the secondary

cycle can be maintained within acceptable limits, as required by the NSSS and turbine suppliers.

Auxiliary systems

Typical secondary side auxiliary systems are provided in support of the main steam & power conversion systems. These systems are based on the AP1000 auxiliary systems and include:

- auxiliary steam
- turbine bypass
- turbine gland sealing steam
- turbine lube oil
- condenser air removal & tube cleaning
- steam generator blowdown and heat recovery
- turbine island closed cooling water
- water treatment and storage
- main generator supporting systems
- chemical feed and sampling
- compressed air & plant gas

5.6 Containment/Confinement

Dimensions

The AP300 SMR design aims to reduce construction, maintenance and operating costs by reducing the safety related footprint to 5 m2 /MWe.

Design pressure/temperature/leak rate at design pressure

Westinghouse can provide this information upon request.

Isolation and fission product retention (including venting/filters)

The AP300 SMR defense-in-depth features enhance safety such that no severe release of fission products is anticipated to occur from an initially intact containment after the onset of core damage. The intention is that the timeframe provides time for performing accident management actions to mitigate the accident and prevent containment failure.

The design arrangement provides physical separation of redundant safety-related components and systems from each other and from non-safety-related components. The design approach includes designing the safety-related systems with redundant divisions and locating these redundant divisions in separate safety-related areas, such that failure of one train or division does not impede the operation of the other train or division. Essential safety actions are provided by equipment of sufficient redundancy and independence such that no single failure of active components can prevent required actions. Sufficient redundancy and independence are designed into the protection systems so that no single failure results in loss of the protection function.

Heat removal systems

The normal residual heat removal system (RNS) removes heat from the core and provides RCS low-temperature overpressure protection (LTOP) at reduced RCS pressure and temperature conditions during

cooldown and shutdown operation. The RNS design provides containment isolation for the RNS piping that penetrates the containment barrier. The RNS design provides a reactor coolant pressure boundary at the RNS suction and discharge interface with the RCS.

The RNS provides a flow path for long-term (post-72 hour) containment inventory makeup in case of design basis leakage from containment after a loss of coolant accident (LOCA). The check valves in this flow path are active to open and inject water to provide a flow path.

The AP300 SMR spent fuel is stored in the IRWST inside containment. The RNS performs the following functions to support spent fuel located in the IRWST:

- Maintain cooling of spent fuel located in the IRWST water pool
- Maintain the water level above the top of the fuel assemblies
- Maintain the safety-related piping connections for makeup to the IRWST
- Maintain proper Refueling Cavity level during refueling operations.

5.7 Electrical, I&C and Human Interface

Turbine and Generator type/model, speed, rated power, voltage, frequency

Major elements of the Main Turbine System (MTS) include one High-Pressure Turbine, two Low-Pressure Turbines (four-flow), Main Stop Valve and Control Valve Sets, and combined Reheat Stop and Intercept Valve Sets. System parameters can be discussed upon request.

The Main Turbine is a 3600-rpm turbine design for a 60Hz frequency. (3000-rpm fpr 50 HZ).

Safety related electrical systems

The Class 1E DC and UPS system (IDS) provides reliable power for the safety-related equipment required for the plant instrumentation, control, monitoring, and other vital functions needed for shutdown of the plant. The IDS is capable of providing reliable power for the safe shutdown of the plant without the support of battery chargers during a loss of all AC power sources coincident with a design basis accident (DBA). The system is designed so that no single failure will result in a condition that will prevent the safe shutdown of the plant.

The IDS is a safety-related system. Normal AC power is supplied to the system and is rectified into DC power which allows the battery bank to be charged and maintained in a standby condition.

In the event of a total loss of off-site AC power sources, the battery is then relied upon to carry the system and critical components requiring DC or AC power. The physical nature of the battery and the way the system is connected means the battery is always ready to supply power when needed. The same is the case for a loss or failure to start of on-site diesel generators.

I&C design architecture and applicable standards

A requirement of the nuclear industry is that SSC in a nuclear plant be classified according to their importance to achieving safe plant operation. This is done so that general design and quality requirements can be established for the SSC. Historically, for electrical and I&C equipment the classification has been

either Class 1E or non-Class 1E.

However, it has been recognized in both international and domestic (US) regulatory practice and industry standards that this binary approach is insufficient. It is the Westinghouse policy to follow a three-tiered classification system for I&C systems that meets the intent of international IAEA NS-R-1, “Safety of Nuclear Power Plants: Design” and IEC 61226, “Nuclear Power Plants - Instrumentation and Control Systems Important to Safety - Classification of Instrumentation and Control Functions” as well as US requirements ANSI/ANS N18.2-1773, “Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants” and Regulatory Guide 1.201, “Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance.”

The AP300 plant I&C architecture is arranged in a hierarchical manner to provide a simplified structured design that is horizontally and vertically integrated. Data gathered by the I&C systems that interact with the plant are distributed between the systems by the Plant I&C Network with both deterministic and aperiodic communication.

The Protection and Safety Monitoring System (PMS) performs the necessary safety-related signal acquisition, calculations, setpoint comparison, coincidence logic, reactor trip (RT)/Engineered Safeguards Features (ESF) actuation functions, and component control functions to achieve and maintain the plant in a safe shutdown condition. The PMS contains maintenance and test functions to verify proper operation of the system.

The PMS consists of four redundant divisions, designated A, B, C, and D. The PMS includes four safety displays, one for each division, located on the Safety Panel in the ESR. Four redundant divisions are provided to satisfy single failure criteria and improve plant availability. The PMS is also responsible for meeting Class 1E post-accident monitoring and display requirements.

The PMS provides detection of system excursions beyond the normal operational limits and automatic actuation of the protective functions necessary to ensure that the plant reaches and remains in a safe shutdown state. The system is designed to incorporate sufficient redundancy to mitigate single failure trip operation. In addition, the PMS includes all the equipment necessary to monitor the plant functions during and following any Design Basis Accident (DBA).

The Plant I&C Network facilitates the interaction between the plant operators and the I&C. These are the Operation and Control Centers System (OCS) and the Data Display and Monitoring System (DDS). The Plant I&C Network includes the systems and functions that perform the protective, control, and data monitoring functions. These include but are not limited to the Special Monitoring System (SMS), the Plant Control System (PLS), and the PMS which includes the Neutron Monitoring System (NMS).

The Main Control Room (MCR) is in the turbine building 1st bay which is a seismic Category II structure. It is defined as the combined area of the Main Control Area (MCA) and other related MCA support facilities, such as the shift supervisor’s office, operations work area, operations break room, kitchen, and restroom facilities.

The purpose of the MCA is to provide a seismically Class II qualified, habitable location housing the HSI resources that allow operators to monitor and control the AP300 plant processes over their entire operating range, including emergency operations. The control room provides integration resources for the HSI of the Nuclear Island (NI), conventional island (CI), and balance of plant (BOP) systems.

The major tasks performed in the MCA include monitoring, supervising, managing, and controlling plant processes under normal, abnormal, and emergency conditions, to effectively produce power and protect the

health and safety of the public. The MCA supports the operator's decision-making process and promotes interaction with other plant personnel while preventing distractions by non-operating personnel. The MCA provides the interfacing resources between the operation of the plant and the maintenance of the plant.

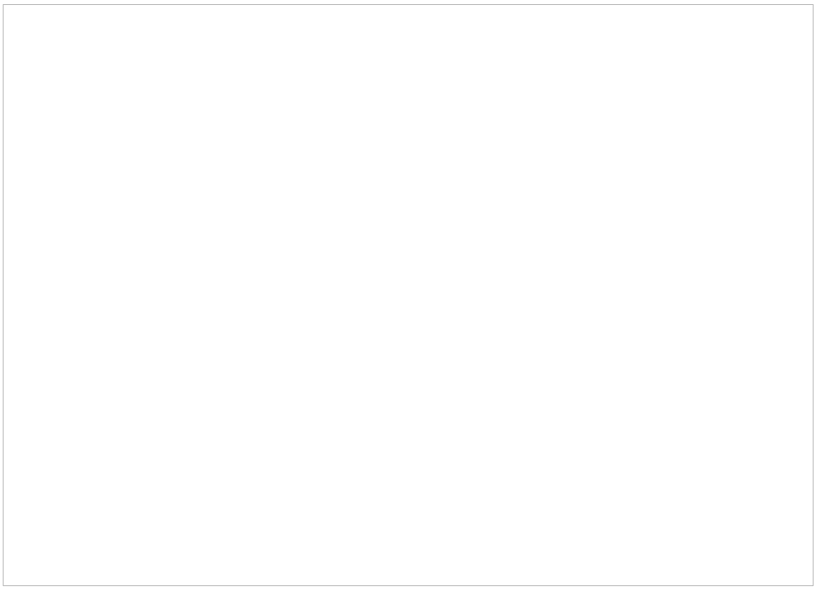


Figure 7. AP300 SMR operator console.

The AP300 MCR is equipped with one Reactor Operator console with three sections. The left section is physically and functionally identical to the right section and consists of two redundant distributed control and information system (DCIS) operator workstations, a Video Display Unit (VDU) with associated input device that provides access to the site LAN, and communications equipment.

One operator can monitor and control the entire plant from one DCIS workstation, however as many as four operators can be physically positioned at the RO console. Each DCIS workstation is composed of one ultrawide VDU (that allows the arrangement of multiple display windows within a single monitor), and the related input devices. Each DCIS operation station on the RO console can access any plant system.

The DDS includes processing, display, trending, and archival of data from the plant. The DDS consists of the Plant I&C Network and a high availability virtualized server architecture. The high availability virtualized server architecture includes virtual host servers and redundant management networking equipment. The DDS includes Nuclear Application Programs (NAP) which performs calculations to monitor AP300 plant parameters and processes, Alarm Presentation System (APS) which provides an application for monitoring and managing alarms, Computerized Procedure System (CPS) which aids operators with managing operating procedures, and datalinks which communicate with outside systems.

The PLS performs signal acquisition, calculations, setpoint comparisons, logic calculations, and component control to maintain the plant systems during all modes of operations. The PLS accepts operator soft control manual commands from the Human System Interface (HSI) over the Plant I&C Network to initiate commands if the plant systems and control systems are in the proper modes. Process variables, component status, and alarm data are generated and processed in the PLS and transmitted over the Plant I&C Network for presentation and recording. The PLS is connected to field devices primarily via input/output (I/O) modules, but also may utilize field bus communications, such as Profibus® and Modbus® communications. The plant control system includes, the PLS, the Control Rod System (CRS), and the Rod Indication System (RIS).

The Diverse Actuation System (DAS) provides a means of initiating the reactor trip and emergency safety

features that is diverse from the PMS. The DAS is included to meet the Anticipated Transient Without Scram (ATWS) trip rule and to reduce the probability of a severe accident resulting from the unlikely coincidence of a transient and common mode failure of the protection and safety monitoring. The PMS is designed to prevent common mode failures with the safety system; however, in the low probability case of a common mode failure, the DAS provides diverse protection.

5.8 Unique Technical Design Features (if any)

6. Technology Readiness

SUMMARY FOR BOOKLET

As an evolution of the already designed, licensed, procured, constructed, and operated Westinghouse AP1000 plant, the Westinghouse AP300 SMR is proven technology incorporated in a compact, lower power, package to timely serve the SMR market. The Westinghouse AP300 SMR, leveraging Westinghouse AP1000 plant technology with demonstrated industry leading reliability, benefits from Westinghouse's 70+ years of nuclear expertise. Building on the demonstrated concepts of simplicity and advanced passive safety, the AP300 SMR achieves an optimized design without adding first-of-a-kind (FOAK) risks, costs and challenges. The AP300 SMR also benefits from improvements and lessons learned in prior and ongoing deployments of the Westinghouse AP1000 plant.

Westinghouse AP1000 plant projects include Sanmen Units 1 & 2, Haiyang Units 1 & 2, and Vogtle Units 3 & 4, and most recently Sanmen Units 3 & 4, Haiyang Units 3 & 4, and two units at Lianjiang Nuclear Power Plant (12 units total). Sanmen Units 1 & 2, Haiyang Units 1 & 2, and Vogtle Unit 3 & 4 are in commercial operation.

6.1 Deployed Reactors

The AP300 SMR technology is based on the proven technology of AP1000 plant, including design & licensing methodologies.

Westinghouse has obtained a generic Design Certification (DC) from the NRC for the AP1000 design under the 10CFR Part 52 licensing process. US utilities have received combined construction and operating licenses based on the certified AP1000 plant design for eight units (Vogtle Units 3 and 4, V.C. Summer Units 2 and 3, Levy Units 1 and 2, and William S. Lee Units 1 and 2).

Preliminary Safety Analysis Reports were submitted for the Sanmen and Haiyang projects to the National Nuclear Safety Administration (NNSA) in 2008. Following its review, NNSA issued all construction permits in 2009 for both sites. The Final Safety Analysis Reports for both sites were submitted to NNSA in 2012. The first Fuel Load Permit was issued to Sanmen Unit 1 in April of 2018.

Additionally, AP1000 plant successfully went through the GDA process between 2007 and 2017, and received a Design Acceptance Confirmation (DAC) from the ONR and a Statement of Design Acceptance (SoDA) from the Environment Agency.

The AP300 plant shares many features with the AP1000 plant encompassing design, licensing methodologies, major equipment & components, passive safety systems, and steel-composite structural modules. These AP1000 design features were already reviewed and approved by regulators.

6.2 Reactors under Licensing Review

Design standardization / simplification, main components that are new designs

Design standardization and high plant availability by design simplification are flag philosophies of Westinghouse AP technology. The best components are the ones that are proven so AP300 plant design makes use of those. No new and not-proven designs are used in the AP300 plant.

Expected reliability and maintainability of systems and equipment

Overall, an important aspect of the AP300 SMR design philosophy focuses on plant operability and maintainability. The plant design includes a simplified system design to improve operability while reducing the number of components and associated maintenance requirements. In particular, simplified safety systems reduce surveillance requirements by enabling significantly simplified technical specifications.

Selection of proven components has been emphasized to ensure a high degree of reliability with low maintenance requirements. Component standardization reduces spare parts, minimizes maintenance, reduces training requirements, and allows shorter maintenance durations. Built-in testing capability is provided for critical components.
The AP300 SMR approach to maintenance is to develop an Equipment Reliability and Maintenance Program that optimizes plant safety performance and reliability. The program establishes a systematic approach to efficiently incorporate a broad range of organizations, programs, and processes to prevent equipment failures, and ensure high levels of safe and reliable plant operations over the lifetime of the plant.

The Equipment Reliability and Maintenance Program for the AP300 SMR design considers procurement, storage, construction, testing, and operation of new installations. It also takes into consideration that design assumptions incorporated into the Probabilistic Safety Assessment (PSA) remain valid throughout the life of the plant. The program establishes an integrated approach to continuous improvement that prevents unanticipated failures of plant structures, systems, and components (SSCs) and restores degraded equipment to full capability in support of safe and reliable plant operation.

The AP300 SMR is designed to reduce single-point vulnerabilities and provide confidence that reliability is designed into the plant. The Equipment Reliability and Maintenance Program ensures reliability and availability assumptions are not adversely affected and ensures the overall reliability and availability of the plant. The program consists of properly scoping the equipment, establishing an equipment reliability strategy that includes predictive maintenance, preventive maintenance, life cycle management, performance monitoring planning, and long-term planning. Integral to an effective Equipment Reliability and Maintenance Program is an interface with established work control and corrective action programs. An effective work control program ensures work is properly prioritized, planned, and scheduled to maintain reliability. The corrective action program ensures program and equipment performance deficiencies identified during

procurement, equipment storage, construction, testing, and operation are properly addressed.

Information on research and technology development status

Westinghouse AP1000 technology was developed and licensed at the end of 2012. AP300 design is based on this proven technology with no additional research needed for this reactor.

Institutions involved in R&D and design

Since AP300 SMR is based on currently developed Westinghouse Advanced Plant Technologies. Based on this premiss, the Westinghouse AP300 SMR does not have any additional research or qualification needs.

Estimate of an overall time frame within which the design could be deployed

The AP300 SMR design is currently progressing through the design development stages with conceptual design completed in 2023, and the basic design phase in progress and culminating in 2025 with the submittal of the Design Certification Documentation to the regulators. Regulator certification is expected in 2027, which will align with the standard plant deployment readiness. Site specific project preparation is expected to commence in 2027 with site specific design & licensing activities, as well as long lead item procurement. The SMR will be ready for construction in 2030 with the Nth of a kind (NOAK) unit construction schedule being 36 months (first nuclear concrete to ready for fuel load).

6.3 Reactors in the Design Stage

Deployment status

Westinghouse is currently engaging with the NRC in a pre-application stage on the AP300 SMR conceptual design. Westinghouse plans to submit a Design Control Document (DCD) under 10 CFR Part 52 subpart E by the end of 2025 and is seeking USNRC Design Certification by the end of 2027 to support standard plant deployment.

Westinghouse submitted a Generic Design Assessment (GDA) Entry Application for the AP300 Plant Design to the UK Department of Energy Security and Net Zero (DESNZ) on January 31, 2024. GDA allows the regulators to get involved with designers at the earliest stage, where they have the most influence. By assessing at the design stage, any potential safety, security, or environmental concerns can be identified and highlighted so they can be addressed by Westinghouse early.

Compliance with worldwide design and licensing regulations

The AP300 plant design complies with all international design and licensing regulations including US, EUR and URD. Lessons learned from the AP1000 licensing process with the US NRC and NNSA, Generic Design Assessment in the UK and Pre-project design review by CNSC in Canada will be incorporated into the AP300 SMR design approval process and will enable a more streamlined, informed approach to worldwide compliance.

Operating experience

AP300 is using a proven technology based on AP1000. The fuel, reactor core internals and reactor vessel

are similar to those used in AP1000 plants. The same pressurizer design as for AP1000 plant is used in AP300 plant. So far (in 2024) six AP1000 units are operational resulting in over 20 reactor years of demonstrated operational excellence and their design, construction, testing data, licensing and operational experience feed into the AP300 program. AP300 is using a proven state-of-the-art safety analysis software package and methods which were validated and used to obtain a license for AP1000 not only from NRC but also from China Regulatory Body.

Design standardization / simplification, evolution, incorporation of lessons learned

The principles of simplifications and standardization are at the basis of the overall AP300 design philosophy and safety concept. The AP300 design is the result of a design philosophy and design process that emphasize safety and simplicity. This is achieved through the use of a reduced number of components, passive safety systems not reliant on AC power, modularization, and the use of proven components. Simplification in design provides the unique advantage for the AP300 plant among other SMR developments to deliver a superior product with reduced construction cost and schedule.

Operability was “designed in” by designing out the operator for response to Design Basis Accidents. This eliminates reliance on operators for response to accidents. Using natural forces promotes the elimination of the operator from safety related responses. Elimination of the reliance on AC power for safety functions is a key overriding concept for design simplification, enhanced safety and greatly improved probabilistic safety analysis (PSA) results. With the simpler safety system design, the number of safety related components, and safety related seismic buildings, is reduced.

Simplifications in overall safety systems, normal operating systems, the control room, construction techniques, and instrumentation and control systems provide a plant that is easier to build, operate, and maintain. Plant simplifications yield fewer components, cable and seismic building volume, all of which contribute to lower operation and maintenance costs.

Standardization

Westinghouse is a pioneer in developing standardization for nuclear power plant designs with demonstrated capabilities for standardized plant design and deployment. Like AP1000 plant design, the AP300 SMR has been developed as a standard plant design. The augmented nuclear island encompasses the shield building, containment (located inside the shield building), auxiliary building, annex buildings, diesel generator building and supporting systems, structures, and components. Overall, the augmented nuclear island serves as the reference plant or starting point for specific project development. The site-specific portion is aimed at integration of the standard plant with the local site geography and characteristics. The turbine building, yard, and other site-specific structures are adapted based on site-specific characteristics.

To ensure the full benefits of standardization in terms of optimizing fleet operation, the AP300 SMR nuclear island design will be maintained for all plants delivered, borrowing from the AP1000 successful implementation and maintain the nuclear island design basis for all plants delivered. A standardized AP300 SMR design will create benefits for procurement, construction, licensing, operation and maintenance of the plant.

Maintaining standardization throughout the design process creates a design with one set of documentation that can be used to construct multiple plants of the same design. This standardized set of documents has the benefit of simpler configuration control. When a change is made to the design, updating one document for the entire fleet instead of updating one document for each specific site has benefits of cost savings and

consistency of documentation.

Westinghouse has developed a suite of processes, procedures, and software that support the development and deployment of advanced nuclear technologies. Identical processes to the AP1000 plant will be used on AP300 SMR to ensure operational excellence from prior and current deployments is continuously incorporated into AP300 SMR.

Reliability and maintainability of systems and equipment

The landmark aspect of plant design philosophy is its simplicity, operability and maintainability. The plant design includes a simplified system design to improve operability while reducing the number of components and associated maintenance requirements. In particular, simplified safety systems reduce surveillance requirements by enabling significantly simplified technical specifications. The maintainability of the design is proven by various means, for instance by redundant plant control outputs which can be taken to service for maintenance while maintaining essential control functions.

7. Safety Concepts

SUMMARY FOR BOOKLET

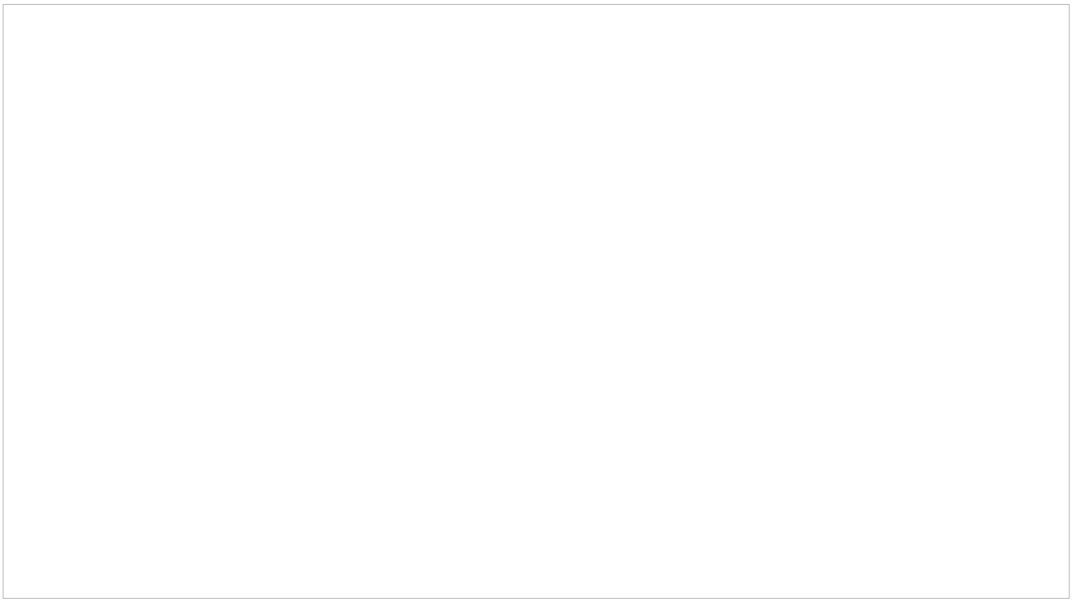


Figure 9. Westinghouse safety inspection.

The Westinghouse AP300 SMR plant design includes passive safety systems and extensive plant simplifications to enhance the safety, construction, operation, and maintenance of the plant. Safety systems use natural driving forces such as pressure, gravity, natural circulation, and convection. Safety systems do not use active components such as pumps, fans, or diesel generators, and are designed to function without safety-grade support systems such as AC power, component cooling water system, service water system, or HVAC. The number and complexity of operator actions required to control the safety systems are minimized; the approach is to eliminate the need for operator action

rather than automate it. The goal is to ensure the plant safe state to be reached without the need for operator action for all the design basis events.

The AP300 SMR passive safety systems do not require the large network of safety support systems found in current generation nuclear power plants. The safety systems are designed to operate for at least 72 hours without AC power. When AC power is available, the plant passive systems can be supplemented with simple, active defense-in-depth systems and equipment. While important to the safe normal operation of the plant, the active systems are not necessary for the safe shutdown of the reactor following a design basis event.

7.1 Safety Philosophy and Implementation

Safety concept, design philosophy and licensing approach

The AP300 SMR is designed to be fabricated, erected, and operated in such a manner that the release of radioactive materials to the environment does not exceed the limits and guideline values of applicable government regulations pertaining to the release of radioactive materials for normal operations and for design basis transients and accidents.

Essential safety actions are provided by equipment of sufficient redundancy and independence so that no single failure of active components can prevent the required actions utilizing the same safety-related equipment known from the AP1000 plant. Passive core cooling systems are provided to limit fuel cladding temperature to provide significant margin in emergency core cooling system (ECCS) performance following a Loss-of-Coolant-Accident (LOCA).

Those portions of the nuclear steam supply system that form part of the reactor coolant pressure boundary are designed to retain integrity as a radioactive material containment barrier following design basis operational transients and accidents.

Standby electrical power sources have sufficient capacity to power the nuclear safety systems and engineered safety features requiring electrical power. Safety-related electrical power requirements needed during a loss of offsite power are supplied via localized Class 1E DC power.

The containment, in conjunction with other engineered safety features, limits the release of radioactivity from inside the containment in the event of a design basis accident. This has the effect of limiting radiological consequences of a design basis accident to within an appropriate fraction of regulatory guidelines.

The fuel handling and storage facility is designed to prevent inadvertent criticality and to maintain shielding and cooling of spent fuel. In the AP300 SMR design the Spent Fuel Pool (SFP) is merged with the In-Containment Refueling Water Storage Tank (IRWST) known from the AP1000 design and is located inside the containment.

The AP300 SMR shall provide a simplified plant to the extent possible considering all phases of the plant lifecycle and shall retain AP1000 plant features where no more cost-efficient alternatives have been identified in order to facilitate design development and licensing.

The AP300 SMR shall maintain a similar level of passive safety as the Gen III+ passive designs, with an

optimization of the safety systems and margins. The AP300 SMR shall be provided with an adequate combination between safety-related systems and active non-safety-related components (defense-in-depth) as to ensure plant capital investment protection.

Defence in-depth description

Six aspects of the AP300 SMR plant design contribute to defense-in-depth:

- *Stable Operation:* In normal operation, the most fundamental level of defense-in-depth ensures that the plant can be operated with stability and reliability. This is achieved by the selection of materials, by quality assurance during design and construction, by well-trained operators, and by an advanced control system and plant design that provide substantial margins for plant operation before approaching safety limits.
- *Physical Plant Boundaries*: One of the most recognizable aspects of defense-in-depth is the protection of public safety through the physical plant boundaries. Releases of radiation are directly prevented by the fuel cladding, the reactor coolant system pressure boundary, and the containment pressure boundary.
- *Passive Safety-Related System*s: The AP300 SMR safety-related systems and equipment are sufficient to automatically establish and maintain core cooling and containment integrity for a significant period of time following design basis events assuming the most limiting single failure, no operator action, and with no onsite and offsite AC electrical power sources.
- *Diversity within the Safety-Related Systems*: An additional level of defense is provided through the diverse mitigation functions within the passive safety related systems. This diversity exists, for example, in the residual heat removal function. The passive residual heat removal heat exchanger (PRHR HX) is the passive safety feature for removing decay heat from the reactor coolant system (RCS) during a transient. In case of multiple failures in the PRHR HX flow path, defense-in-depth is provided by gravity injection of borated water into the RCS and operation of the automatic depressurization functions of the passive core cooling system. This establishes passive feed and bleed which also results in the removal of core decay heat as well as RCS cooldown and depressurization.
- *Non-Safety Systems*: The next level of defense-in depth is the availability of certain non-safety systems for reducing the potential for events leading to core damage. For more probable events, these highly reliable non-safety systems automatically actuate to provide a first level of defense to reduce the likelihood of unnecessary actuation and operation of the passive safety-related systems.
- *Containing Core Damage*: The AP300 SMR design provides the operators with the ability to drain the in-containment refueling water storage tank (IRWST) water into the reactor cavity in the event that the core has uncovered and is melting. This prevents reactor vessel failure and subsequent relocation of molten core debris into the containment. Retention of the debris in the vessel provides high confidence that containment failure and radioactive release to the environment will not occur due to ex-vessel severe accident phenomena.

The AP300 SMR defense-in-depth features enhance safety such that no severe release of fission products is anticipated to occur from an initially intact containment after the onset of core damage. The intention is that the timeframe provides the ability to perform accident management actions to mitigate the accident and prevent containment failure.

The design arrangement provides physical separation of redundant safety-related components and systems from each other and from non-safety-related components. The design approach includes designing the safety-related systems with redundant divisions and locating these redundant divisions in separate safety-

related areas, such that failure of one train or division does not impede the operation of the other train or division. Essential safety actions are provided by equipment of sufficient redundancy and independence such that no single failure of active components can prevent required actions. Sufficient redundancy and independence are designed into the protection systems so that no single failure results in loss of the protection function.

The combination of redundant passive safety systems (containing diverse capabilities) and redundant active Defense-in-depth systems, as well as diverse actuation capability, provide multiple diverse levels of defense for the most frequent postulated design basis events. The following Defense-in-depth (DiD) systems provide diverse means of maintaining nuclear safety:

- The start-up feedwater portion of the feedwater system (FWS) supplies feedwater to the steam generators and, together with the steam generator system (SGS), removes heat from the RCS during plant start-up, hot standby and shutdown conditions, and following events such as a loss of main feedwater.
- The SGS provides decay heat removal capability during plant start-up, hot standby, and shutdown operations by delivery of start-up feedwater flow to the steam generator and venting of steam from the steam generators to the atmosphere via the power-operated relief valve.
- The chemical and volume control system (CVS) consists of four centrifugal makeup pumps providing makeup flow to the RCS.
- The normal residual heat removal system (RNS) removes heat from the core and RCS and provides RCS low-temperature overpressure protection (LTOP) at reduced RCS pressure and temperature conditions during cooldown and shutdown operation.
- The component cooling water system (CCS) is a closed-loop cooling system that transfers heat from the RNS and CVS to support their DiD functions during fault conditions.
- The non-Class 1E DC and uninterruptible power supply system (EDS) provides continuous, reliable electric power to the DiD components above.
- The onsite standby power system (ZOS) consists of two onsite DiD standby diesel generator units and support systems that provides onsite AC electrical power for the EDS functions.
- The standby diesel fuel oil system (DOS) supplies fuel to the onsite standby power diesel generators.
- Heating and ventilation systems for each building provides necessary ventilation and cooling of the DiD safety-related systems, structures, and components (SSCs). The central chilled water (VWS) provides chilled water to support the Nuclear Island Nonradioactive Ventilation System (VBS), to support the cooling functions of the compartment unit coolers for the CVS and RNS pumps.

Identify main ageing mechanisms and how they are addressed

The plant design life of the AP300 SMR is 80 years, with the potential to extend up to 100 years. The design life is a critical aspect of the reactor's development, ensuring that major systems, structures, and components (SSCs) are designed for durability without significant degradation over the plant's operational period.

Radiation protection goals and measures, implementation of ALARA and International Commission of Radiological Protection (ICRP) standards

The AP300 SMR is designed with the overall plant goals of As Low As Reasonably (ALARA) exposure to radiation. The AP300 SMR compliance with all ICRP standards and regulations.

7.2 Transient/Accident Behaviour

Description of limiting DB and severe accidents

The AP300 SMR design provides multiple levels of defense for accident mitigation (defense-in-depth), resulting in extremely low core damage probabilities while minimizing the occurrences of containment flooding, pressurization, and heat-up. The combination of redundant passive safety systems (containing diverse capabilities) and redundant active Defense-in-depth systems, as well as diverse actuation capability, provide multiple diverse levels of defense for the most frequent postulated design basis events like seismic event, loss-of-site-power or LOCA. In the extremely unlikely event of a core melt, in-vessel retention of core debris provides high confidence that containment failure and radioactive release to the environment will not occur due to ex-vessel severe accident phenomena.

Safety systems to cope with design basis accidents

The Protection and Safety Monitoring System (PMS) performs the necessary safety-related signal acquisition, calculations, setpoint comparison, coincidence logic, reactor trip (RT) / ESF actuation functions, and component control functions to achieve and maintain the plant in a safe shutdown condition. The PMS contains maintenance and test functions to verify proper operation of the system.

The PMS consists of four redundant divisions, designated A, B, C, and D. The PMS includes four redundant safety displays, one for each division, located on the Safety Panel (SP) in the Emergency Safety Room (ESR). Four redundant divisions are provided to satisfy single failure criteria and improve plant availability. The PMS is also responsible for meeting Class 1E post-accident monitoring and display requirements.

The PMS provides detection of system excursions beyond the normal operational limits and automatic actuation of the protective functions necessary to ensure that the plant reaches and remains in a safe shutdown state. The system is designed to incorporate sufficient redundancy to mitigate single failure trip operation. In addition, the PMS includes all the equipment necessary to monitor the plant functions during and following any design basis accident (DBA).

Behaviour under major DBA accident types

The AP300 SMR safety-related systems and equipment are sufficient to automatically establish and maintain core cooling and containment integrity for a significant period of time following design basis events assuming the most limiting single failure, no operator action, and with no onsite and offsite AC electrical power sources.

Safety systems to cope with severe accidents (beyond design basis accidents)

The AP300 SMR will consider internal hazards in accordance with regulatory and industry expectations. Systems, Structures, and Components (SSC) important to plant protection are designed to maintain their functionality and integrity when subjected to potential probable hazards that could challenge plant safety. In addition, assessments have been completed to demonstrate that the plant can achieve safe shutdown even if the SSC fails to perform its intended function.

The types of internal hazards considered for the AP300 SMR will be fires, toxic substances, flooding, and pressure part failure.

Internal fire

The fire protection and evaluation of the plant design is based on NFPA 804-2001, “Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants.” The general approach to preserving safe shutdown capability of the plant, for postulated fires in areas outside containment, is to provide 3-hour fire barrier separation between redundant safe shutdown equipment. It is assumed that all unprotected equipment in any one fire area are rendered inoperable and restoration is not possible when evaluating the safe shutdown capabilities. Safe shutdown is maintained through use of redundant trains and separation between fire areas. This is done to isolate hazards and minimize the risk of spread of fire and the resultant consequential damage and to facilitate access for firefighting personnel and equipment. Following this approach, the plant arrangement, spacing, and pathways consider the separation process and where a full barrier cannot be used. The mitigation features, such as special fire barrier materials (i.e., gypsum, Dura-Steel barriers and/or fire stop materials), are used to ensure separation and segregation of the SSEs.

Toxic substances

Evaluation for the impact of toxic substances is generally preformed considering the guidance and criteria in Regulatory Guide 1.78, “Evaluating the Habitability of a Nuclear Power Plant Control Room during a Postulated Hazardous Chemical Release.” Impact to habitability of a Main Control Room represents a risk to nuclear safety. The AP300 SMR does not have a Main Control Room directly located within the nuclear island, therefore, separation of toxic substances and the control room is not as limiting as compared to traditional power plant designs. The toxicity limits are based the National Institute of Occupational Safety and Health (NIOSH). Toxic materials are quite limited (i.e., hydrogen, and chemical treatment materials) and are stored in locations with substantial wall thickness and away from the Nuclear Island facilities and other important equipment to minimize the risks of explosion.

Internal flooding

Safety related/essential systems, structures, and components (SSC)are protected against the consequences of flooding from postulated pipe failures. These SSCs are protected to the extent that the plant can achieve and maintain a safe shutdown condition and prevent unacceptable radiological releases to the environment. Flooding analyses are required to document that these SSCs are protected against flooding caused by postulated High-energy Line Breaks, Through-wall Cracks, Moderate-energy Line Breaks in non-seismically-supported piping systems, tank and vessel ruptures, flow from adjacent areas, pump mechanical seal failures, inadvertent discharge from a pipe that results in mass flow from the pipe, or by the activation of the fire protection system. Protection is done by mitigation of the flood or the safety-related/essential SSC are designed to be submerged. The design criteria and methodology are per ANSI/ANS Standard 56.11 “Design Criteria for Protection Against the Effects of Compartment Flooding in Light Water Reactor Plan”. Inside containment High Energy Line Breaks are evaluated and flood waters directed to appropriate drains, preferentially directed to support the passive safety heat rejection. Where necessary, mitigation features are incorporated into the design to ensure all applicable safety functions are maintained during Design Basis Events. In the Nuclear Island, the various postulated breaks are evaluated to ensure that flow pathways are created to direct flow to sumps, safety-related/essential SSCs are located above the critical flood elevations, or safety-related/essential SSCs are protected to ensure their safety functions are not compromised.

Pressure part failure

NUREG-0800, “Standard Review Plan,” Sections 3.5.1.1, 3.5.1.2, and 3.5.1.3 for “Internally Generated

Missiles (Outside Containment)," "Internally Generated Missiles (Inside Containment)," and "Turbine Missiles," provided the basis for evaluation of systems, structures and components within the plant design along with ANSI/ANS Standard 58.3 "Physical Protection for Nuclear Safety-Related Systems and Components." Potential missile hazards shall be eliminated to the extent practical by minimizing the potential sources of missiles through proper selection of equipment, and by arranging equipment in a manner to minimize the potential for damage from missiles. The approach to the design is to first seek to design for missile prevention and if not possible then design for missile protection. A design example for prevention is in the case of rotating equipment where the design ensures there is insufficient energy to move the mass of rotating parts through the surrounding housings and using spatial separation to ensure the missile would be directed away from the potential target. Examples of design for protection can include walls or partitions that enclose safety-related systems or separate redundant trains of safety-related equipment. The protection barriers are constructed such that a credible missile cannot damage the components required to achieve safe shutdown or significant release of reactivity.

Earthquake

The standard plant is conservatively designed to protect the plant against design basis safe shutdown earthquake with a peak ground acceleration (pga) of 0.3g. Westinghouse will demonstrate that the standard plant seismic design envelopes the site-specific earthquakes. As part of the detailed design, site specific reconciliation analysis, or equipment qualifications, the site-specific earthquake requirements can be used to justify relaxing seismic requirements. This may be necessary for reasons such as detailed design changes due to as-procured or as-built changes in component mass or center of gravity and support configuration based on as-procured equipment information.

The seismic ground design response spectra are based on Regulatory Guide 1.60 spectra that have been enhanced to include the high frequency characteristics of the Eastern United States. Applying the requirements of Regulatory Guide 1.60 aligns with the guidance in NUREG 0800, which is the standard review plan for new plant design certifications in the United States.

External flooding

The AP300 SMR is designed for a normal groundwater elevation up to 1m below grade and for a probable maximum external flood level up to plant grade. The probable maximum flood is defined on a site-specific basis to bound site-specific external hazards such as river flooding, upstream dam failure, tsunami, or other natural causes. The site is also required to be graded such that water will drain away from the nuclear island and adjacent buildings in order that any local flooding is quickly dissipated.

What differentiates the AP300 SMR design from other plants relative to external flood protection is the ability of the plant to cope with flood levels that exceed the maximum probable site flood. The margin is directly attributable to the following key features:

Safe shutdown and core cooling are provided by systems located inside the containment vessel.

The systems are designed to "fail safe" upon loss of power, loss of instrumentation and controls, or loss of instrument air.

The AP300 SMR provides margin beyond the design basis flood to maintain a safe shutdown condition with no fuel damage or radiological releases to the general public for extreme flood levels.

Aircraft crash

The evaluations for the intention aircraft crash for the U.S. NRC are performed based on Rierra functions that were agreed upon with the regulator. Security restrictions prevent Westinghouse from providing the input Rierra functions used in these assessments. However, the size and configuration of design features to

resist aircraft impact are consistent with those used in AP1000 plant. The AP1000 plant aircraft impact assessments have been subjected to detailed reviews in both the U.S. and Europe from an independent peer panel, the U.S. NRC, and the U.K. Office for Nuclear Regulation (ONR). All three reviews accepted the conclusion that an aircraft impact would not inhibit the plant's core cooling capability, would not impact containment integrity, and would not impact spent fuel pool integrity based on best-estimate assessments.

Security

Westinghouse will produce a Generic Security Report (GSR) for the AP300 SMR which will describe the conceptual security organization and design inputs to allow a prospective site licensee to produce a site-specific security plan as part of the Site Licence Grant application.

Severe accident management guidelines (SAMG) status

The plant self-actuates so no operator actions are required for 72 hours after the accident. Systems, structures and components critical to placing the reactor in a safe shutdown condition are protected within the steel containment vessel which is protected by a robust shield building. The AP300 SAMG are under development.

Safety goals

The AP300 design target for core damage frequency 1E-5/year and Large Release Frequency (LRF) less or equal than 1E-6/year from at power and shutdown conditions, considering internal and external events.

Emergency planning measures

Reduced size emergency planning zones (relative to those defined in regulation for large legacy reactors) are expected to be achievable for the AP300 SMR due to the reduced core source term for accidents, improved analytical techniques (e.g., atmospheric dispersion factor assessments).

8. Fuel and Fuel Cycle

SUMMARY FOR BOOKLET

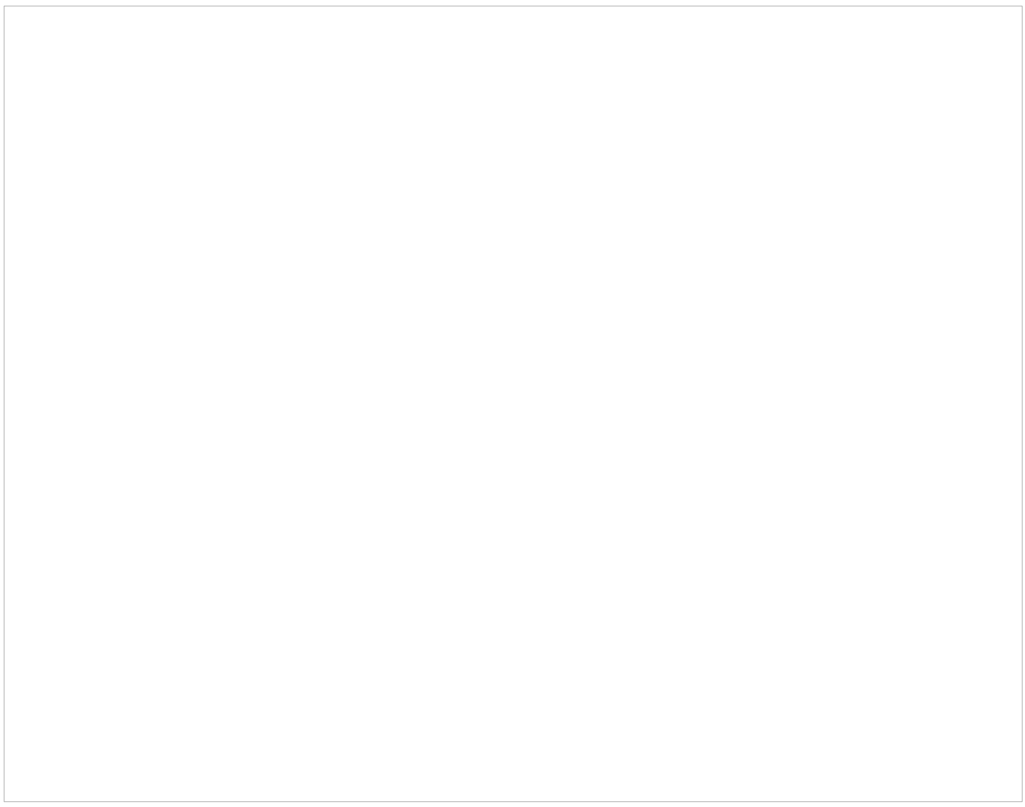


Figure 9. PWR fuel assembly.

The reference fuel assembly design for the AP300 SMR is based on the Westinghouse 17x17 Robust Fuel Assembly-2 (RFA-2, referred to as “RFA” throughout). The Westinghouse RFA fuel product has been utilized extensively in the United States and globally used in more than 50 plants worldwide and has exhibited excellent fuel performance over 20+ years. Based on a long history of experience gained from earlier Westinghouse designs, the RFA fuel design was first introduced in 1997, and since then has undergone numerous design enhancements and evolutions to further improve fuel and plant performance and reliability.

An AP300 SMR Fuel Assembly (FA) consists of 264 fuel rods in a 17x17 square array. The center position in the fuel assembly has a guide thimble that is reserved for in-core instrumentation. The remaining 24 positions in the fuel assembly have guide thimbles. The guide thimbles are joined to the top and bottom nozzles of the fuel assembly and provide the supporting structure for the fuel grids. A number of proven design features have been incorporated in the AP300 fuel assembly design. The basic RFA design includes the following major features:

- 17x17 pattern PWR fuel lattice based on PRIME fuel assembly skeleton along with related core components,
- Westinghouse integral (top) nozzle,
- Reduced rod bow Alloy 718 top grid,
- Low Tin ZIRLO™ Robust Fuel Assembly structural mid-grids,
- Low Tin ZIRLO™ Intermediate Flow Mixing (IFM) grids,
- High spring force Alloy 718 bottom grid,
- Alloy 718 robust protective grid,
- ZIRLO guide thimble tube with tube-in-tube dashpot,
- ZIRLO instrument tube,
- PRIME Bottom Nozzle with low pressure drop and Advanced Debris Filter Bottom Nozzle features

The Westinghouse AP300 SMR fuel cycle is 3 years, with design considerations to accommodate a 2- and 4-year cycle length.

8.1 Fuel Cycle Options

Spent nuclear fuel and disposal plans

In the AP300 SMR, spent fuel is stored in a portion of the IRWST inside the seismic Category I Containment Building. This design provides a simplification by limiting irradiated fuel movement during core offload and core reload and enhancing the overall safety case of storing fuel within the containment structure. The spent fuel storage area in the IRWST is designed to store the spent fuel rods until they have cooled sufficiently to allow transfer to dry cask storage during a refueling outage. As a result of storing fuel inside containment, the AP300 SMR outage will require casking operations. Casking is performed within the Fuel Handling Area of the Auxiliary Building, which incorporates design features to minimize impacts to outage critical path.

Spent Fuel Storage

Spent fuel is stored within the IRWST inside containment in low density racks, which include integral neutron absorbing material to maintain the required degree of subcriticality. The racks are designed to store fuel of the maximum design basis enrichment. Each rack in the pool consists of an array of cells interconnected to each other at several elevations and to a thick base plate at the bottom elevation. These rack modules are free standing, not braced to the pool wall. The design of the spent fuel racks is such that a fuel assembly cannot be inserted into a location (e.g., between racks) other than a location designed to receive an assembly.

The IRWST is designed with a leak chase system which consists of collection channels (which are part of structural modules) surrounding pool welds. The leak chase system collects leakages from the IRWST allow identification of the source of the leakage. This includes leak chases specific to the spent fuel pool area of the IRWST to identify leakage.
The spent fuel pool provides enough storage space to support sufficient amount of cooling to allow for casking and also considers space requirements for a full core offload. The decay heat generated by the stored fuel assemblies is removed with the Normal Residual Heat Removal System (RNS). This is done by pumping the higher temperature water from within the IRWST through the RNS heat exchangers and then returning the cooled water to the pool. A secondary function of the RNS is clarification and purification of the water in the IRWST, the neighboring transfer canal and the dry cask loading pit.

Fresh Fuel Storage

The AP300 SMR provides for one full cycle of new fuel storage in the Fuel Handling Area of the Auxiliary Building that will be brought into Containment during the refueling outage campaign. Additional new fuel storage capacity can be provided and planned for storage in other areas of the AP300 SMR plant based on local and regulatory requirements. The additional fuel storage strategy would be to dedicate a storage location for new fuel stored in travelers based on these site-specific requirements.

Fuel handling systems

Although the spent fuel is located inside Containment, the Auxiliary Building contains a fuel handling area (FHA). The FHA has storage space for new fuel, a cask loading pit (CLP), and cask washdown pit (CWP) to support the cask loading operations and fuel receipt. The CLP is connected with the inside of the

Containment building with a fuel transfer canal.
To maintain storage space in the spent fuel pool, casking operations are required during the refueling outage. Cask loading of spent fuel assemblies during an outage will be performed using the Fuel Handling Area equipment, which consists of fuel and cask handling equipment, cask loading pit, cask washdown area, and fuel transfer canal. Once a casks is loaded, it will be brought to an interim spent fuel storage installation (ISFSI) located on or off site for longer term storage. The AP300 SMR standard plant site provides provisions for an ISFSI.

Failed fuel detection

Cladding damage can be detected through the following equipment:

- Coolant activity monitoring during the reactor operation. Deviation from normal activity level may indicate cladding damage and are monitored with respect to operating limits and allow to predict the potential amount of damage to fuel assemblies in operation.
- Fuel sipping is performed during core offload to identify which fuel assembly releases radionuclides to the coolant.
- Can sipping in the spent fuel racks if required for the same purpose.
- Automated Fuel Inspection System to identify the damaged rod(s) within the assembly prior to repair. This inspection is performed in the spent fuel racks.

8.2 Resource Use Optimization

Provisions for minimum generation of wastes at the source

The basic AP300 SMR design principles minimize the creation of radwaste during operations and decommissioning. With fewer valves, pipes, and other components, less waste will be generated during maintenance activities (repair and replacement) and decommissioning.

Waste generation will be minimized in AP300 SMR due to material selection. For example, the level of cobalt in reactor internal structures and in primary and auxiliary materials is limited. This limits the activation of the metal components. Surfaces, including steel wall and floor surfaces, will be sealed to prevent penetration and to facilitate decontamination. Also, during operation and maintenance, waste will be minimized by using best industry practices (for example, limiting the amount of material brought into containment).

Considering these characteristics, the decommissioning phase of the AP300 SMR is expected to be shorter. The decommissioning activities are expected to produce smaller quantities of activated or contaminated materials that need to be treated and conditioned for interim storage, and (potentially) final disposal as radioactive waste, when compared with other nuclear power plants of similar power rating.

Provisions for acceptable or reduced dose limits

The Westinghouse operational experience comes with the organisational and design provisions to reach as low as reasonably achievable doses.

8.3 Unique Fuel/Fuel Cycle Design Features

The reference fuel cycle length for the AP300 SMR is 3 years, operating cycles of 2 to 4 years in length will

also be considered.

9. Safeguard & Physical Security

SUMMARY FOR BOOKLET

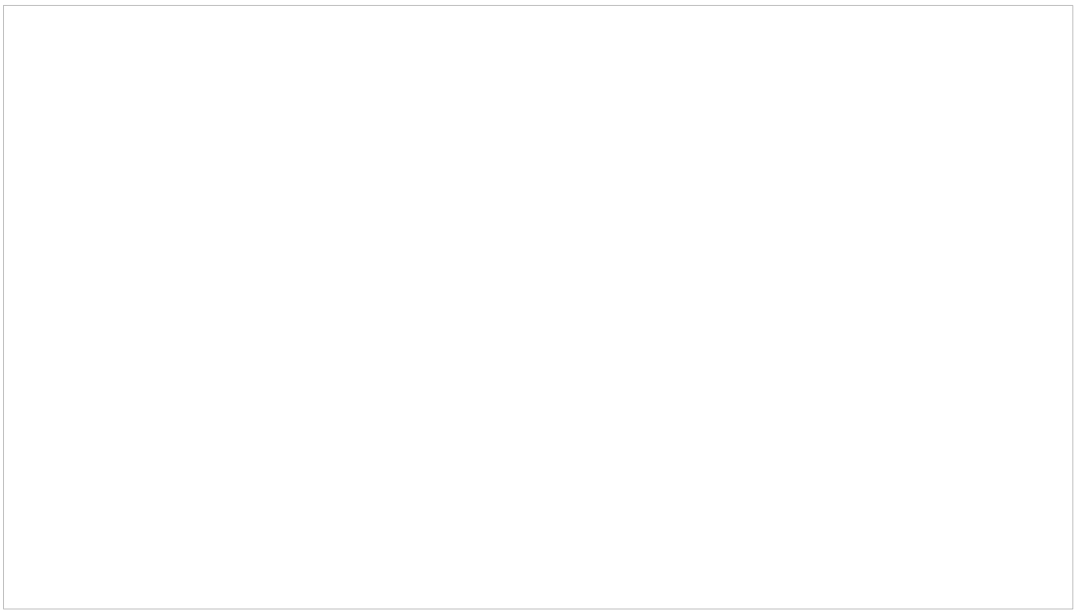


Figure 10. AP300 SMR full site overview.

Westinghouse Electric Company, LLC (Westinghouse), together with the world's leading civilian nuclear power plant vendors, have adopted a common set of principles that reflect global best practices in connection with the export of nuclear power plants. Known as the Nuclear Power Plant Exporters' (NPPE) Principles of Conduct, the principles articulate the nuclear power plant industry's shared high standards in the areas of safety, security, environmental protection and spent fuel management, compensation in the unlikely event of nuclear-related damage, non-proliferation, and ethics. This type of voluntary code of conduct has never existed in the nuclear industry. Westinghouse is committed to the peaceful use of nuclear energy and the promotion of proliferation-resistant designs and taking IAEA safeguards requirements into account in the reactor design phase.

The AP300 SMR is designed to the highest criteria to provide assurance for the protection of the health and safety of the public against radiological sabotage.

The key design objectives of the AP300 SES include the following:

• Providing access control capability for the plant protected and vital areas by limiting entry to authorized personnel, vehicles, and material only.
• Providing video surveillance and assessment capability.
• Providing a centralized command-and-control computer network and communications for the plant security response force.
• Providing or utilizing communications capability for the plant security response force, operations, and emergency response personnel.
• Providing deterrence and delay of attempted unauthorized entry into the plant protected and vital

areas.
• Providing hardened defensive positions for protection of the plant security response force from the elements of the design basis threat.
• Ensuring adequate lighting as necessary for essential elements of the surveillance and assessment security systems and to allow effective response by the plant security response force.
• Providing a power supply as necessary for subsystems of the security system, including but not limited to: intrusion detection, access control, and video assessment/surveillance security systems.
• Providing detection of attempted unauthorized entry to the plant protected and vital areas.

9.1 Safeguards

Technical features to facilitate implementation of IAEA safeguards

To further demonstrate its commitment to the peaceful use of nuclear energy, Westinghouse developed a partnership with the International Atomic Energy Agency (IAEA) and the U.S. Nuclear Regulatory Commission to a establish a voluntary safeguards transparency program at the AP1000 plants in the United States. As part of this effort, Westinghouse engineers received training from the U.S. National Laboratories on the technical requirements and generalized approaches to IAEA safeguards technical systems utilized for nuclear reactor systems. One major objective of this program included the design of a generalized safeguards approach to AP designed nuclear reactors and developing the design information questionnaire for a customer as part of a regulatory requirement for international safeguards compliance.

Special processes or measurements, I&C needs

The AP300 SMR, like the AP1000 advanced passive nuclear power plant, will utilize advanced digital control systems, voice, and information systems to simplify operation and maintenance of the plant. The design incorporates a defensive strategy for implementing cyber security during development and construction that simplifies the selection of risk mitigation measures used during design finalization to ensure that components and systems meet the established cyber security design criteria. By utilizing a layered and graded approach for cyber security on the AP300, the effectiveness of managing connectivity security concerns within and between levels is optimized.

Major developments (technology and process) needed to ensure safeguards implementation

Westinghouse recognizes the importance of implementing security measures in accordance with the FSyPs. Specifically, Westinghouse has well-established conditions that are the strategic enablers to support high-reliability security arrangements.

Intrinsic features and extrinsic measures that ensure enhanced protection against nuclear material theft and misuse (proliferation resistance)

The plant security is ensured by limited access to authorized personnel, the unauthorized entrance is instantaneously noticed. Moreover, the plant has its internal network to serve the surveillance and communication purposes to prevent unauthorized usage. Security is enhanced with all safe shutdown equipment located in safety concrete nuclear island buildings.

9.2 Security

Features against human-induced malevolent external threats and insider actions

Access control capability for the plant protected and vital areas is provided by limiting entry to authorized personnel, vehicles, and material only. The plant is constantly under video surveillance, the adequate lighting and power supply is provided, as necessary, for essential elements of the surveillance and assessment security systems and to allow effective response by the plant security response force.

9.3 Unique Safeguards and/or Security Features

10. Project Delivery & Economics

SUMMARY FOR BOOKLET

Benefiting from the experience gained on Westinghouse AP1000 plant projects, Westinghouse offers the highest level of delivery certainty for the AP300 SMR projects. These benefits include technology maturity, licensing confidence, established design and modularization, proven construction and commissioning approaches, resolution of first-of-a kind (FOAK) challenges, and incorporation of lessons learned. All of which provide a high-level of certainty in our team's ability to achieve the overall project schedule in a safe and quality-focused manner to deliver a plant that meets all operational parameters.

As an added advantage, Westinghouse's experience with the AP1000 has paved the way for the AP300 SMR's supply chain strategy. The AP300 SMR is positioned with a network of world-leading constructors, suppliers, and other business partners to provide a seamless and fully integrated delivery model for deploying the AP300 SMR technology.

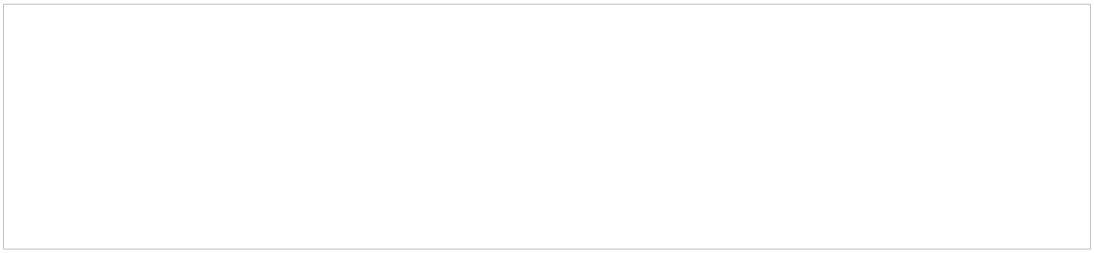


Figure 11. AP1000 control room.

10.1 Project Preparation and Negotiation

Technology transfer of design basis information

Westinghouse provides information to the ultimate owner/operator necessary to be able to operate and maintain the plant.

Simulator and training programs

Westinghouse has an extensive training programme to develop employees and for training personnel who would ultimately be operating the fleet of AP300 SMRs. Westinghouse's world-class training programme has been leveraged by the global nuclear fleet to develop human capital resources. Westinghouse established training services in the early 1960's and has continued to transform its programmes to use a systematic approach to learning.

Westinghouse focuses the development of its training programmes on three main cornerstones:

- Develop long-term partnerships to grow the knowledge and skills of nuclear professionals.
- Use of student-centred, blended learning techniques through application of performance-driven approaches.
- Focus on integrated plant operations to educate a nuclear workforce to meet the unique challenges of the complexity of nuclear power plant technology.

Westinghouse's training programmes include the use of its state-of-the-art simulator facilities which have been used to train hundreds of operators on the newest digital control rooms. Since the AP300 SMR technology is based on the AP1000 design, Westinghouse can leverage our existing facilities to be able to start initial training programmes on the simulator much earlier in the process because of the already established tools and processes. Additional overviews of Westinghouse's training programmes for customers and operators can be found at the following link: https://training.westinghousenuclear.com/

Westinghouse's training programmes are established within the Westinghouse Management System and governed by policies, procedures, and processes including our apprenticeship programme requirements. The Management Systems including our training programmes have been extensively evaluated by various regulators and other accreditation bodies and have achieved praise among the stakeholders for our programmes and state of the art training facilities.

Finally, for the AP1000 projects Westinghouse has established in country training programmes to train the next nuclear workforce. Westinghouse has established internship programmes with local universities to embed university students into various Westinghouse businesses. Westinghouse currently has 15 interns embedded in the organization from Poland and 5 interns from the Czech Republic with an expectation that those programmes will continue to grow as our AP1000 plant projects mature.

Owner/operator options, risk sharing

Westinghouse is not an owner operator but has experience in partnering and working with owner/operators in the deployment of new build technology.

Financing arrangements available

Westinghouse has experience in supporting owners and operators in securing financing specifically with respect to debt financing. Westinghouse has experience working with Export Credit Agencies primarily with the Export-Import Bank of the US (EXIM).

In addition, there are options depending on the project to leverage the Engineering Multiplier Program (EMP), offered by EXIM, which could potentially provide early funding for engineering services prior to first nuclear concrete and procurement of long lead components.

In addition to ECA's, the US International Development Finance Corporation (DFC) is the US government's development finance institution which can also support project financing. DFC was established in 2019

through the passage of the Better Utilization of Investments Leading to Development (BUILD) Act which strengthened and modernized American development finance. The BUILD Act combined the capabilities of the Overseas Private Investment Corporation and the Development Credit Authority (DCA) which had previously been housed in the US Agency for International Development (USAID). DFC advances American foreign policy and American commercial competitiveness. The investments DFC mobilizes serve as stabilizing forces in developing countries around the world. Investment in these markets also helps American businesses gain footholds in many of the world's fastest growing markets.

Project risk factors and warranties

Project risk factors are dependant on the project structure and commercial / delivery model, site and requirements. Westinghouse generates a comprehensive site based risk register for all projects to assess the specific risk.

Potential benefits to customer member states

Westinghouse's approach to its projects is a "buy where we build" mentality that maximizes local content bringing significant value to the local economy. The general localization strategy encompasses broad local benefits that include skill development, nuclear cluster and supply chain development, and climate, safety, and community engagement.

Westinghouse's skills development activity supports efficient and safe operations and provides opportunities for employees where its plants are located.
Westinghouse actively builds partnerships with local educational institutions to support development of a pipeline of employees. In order to support the localization of resources, Westinghouse has an extensive training program to develop employees and for training personnel that would operate an AP300 plant. Westinghouse works closely with its customers to establish an approach to social value, human capacity development and localization that meets the needs of the project and the community.

Locality factors with high influence on costs

The AP300 SMR is a standard design considering bounding site parameters that encompass the majority of potential sites and locations worldwide. As a result, the AP300 SMR design can be applied to various geographical regions around the world with varying regulatory standards and utility expectations without major changes. Site-specific assessments will be performed on a project specific basis as needed in the event a specific locality factor is not bounded by the standard site parameters.

10.2 Construction and Commissioning

Project planning and scheduling methods

Westinghouse leverages its comprehensive Westinghouse Management System and extensive AP1000 database for AP300 project planning and scheduling activities. Depending on the project needs, Westinghouse has extensive experience leading or supporting integrated project planning and scheduling with the Owner, constructor and other project stakeholders under a variety of project delivery models. Local labor requirements, site characteristics, climate, owner and regulatory requirements are assessed in the early stages of project planning. Standardized means of risk management, contingency planning and project controls are deployed.

Schedule adherence and supply chain assurance

Westinghouse has a mature supply chain with on-going involvement in AP1000 plant projects. In addition, Westinghouse has manufacturing facilities in the United States and Italy for the fabrication of major components. The leveraging of the AP1000 plant technology in the Westinghouse SMR enables the direct use of this mature supply chain and internal capabilities. By using AP1000 components, when possible, the Westinghouse SMR also reduces component development costs and provides more certainty in cost estimates. The current suppliers on the Westinghouse qualified suppliers list are providing Westinghouse goods and services in support of the AP1000 plant, as well as the operating fleet. These suppliers are positioned to provide additional equipment and services, representing significant depth, and breadth of resources to the AP300 SMR supply chain.

Localization during construction

Westinghouse's "buy where we build" philosophy maximizes localization during construction. A comprehensive localization strategy is developed that is specific to each project as the project is being developed.

Overnight capital cost

To achieve the target Overnight Capital Cost (OCC), Westinghouse is focused on the standardization and simplification of the Westinghouse AP300 SMR design. The Westinghouse AP300 SMR attenuates key cost drivers for nuclear plants by innovatively reducing the AP300's safety related footprint and optimizing the design for construction with extensive modularization. These design advantages will coalesce with Westinghouse's recent and extensive new plant delivery experience and an established and proven global nuclear supply chain to achieve an OCC that is competitive economically with grid-scale SMR nuclear power.

10.3 Operation and Maintenance

O&M costs

An important aspect of the AP300 SMR design philosophy focuses on plant operability and maintainability. The plant includes a simplified system design to improve operability while reducing the number of components and associated maintenance requirements. In particular, simplified safety systems reduce surveillance requirements by enabling significantly simplified technical specifications.

Selection of proven components has been emphasized to ensure a high degree of reliability with low maintenance requirements. Component standardization reduces spare parts, minimizes maintenance, reduces training requirements, and allows shorter maintenance durations. Built-in testing capability is provided for critical components.

Fuel costs

The AP300 SMR fuel technology will be based on existing fuel design making the costs comparable to current fuel costs.

Plant decommissioning costs

The basic AP300 SMR design principles minimize the creation of radwaste during operations and decommissioning. With fewer valves, pipes, and other components, less waste will be generated during

maintenance activities (repair and replacement) and decommissioning.

Waste generation will be minimized in AP300 SMR due to material selection, for example, the level of cobalt in reactor internal structures, which limits the activation of the metal components. Surfaces, including steel wall and floor surfaces, will be sealed to prevent penetration and to facilitate decontamination. Also, during operation and maintenance, waste will be minimized by using best industry practices (for example, limiting the amount of material brought into containment).

Considering these characteristics, the decommissioning phase of the AP300 SMR is expected to be shorter. The decommissioning activities are expected to produce smaller quantities of activated or contaminated materials that need to be treated and conditioned for interim storage, and (potentially) final disposal as radioactive waste, when compared with other nuclear power plants of similar power rating.

Support for future design changes

Westinghouse is a lifetime partner for any owner/operator of an AP300 plant. Offering an extensive array of experience and subject matter expertise in a variety of areas not limited to design, procurement and systems engineering and digital solutions Westinghouse is positioned as a partner for a one-stop-shop for long term and outage and maintenance operations.

The AP300 SMR design will take advantage of digital technologies to streamline day-to-day outage and maintenance operations enabling design standardization and allowing for a potential centralization of certain utility functions. The AP300 SMR design and Westinghouse overall strives to provide an integrated services model to support in the day-to-day operating and maintenance activities of operating plants, utilizing data, technology, standard plant design and centralizing staffing models to offer a streamlined O&M process and procedure approach.