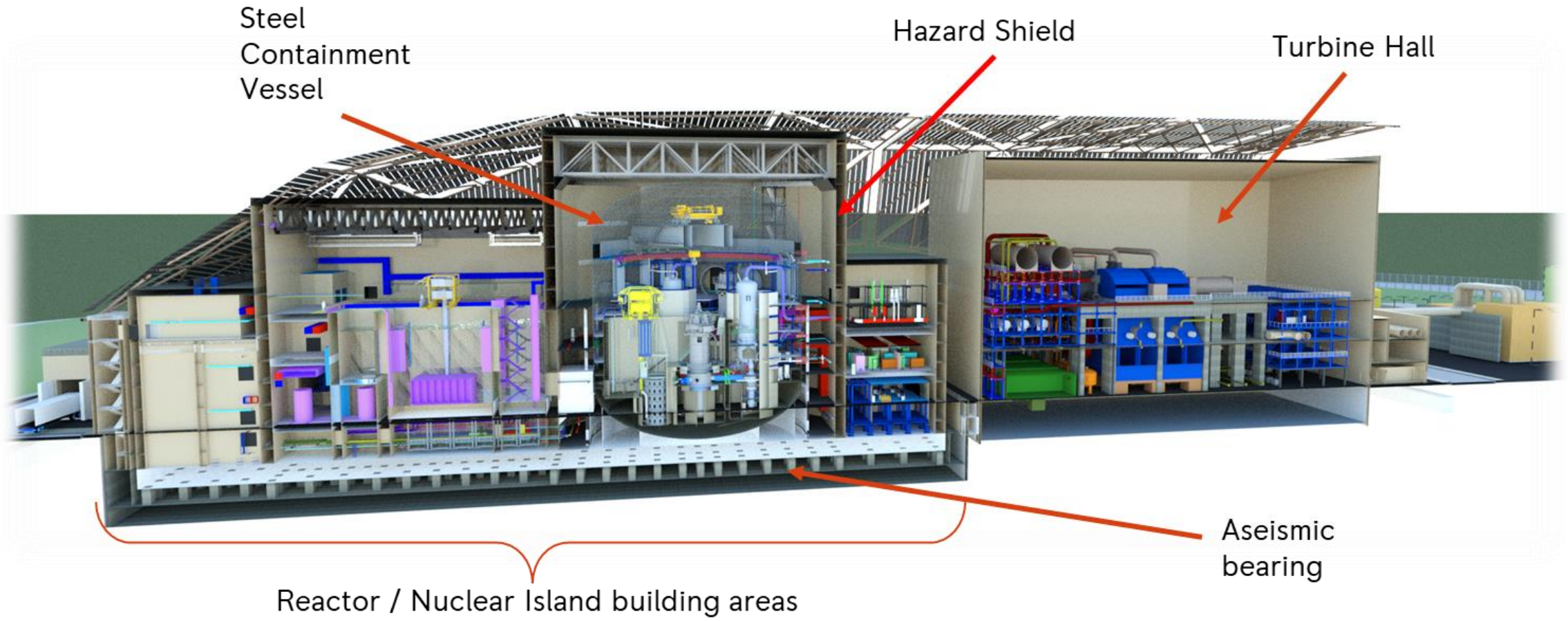
Rolls-Royce SMR Overview for US NRC

11th February 2026

PLANT LAYOUT



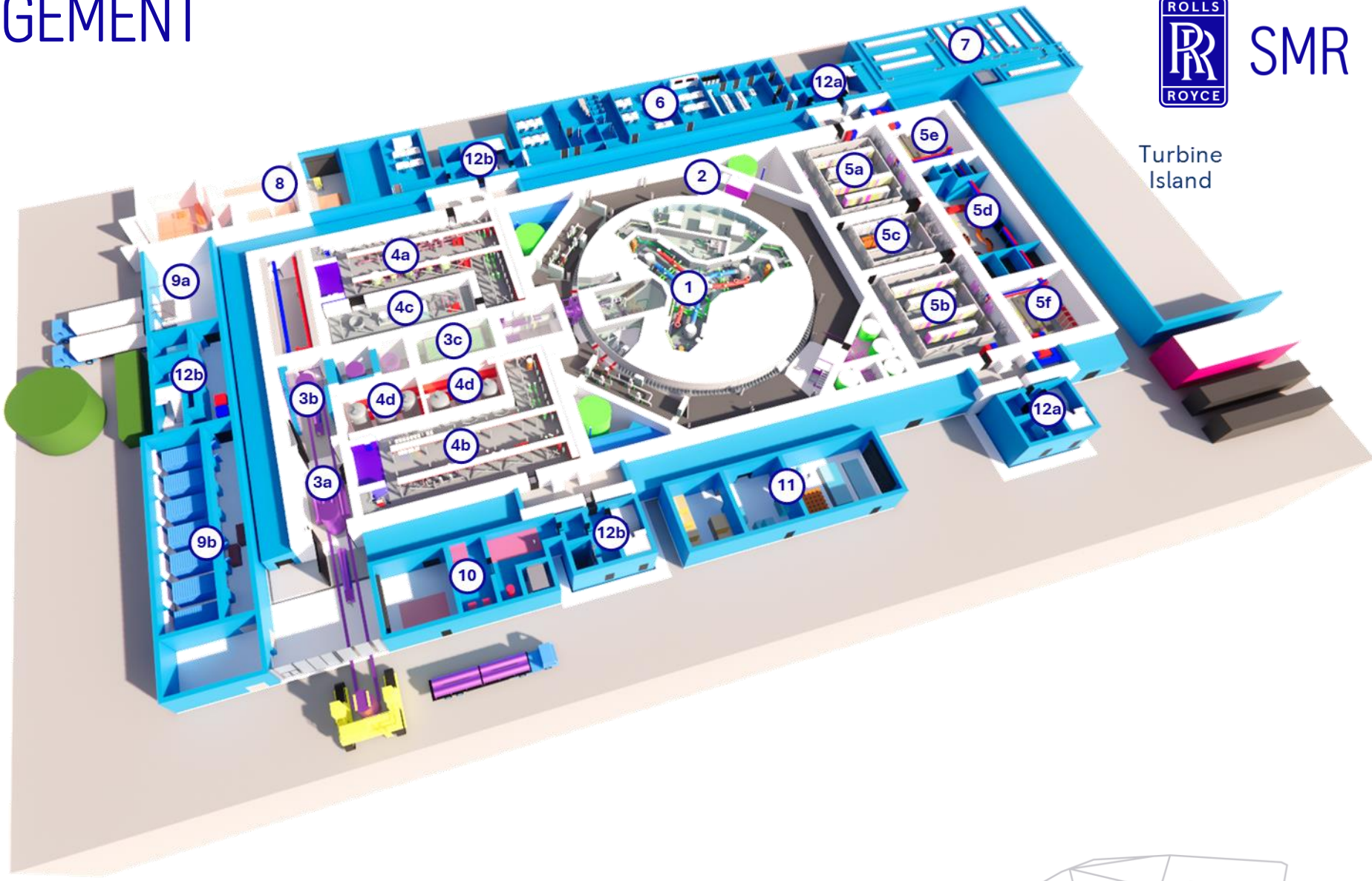
KEY TECHNICAL PARAMETERS

Parameter	Value
Reactor Power, MW_{th}	1,358
Electrical Power, MW_e	Up to 470*
Expected Availability, %	> 95
Design Life, years	60
Power Ramp Rate, %/Min	3 – 5 between 50 and 100 % power
Fuel Cycle Length, Months	18
Refuelling Outage Length, Days	< 18
Plant Coding System	RDS-PP

01 Reactor Island

GENERAL ARRANGEMENT

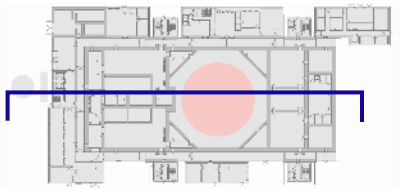
1. Containment
2. Interspace
3. Fuelling Block
   a) Fuelling Labyrinth (Cask Route)
   b) Outage and Fuelling Hoist Well
   c) Pools and Pits
4. Fluids/Auxiliary Block
   a) Fluids Train 1
   b) Fluids Train 2
   c) Shielded enclosure (KME tanks with KNF20 RO/Evaporator above)
   d) Shielded enclosures (KNF10/20 Tanks)
5. EC&I Block
   a) Division 1
   b) Division 2
   c) Division 3 with Supplementary Control Room (SCR) at Level 03
   d) Main Control Room (MCR)
   e) MCR North Annex
   f) MCR South Annex
6. Support Block
7. Duty EC&I Block
8. ILW/LLW Wet Waste Processing
9. Outage
   a) Flexi Warehouse
   b) Container Warehouse
   c) Container Warehouse Flexible Overflow
10. Hot Workshop and Decontamination
11. LLW Dry Waste Processing
12. Horizontal and Vertical Circulation
    a) Non-RCA Stair/Lift Core
    b) RCA Stair/Lift Core
    c) Ground Level 'Moat' Corridor



OVERVIEW

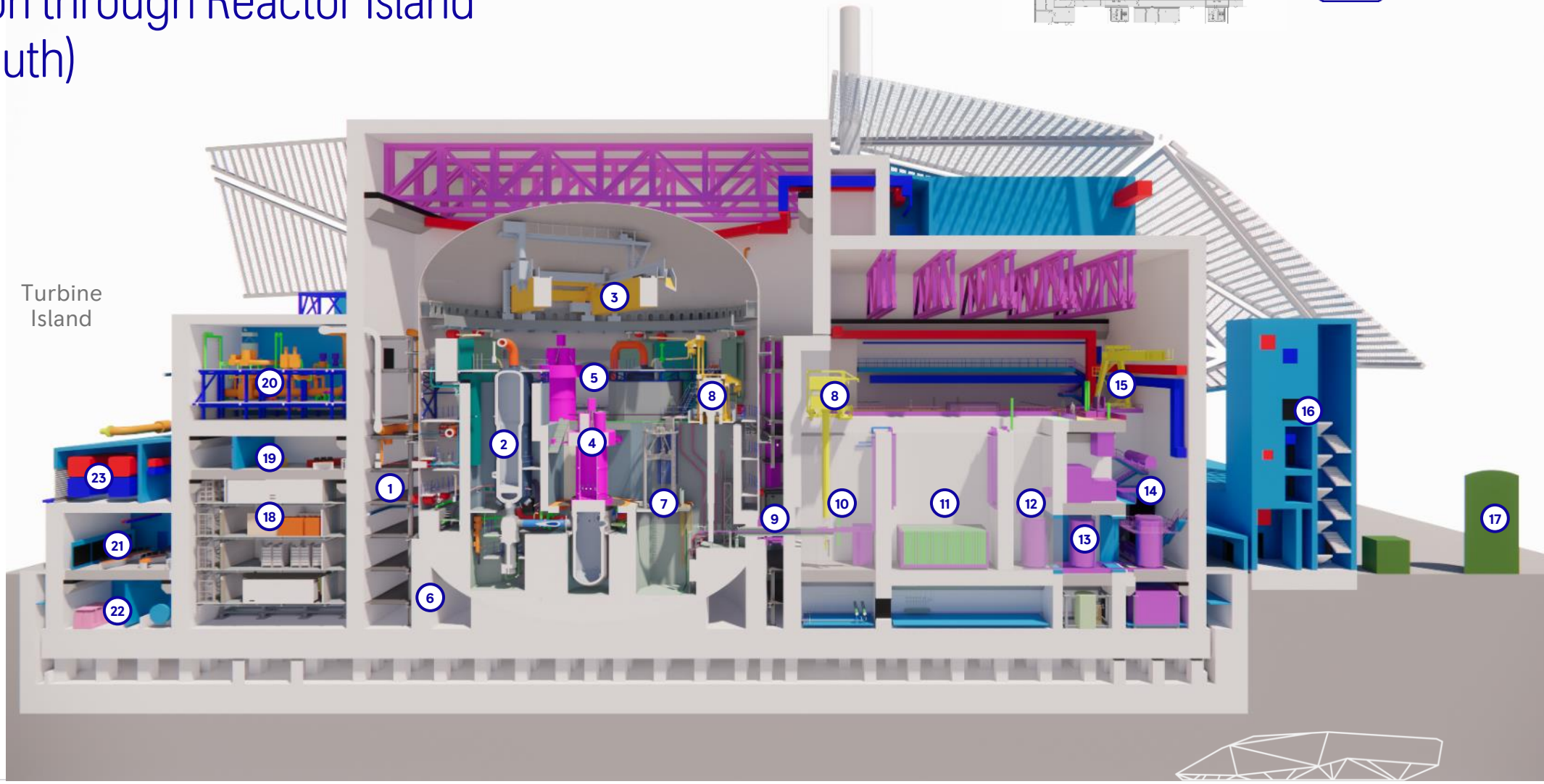
Long Section through Reactor Island (Looking South)

Key Plan:



Key

1. Interspace
2. Steam Generator
3. Polar Crane
4. Integrated Head Package (IHP)
5. Main Equipment Access Hatch (MEAH)
6. Containment Support Structure
7. Re-fuelling Pool
8. Fuel Handling Machine (FHM)
9. Fuel Transfer Channel (FTC)
10. Upender Pit
11. Spent Fuel Pool
12. Cask Loading Pit
13. Antichamber
14. Outage and Fuelling Hoist well
15. Goliath Crane
16. Circulation Core 5 housing stairs and 2 number Goods Lifts for small and medium equipment up to Level 04.5 Fuelling Deck
17. FAT Tank and equipment equivalent of a full-length type A frame located to western end of Reactor Island
18. EC&I Division 3
19. Supplementary Control Room (SCR)
20. MSIV Compartment
21. Main Control Room (MCR)
22. MCR endurance tanks and habitability gas bottles located below MCR (separated by a CKoP floor).
23. EC&I HVAC

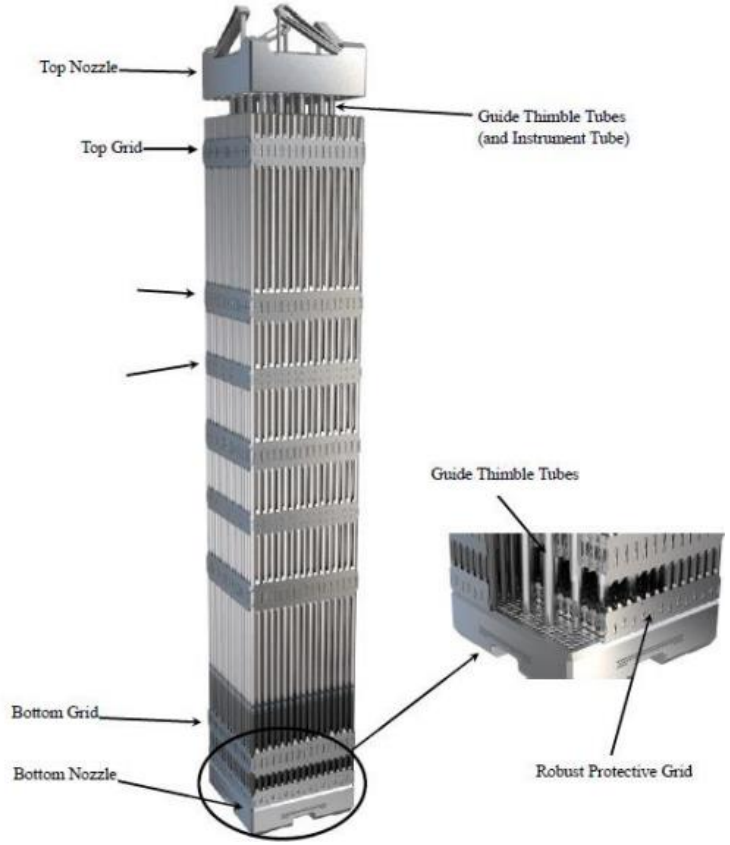


KEY FUEL PARAMETERS

Type	PWR
Fuel Enrichment	< 4.95 % U-235
Fuel Assemblies	121
Number of Loops	3
SG Tube Material	I690 TT
RCS Temp & Pressure	295 °C / 15.5 MPa 563 F / 2,248 psi
Core Power	1358 MW_{th}

FUEL DESIGN

- Fuel enriched to < 4.95 % U-235 in pellets of Uranium Dioxide (UO_2),
- Pellets enclosed in zirconium alloy tubes,
- Tubes use top and bottom plates and spacers to form a 17 x 17 array,
- Rolls-Royce SMR uses 121 fuel assemblies in the core, each approximately 3 m long (~9 feet).



OUR REACTOR ISLAND IS ALMOST ENTIRELY STANDARD

REACTOR ISLAND COMPONENTS & VESSELS

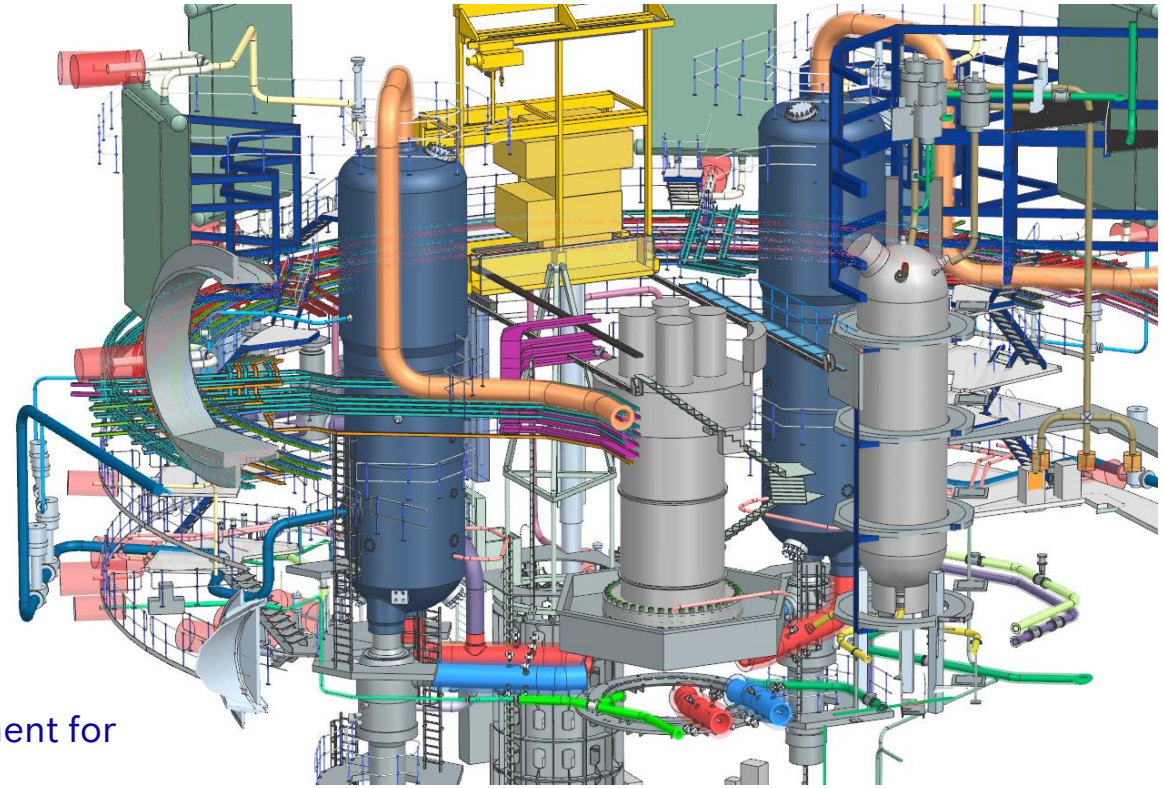
Our plant uses standard components that are all within the capabilities of multiple nuclear suppliers all around the World. This includes critical safety components such as Control Rod Drive Mechanisms as well as major tanks and vessels,

STEAM GENERATORS

The SG design is a standard U-tube SG used in plants all over the World.

CONTAINMENT

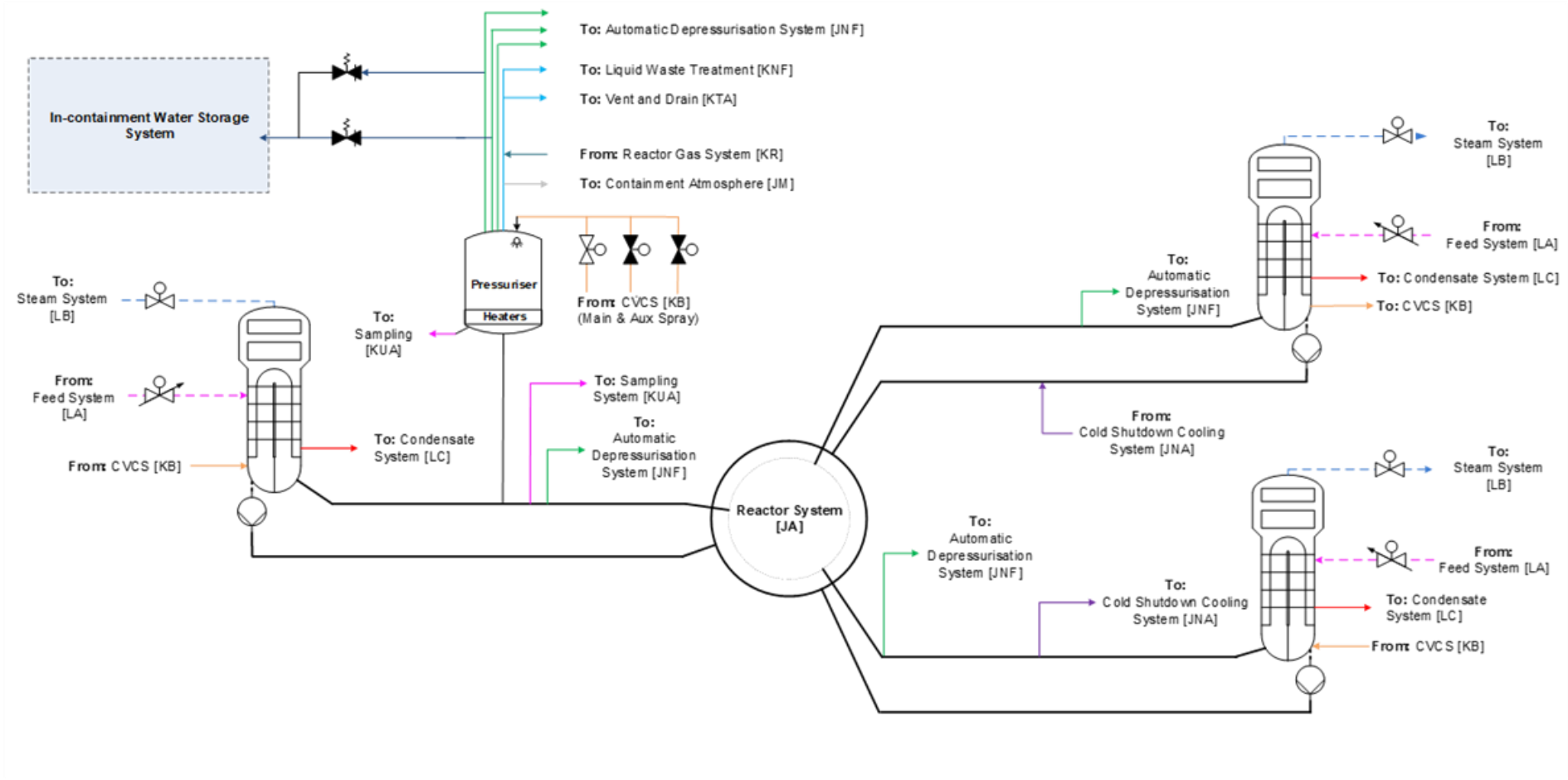
The RR SMR utilises a stand-alone steel containment vessel inside the reinforced concrete hazard shield which provides protection from external hazards. This simplifies the construction sequence. Steel containment structures are utilised in global NPPs including Vogtle.



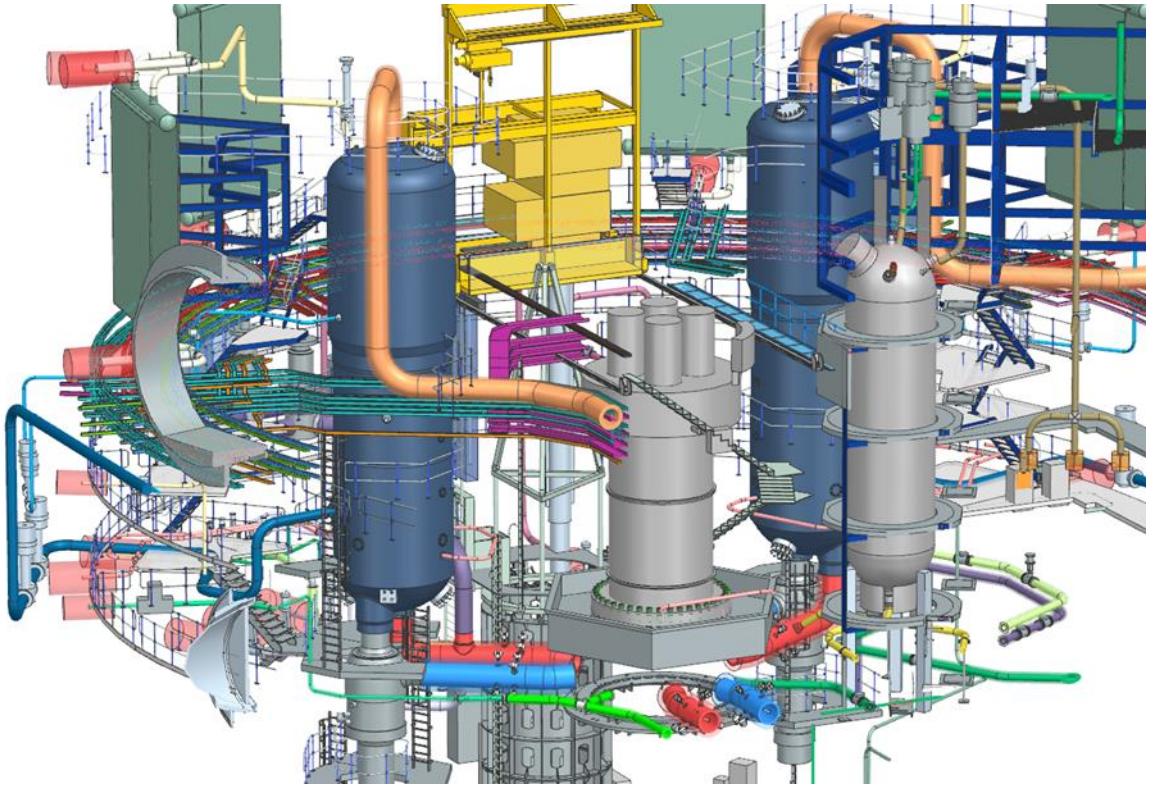
REACTOR COOLANT PUMPS

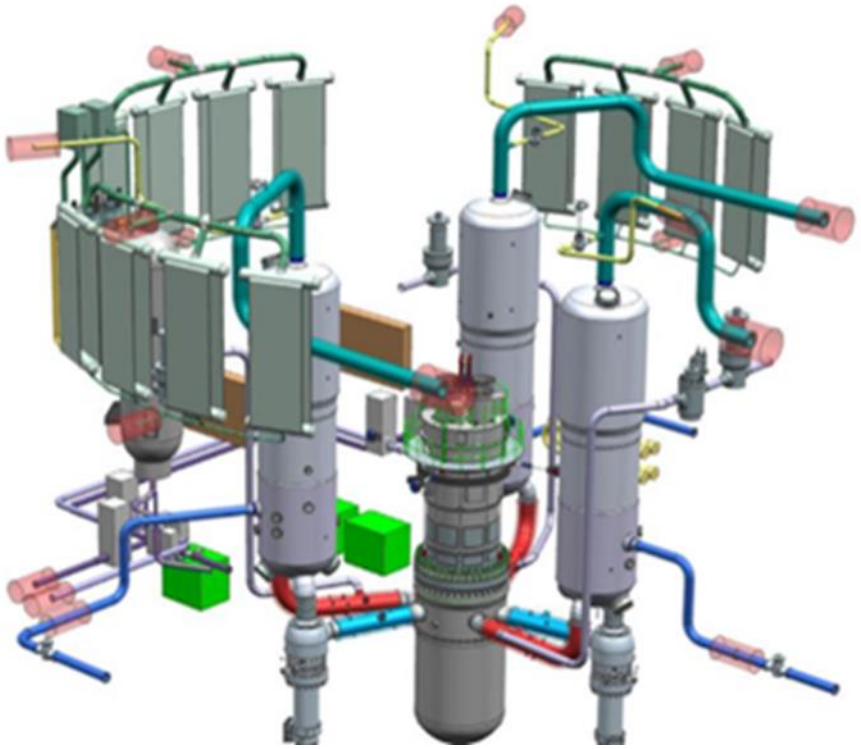
Reactor coolant pumps are based on proven seal-less designs, in development for >20 years and in operation in the US and China.

PRIMARY CIRCUIT



PRIMARY CIRCUIT



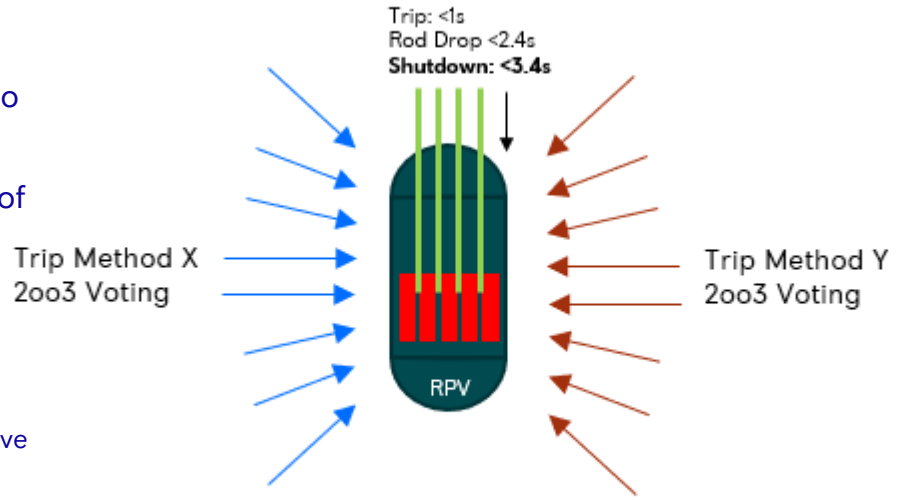


PRIMARY CIRCUIT CHEMISTRY

- Rolls-Royce SMR uses control rods and coolant temperature for power operation reactivity control,
- Full shutdown capability on control rods alone,
- Large negative moderator temperature coefficient at all times during the cycle,
- We have an Aux Shutdown Function (ASF) boron injection in case of control rod failure,
- We eliminate boron dilution faults, boric acid corrosion programmes,
- Discharges of boron and tritium drastically reduced,
- Allows the use of minimal amounts of base for pH control.

SAFETY MEASURES (Control Of Reactivity)

- The first action in response to most faults is to shutdown the reactor.
- Shutdown reduces the heat production rate of the plant (decay heat production only).
- The RR SMR has two means of achieving shutdown:
  - **Control rod insertion:**
    - Duty Shutdown (Cat C) – slow and active (motor driven control rod drive mechanisms).
    - Scram (Cat A) – fast and passive (gravity).
  - **Reactor coolant boration:**
    - Alternative Shutdown Function (Cat B) – fast and active (pumped boron).
- In some faults, these shutdown means are complemented by elevated coolant temperature failing to provide sufficient moderation to maintain criticality, which provides inherent and passive shutdown during a fault.



Scram:

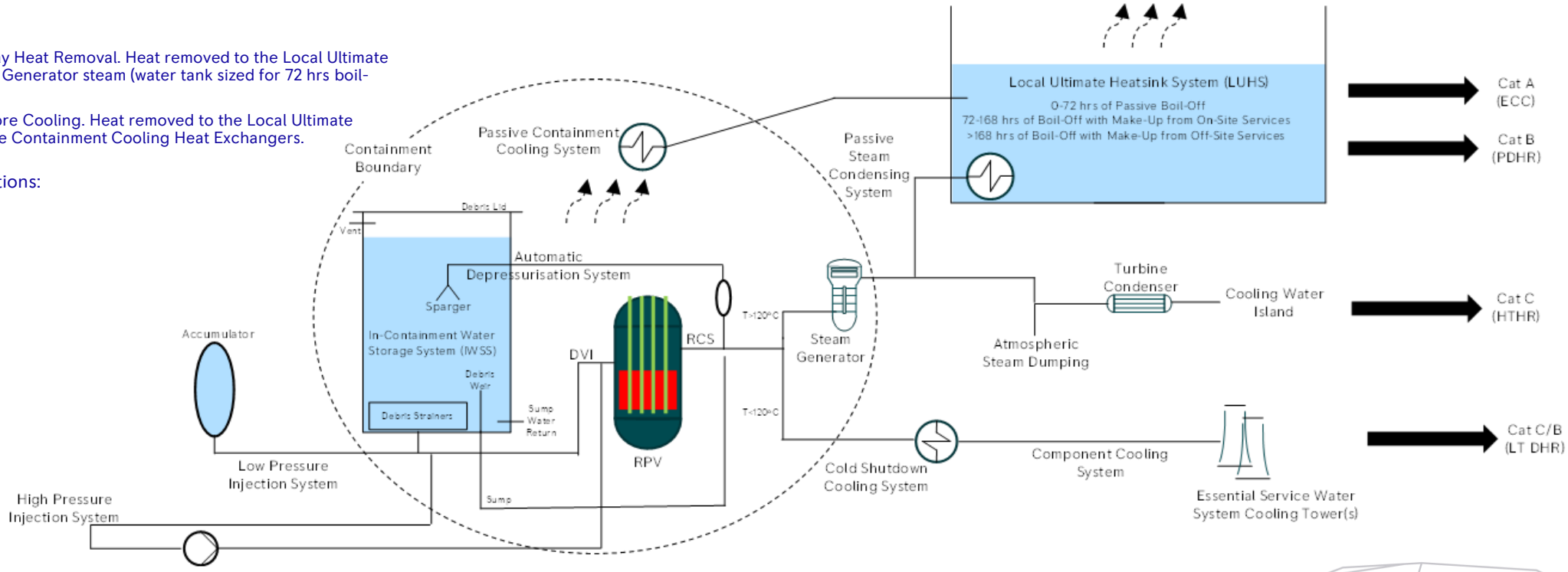
- 89 control rods insert into a core of 121 fuel assemblies.
- Full cold shutdown capacity within 3.4s.
- Tolerant to stuck rod
- Redundant (1oo2) power breakers to initiate:
  1) RPS: 2oo3 sensor voting logic
  2) DPS: 2oo3 sensor voting logic
- Measure tolerant to worst credible single failure

Alternative Shutdown Function:

- ~4 m^3 (~ 141 ft^3) boron solution achieves reactor shutdown.
- ~40 m^3 (~ 1412 ft^3) boron solution in refuelling pool protects small (frequent) leaks.
- Delivery to the reactor via High Pressure Injection System at ~10 kg/s (~ 22lb/s).
- 1oo2 redundancy on fluid system trains (excl. boron tank, which is 1oo1).
- DBC-4 with clean up required after use.

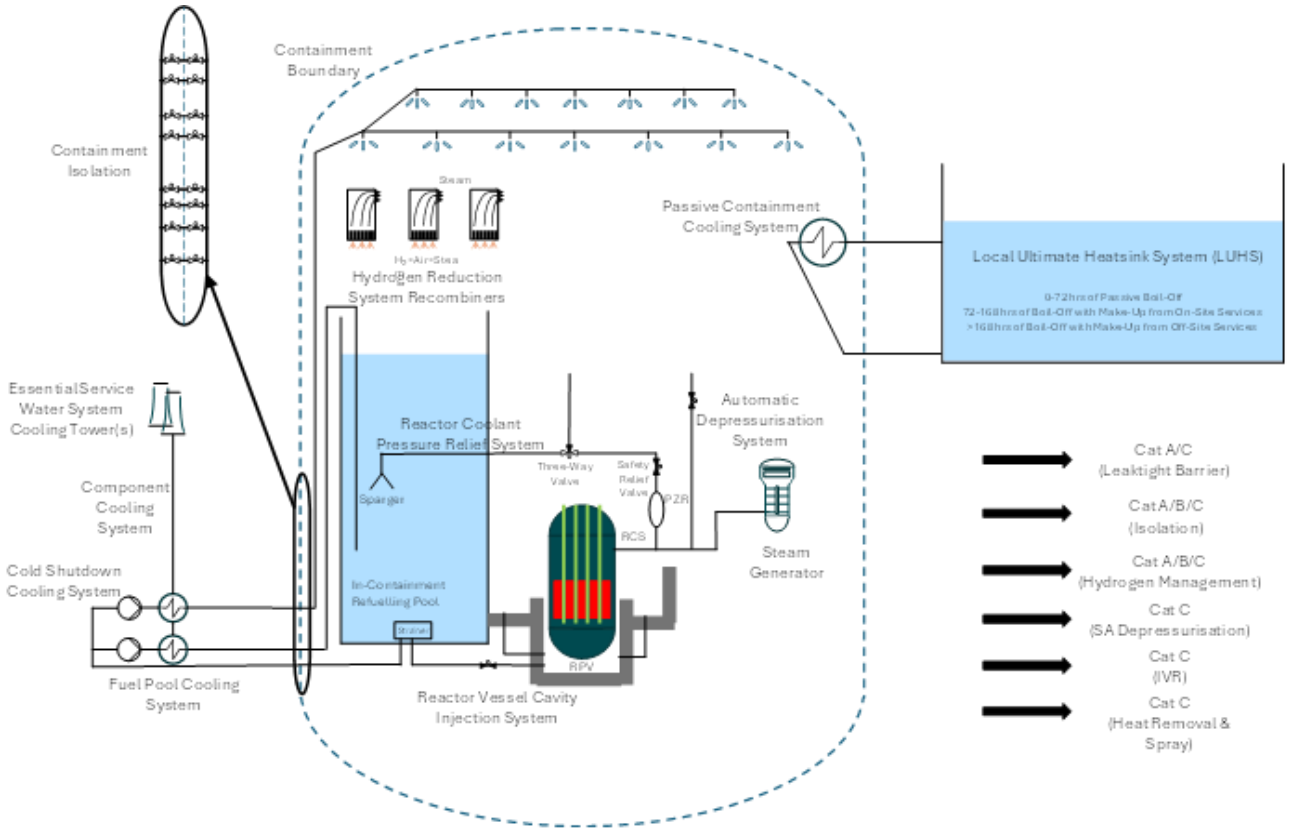
SAFETY MEASURES (Control Of Fuel Temperature)

- Once the reactor is shutdown, decay heat is removed.
- Duty Heat Removal:
  - **HTHR:** High temperature (reactor coolant >120°C/248 °F) heat is removed to the turbine condenser (cooling tower heat sink)
  - **LTDHR:** Low temperature (reactor coolant <120°C/248 °F) heat is removed to the Essential Service Water System (cooling tower heat sink)
- Faulted Heat Removal:
  - **PDHR:** Passive Decay Heat Removal. Heat removed to the Local Ultimate Heat Sink via Steam Generator steam (water tank sized for 72 hrs boil-off).
  - **ECC:** Emergency Core Cooling. Heat removed to the Local Ultimate Heat Sink via Passive Containment Cooling Heat Exchangers.
- Design Extension Conditions:
  - Not shown

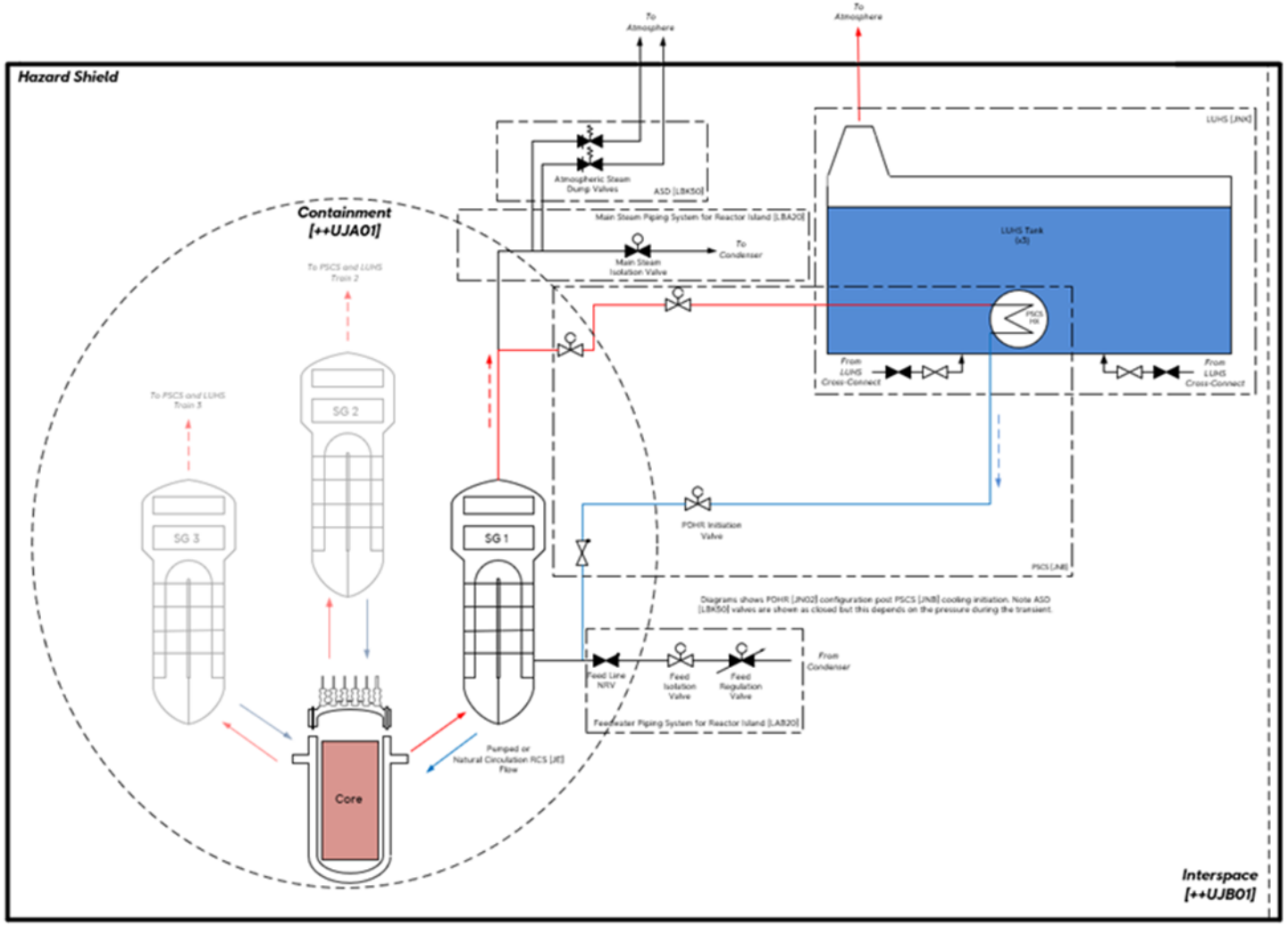


SAFETY MEASURES (Containment)

- Principal confinement functions in the SMR design:
  - **Containment isolation functions.** A graded approach to isolating the containment vessel boundary in faults. Only permitting open penetrations where required for Safety Measures.
  - **Severe Accident Depressurisation functions.** Ensuring that, in Severe Accident conditions, the Reactor Coolant System is de-pressurised. Mitigate risk of core melt ejection (in-conjunction with In-Vessel Retention).
  - **In-Vessel Retention (IVR) functions.** Ensuring that, in Severe Accident conditions, the Reactor Pressure Vessel body is cooled to maintain its integrity (contain molten fuel) and heat is removed from the containment atmosphere via Passive Containment Cooling (PCC).
  - **Diverse containment cooling functions.** Providing diversity to PCC for maintaining containment vessel integrity and removing decay heat.
  - **Hydrogen reduction functions.** Mitigating the risk of detonation, which could compromise the integrity of Structures, Systems and Components demanded by Safety Measures.

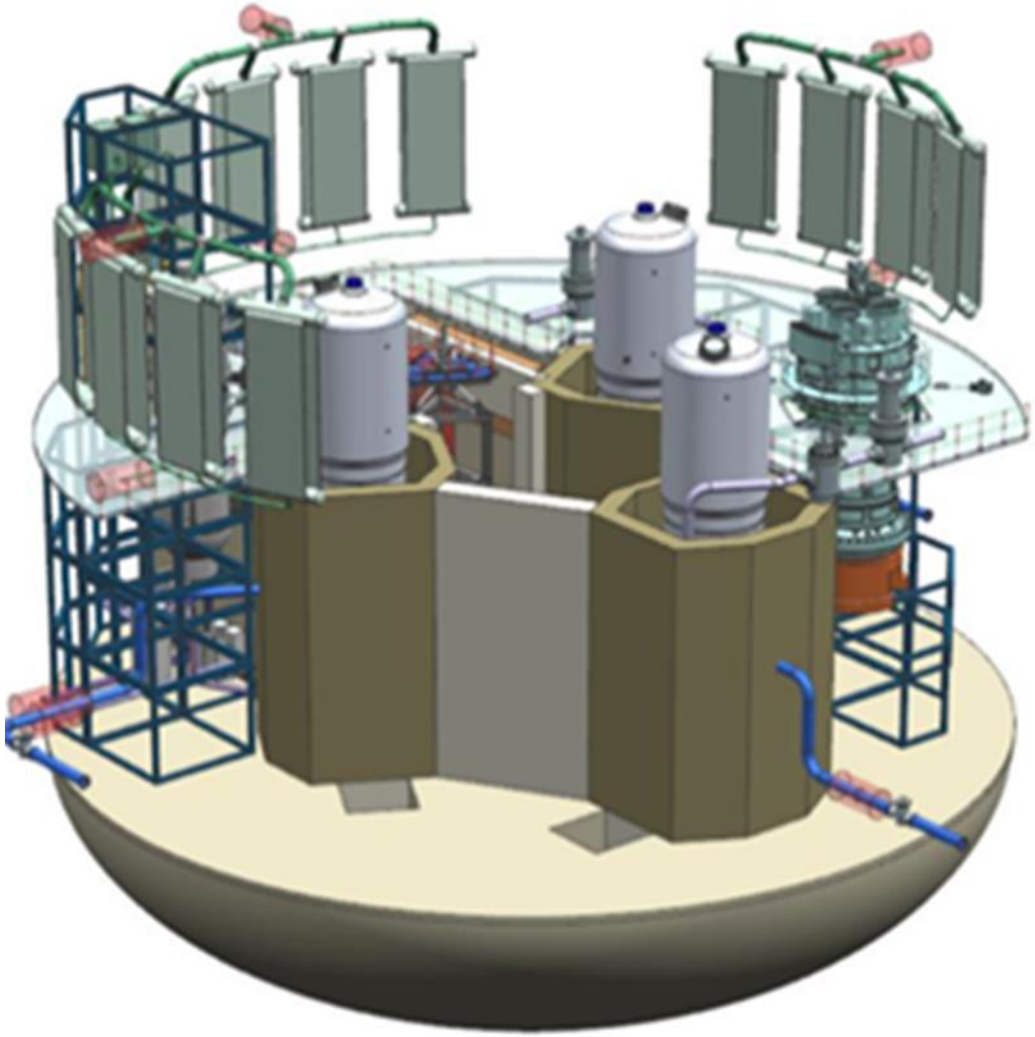


LUHS AND PASSIVE CONTAINMENT COOLING

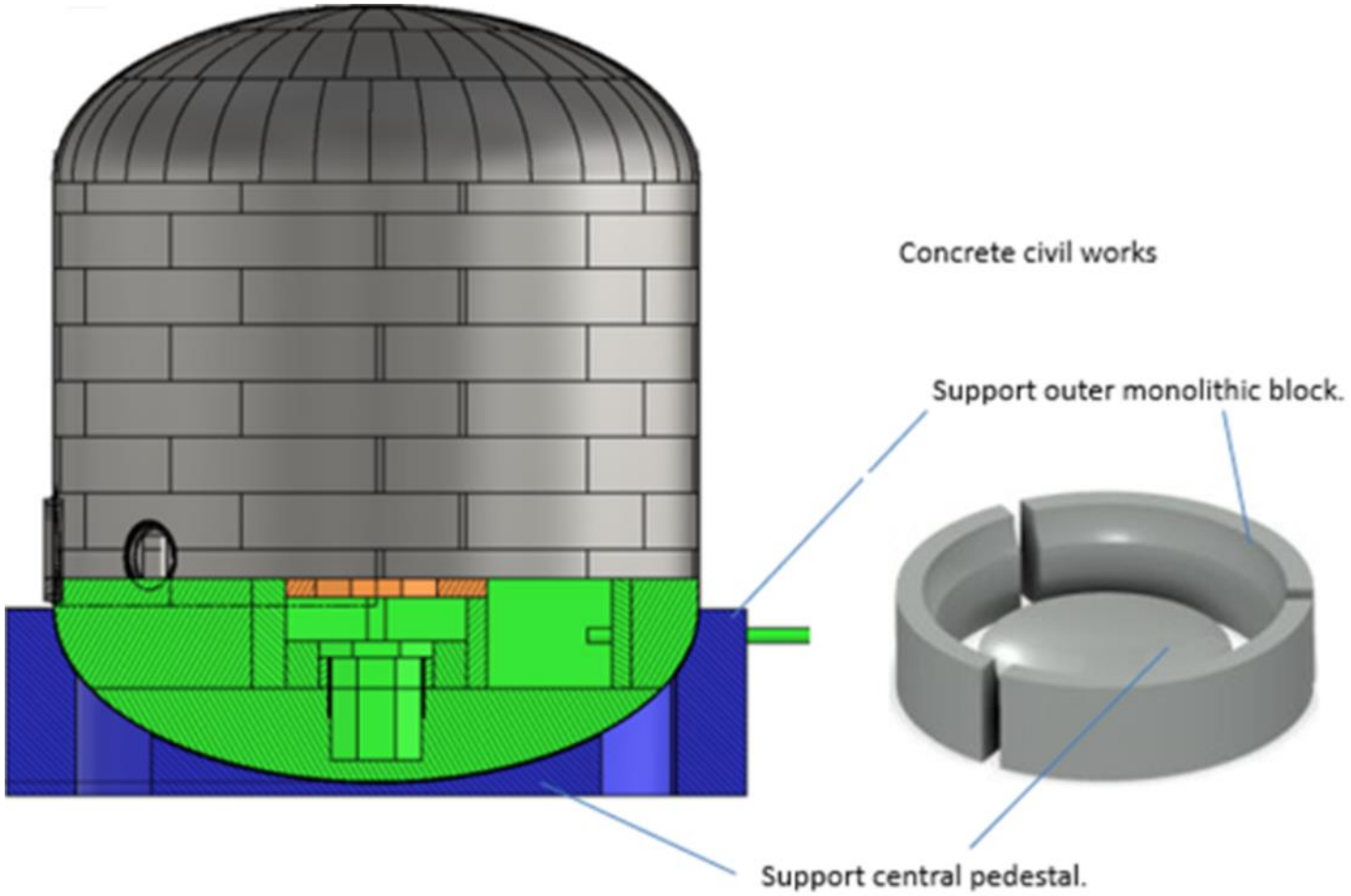


- 1 LUHS train provides 24 hours cooling,
- 2 LUHS trains provide 72 hours cooling,
- 3 LUHS trains provided.

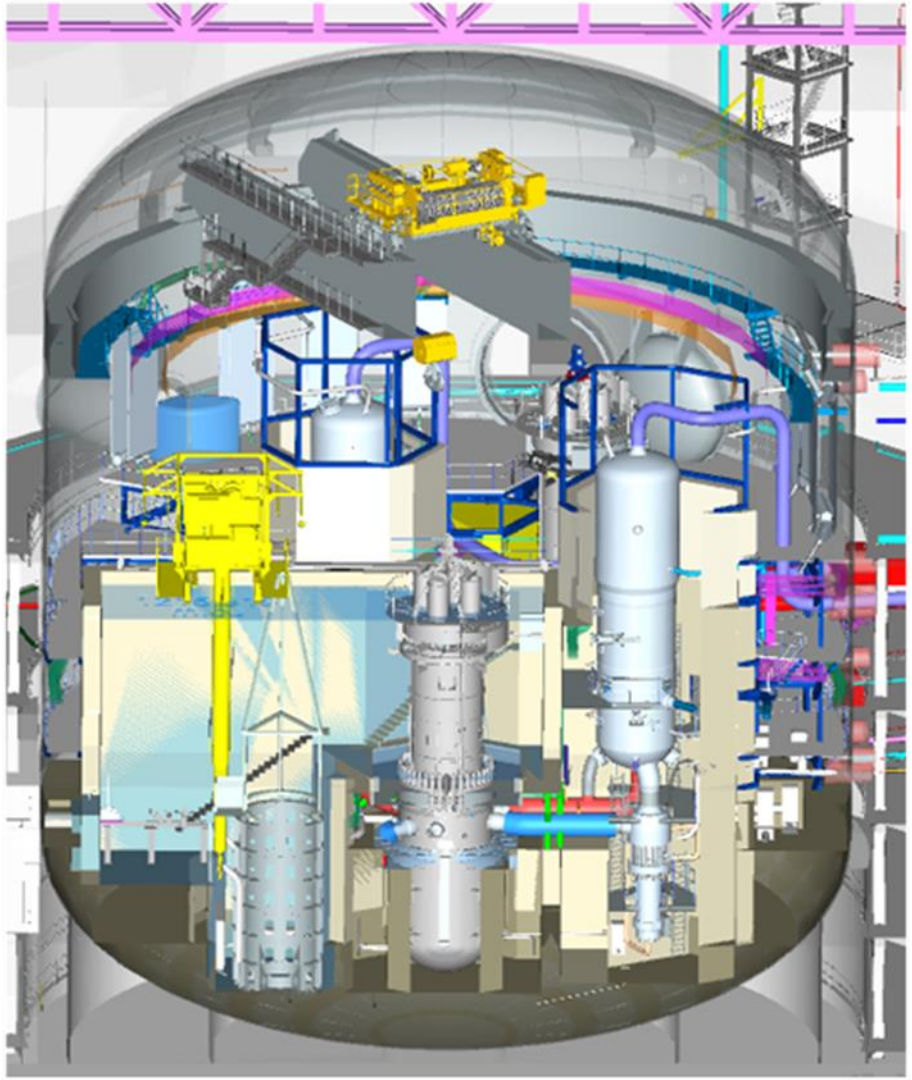
LUHS AND PASSIVE CONTAINMENT COOLING



CONTAINMENT

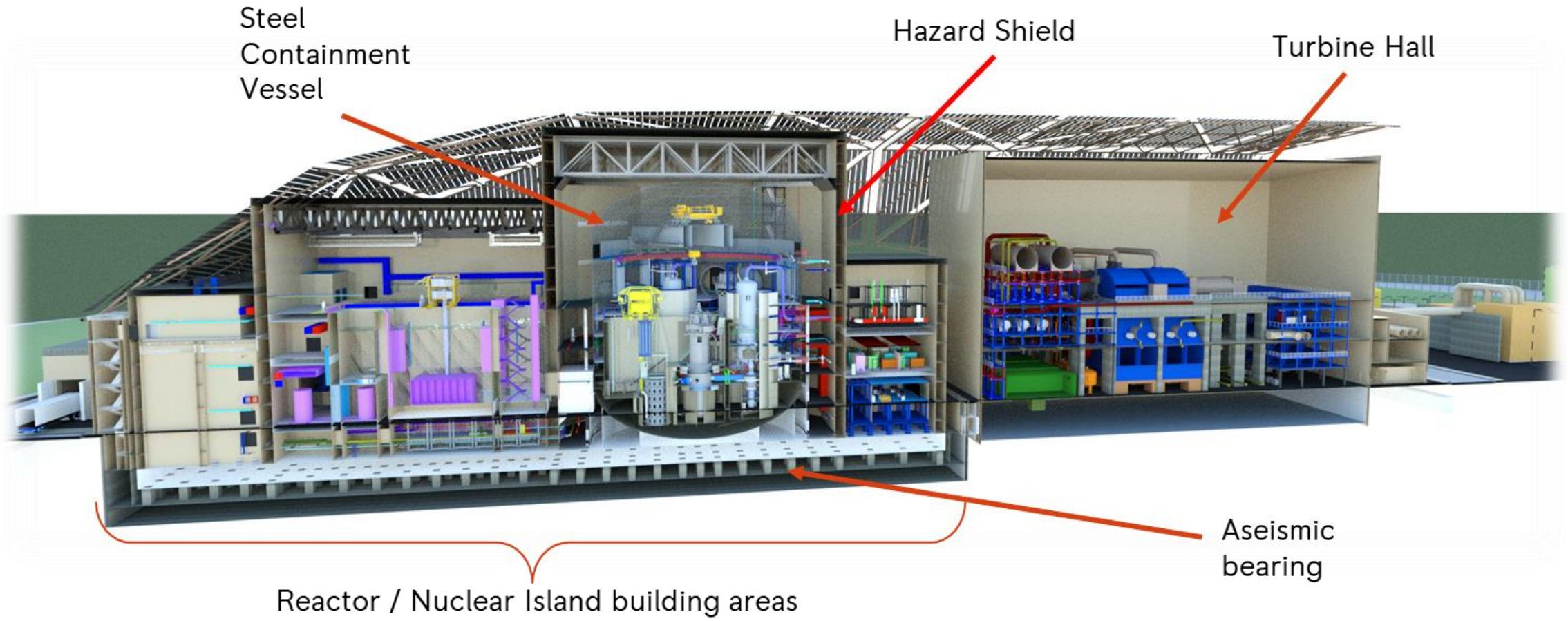


CONTAINMENT



02 Turbine & Circulating Water Island

PLANT LAYOUT



OUR TURBINE ISLAND IS ALMOST ENTIRELY STANDARD

MAIN STEAM TURBINE - GENERATOR

The technology at the heart of the 50 Hz TI proposed is developed on the Siemens SST-8000 which is a commercially available steam turbine based on mature technology and industry best practice.

WASTE STORAGE

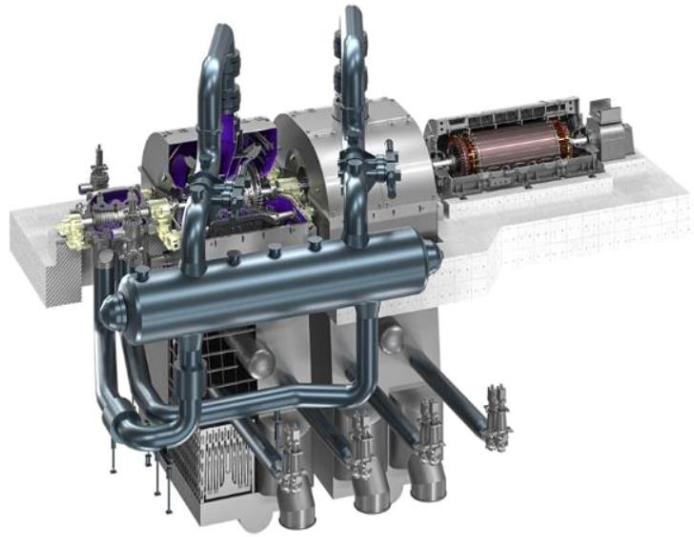
Our plant is designed to accommodate standard spent fuel casks. Increasing flexibility for operators and removing the need for novel spent fuel storage solutions.

BALANCE OF PLANT

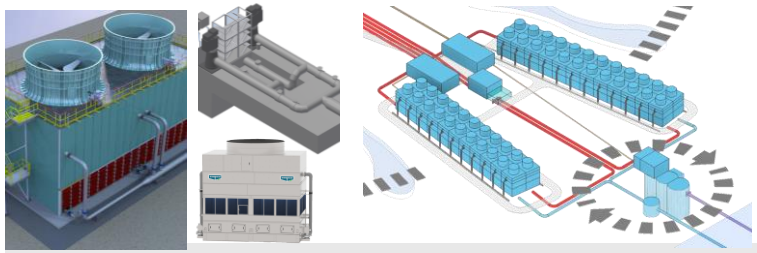
OEM Modules (Skids): In instances where systems are determined to be small enough to be fully self-contained, to have low build complexity, to not feature in a cluster of functional system modules, or to be available as commercial off-the-shelf modules, they will be supplied directly from an OEM, providing the most expedient and cost-effective solution.

COOLING WATER ISLAND

Our cooling water solution is similar to those adopted by other PWR power stations around the world. Our plant does not rely on the main cooling water for safety, which greatly reduces complexity and cost of the cooling water infrastructure. There are two variants for cooling water solution depending on site location – direct (sea) water cooling and an indirect mechanical forced draft system for sites with more limited water availability.

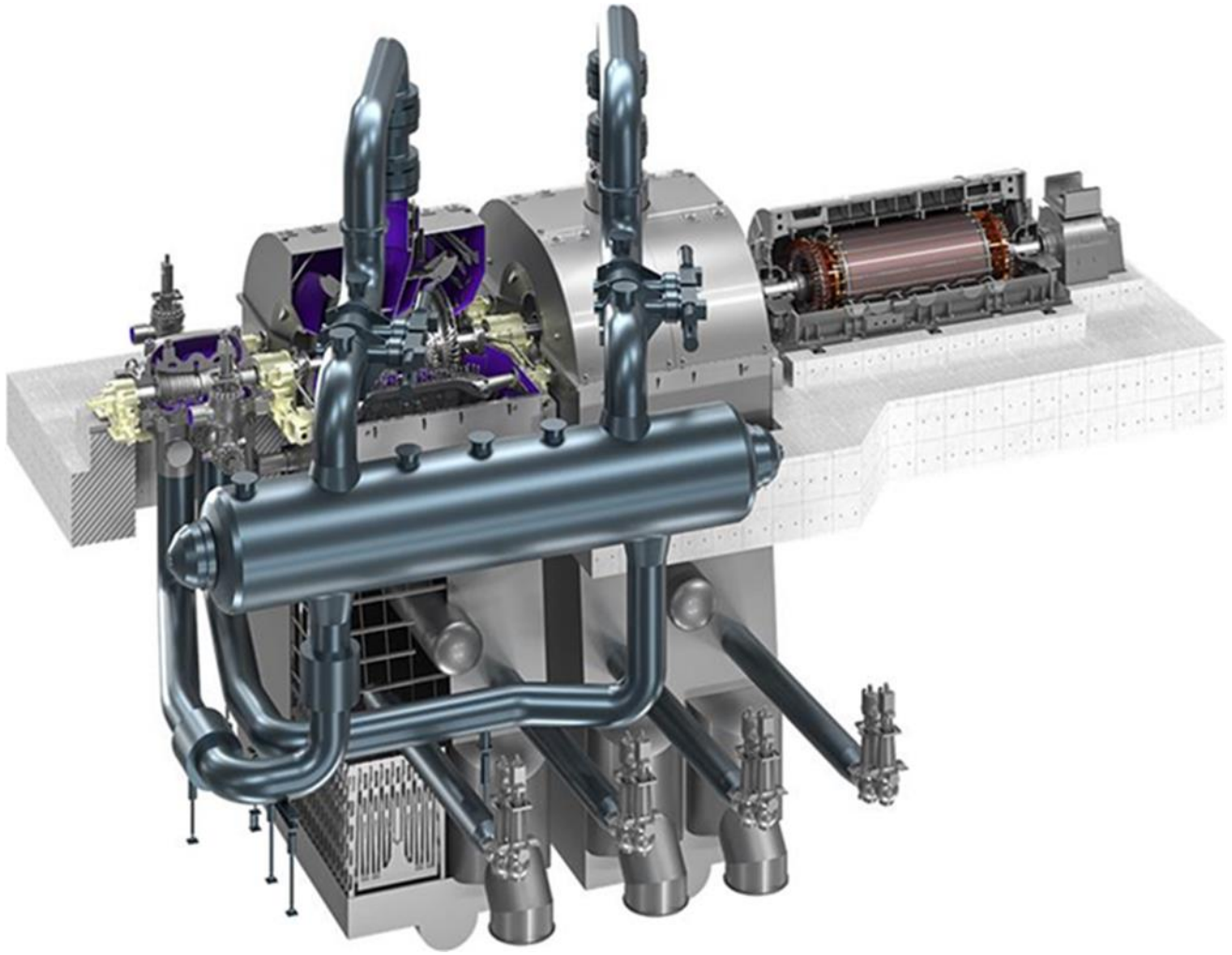


ROLLS-ROYCE SMR STANDARD SIEMENS TURBINE

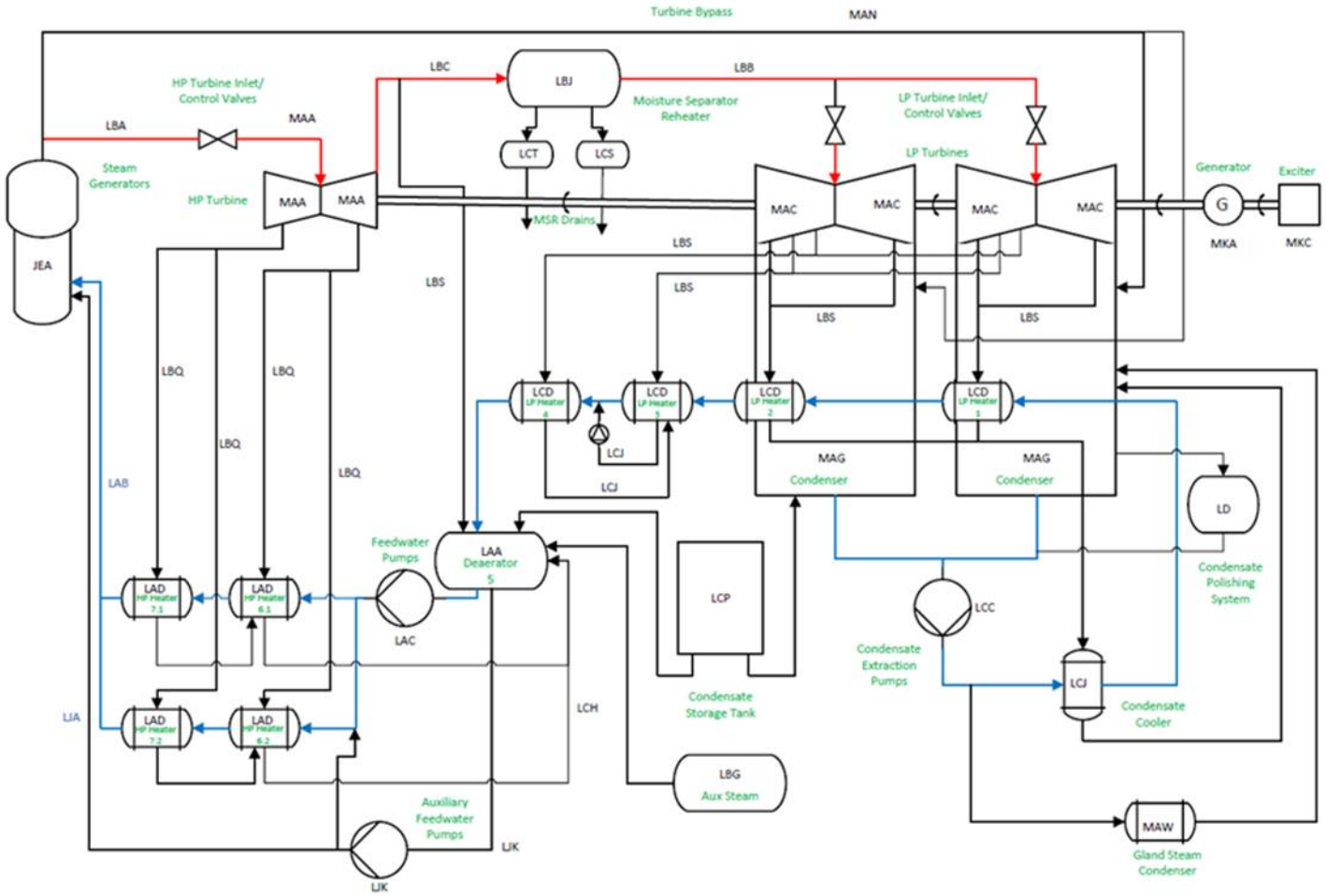


ROLLS-ROYCE SMR INDIRECT COOLING SOLUTION
BASED ON PROVEN EXISTING TEHNOLOGY

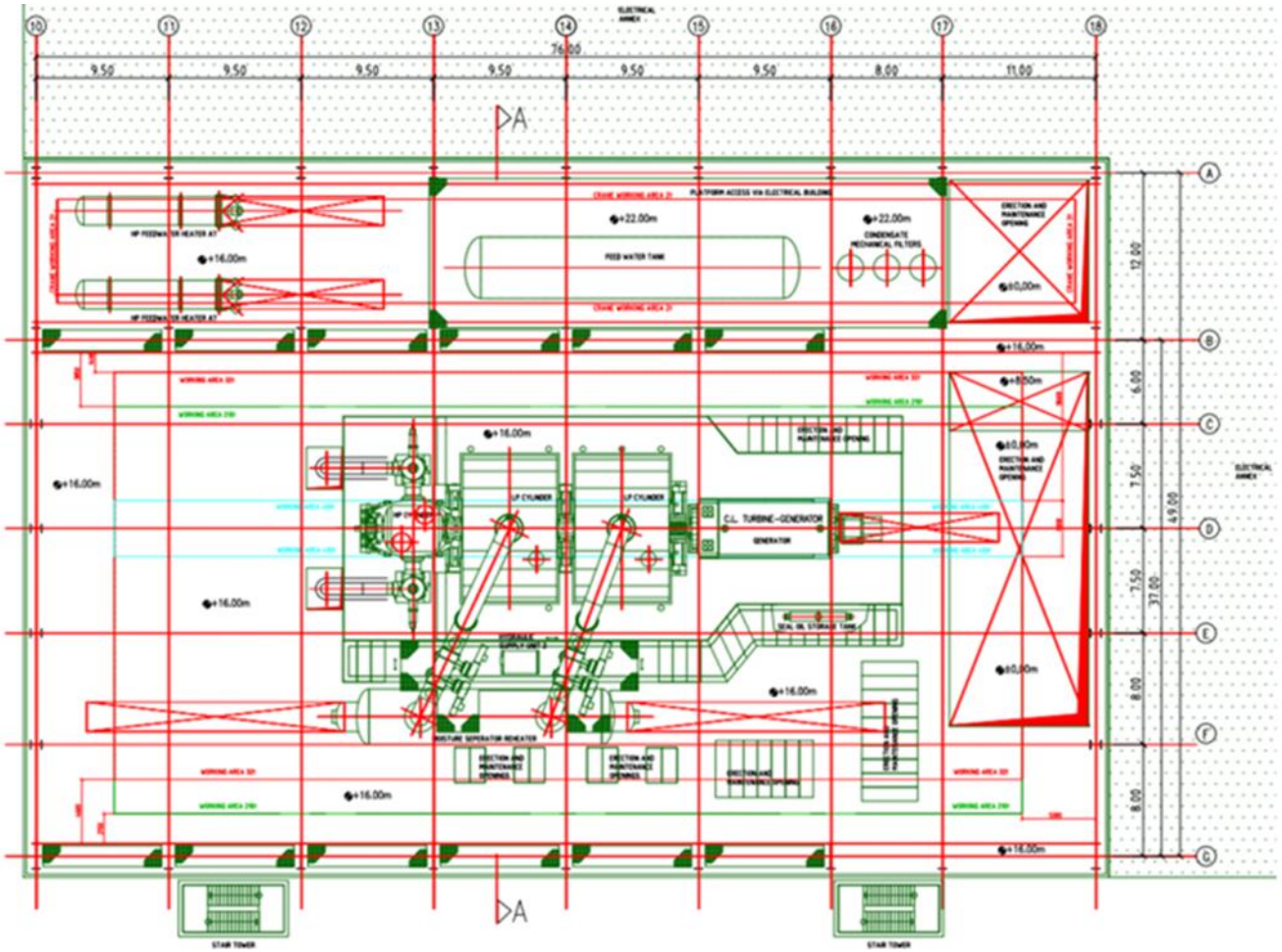
TURBO-GENERATOR ARRANGEMENT



SECONDARY CIRCUIT



SECONDARY CIRCUIT



INDIRECT CIRCULATING WATER SYSTEM

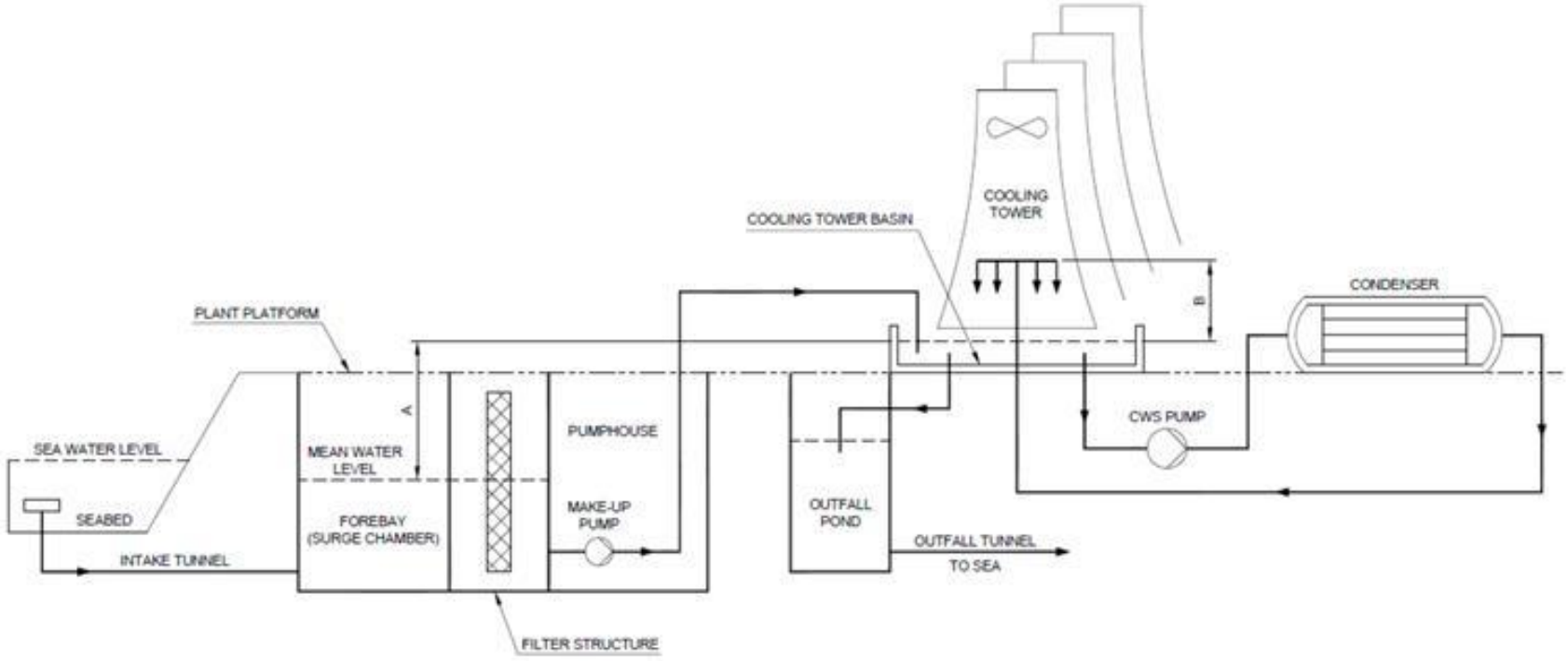


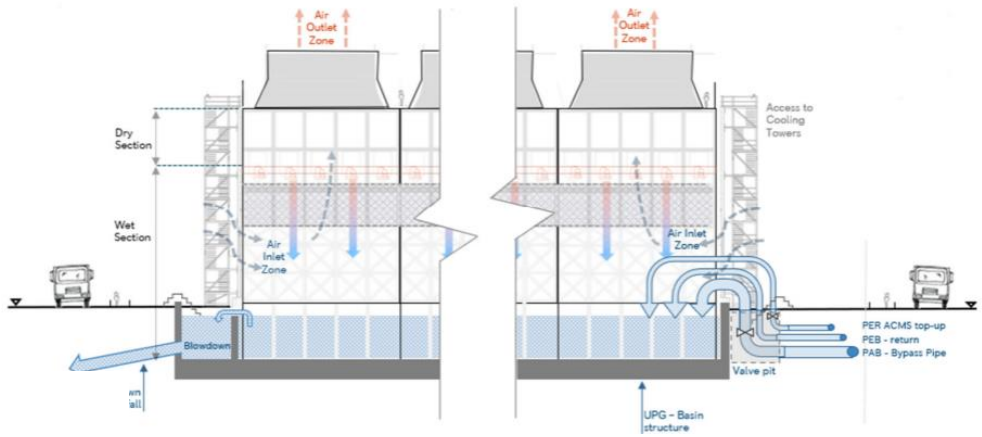
Figure 1 - Indirect cooling diagram

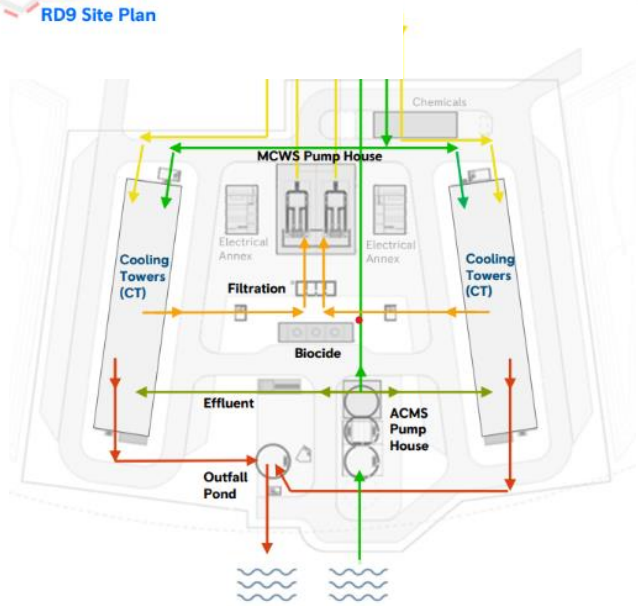
INDICATIVE COOLING ISLAND LAYOUTS

RD9 MASTERPLAN

1. Chemical Storage (UPN)
2. Effluent Treatment (ZXH02)
3. **Cooling Towers / Basin (UPG)**
4. Electrical Annexes (UBB)
5. MCWS Pump House (UPC)
6. MCWS Filtration (UPC)
7. Biocide Treatment Tanks (UPN)
8. ACMS (UPF)
9. Outfall Pond (UPK)
10. Attenuation Ponds (code TBC)
11. Water Source

(assigned RDS-PP CSA code)





DIRECT CIRCULATING WATER SYSTEM

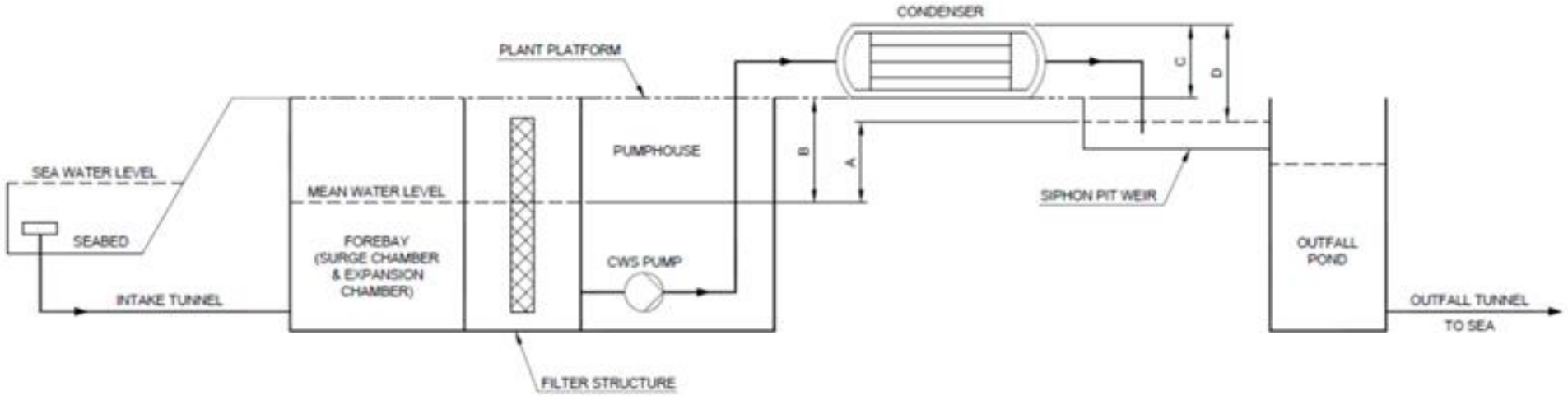
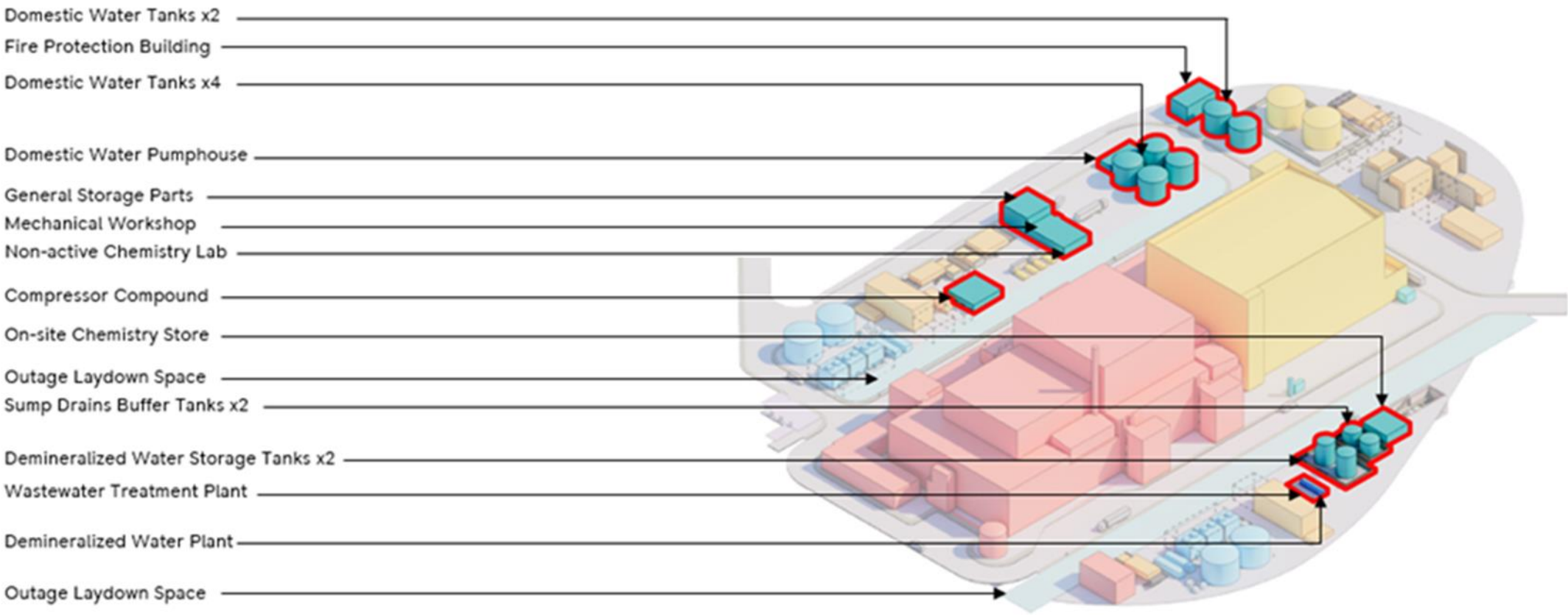


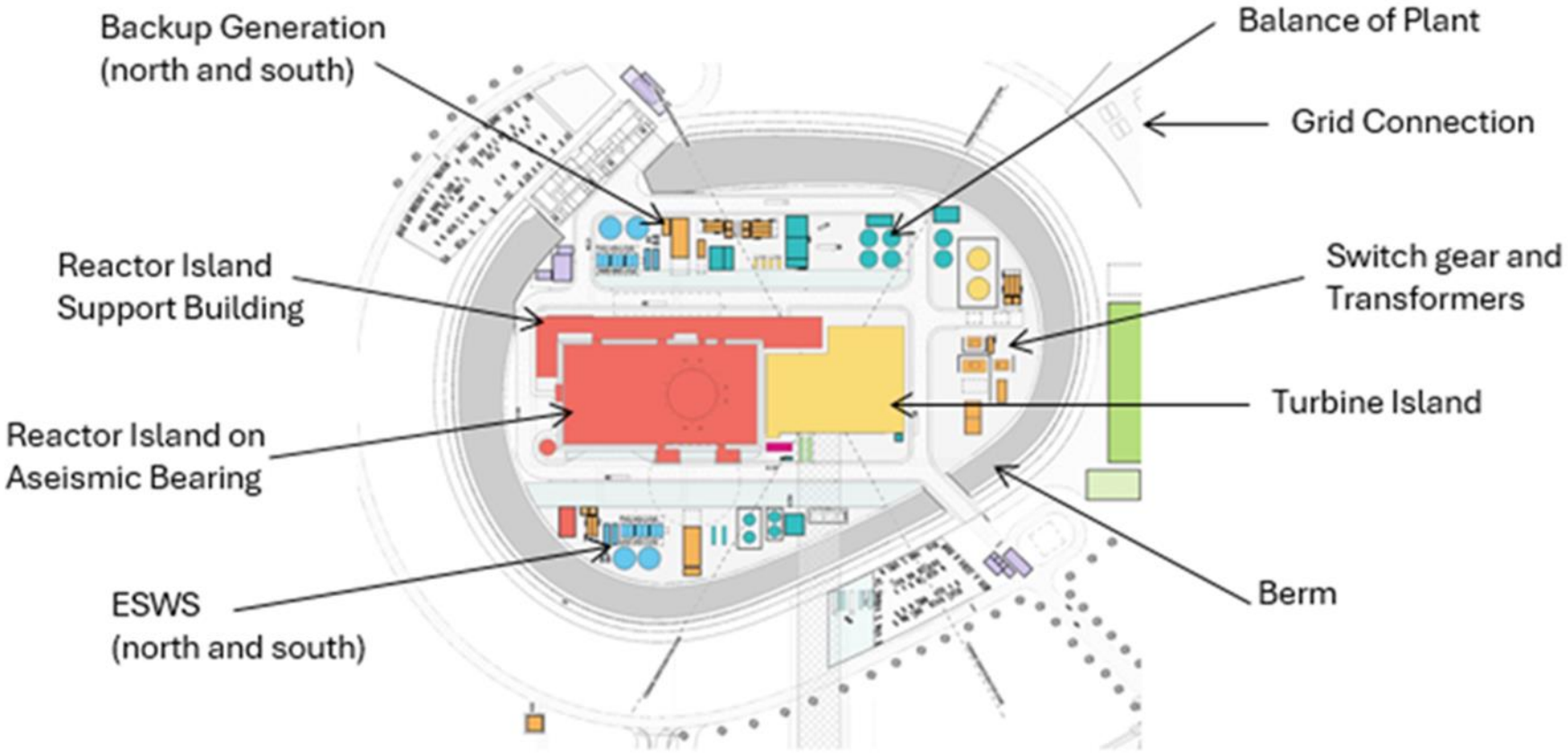
Figure 1- Direct cooling diagram

03 Balance of Plant, Layout & Modularization

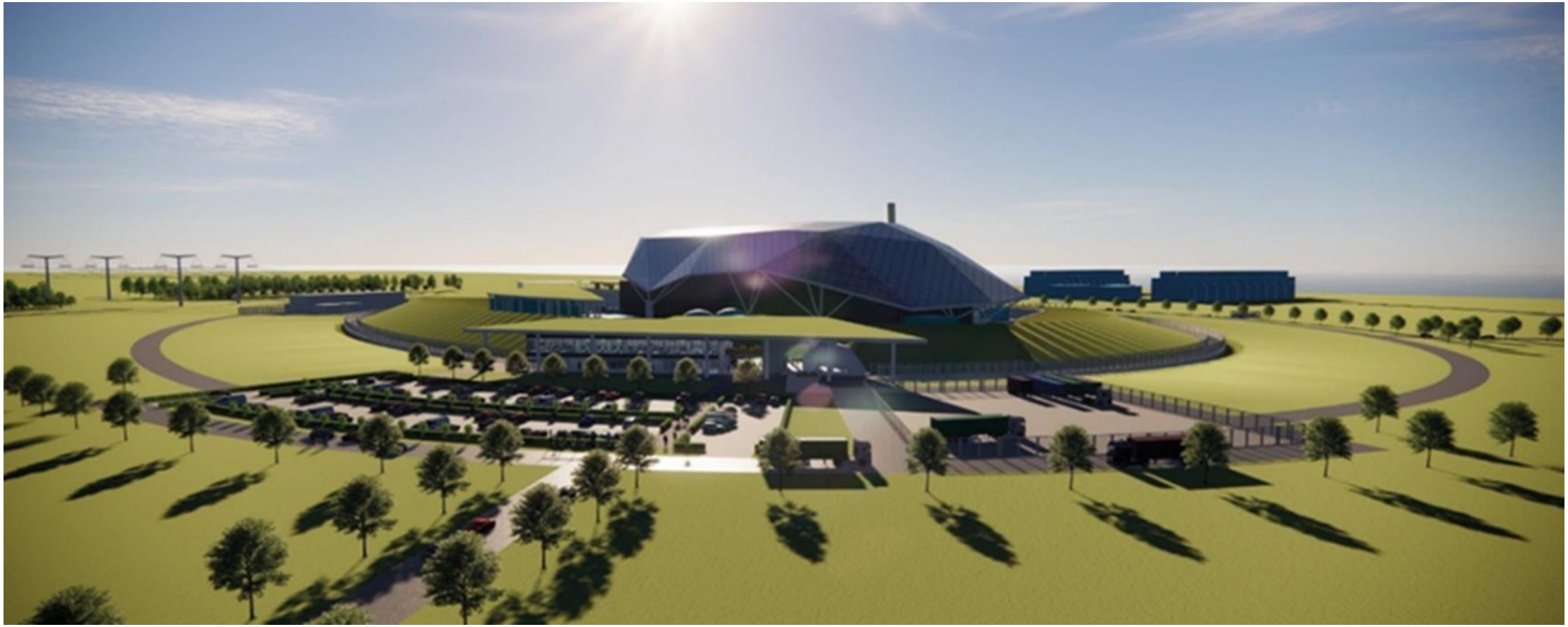
BALANCE OF PLANT



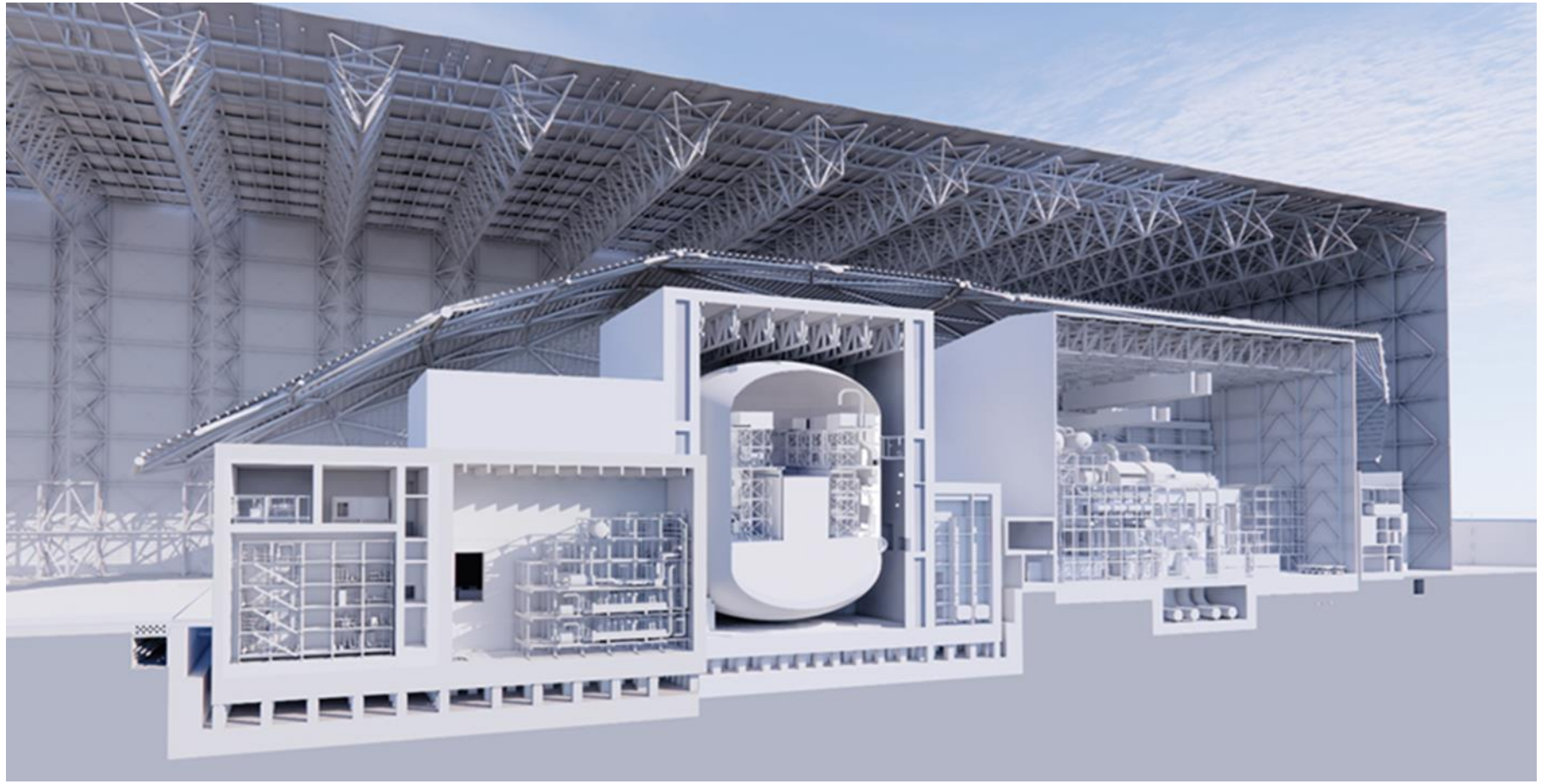
SITE LAYOUT



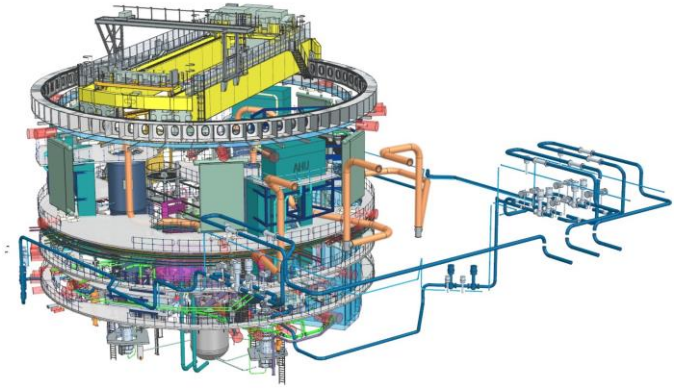
ARTIST'S IMPRESSION



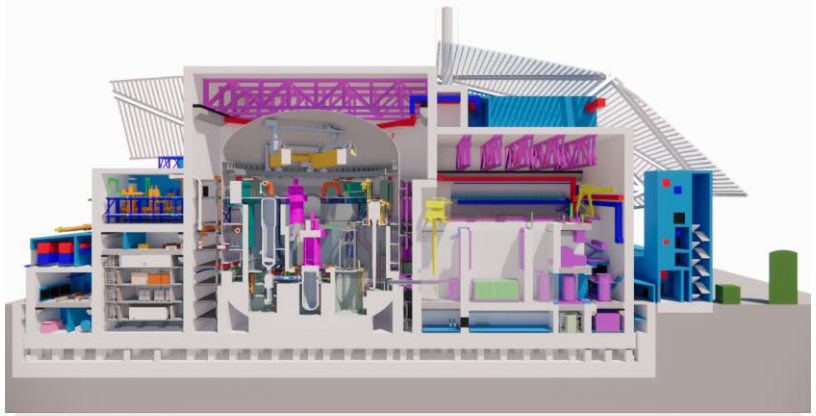
CUTAWAY (UNDER CONSTRUCTION)



DETAILED INSTALLATION DESIGN

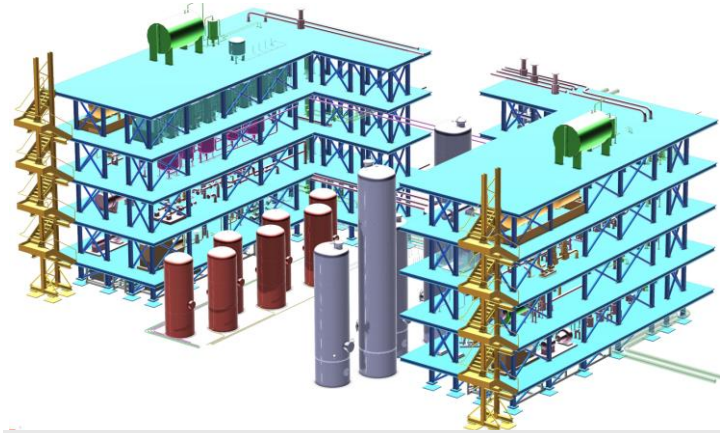


DETAILED IN-CONTAINMENT LAYOUT OPTIMIZATION

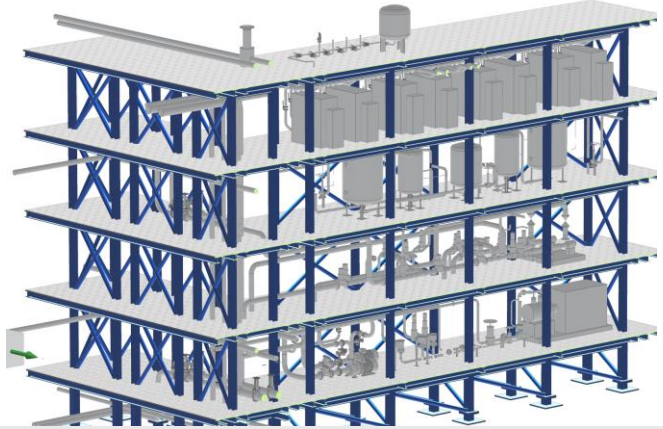


OPTIMIZED COMPACT RI LAYOUT

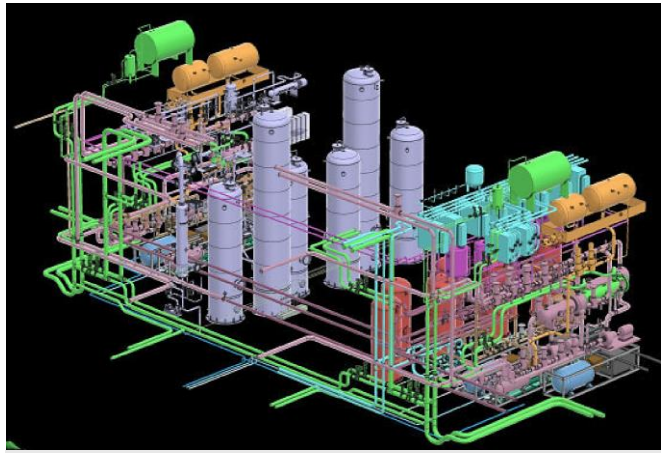
REACTOR ISLAND CROSS SECTION THROUGH FLUIDS AND FUEL BLOCK



FLUIDS BLOCKS ISOMETRIC



DETAILED FLUID BLOCK LAYOUT

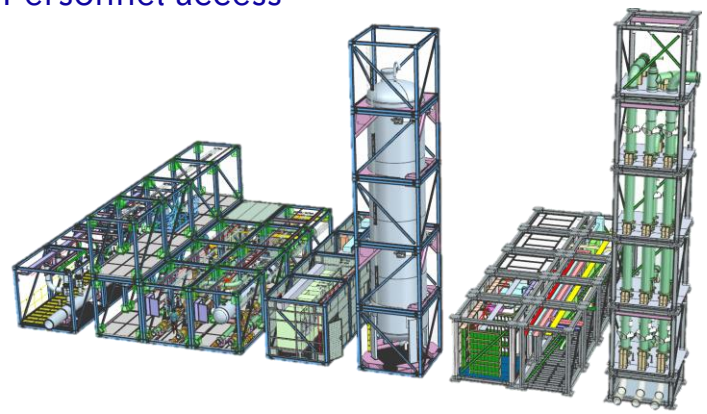


EQUIPMENT INSTALLATION DESIGN (FRAMES REMOVED)

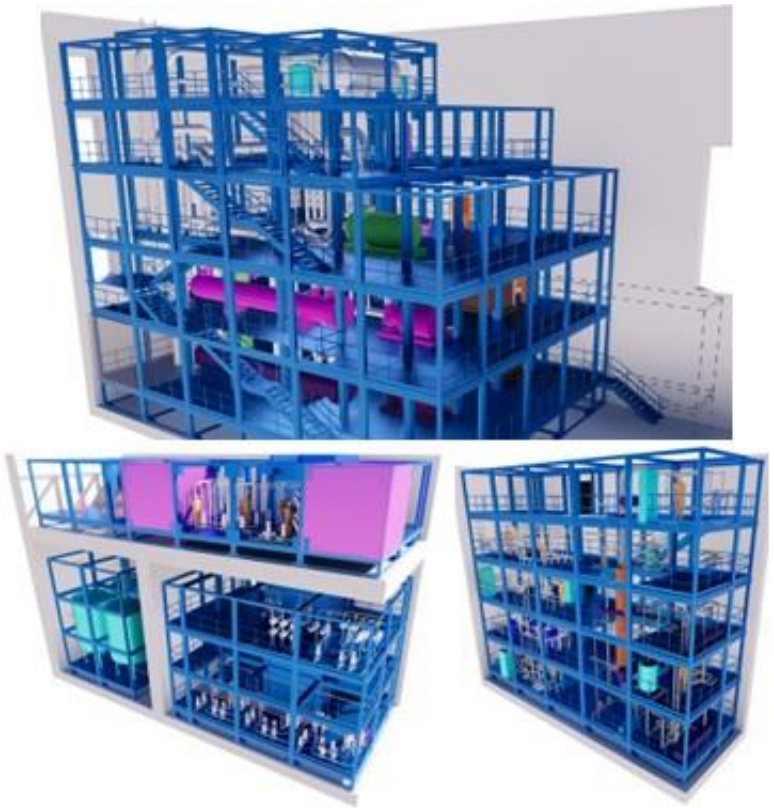
DESIGNED FOR MODULARIZATION

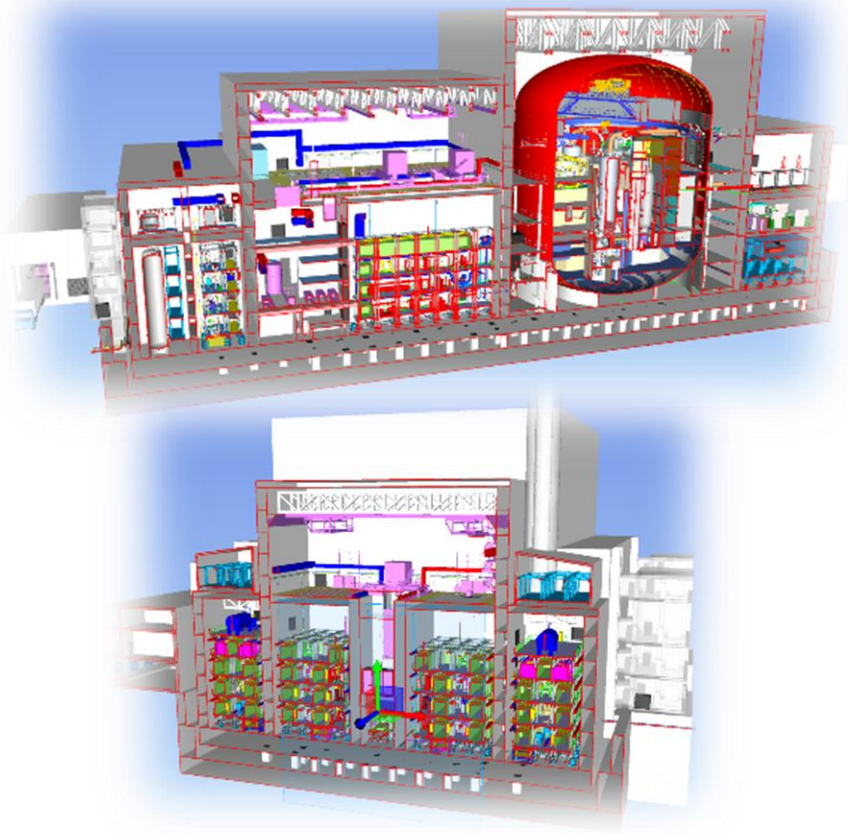
Standard Modules:

- Vertical and horizontal MEP modules
- Tank modules
- Personnel access
- Pipe cable and utility routing
- Shielding and segregation
- Structural modules
- EC&I modules



All designed around a standard grid size for integration



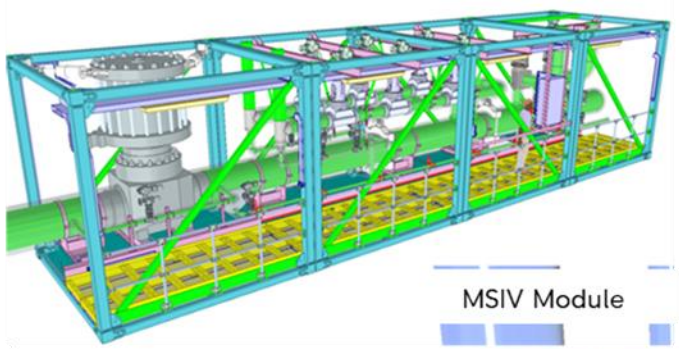


Modules
(assembled components)

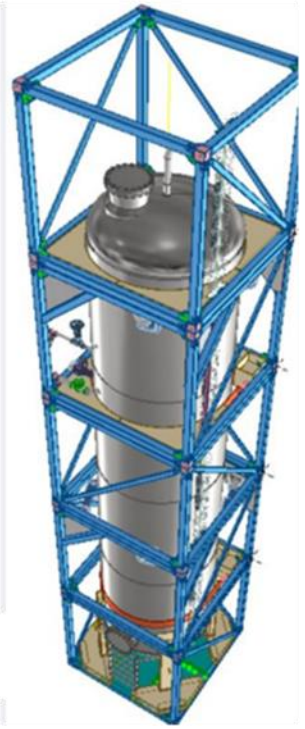
Clusters
(assembled modules)

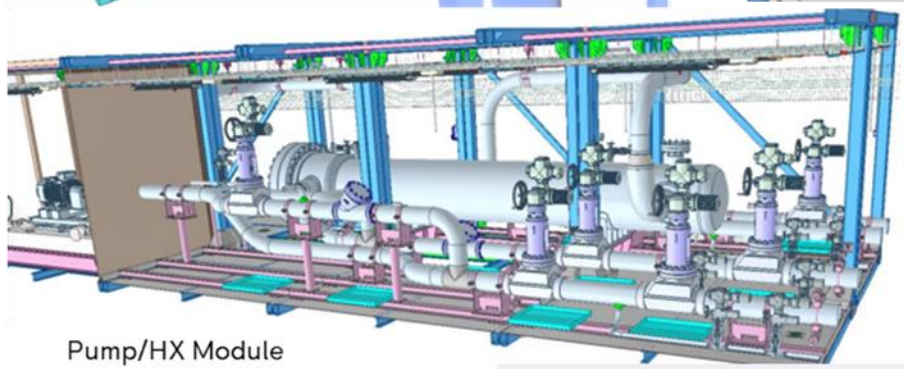
Blocks and Buildings
(Power Station)

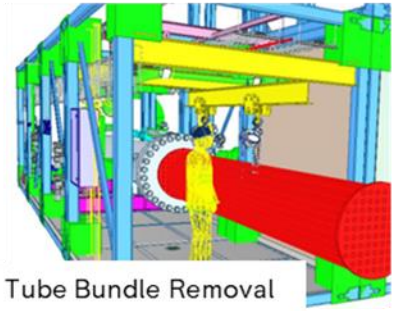
END STATE MODULES

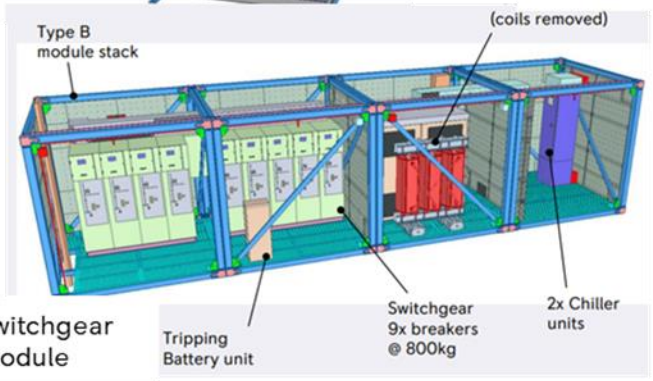

MSIV Module


Access Module

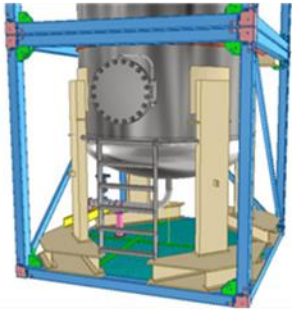

Tank Module


Pump/HX Module

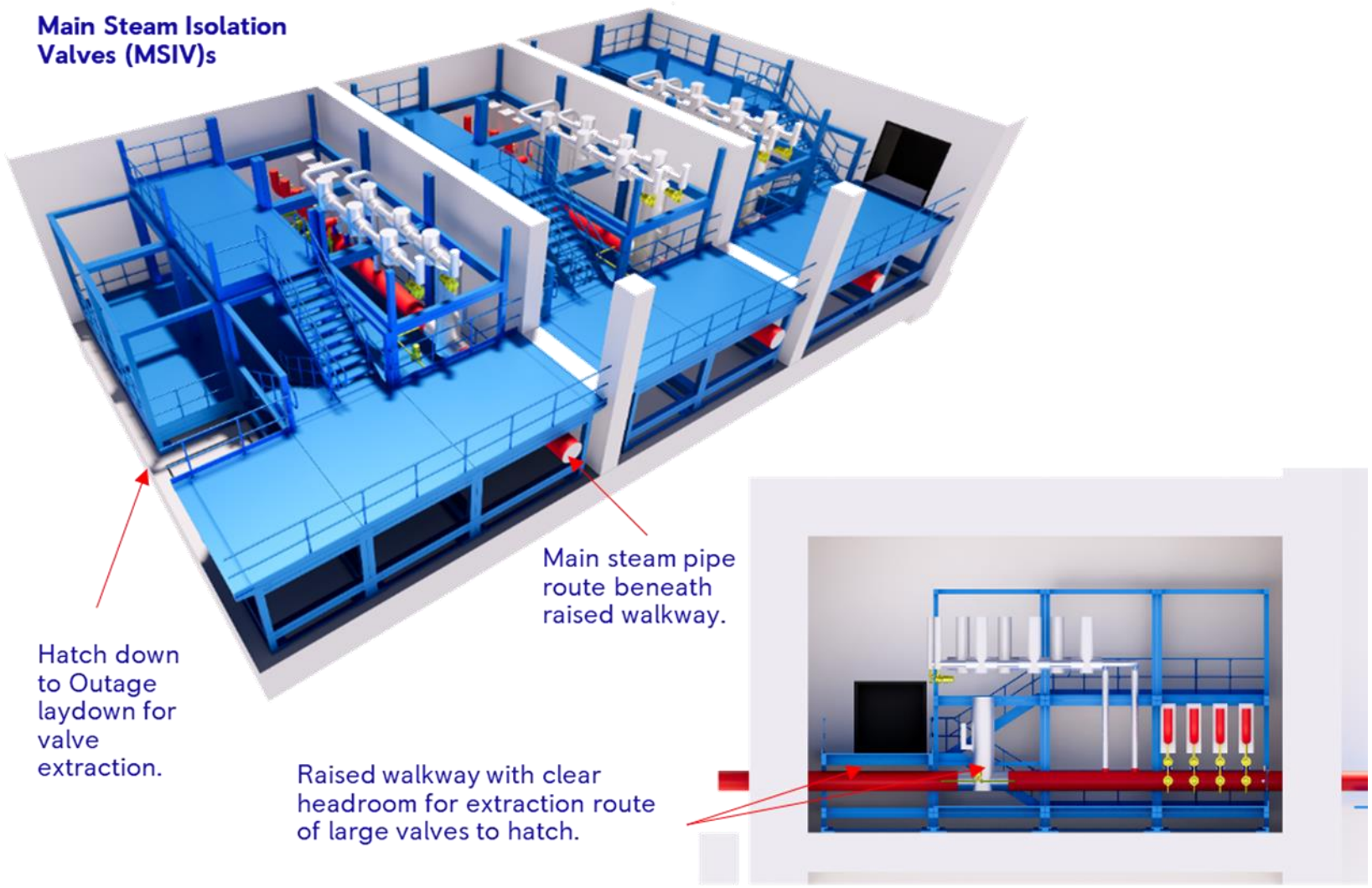

Tube Bundle Removal



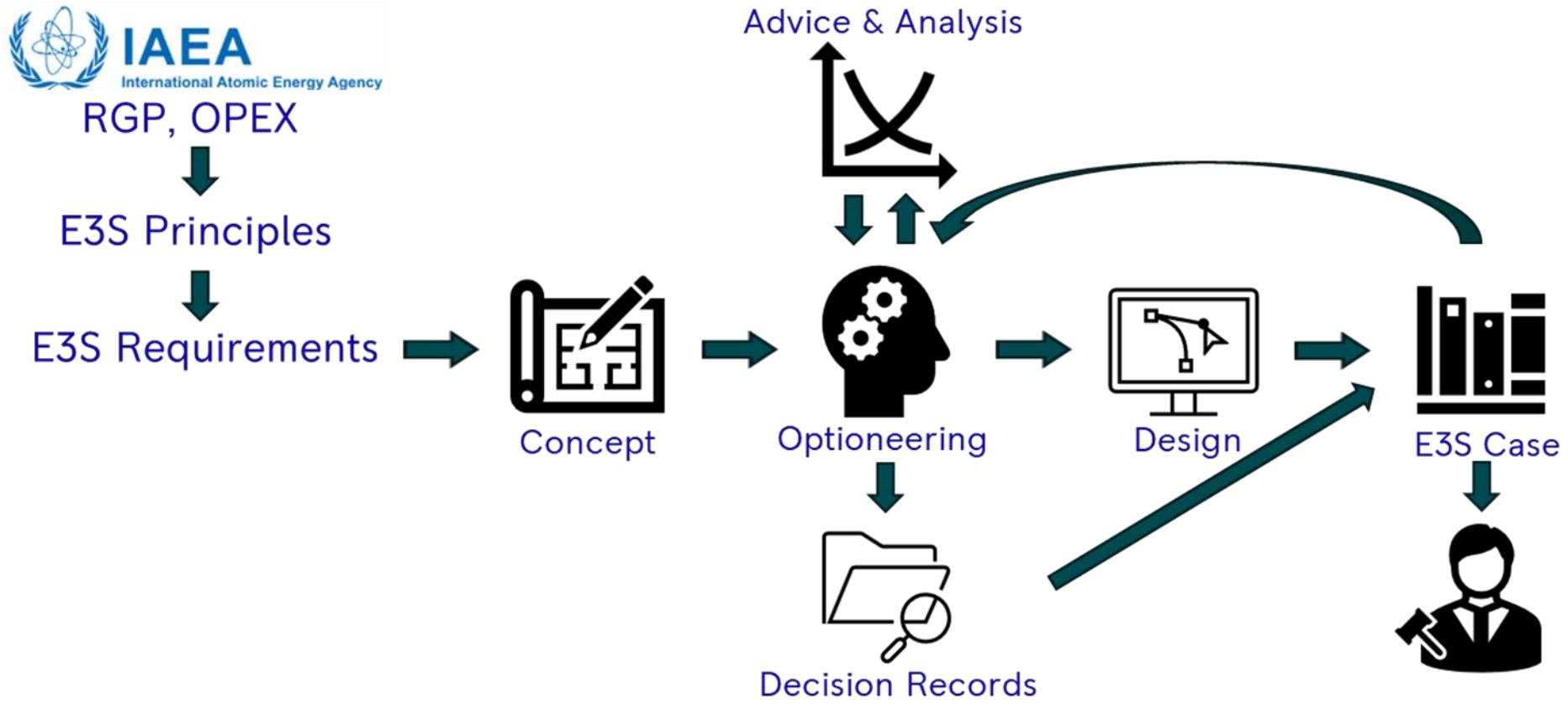
Switchgear Module



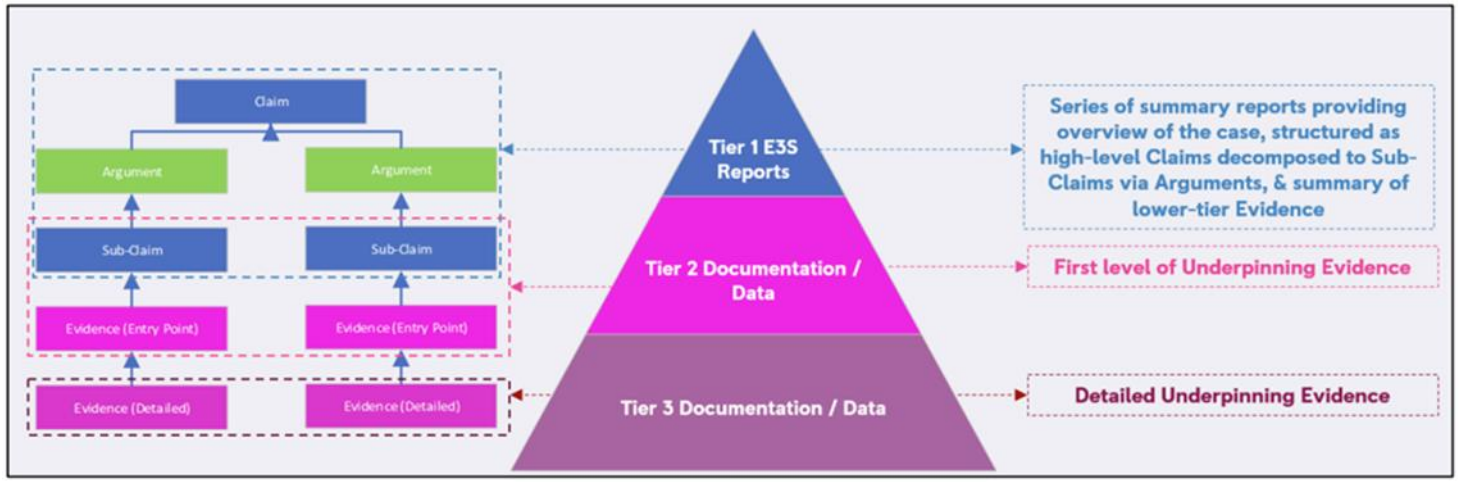
MODULE EXAMPLE

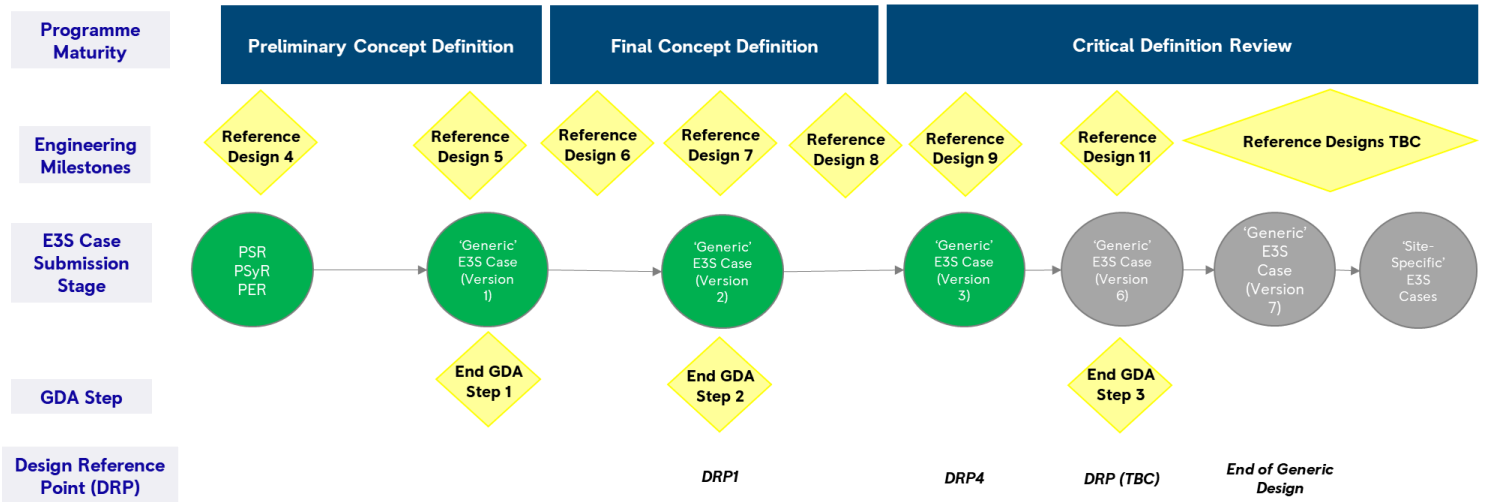


HOW DID WE DO IT?



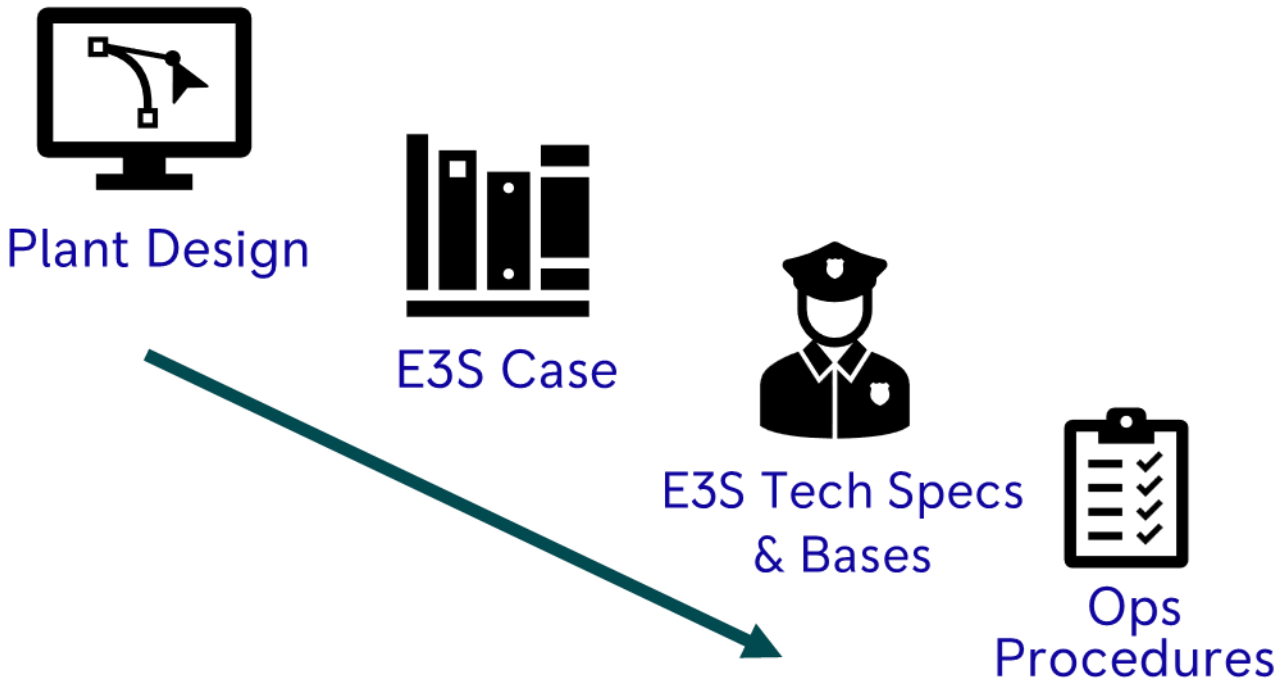
E3S CASE STRUCTURE AND EVOLUTION





MAINTAINING THAT GOLDEN THREAD

- Requirements can be traced through the design into the E3S Case.
- The E3S Case records and justifies the Operating Limits and Conditions.
- The OLCs inform the integrated E3S Technical Specifications and Bases.
- All maintained in a digital environment.



ROLLS ROYCE SMR

BE SAFE. BE BOLD. BE INCLUSIVE. BE IMPACTFUL. BE CREATIVE. BE ENGAGED