

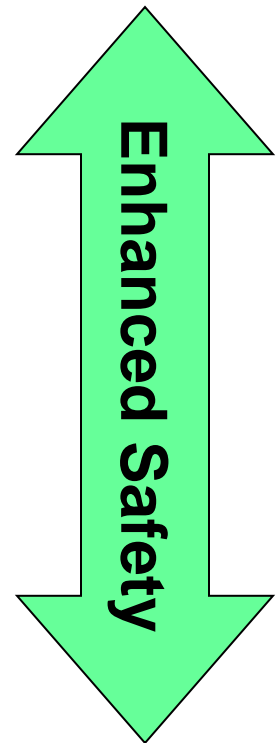


# **An Evolutionary and Innovative Design**

## **Advanced CANDU Reactor**

### **Systematic Approach to Optimization**

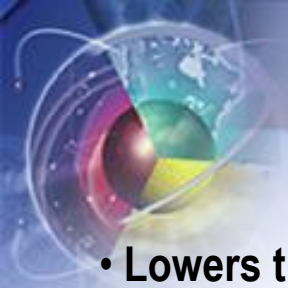
- **Fuel performance**
- **Fuel channel output**
- **Reactor core configuration**
- **System simplification**
- **Plant components standardization**
- **Modularization & Construction**
- **Engineering and management tools**
- **Plant operability and maintainability**





# **ACR Construction Strategy To Shorten Schedule**

- **“Open Top” construction using Very Heavy Lift (VHL) crane for the reactor building**
- **Parallel construction**
- **Prefabrication/Modularization**
- **Use of advanced construction technologies and engineering tools**



# Prefabricated Permanent Formwork at Qinshan



- Lowers the fabrication to ground level
- Improves safety
- Increases efficiency
- Reduces congestion in the RB
- Eliminates/reduces scaffolding
- Reduces critical path activity



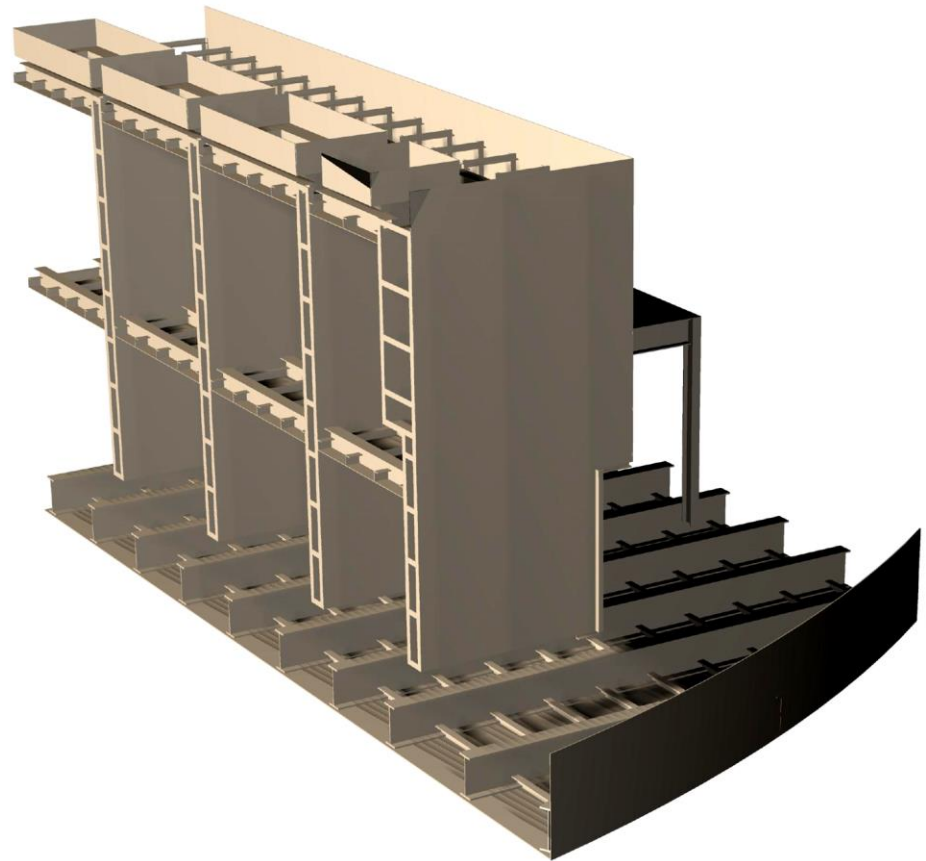


# Example of Composite Structure and Permanent Prefabricated Formwork



## Moderator Purification Module Structure:

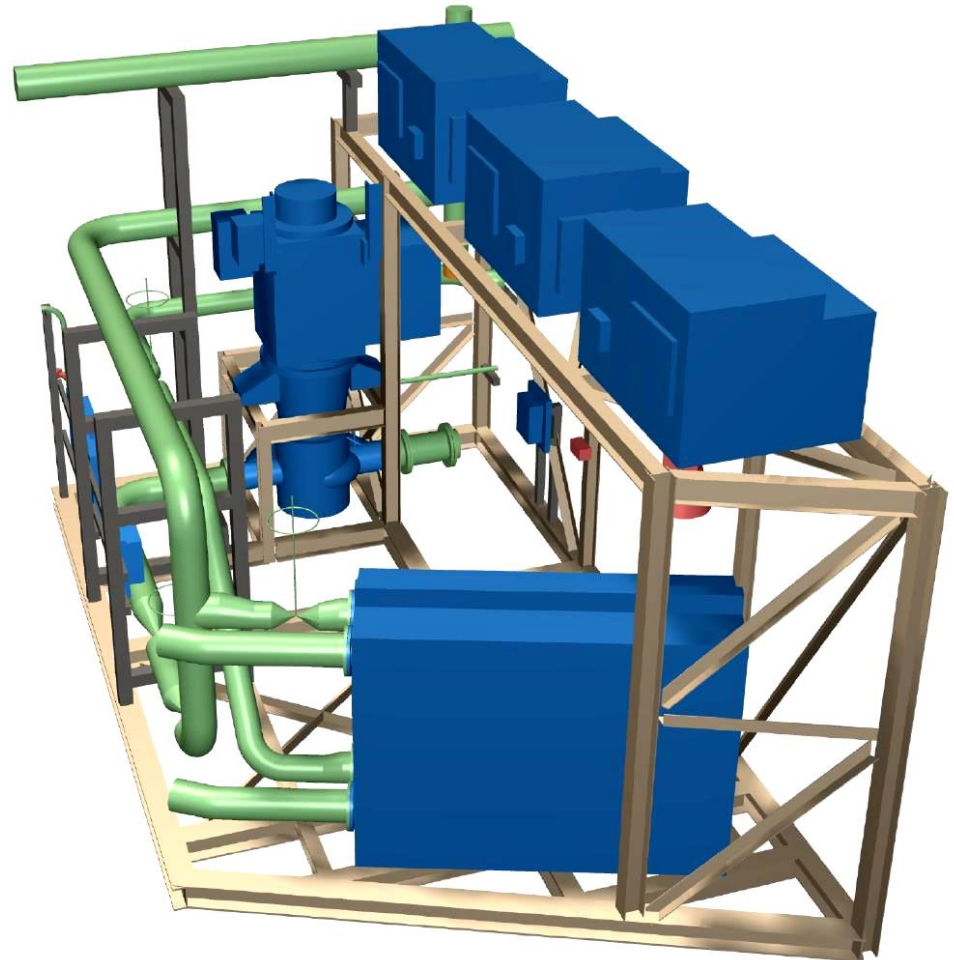
- Prefabricated permanent formwork will be used for the shielding slab
- Composite Structure can be used for Shielding walls
- Composite structure used as base for prefabricated systems within same volume





# Multidiscipline Moderator Pump/HX Module

- Moderator pump, and the heat exchanger are located at the base
- Coolers are located on an elevated steel platform
- Include piping, equipment and electrical



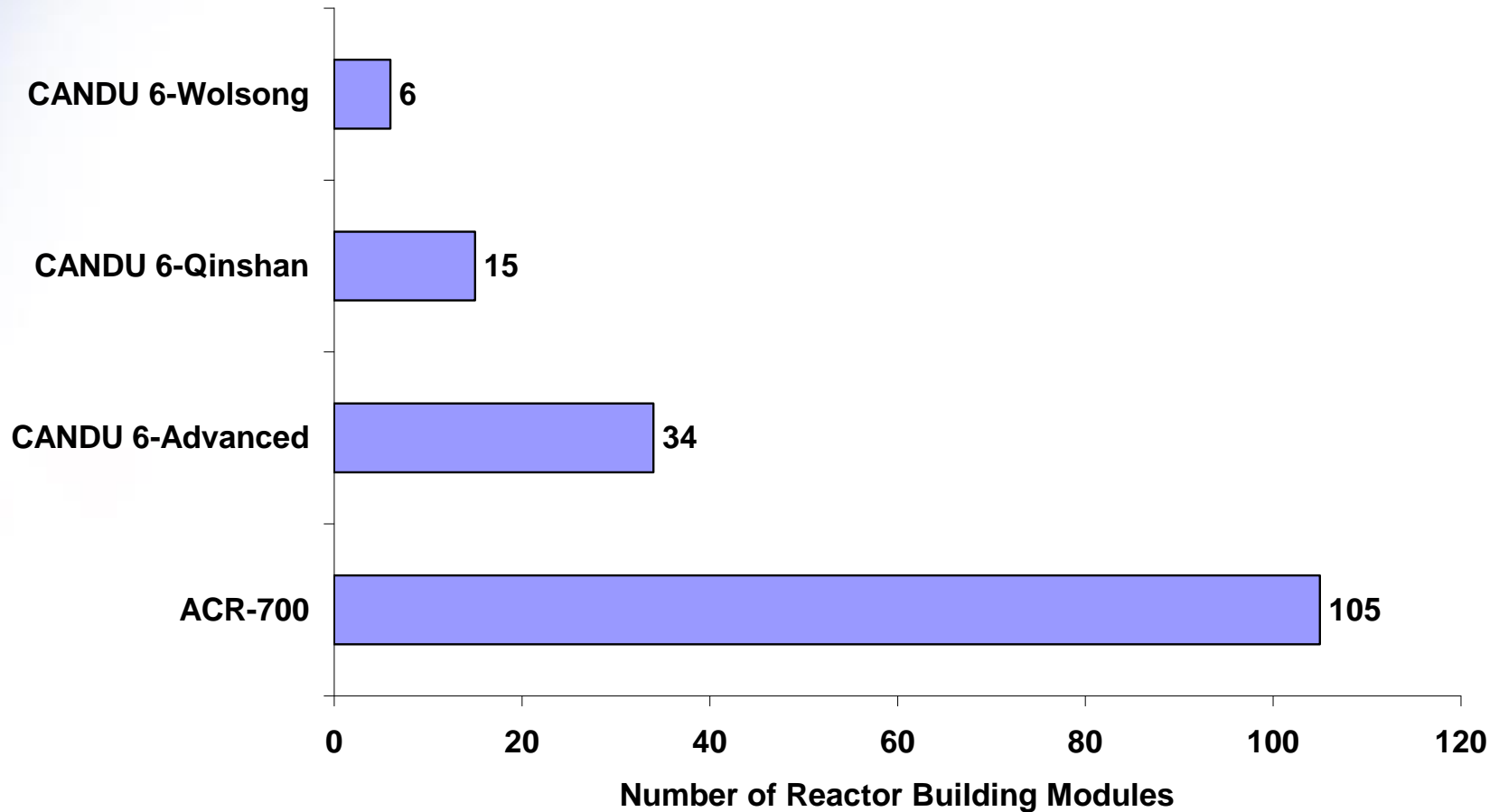


# A Dousing Module





# Module Implementation – Project Experience







## New Record for Chinese NPP Construction

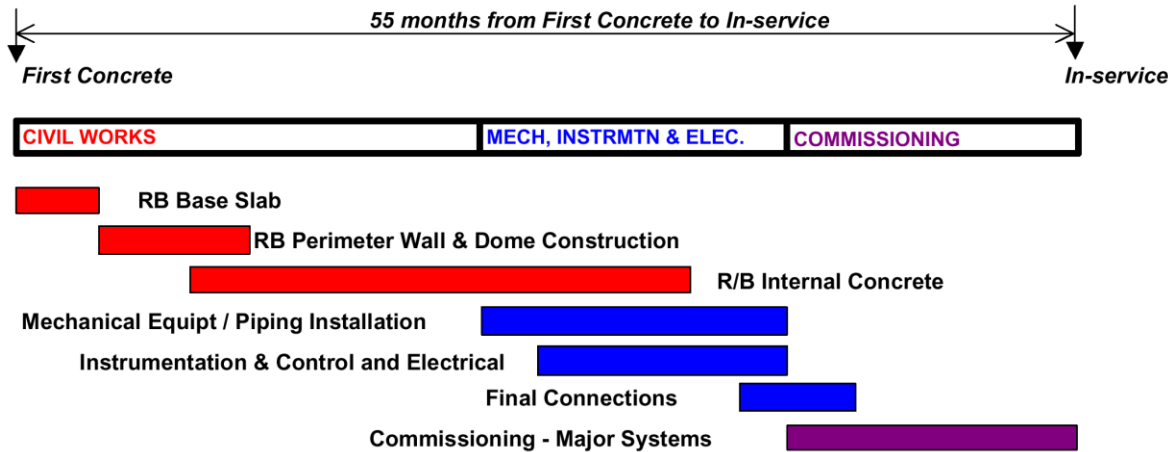
	First Concrete to Criticality (Months)	Criticality (Year)	First Concrete to 100% Power
Qinshan I	77	1991	87
Qinshan II (U 1)	66	2001	70
Daya Bay U1	71.5	1993	75.5
Daya Bay U2	69.5	1994	71.5
Lingao U1	56.5	2002	60.5
Lingao U2	55.5	2002	
Qinshan III (U 1)	51.5	2002	54



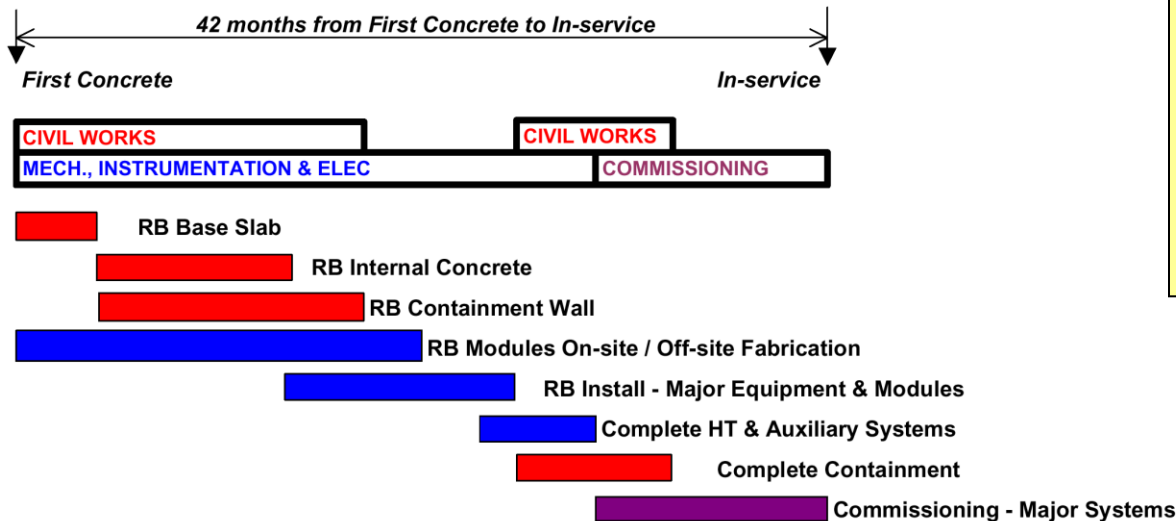


# Traditional CANDU Construction (72m schedule) vs ACR Modularization (48m schedule)

## Traditional CANDU Construction (Wolsong 3)



## ACR Modularization



**Series  
Critical  
Path**

**Parallel  
Critical  
Paths**

**Activity  
durations may  
increase or  
decrease.**

**Parallel  
construction  
logic using  
modules gives  
reduced  
schedule  
duration.**

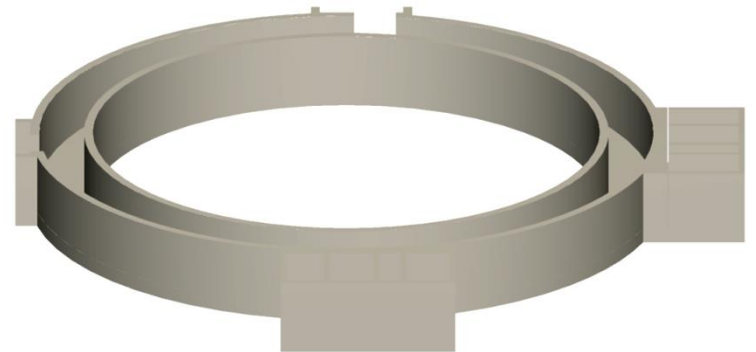


# Reactor Building Construction Sequence



## Month 12

1.
  - Base Slab
  - Tendon Gallery and Access
  - LTCS Pump Pit



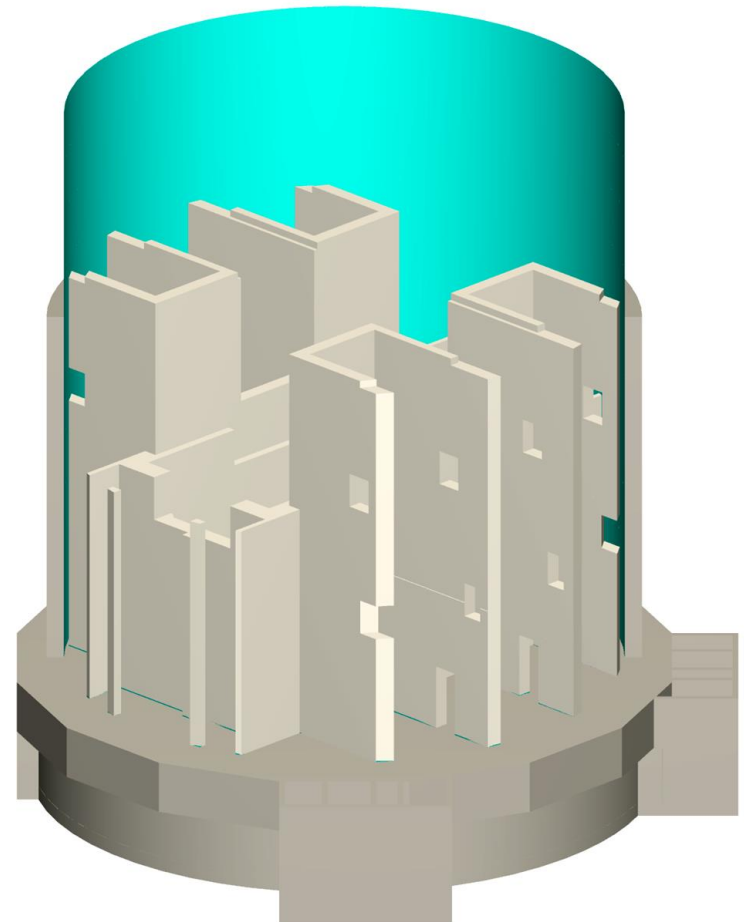


# Reactor Building Construction Sequence



## Month 25

- 7.**
- Containment
    - Wall Liner Sections to 140m Elev.
    - Concrete to 130m Elev.
  - Internals
    - Concrete to 124m Elev.  
(Leave out S.G. Enclosures)

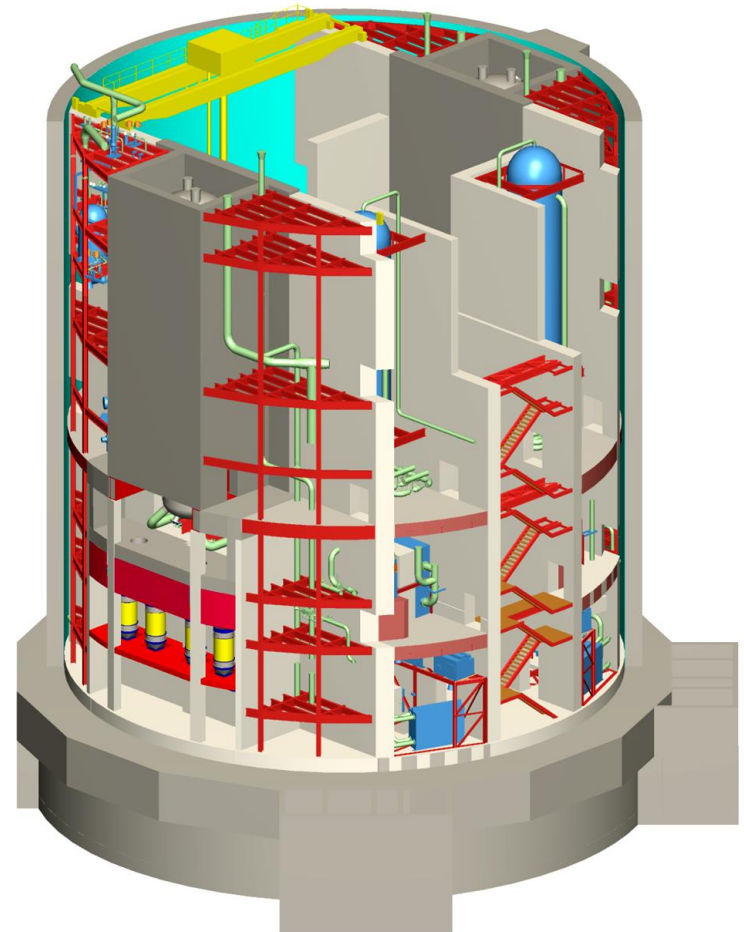


# Reactor Building Construction Sequence

Month 35 - 38

## 22. - Internals

- Complete installation of all modules and equipment installed through the "Open Top"
- Install boiler room crane



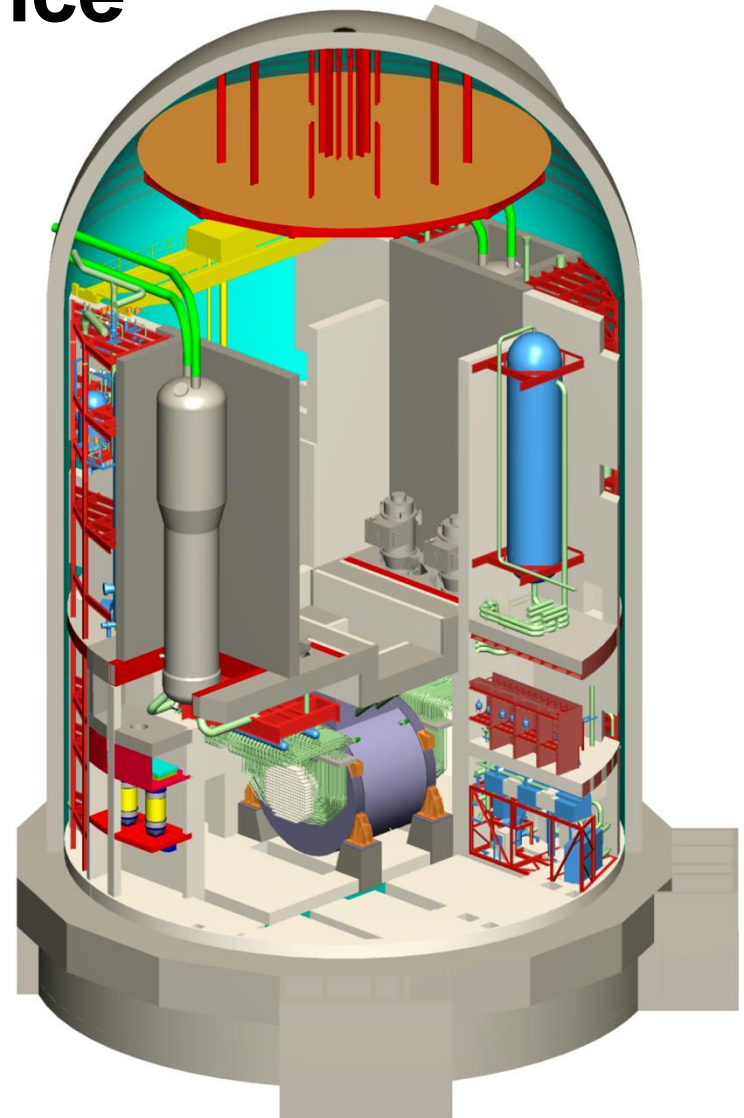


# Reactor Building Construction Sequence



**Month 46**

- 25.**
- Containment
    - Concrete poured on dome
  - Internals
    - All final connections progressing





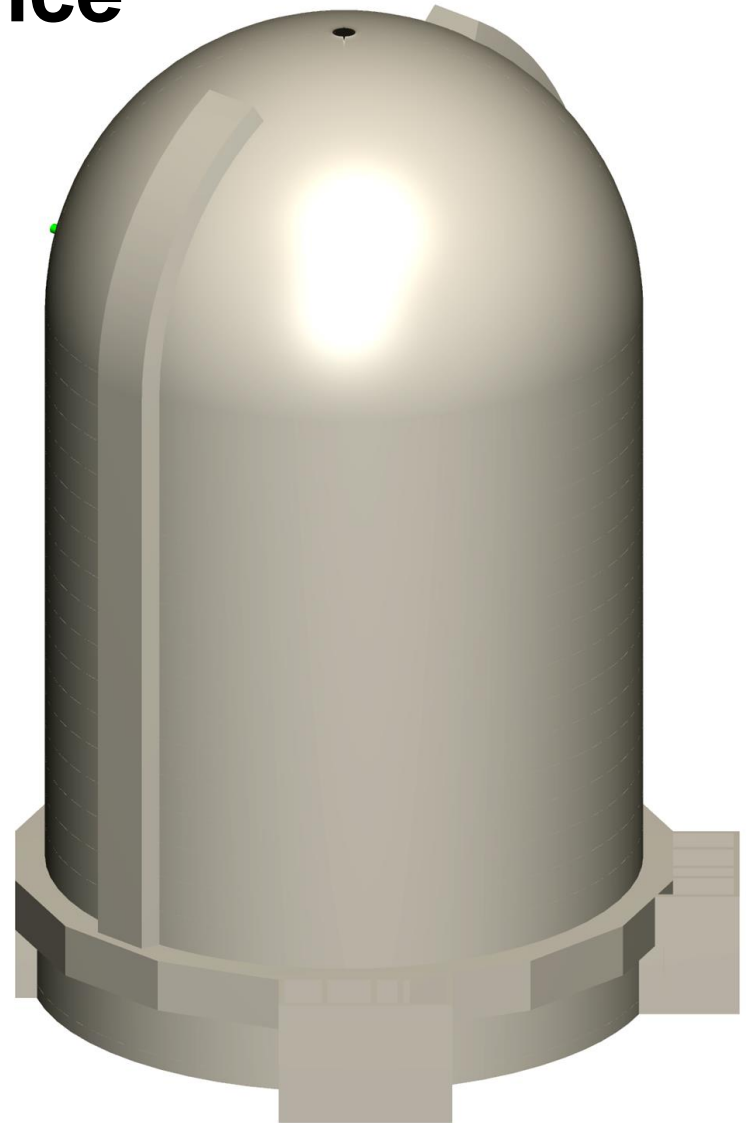
# Reactor Building Construction Sequence

**Month 48**

**26.** - Containment  
- Externally complete

- Internals  
- Final connections progressing

**NOTE:**  
Still 12 months to go to  
unit “In-Service”





# Building on Experience

- **ACR leverages current experience with construction management and technology:**
  - Completion on schedule for Wolsong 2,3,4, Cernavoda-1, Qinshan, 1, 2
  - Schedule reduction on successive projects via enhanced construction techniques
- **Short construction schedule achieved by:**
  - Integrating construction strategy with overall design process
  - Incorporating benefits from ACR design improvements
  - Realizing benefits from full-scale application of constructability studies including advanced construction techniques
  - Application of ACR Project Delivery Tools
  - Adopting feedback



# **Building Achievable Schedules**

- **ACR Supply Schedule**
  - All long-lead item delivery schedules as supplied by manufacturers
  - Installation times based on installation of equipment components for current projects
- **ACR Commissioning Schedule**
  - Based on CANDU 6 schedule, with improvements due to design simplifications, and allowance for innovation
- **ACR Advanced Technology Tools**
  - Information generated with an integrated set of tools covering physical layout, procurement, computerized wiring and cabling, and document control