International Conference on Topical Issues in Nuclear Installation Safety: Safety Demonstration of Advanced Water Cooled Nuclear Power Plants

PLENARY 2: Insights Gained From Design, Construction and Commissioning of Advanced Water Cooled Reactors
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Modern approaches and challenges in construction of nuclear power plants

- World trends in NPP construction
- Advanced construction methods
- Examples of IAEA activities
Construction of NPPs

• Critical stage of an NPP project
  – Quality during construction will impact future safety and performance of the plant
  – Complex by technical basis, design and organizational cultures
  – High capital investment and amount of mobilized labour

• Challenges
  – Quality - were the requirements and scopes defined beforehand?
  – Civil engineering, manufacturing of large components
  – Project management and schedule
  – Alignment of all organizations involved
Reactors Under Construction

Total Number of Reactors: 60

- CHINA: 20
- RUSSIA: 10
- INDIA: 8
- UNITED ARAB EMIRATES: 6
- UNITED STATES OF AMERICA: 5
- KOREA, REPUBLIC OF: 5
- PAKISTAN: 4
- BELARUS: 4
- JAPAN: 4
- SLOVAKIA: 4
- UKRAINE: 4
- ARGENTINA: 3
- BRAZIL: 3
- FINLAND: 3
- FRANCE: 3

Number of Reactors

Countries are listed in descending order of number of reactors.
Number of reactors under construction by region

Source: Power Reactor Information System [http://www.iaea.org/pris]
Information system for engineering data management, based on 3D models.
Modularization Design and Construction

- Parallel construction, shorten the construction period
- Pre-fabrication and pre-assembly, to improve the production quality

<table>
<thead>
<tr>
<th>Nuclear Island</th>
<th>Struc. Module</th>
<th>Equip. Module</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor Building</td>
<td>65</td>
<td>12</td>
<td>77</td>
</tr>
<tr>
<td>Auxiliary Building</td>
<td>19</td>
<td>42</td>
<td>61</td>
</tr>
<tr>
<td>Total</td>
<td>84(29)</td>
<td>54(59)</td>
<td>138(88turbine)</td>
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Modular Construction

Pros and Cons need to be evaluated based on the job site conditions

**Advantages**
- Reduce Schedule
- Reduce Field Work and Leveled On-site Manpower
- Increase Productivity and Quality under Factory Environment
- More Safe and efficient at Ground Level Work
- Reusability of Engineering

**Disadvantages**
- Increase Engineering for Module
- Increase Temporary Support Structure
- Early Material Requirements
- Additional Transportation Cost (Large trailer truck, Barge)
- Increase Lifting/Rigging Requirements (Crane, Lifting Jig)
- Inspection of Modules
Examples of IAEA activities

Publications

IAEA Nuclear Energy Series
No. NP-T-2.5

Construction Technologies for Nuclear Power Plants

IAEA Nuclear Energy Series
No. NP-T-2.7

Project Management in Nuclear Power Plant Construction: Guidelines and Experience

Integrated Risk Management Process in Life Cycle of Nuclear Power Plant

eLearning Module on construction and procurement

https://www.iaea.org/NuclearPower/Infrastructure/elearning/
Construction Readiness Review Guidelines

- Self-assessment for Construction Readiness
- Conducting peer reviews of construction projects related to nuclear power plants.
- Provides a detailed assessment
  - Readiness for construction,
  - Construction progress,
  - Readiness for turnover, as well as recommendations for improvement.
Conclusions

• Construction is a critical stage of NPP projects
• In many cases problems not identified before they come visible in an expensive way
• It is important to update current and complete new IAEA publications
• A detailed analysis of past construction positive and negative lessons learned