Westinghouse: Making a Positive Impact on the Nuclear Sector in Latin America

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October 2016
III SENCIR

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AP1000 Plant Experience Driving Global Delivery Certainty

- Eight AP1000 units under construction
  - Four units in China (Sanmen and Haiyang)
  - Four units in the United States (Vogtle and V.C. Summer)





Establishing delivery improvements from eight units worth of experience

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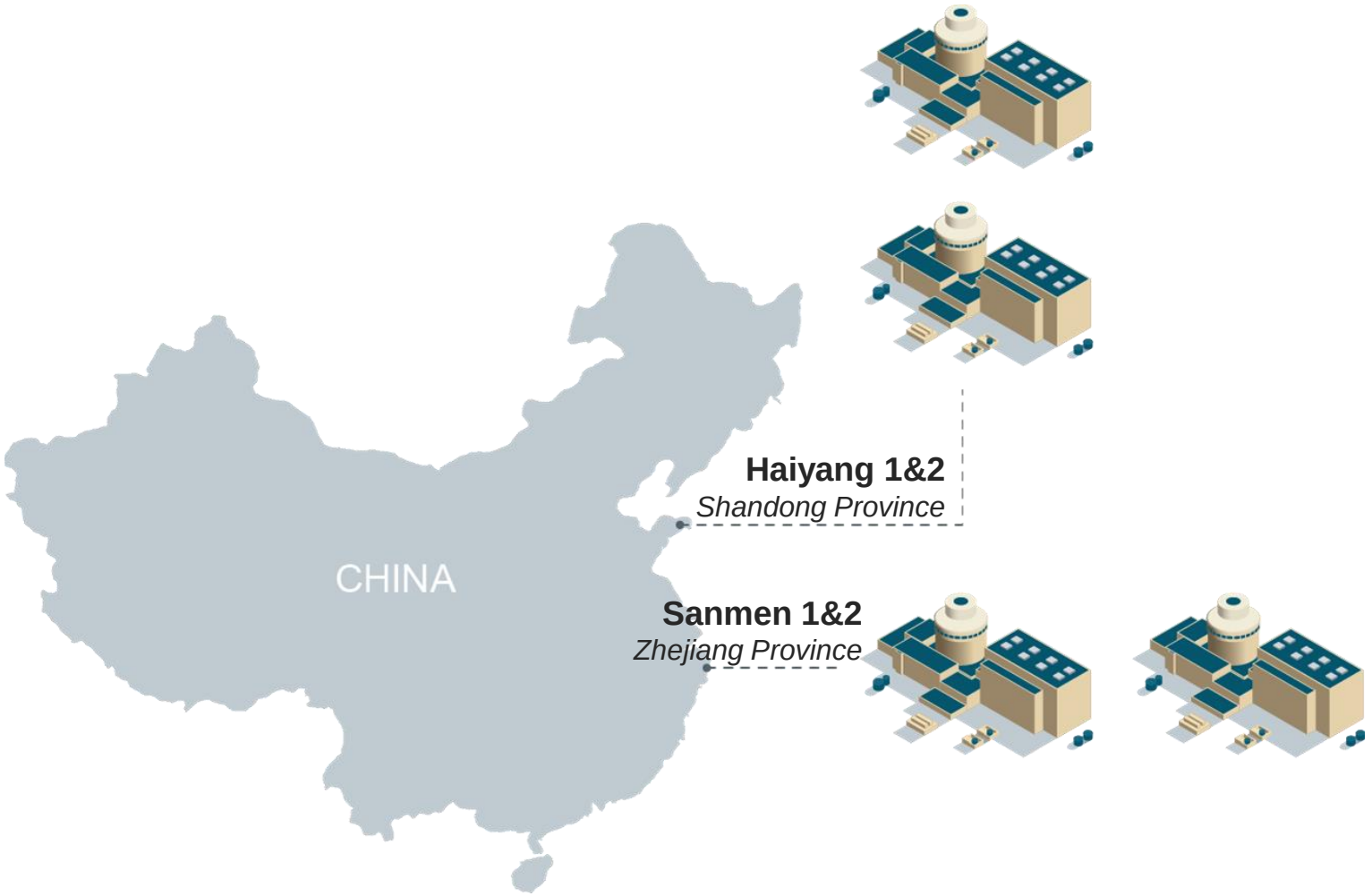
China AP1000 Plant Projects



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China AP1000 Plant Progress

Sanmen 1 – February 2016

Sanmen 1 RCP installation – February 2016

Haiyang 1 and 2 – February 2016

Haiyang 2 – February 2016

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Sanmen Site Progress: Time Lapse View

2009 to 2016

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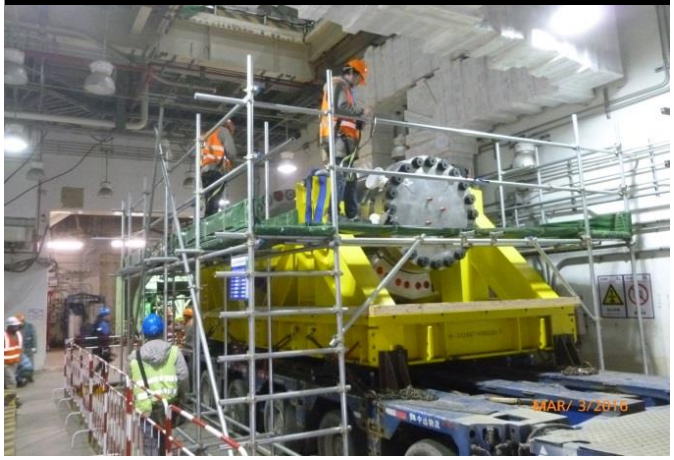
China Projects Update

- Completed 4 RCPs installation in Sanmen Unit 1 (The fourth one completed on March 1)
- Completed 4 RCP installation in Haiyang Unit 1 in April with 37% reduction in time compared to Sanmen 1.
- Haiyang Unit 2 CB20 last concrete poured on Jan. 28
- Completed PMS pre-operational test and CHT at both SM1 & HY1, which are now in HFT.

Haiyang 1 First two RCPs at Site – March 2, 2016



Sanmen 1 RCP Installation – February 2016

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The Path to Completion: Next Milestones for Sanmen and Haiyang

RCP Deliveries/ Installations

100% Power Operation

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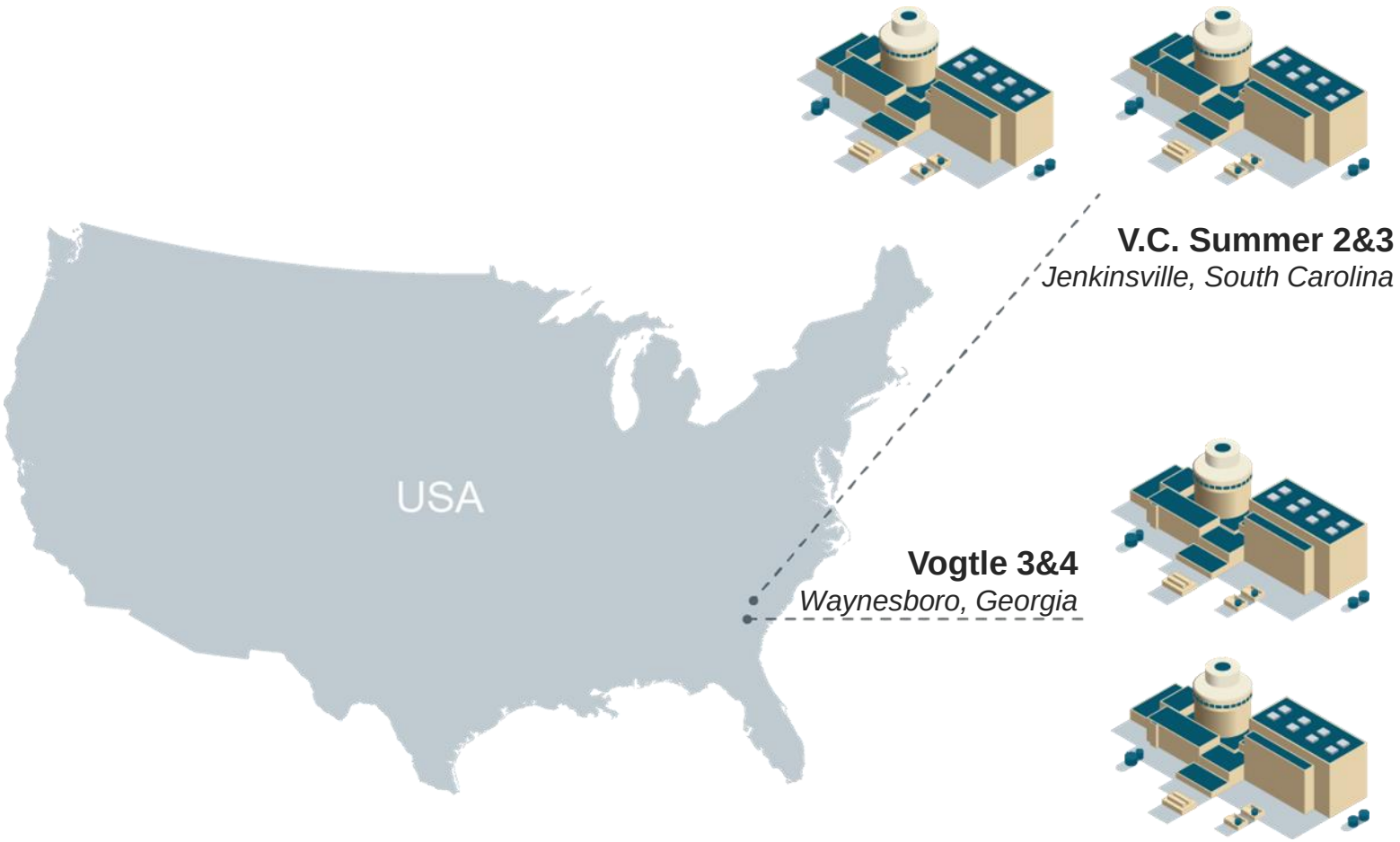
U.S. AP1000 Plant Projects



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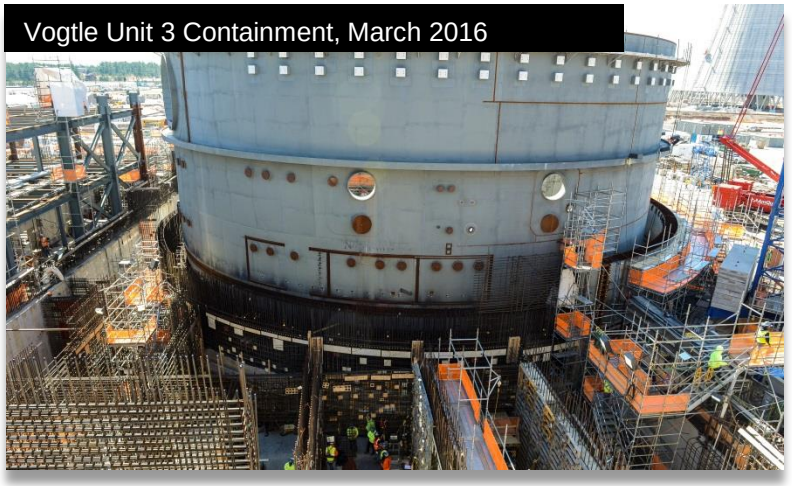
U.S. Projects Recent Updates

- V.C. Summer
  - Unit 3 Turbine table top concrete placed in Dec.
  - Unit 2 Shield Building layer F1 wedge concreate placed in Feb.

- Vogtle
  - Unit 3 Containment Vessel lower ring set in Dec.
  - Unit 3 concrete fill of CA20 module completed in March

V.C. Summer Unit 2 NI and Turbine Building, March 2016

Vogtle Unit 3 Containment, March 2016



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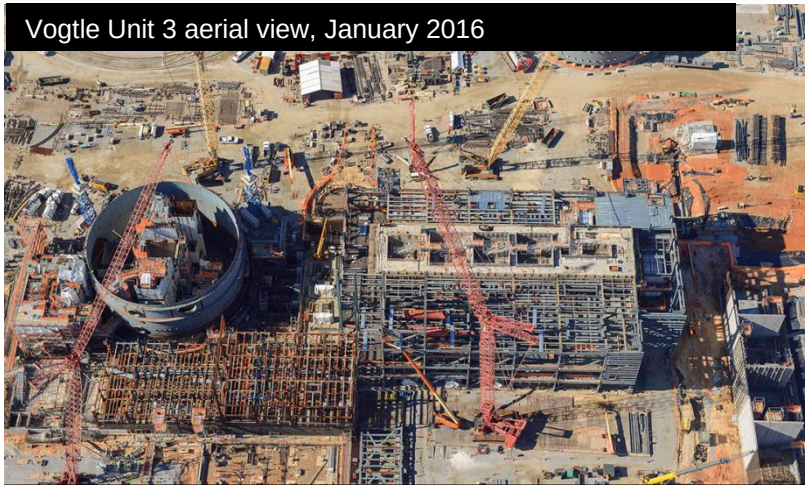
U.S. Projects Updates

Vogtle Site, January 2016

Vogtle Unit 3 aerial view, January 2016



V.C. Summer Unit 3 Shield Building, February 2016

V.C. Summer Site, Fall 2015

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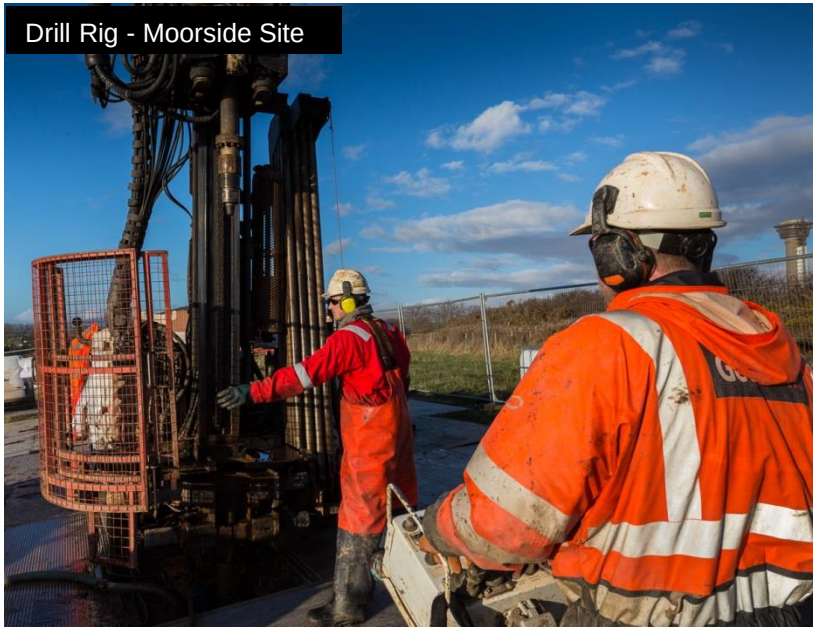
U.K. Project Update: Moorside (NuGen)

- Generic Design Assessment (GDA)/Licensing
  - Scheduled to receive Design Acceptance Confirmation/Statement of Design Acceptability by March 2017 from HMG
  - Focused on reaching convergence and closing out GDA issues


Drill Rig - Moorside Site


Moorside Site

- Focus Areas
  - Project Strategy/Plans Development
  - Finalize Design Requirements
  - Preliminary Engineering
  - Developing Delivery Certainty

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Building up an AP1000 Plant Global Fleet

- China:
  - Under Construction:
    - Sanmen 1 & 2
    - Haiyang 1 & 2
  - Under Development
    - Sanmen 3 & 4
    - Haiyang 3 & 4
    - Lufeng 1 & 2
- United States:
  - Under Construction:
    - V. C Summer 1 & 2
    - Vogtle 1 & 2
- United Kingdom:
  - Under Development:
    - Moorside 1, 2 & 3

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17 AP1000 Plants under construction/development: A World Class Gen III+ Fleet

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Eletronuclear

- Technology transfer
- Outage services
- Components and maintenance
- Steam generator replacement for Angra 1

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Brazilian Supply Chain Development: INB

- Fuel Manufacturing Technology Transfer
- Nuclear Codes and Methods Technology Transfer
- Joint development of 16x16 Next Generation Fuel Technology (16NGF) which is now being used at Angra 1
- INB provides technical services to Westinghouse
- Technical Exchange Program in Brazil, USA and Sweden

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Brazilian Supply Chain Development: NUCLEP

Westinghouse signed MOU with NUCLEP for the potential localization of AP1000 plant heavy components

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Westinghouse Actively supports the Human Resources Development in Brazil

Westinghouse Seminar Series at Universities

Internships at Headquarters in USA since 2014 for UFRJ and UFMG

Committed to the development of the next generation of nuclear professionals

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Experience at Westinghouse

Alice Cunha (represented by Andre)

André Rebello

Igor Santos – UFMG

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Internship Process

- Brazilian Mobility Program - Science Without Borders
  - Andre and Alice - Pennsylvania State University - 2014
  - Igor – The University of Alabama - 2015

Undergraduate Brazilian's Students
At Pennsylvania State University

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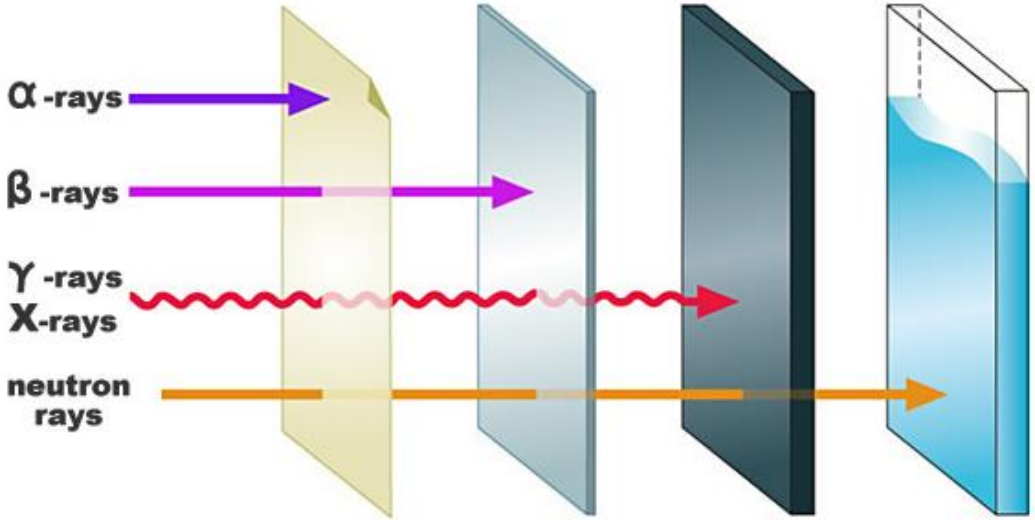
Shielding Analysis – Radiation Engineering & Analysis Group (2014)

- Neutron and Photon Streaming and Dose Attenuation Analysis in Common Shielding Materials
  - Radiation streaming in the concrete shield and through gaps in the pre-cast concrete slabs in some reactors floors.
  - MCNP (Requested from RSICC - Radiation Safety Information Computational Center)



Reduced Reload Safety Analysis Checklist – Core Engineering Group (2015)

- The RSAC is issued each reload and is a selectively edited list of limiting values for those parameters that are reload sensitive and can affect the accident analysis of a plant.
- The “Reduced RSAC” (RRSAC) approach provides one method of reducing the reload safety analysis and emergency core redesign cycle time.

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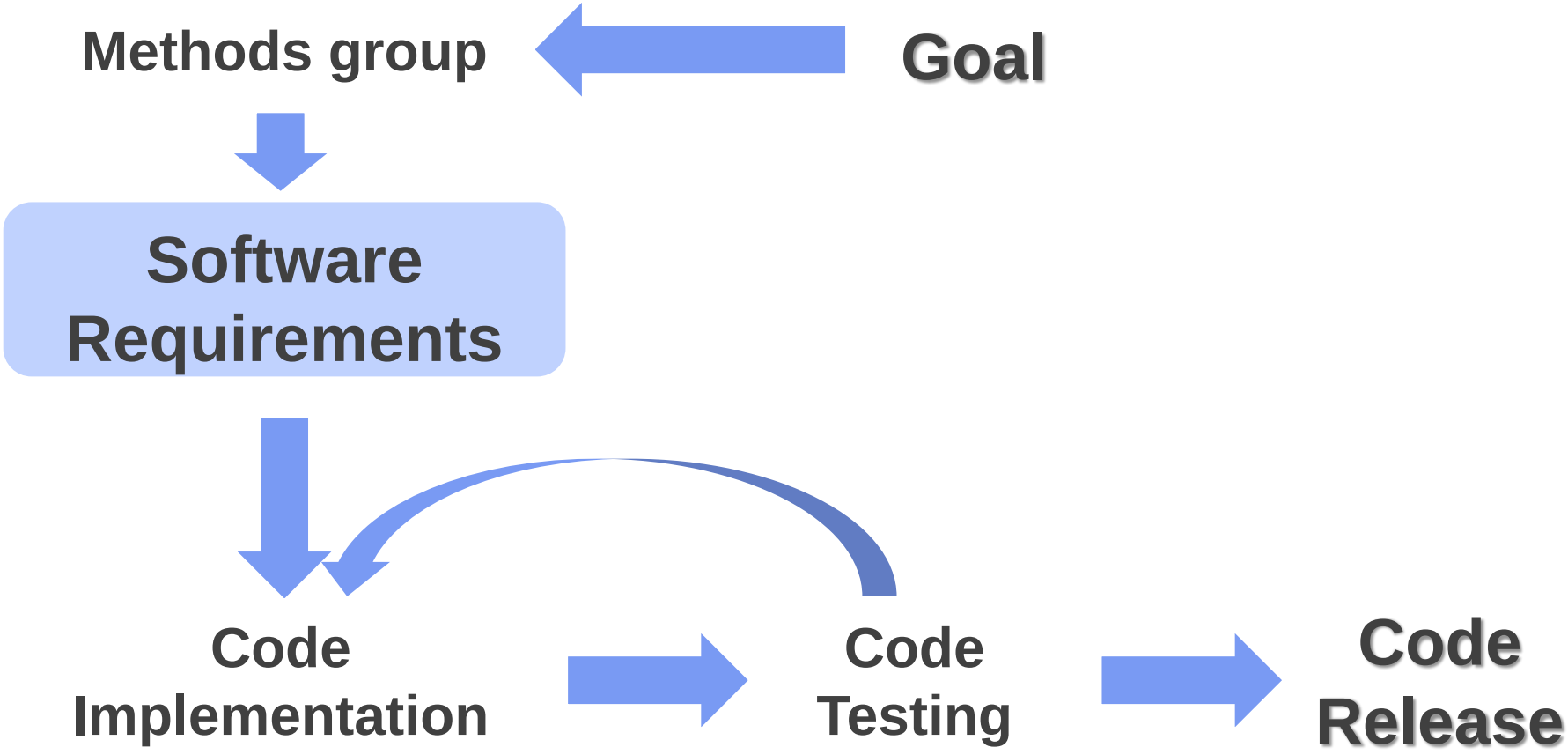
We need to study Fast Transients when performing a BWR reload analysis (2014)

3D Steady-State Core Simulator

?

1D Fast Transient Code

The software development process involves several steps, including Testing (2015)



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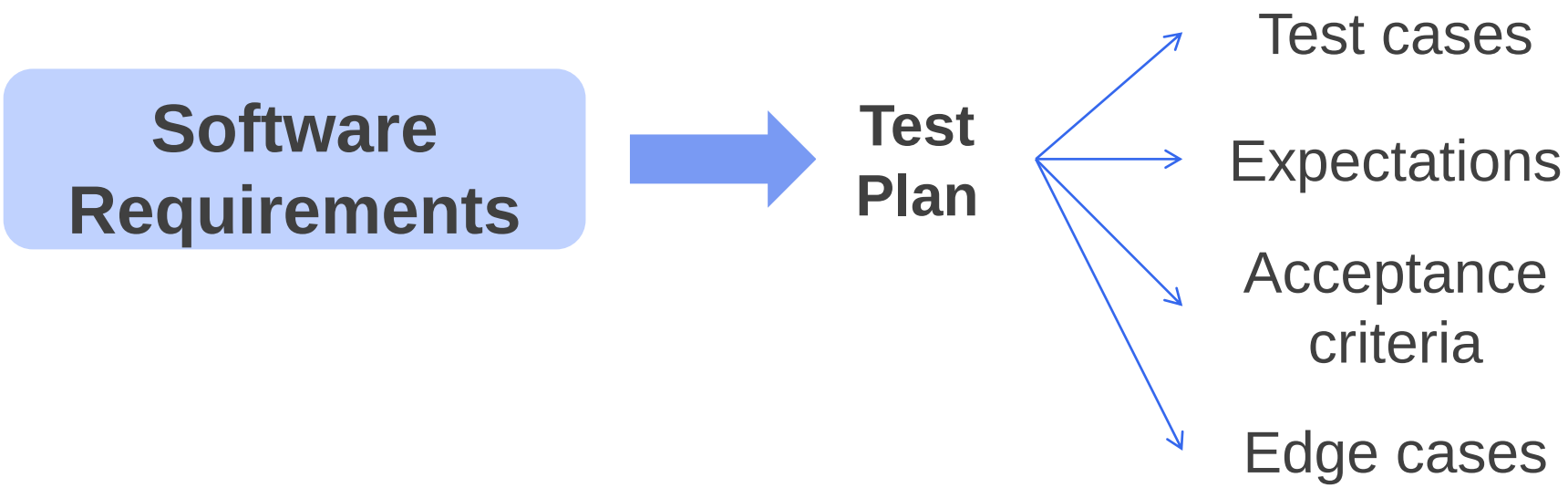
When code testing, we develop a test plan based on software requirements (2015)



China Response Team

- Orientation day
- Mentoring relationship
- Engineering support to 4 AP1000s under construction in China;
- Average of 5 new issues per day;
- Work with different functional groups;
- Team work, communication, deadlines commitment

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Interning at Westinghouse is not only just about the technical projects.

- Orientation day
- Mentoring relationship
- Wrap-up
- Breakfast with the CEO
- Intern competition within the Core Engineering group
- Barbecue with the Young Generation group from Pittsburgh

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Highlights

- Networking
- We are always learning new things
- Concern with employees' welfare
- Friendly environment to raise concerns
- Great mentoring
- Time flexibility
- Safety

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June 2016 – We got hired!

Andre's worklife

- Nuclear Design
  - Important Specific Subjects: Reactor Physics, Reactor Dynamics, Reactor Engineering...
- Qualification
  - Learning the codes
    - ANC
    - APOLLO
  - Weekly Video Conferences
  - Pass the board to be qualified
- Perform Reload Calculations
  - Examples: calculate shutdown margin, perform rod accident analyses, check peaking factors,...
- Current development of a Loading Pattern for Callaway.
- Support Westinghouse Latin America Operations

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How can you prepare for the future?

- **Build a strong academic record**
  - Learn the basic science and fundamentals of engineering
  - Explore across technical disciplines
- **Get involved in projects**
  - Develop leadership and experience
  - Practice teamwork
- **Get involved in professional organizations**
  - Build a network
  - Learn about industry trends, challenges and opportunities
- **Get involved in community service and activities**
  - Make a difference . . . Even in social networks
- **Maintain a balanced personal and professional life**
  - Focus on Excellence!
  - Have fun!

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Questions and Answers

During FIFA's World Cup,
at the Westinghouse HQ