TECHNICAL AND REGULATORY ISSUES FACING NUCLEAR POWER PLANTS *LEVERAGING GLOBAL EXPERIENCE*

World Nuclear Association

Session 2: Setting the Scene Regional Topics
"Industry Challenges/Opportunities:
Operating Plants and New Construction"

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Sargent & Lundy

Profile

- Founded in 1891
- Headquartered in Chicago, USA with offices worldwide
- Exclusive focus on power industry
- Nuclear Quality Assurance Program
- ISO 9001:2008 Certified Quality System
- 2,500+ staff members
- Client base: Over 600 clients
  - 150 fossil power clients
  - 120 nuclear power clients
  - 40 power delivery service clients
  - 340 consulting clients

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Services Overview:

Fossil	New units	Gas
		Coal (and other opportunity fuels)
	Operating units	Air quality control
		Modification services
Nuclear	New Units - Licensing, BOP Engineering, Owner's Engineer	
	Operating plant services	
Renewable Energy	Wind, solar, biomass	
Power Delivery	New transmission lines and substations	
	Upgrade of existing transmission lines and substations	
Consulting	Economic analysis	
	Due diligence	
Operations & Maintenance	Operations enhancement	
	Maintenance and inspection procedures	
Construction Services & Commissioning	Construction management and QC surveillance	
	Electrical testing and commissioning	

Nuclear Energy "At-a-glance"

- Globally, 436 reactors generating <20% of world electric energy (379,463 MWe)
- US, 100 reactors generating <18% of the US electric energy (107,031 MWe)
- Significant increase in capacity of the existing fleet through power uprate and life extension
- About 107 nuclear reactors were under construction in 20 countries at time of Fukushima event (march 2011)
- Although progress has slowed down since the Fukushima plant fallout, with new projects being suspended for unknown periods and older plants being shut down, 65 new projects are still going ahead in 15 countries.
- Under strong regulation, nuclear power can and will continue to provide consumers with Clean, Safe And Reliable Nuclear Energy

Nuclear Energy "At-a-glance"

- Challenges:
  - Low natural gas prices
  - Slower demand growth
  - Energy policy
  - Manufacturing infrastructure
  - Nuclear fuel cycle (Waste Confidence Rule)
- Opportunities:
  - Current fleet retirement (Coal)
  - Gas prices uncertainty over time
  - Shale gas risks (Methane gas and cost)
  - CO_2 cap and climate change
  - Limitations of renewable energy (wind, solar, etc..,)

Industry Challenges/Opportunities: Operating Plants and New Construction

- *Aging of the world operating reactors*
  - *License Renewal*
  - *Aging Management and Long-Term Plant Reliability*
- *Nuclear Promise*
- *Fukushima*
- *New Construction*

Industry Challenges/Opportunities: Operating Plants and New Construction

- License Renewal
  - License Renewal Application Process (In US, NRC issued a total of 83 license renewals out of 100 licensed to operate)
  - Can Plants Go From 60-80 Years?
  - What Will It Take To Make This Happen?
    - Understanding the subsequent license renewal process
    - Addressing significant technical issues
      - Reactor pressure vessel neutron embrittlement at high fluence
      - Irradiation-assisted stress corrosion cracking of reactor internals and primary system components
      - Concrete and containment degradation
      - Electrical cable qualification, condition monitoring and assessment
    - Developing subsequent license renewal guidance
    - Preparing for subsequent license renewal applications

Industry Challenges/Opportunities: Operating Plants and New Construction

- Delivering the Nuclear promise
  - Nuclear Promise initiative to identify efficiency measures and adopt best practices and technology solutions to improve operations, reduce electric generating costs improving the economic competitiveness of nuclear power plants to preserving the country's operating reactors.
  - Utilities partnering on a multiyear strategy to transform the industry in Advancing Safety, Reliability and Economic Performance (Three Strategic Areas):
    - Maintain Operational Focus
    - Increase Value
    - Improve Efficiency

Industry Challenges/Opportunities: Operating Plants and New Construction

- Fukushima
  - NRC Order EA 12-049 “MODIFY LICENSES WITH REGARD TO REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN-BASIS EXTERNAL EVENTS”
  - Order requires a three-phase approach for mitigating the consequences of postulated beyond-design-basis external events that are most impactful to reactor safety are loss of power and loss of the ultimate heat sink. The order outlines an approach for adding diverse and flexible mitigation strategies—or FLEX— that will increase defense-in-depth for beyond-design-basis scenarios:
    - Phase 1: Cope relying on installed plant equipment.
    - Phase 2: Transition from installed plant equipment to on-site FLEX equipment.
    - Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned

Industry Challenges/Opportunities: Operating Plants and New Construction

- New Construction
  - Conventional nuclear plants were designed based on limited information available at the time of their construction (just in time deliveries)
  - "Stick Build" was the term in plant construction
  - Standardization benefits were minimal
  - Solution: Modularization/3D Models
    - Need to complete early detailed design information to support early procurements and fabrication/ assembly
    - Need to address lifting and handling as part of the design deliverables
    - Need for early alignment, embedment and anchoring details/tolerances
    - Need to address interior wall attachments for pipe routing/HVAC/cable-trays/equipment attachments that have to be complete early before modules are set
    - Need to address access plans for concrete placement in structural modules
    - Modularization can reduce field labor and overall schedule duration costs

Industry Challenges/Opportunities: Operating Plants and New Construction

Thank You

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