Developing a 3 Loop PWR and Severe Accident Simulator for the Japanese Nuclear Regulatory Agency
Developing a 3 Loop PWR and Severe Accident Simulator for the Japanese Nuclear Regulation Authority (NRA)

Barney Panfil – Production Manager - CORYS

John Shriver – Business Development - CORYS
This Presentation

- Project Specification
- Nuclear Regulation Authority (NRA)
- Specifics
- Challenges
- Lessons learned
Project Specification

• Supply a generic 3 Loop PWR Plant Simulator with full digital controls at the NRA offices in Tokyo.
• Use existing installed hardware
Project Specification

• Allow NRA Staff to fully understand the configuration and plant response of a 3 Loop PWR.

During

• Normal plant start-up & shutdown operation
• Load Fluctuation
• Mid-loop operation
• Abnormal Transients
• Design Basis Accident
• Other Severe Accidents
Project Specification

• We can do this – Similar to previous projects completed for the USNRC and others.

• CORYS has long served the market for non-standard solutions and flexibility for our customers.

• CORYS always willing to accept a challenge.
Regulatory Agencies

• Japan-NRA-Nuclear Regulation Authority

• US-NRC – Nuclear Regulatory Commission

• France-ASN-Autorite de Surete Nucleaire

• IAEA – International Atomic Energy Agency
➢ Proposed as a New Regulatory Structure August 2011 following the Fukushima Accident in March.

➢ Formally Established in September 2012.

➢ Prior to the NRA, overlapping agencies were responsible for the regulation of the industry.

➢ Before Fukushima, the agency responsible for nuclear safety, the Ministry of Economy, trade and Industry (METI), was also involved with promoting nuclear energy.
Previous Regulatory Structure

- Cabinet Office
  - Nuclear Safety Commission (NSC)
  - Atomic Energy Commission (AEC)
  - Ministry of Economy, Trade and Industry (METI)
    - Nuclear and Industrial Safety Agency (NISA)
Current Regulatory Structure

Nuclear Safety Investigation Committee (NSIC)

Part of Ministry of Environment (MOE)

NRA
Nuclear Regulation Authority
Human Resource Development Center (HDRC)

➢ Part of the NRA - Established March 2014

➢ Located within the main NRA office complex in Tokyo.
Human Resource Development Center (HDRC)

➢ Provides hands-on simulator training for NRA inspectors and staff.

➢ HDRC includes a Multi-element Glass Panel Simulator (23 Glass Panel Units).

  • Collection of installed PWR & BWR simulators for display and control. Three (3) touch monitors each.

  • Glass panel arrangement greatly reduces hardware requirements as compared to full scope panels with I/O.

 ➢
Project Specifics

➢ Start from a generic 3-loop PWR simulator containing CORYS advanced fluid system models (THOR).
Project Specifics

➢ Add Severe Accident Modeling (MELCOR).

➢ Six installations with 2 pending
  • Monticello – Perry (BWR)
  • Calvert Cliffs – Point Beach (PWR)
  • Millstone 2 & 3 (in progress)
  • NRC Training Center

➢ MELCOR model runs in real time with complete full scope simulation still active.
Project Specifics

➢ Include Japanese specific Severe Accident Mitigation Facilities (similar to FLEX but more rigorous).

➢ Re-assign controls for pumps. Valves and controllers from panel I/O to soft controls (selectable targets and pop up drawings).
Project Specifics

➢ Supply a standard CORYS T-Rex Instructor Station for simulator control.
Project Specifics

➢ Develop drawings for soft panel controls

➢ Each system is created in P&ID style allowing component operation in a natural/intuitive nature.
➢ Develop plant operating procedures

➢ Write Acceptance Test Procedures

➢ Provide everything in Japanese.

コンサート

- Operating Procedures
- Acceptance Tests
- Documentation
- T-Rex Instructor Station
Challenges

➢ Working through an intermediary – the Mitsubishi Research Institute (MRI). Principle supplier to the NRA.

➢ Two step process:
  • Submit documents & drawings to the MRI
  • MRI translates material to Japanese and submits to the NRA
  • NRA reviews material and submits comments to the MRI.
  • MRI translates comments to English and submits to CORYS.
  • Process repeats.
  • All accomplished remotely.
Challenges

➢ Sometimes there can be a significant loss of meaning in the translation process.

の, は, でしたコンサート

➢ We are finding the Japanese are very meticulous as the questions and comments received reflect this mindset.

➢ Meticulous is good. Keeps everyone focused and makes for a high-quality product.
Challenges

➢ Adding the Severe Accident (MELCOR) and FLEX codes.

➢ Re-writing the Instructor Station applications to display Japanese characters using the Unicode standard.

➢ Unicode is the computing industry standard for the consistent encoding, representation, and handling of text expressed in most of the world's writing systems.
Challenges

➢ Unicode Standard covers the character sets of all existing languages.

➢ Now that the Unicode standard has been implemented, text for any language can be employed in the CORYS suite of Instructor Station Applications.

➢ Adding more languages is very simple. Requires editing of a few text files (no need to modify the T-Rex application itself to support a new language).
Challenges

➢ Converting standard I/O interface to soft panel controls for simulator control.
Challenges

➢ Develop reusable popup graphical interface for pumps, valves and controllers.

Valves

Pumps
Lessons Learned

➢ Project is on-going – Lessons are still being learned.

➢ Projects are always more challenging than we are led to believe.

➢ It is important the project management resources budgeted mirror the project management resources the customer will apply.

➢ Communication with the customer always important. Differing language makes communication more of a challenge.
Questions and Comments?

Barney Panfil – Production Manager
904-516-4170
Barney.panfil@corys.com

John Shriver – Director Business Development
912-322-5303
John.shriver@corys.com