U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Application of Digital Platforms in Advanced Construction

Madhumita Sircar
Senior Structural Engineer
Division of Engineering
Office of Nuclear Regulatory Research
US Nuclear Regulatory Commission
September 21, 2023

Preamble

- Based on discussions, interactions, and application of digital platforms in non-nuclear it is potential that use of digital innovations could be beneficial for future nuclear plants.
- Digital innovations are amenable for improving construction, monitoring and plant life management.

Use of Digital Platform

Digital Platform as integrated system including engineering, construction, and aging management

- Building Information Model
- Digital Twins for Important SSCs for structural health monitoring and aging management
- Requirements management

Use of Digital Platform for Construction

Building Information Model

- Repository for information – e.g., material, analytical, design, fabrication, construction, inspection, as built, modification etc.
- Digital innovations are amenable for the modularization in the construction of future nuclear power plants. Benefit: Speed up construction
- Platform for digital information exchange for various activities at various stages
  - as-designed/as-fabricated/as-built/repair/modification and synchronization for efficiency
- Early detection of issues and take optimal actions
  - Difference between designed vs. as-built
  - Mismatch between parts
- Reduce license amendment request and field work
- Reduce rework and improve efficiency (time and cost)

Use of Digital Platform for Construction

- Use of proven technology during construction
  - Drones, Radar, Camera, Laser
  - Sensors, Instruments, Data Acquisition System
  - Geotechnical and Structural Response
  - Nuclear Quality Assurance
- Mapping inspections, tests, analyses, and acceptance criteria (ITAAC)
- Efficiency analysis for implementation

Use of Digital Platform for Structural Health Monitoring and Aging Management

- Digital Twins for Important SSCs for structural health monitoring and aging management.
  - Sensors, Devices, Instruments, Data Acquisition

- Create and maintain an as-built model which can be fed with data recorded from sensors and instruments to replicate the plant response to internal and external hazards, environmental and mechanical stressors
  - Geotechnical and Structural Response

Use of Digital Platform for Monitoring

In-service inspection for inaccessible or hazardous location

- Remote inspection using drones, radar, camera, laser
- Digital information, data, images
- Artificial Intelligence and Machine Learning

Remarks

- No change in Rules and Regulation but improved ways of construction and in-service monitoring and aging management
- When practical, proven, and improved with innovation
  - Digital platform offers benefits of Big Data analysis and interpretation
  - Abundance of data provide risk insights and enable risk-informed performance-based decisions
- Challenges:
  - Reliability and consistent availability of the digital platform
  - Data protection

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Thank you!