Human and Technology Integration

A Dominion/INL Joint Effort

Dominion's Plant Modernization Activities:

Human Factors Multi-Stage Validation Lesson Learned

Stephen J. Kenney, Contractor
Human Factors Consulting SME
BCP Engineers & Consultants

Dominion Energy®

The Plan

Begin with the end in mind – designing the end state

SPS

NAPS

Phased Evolution

5 sequential outages

CV

PV

ISV

Procedures

Training

Procedures

Training

Dominion Energy®

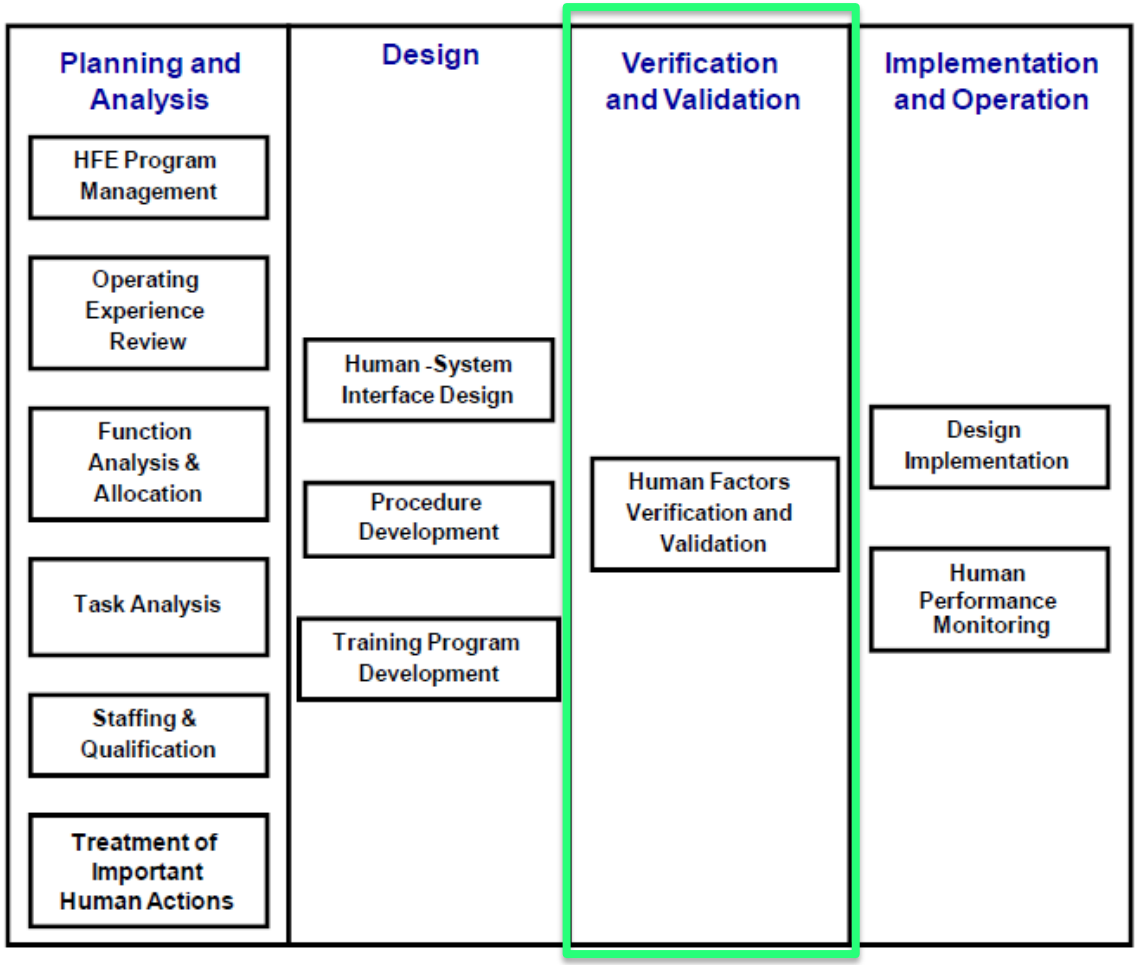
Process Flow Illustrated

Initial Scoping	Concept Design	Detailed Design/Final Design		Installation Planning	Installation and Testing	Operations and Maintenance
	Conceptual Validation Workshop	**Preliminary Validation Workshop**		**Integrated System Validation Workshop**		
	Conceptual Design Development	Final Design Development	Issue Final Design	Pre-Installation	Ready for Training & NRC Inspection	
	- Doc reviews - Meetings - HFE Eval Plan	- Address CV findings - Complete HFE Evaluations - Modify design to minimize HEDs - Develop compensatory actions as needed	- Address PV findings - Issue Results Summary Report	- Address PV findings - Modify design to minimize HEDs - Compensatory actions as needed - Training & Procedures - Modify Plant-Reference Simulator	- Issue Results Summary Reports Rev.1 - Licensed Operator Training	

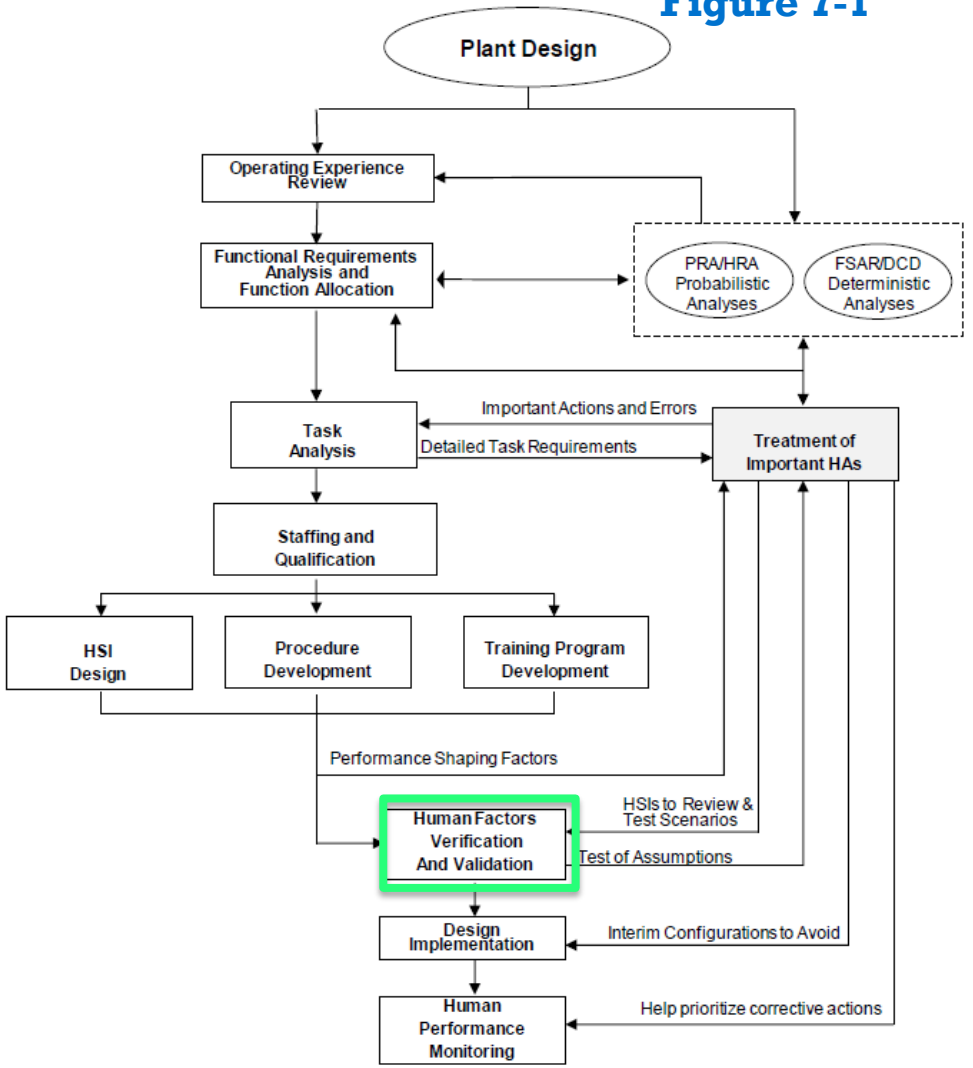
Dominion Energy®

HFE Program, V&V Focus

NUREG-0711 Rev. 3, Figure 1-1

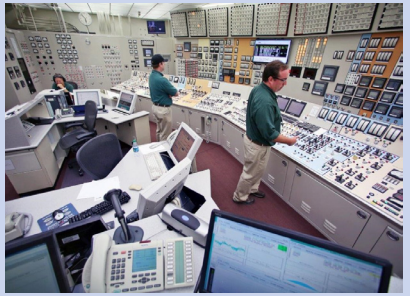


NUREG-0711 Rev. 3, Figure 7-1



Dominion Energy®

Multi-Stage Validation Environments

3D Models	Photo Mosaics	Human Factors Engineering Grade Simulator (HFEGS)	Glass Panel Main Control Room Simulator (GPMS)	Plant Reference Simulators
Surry 				
North Anna 		No HFEGS	Planned GPMS	

Dominion Energy®

Validation Workshops

Conducted to Date

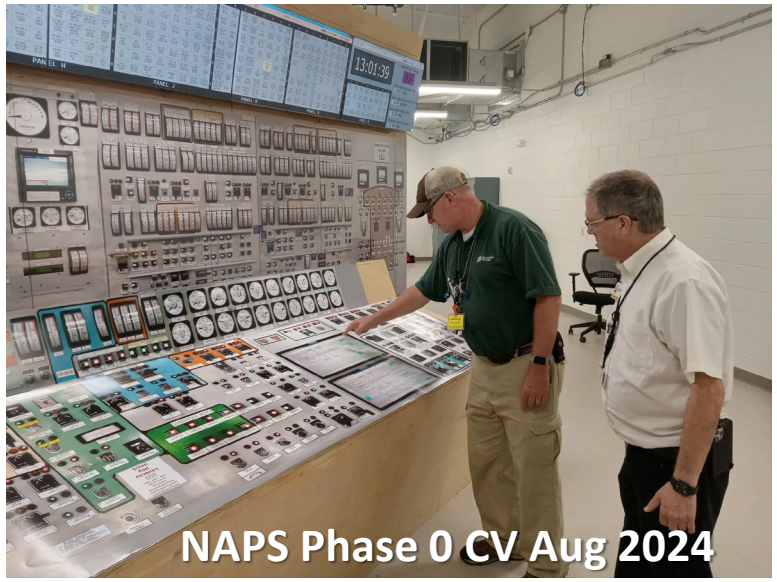
- SPS Phase 0/1A CV
- NAPS/SPS ICCM CV
- NAPS Rod Control CV
- SPS Phase 0/1A PV
- NAPS Phase 0 CV

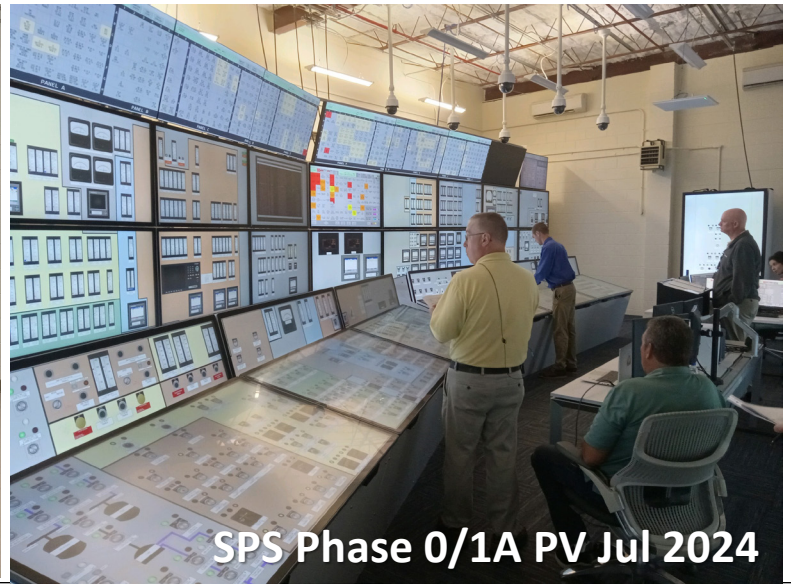
Planned

- SPS CVs Phase 1B …
- SPS PVs Phase 1B …
- SPS ISVs Phase 0/1A
- NAPS CVs Phase 1B …
- NAPS PVs Phase 0/1A …
- NAPS ISVs Phase 0/1A …

Acronyms

- CV = Conceptual Validation
- ISV = Integrated System Validation
- NAPS = North Anna Power Station
- PV = Preliminary Validation
- SPS = Surry Power Station


NAPS Phase 0 CV Aug 2024


SPS Phase 0/1A PV Jul 2024

SPS Phase 0/1A PV Jul 2024 STEAMS PC

Dominion Energy®

ISV Environment

- Guidance states use Plant Reference Simulator (PRS)
- Availability of PRS due to Operator License examinations
- Time to complete PRS modifications and execute the ISV before plant implementation
- Use of alternate environments (ANS-3.5.1)

Lessons Learned (so far)

Planning

- Identify potentially affected Important Human Actions (IHAs) ASAP
- Develop scenarios using a cross-discipline team and available resources (e.g., Ops, design engineers, HFE, safety analysis, procedures, training, sim support, NUREG-0711 Appendix A)
- Leverage prior NRC submittals for report content/presentation to set up workshop plan

Preparing the Environments

- Plan Ops resources well in advance to find available windows to conduct workshops
- Understand resource needs for graphics development and programming
- Install, prepare, and test quality A/V tools before conducting workshops
- Develop appropriate draft procedures for demonstration

Lessons Learned (so far – cont.)

Executing the Workshop

- Set up observation collection aligned with report presentation
- Clarify feedback at the end of each day to pinpoint issues, what is affected, and who to contact for additional information
- Involve key stakeholders to increase awareness of the changes, quality of implementing actions, and receiving organization ownership
- Dedicated support is needed for the overall coordination of the multiple concurrent activities (before, during, and after)
- Collect and implement process improvements after each stage
- IEEE-2411 Multi-Stage Validation works (so far)

Summary

- Dominion is the 1st U.S. utility planning full Control Room Modernization as part of its Subsequent License Renewal program
- Dominion is evolving its Control Room Modernization Process using best available information (internal and external)
- Dominion is leveraging its relationship with INL (CRADA) and other industry groups to address HFE challenges
- Opportunities for collaboration
  - Qualification of simulation environments (ANS-3.5.1, PWROG)

- Achieving Control Room Modernization as part of the SLR program extending by 20 years the life of the 4 nuclear plant assets will contribute to the Sustainability of these Carbon Free Processes

Questions?