

Nuclear Regulatory Commission-Human Performance Test Facility

Enhancing the technical basis for the Nuclear Regulatory Commission's Guidance in Human Factors Engineering



The Nuclear Regulatory Commission (NRC) regulates the safe operations of Nuclear Power Plants (NPP). To assist the NRC in meeting their mission of informing minimal safety requirements for the regulation of NPPs, Prodigy at the University of Central Florida's Institute for Simulation and Training (IST) was enlisted to house and adapt the GSE Generic Pressurized Water Reactor (PWR) simulator for human-in-the-loop experimentation. The simulator is fully physics-based and the Prodigy adapted version is referred to as the Experimental Platform for

Instrumentation and Controls (EPIC). This simulator is used to assess legacy and new NPP Main Control Room designs and technologies to reduce Reactor Operator (RO) errors by identifying the workload levels and types associated with common NPP task types. Electroencephalogram (EEG), Electrocardiogram (ECG), transcranial Doppler (TCD), and functional Near Infrared devices were used to continuously assess workload throughout task execution.



Investigative Questions

1. Is it feasible to use novice participants for NPP Main Control Room experiments?
2. What is the workload levels and types associated with each task type (checking, detection, and response implementation)?
3. What types of errors are associated with different task types?
4. How does the Main Control Room Interface (legacy versus future) influence RO workload and error?

Experiment Highlights

- Utilize novice and experienced/confederate participants
- Collect subjective, physiological, and performance measures of workload
- Employ a mouse and keyboard for interacting with the instruments and controls, resembling the future digital Main Control Room interfaces
- Employ large touchscreens for interacting with the instruments and controls, resembling the legacy analog Main Control Room interfaces

Approach

Design

- Design Experimentation simulating critical NPP tasks
- Develop protocols, training, and simulation scenarios
- Create supplemental experimental platform

Measurement

- Utilize human performance measures
- Record physiological responses
- Administer subjective metrics

Analysis

- Create codebook of variable definitions
- Analyze data to serve as reference point for future research and design

