**Evaluation of Rancor Microworld Human-System Interface Against NUREG-0700 Standard**

Olugbenga Gideon

Department of Psychology and Communication, University of Idaho

PSYC 562: Advanced Human Factors

Dr. Roger Lew

February 7, 2023

**Evaluation of Rancor Microworld Human-System Interface Against NUREG-0700 Standard**

The U.S. Nuclear Regulatory Commission (NRC) granted license extensions to commercial fleets approaching the end of life from the original 40 years to 60 years (Boring et al., 2013). Plant modernization is a critical requirement for life extension. Enhancing existing plant instrumentation and technology and outright replacing others is pivotal for the sustainable operation of nuclear plants with life extensions. Control room simulator-based research is an efficient and expedient strategy to shorten design timelines for digital instrumentation and control and allows for flexible, iterative development and validation (Gideon & Ulrich, 2021). Full-scope simulator studies require operator participants and other experts (Ulrich et al., 2017), which are in short supply and expensive. Microworlds provide a suitable alternative for conducting simulator-based research to enable control room modernization. Rancor is a gamified microworld simulation environment for conducting basic psychological research in NPP process control with novice operators. Rancor may be used to support rapid design, usability testing, verification, and validation of MCR HMIs that are mandated to meet the NRC's Human Factors Engineering (HFE) program review requirements towards control room modernization.

The Human-System Interface Design Review Guidelines (NUREG-0700, Revision 3) enable interfaces between plant personnel and the plant's systems and components to be evaluated for conformance with HFE guidelines. NUREG-0700 guidelines are organized into four basic parts, which are divided into fourteen sections (O'Hara & Fleger, 2020). The goal of this project is to evaluate the HSI of Rancor against seven sections of NUREG-0700 considered most relevant to NPP MCR HFE research audience, namely: information display, user interface interaction and management, alarm system, safety parameter display system, soft control system, computer-based procedure, and automation system*.*

**References**

Boring, R. L., Agarwal, V., Fitzgerald, K., Hugo, J., & Hallbert, B. (2013). Digital full-scope simulation of a conventional nuclear power plant control room, phase 2: installation of a reconfigurable simulator to support nuclear plant sustainability (No. INL/EXT-13-28432). Idaho National Lab.(INL), Idaho Falls, ID (United States).

Gideon, O., Ulrich, T. A. (2022). Simulator Capability Framework. [Unpublished Manuscript]

O'Hara, J. M., & Fleger, S. (2020). *Human-system interface design review guidelines* (No. BNL-216211-2020-FORE). Brookhaven National Lab. (BNL), Upton, NY (United States).

Ulrich, T.A., Lew, R., Werner, S. and Boring, R.L., (2017), September. Rancor: a gamified microworld nuclear power plant simulation for engineering psychology research and process control applications. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 61, No. 1, pp. 398-402). Sage CA: Los Angeles, CA: SAGE Publications