Investigating Display-Related Cognitive Fatigue in Oil and Gas Operations

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Abstract

In the oil and gas industry, rapid technology adoption from the well site to the refinery has led to the introduction of increasingly complex digital displays and operator interfaces. The introduction of these technologies poses new challenges to managing fatigue-related risks for human operators, who already face challenges associated with working extended and irregular shifts to monitor oil and gas operations. Strategies for fatigue risk management, such as shift scheduling and fatigue assessment surveys, primarily target sleep-related fatigue issues; however recent research has indicated that operators also experience significant performance deficits from cognitive fatigue, as well as other task-related mental factors which are conceptually distinct from sleepiness. All of these factors contribute to performance failures and the cost of preventable incidents.

As part of an industry-academic collaboration, this paper highlights ongoing research efforts to isolate and document the extent of operator performance- and safety-related implications of cognitive fatigue, as well as to develop effective countermeasures in mitigating the negative effects of this particular type of fatigue. Examples of how aspects of common display and interface technologies in current upstream operations directly contribute to cognitive fatigue are discussed. Concrete examples of well-known problems in the oil and gas industry, such as alarm fatigue, are described within a developed theoretical paradigm that incorporates physical and cognitive fatigue, sleep-related fatigue, and other mental and physical factors such as motivation and the prevalence of environmental stressors. The paper also describes a planned in situ task analysis, and explores assessment methods for human factors display/interface design guidelines that will ultimately be applied to address the risk factors identified in those efforts.
Keywords: Fatigue Risk Management, cognitive fatigue, display design, operator performance, human factors