

Differential usability of paper-based and computer-based work documents for control room operators in the chemical process industry

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Abstract

In most process control workplaces in the chemical industry, paper-based or computer-based work documents or even both are available to the operator. It was therefore investigated whether one of these versions is preferable and what are the ergonomic recommendations for the design of each. In a repeated-measures simulation study eight operators performed process control tasks in a control room of a simulated benzene/toluene distillation plant. Task performance included typical operational states and was supported by either paper-based or computer-based work documents – identical in content but necessarily different in functional design. Differential handling and usability of the work documents were evaluated using subjective ratings of user satisfaction and workload as well as performance and observational measures. Results show that there are no categorical differences in the usability of paper based versus computer based work documents. Effects of differential usability became obvious, however, for specific tasks, operational states, and work system components in interaction with the media used for documentation. Thus, recommendations for an ergonomic design of work documents must be based on their specific context of use. The results presented were derived from the chemical process industries but should also apply to other process control settings, e.g. pharmaceutical, power, food and transportation industries.

Introduction

According to legal requirements in the European Union and its member countries (e.g. Seveso II Directive, 1996; Safety and Health Directive, 1989; Work Equipment Directive, 1989; VDU-Directive, 1990) human factors and ergonomics design strategies (e.g. task orientation) and principles (e.g. compatibility) have to be observed in the design of process control systems. This also applies to the design of work system interfaces with a view to the effectiveness, efficiency, and safety of the process under control and to the resulting workload for the operators — which in turn should improve system reliability and productivity (Nachreiner, 1998; Nachreiner et al., 2005).

In D. de Waard, K.A. Brookhuis, R. van Egmond, and Th. Boersema (Eds.) (2005), *Human Factors in Design, Safety, and Management* (pp. 299 - 314). Maastricht, the Netherlands: Shaker Publishing.