

Investigating Written Procedures in Process Safety: Qualitative Data Analysis of Interviews from High Risk Facilities

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Socio-technical systems, such as those in oil and gas, or the petrochemical and energy industries, are escalating in complexity, a consequence of increasingly advanced technologies, organizational constructs, and business functions that interact and depend on one another. These dynamic social and technological elements, coupled with the high risk inherent in these systems, have generated conditions that can bring about catastrophic failure and the tragic loss of human life, such as the disaster in Bhopal, India (1984) or the explosion in the Houston Ship Channel near Pasadena, Texas (1989).

Historically, the perception of such complexities and the struggle to minimize catastrophic failures observed within the petrochemical industry have been attributed to the inherent variability in people. Therefore, process safety regulations associated with the Clean Air Act Amendments of 1990 and the Occupational Safety and Health Administration (OSHA) require employers to develop written process safety information or “procedures” which aim for consistency in plant operations and to help workers at the “sharp-end” of the system cope with unexpected events (OSHA, 2000). However, investigation reports since, such as the BP Texas City incident of 2005, suggest “outdated and ineffective procedures” as significant contributing factors to failure. Evidence from other studies suggest that procedures in complex environments are sometimes misunderstood, outdated, or simply not used (Bullemer & Hajdukiewicz, 2004). While there have been studies on procedural deviations and safety violations (Alper & Karsh, 2009; Jamison & Miller, 2000), employers continue to report a high rate of procedural breakdown as root causes for incidents (Bates & Holroyd, 2012). This warrants a contemporary, systems-oriented inquiry into process safety and behavior surrounding the use of the documents at different individual (e.g. cognitive), task, cultural, organizational, and environmental levels. This perspective appreciates the interdependent nature of these interrelated socio-technical elements and should provide insight into the effectiveness of current procedure systems, thereby informing future work in creating and empirically testing mitigation methods to address potential barriers.

This research documents one part of a three part, large-scale project that investigates the issues with procedure forms, usage, adoption, and challenges in a wide range of high-risk industries. As such, the method was framed around first understanding the extent to which these challenges could be generalized between various locations. A grounded theory approach in qualitative data analysis, influenced by the Strauss & Corbin and Charmaz approaches (Bryman 2015) and facilitated by the analysis software MAXQDA-12 was used to examine 72 semi-structured interviews with operators of varying roles and experiences across 6 countries and an offshore drilling vessel.

Findings reaffirm previous research, suggesting that the effectiveness of written procedures is limited by an abundance of outdated procedures plagued by information overload. New findings suggest that frequency of the task and the experience level of the worker would impact workers’ procedure use, with participants commenting that the perceived importance of these documents decreases significantly after initial training periods. Other unintended consequences associated with written procedural systems range from complications in using the documents around personal protective equipment (PPE) requirements and harsh weather, reactive organizational behavior surrounding changing procedures, and a general disconnect between the users and the writers of these documents. This is only exacerbated as management imposes pressure to use procedures on personnel despite the issues encountered with the documents, inhibiting valuable feedback within their organizations as personnel withhold information for fear of job security and potential punishment (in the form of 20-day suspension programs or termination).

Moving forward, research is in-progress to identify the interdependencies between environmental, cultural, organizational, task, and personal factors unique to each location. This will provide insight regarding the extent to which procedures may *not* be generalized, after which a holistic view of procedure use in the industry will be offered. The resulting insight will point to recommendations for the future redesign of procedures’ role in promoting safe operations within petrochemical systems. Finally, the third part of this research project will demonstrate the efficacy of using visualizations as tools and methods in qualitative research for modeling complexity in socio-technical systems.

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