

Relationship between safety culture and safety outcomes

This sheet outlines the relationship between safety culture and safety outcomes and presents evidence of the strength of the relationship. Safety culture influences safety through the behaviour of managers, supervisors and frontline employees. Safety culture determines the effectiveness of the safety management system and the quality of barriers that are in place to manage hazards. If an organization has a poor safety culture then the systems designed to minimize risk will not be implemented as intended. It is important to note that safety culture influences the behaviour (including decisions) of all levels within the organization not just frontline staff. For example, a senior manager could manipulate the risk assessment process to justify the decision to perform an operation without adequate risk controls in place.

Safety culture and outcomes



As outlined in the diagram above, there is a two way relationship between safety culture perceptions and safety outcomesⁱ. Employees' perceptions of the relative priority placed on safety will influence their behaviour which in turn influences the likelihood that they will be injured. If an employee is injured at work it is likely to negatively influence their perceptions of the safety culture. In addition, if a serious event occurs (e.g. a fatality) or an increase in the injury rate, then the safety culture at that location is likely to decline.

Although the term safety culture was coined in the aftermath of the Chernobyl nuclear disaster much of the empirical evidence linking safety culture to outcomes focuses on occupational injury. The focus on occupational injury is likely a result of methodological challenges in determining the causal factors associated with disasters.

Since the early 1990's the offshore oil and gas industry has supported research investigating the relationship between safety culture perceptions and injuries. In general these studies correlated employee ratings of a

number of safety culture dimensions and self-report injury involvement. These studies provide evidence of a moderate correlation between safety culture perceptions and injury involvement.

Outside the petrochemical industry, there is a large body of research that provides support for the association between employees' perceptions of the safety culture and occupational injuryⁱⁱ. A recent comprehensive review of the literatureⁱⁱ provides evidence that there is a negative relationship between safety culture perceptions and occupational injuries (i.e. the more positive employee perceptions the lower the injuries). While on average there was a significant relationship between perceptions and injury, there was a high level of variability across the 28 studies included in the review. This means the association between safety culture perceptions and occupational injuries is indirect and complex. The indirect relationship is supported by evidence of a large correlation between safety culture perceptions and safety behaviour, which is in turn strongly correlated with occupational injury.

Safety culture is frequently cited as a causal factor in disasters, for example Chernobyl, Fukushima, Texas City, Piper Alpha and Deep water horizon disasters. Investigating the relationship between safety culture and disasters is challenging, as disasters are thankfully rare events. It is therefore impractical to attempt to correlate safety culture perceptions with disasters. There is evidence from the nuclear industry that safety culture perceptions can be used to predict major hazard safety performance indicators (e.g. scrams)ⁱⁱⁱ. An alternative approach is to review the causes of major disasters and identify how often safety culture is a causal factor.

Recently, the public inquiry reports of 15 offshore disasters were reviewed to investigate the extent to which a poor safety culture was identified as a causal factor^{iv}. The study reviewed disasters from 1980 (Alexander Kielland) to 2010 (Deep water horizon). Only disasters with an English language public inquiry report were reviewed. Since the term safety culture had not been coined in 1980 the inquiry reports were reviewed

Relationship between safety culture and safety outcomes

for evidence of the presence of safety culture threats rather than searching for the term 'safety culture'. The following four safety culture threats were used to analyse the inquiry reports:

- Tolerance of inadequate systems (9 disasters),
- Normalization of deviance (7 disasters),
- Complacency (7 disasters)
- Production pressure (3 disasters).

Twelve of the 15 reports provided evidence that a poor safety culture was a contributory factor. The three inquiry reports that did not provide any evidence of safety culture as a causal factor were the Cormorant Alpha helicopter crash (1992), the East Cameron Block blow-out (1997) and the Lemna Field helicopter crash (2002). These reports focused mainly on technical aspects of the disaster rather than organizational factors. It is therefore possible that safety culture was a contributing factor but the information was not presented in the inquiry report.

The majority of the disaster inquiry reports provided evidence that more than one safety culture threat was a contributing factor. Tolerance of inadequate systems was identified as a causal factor in nine of the 15 inquiry reports. This threat refers to the acceptance that safety critical equipment or systems are not working as intended. These are long standing issues that have not been address over time, as the criticality of the systems is not recognized.

Normalization of deviance was identified as a contributory factor in seven of inquiries reviewed. This threat refers to the situation when non-compliance with safety rules becomes the accepted practice. Complacency was also identified seven times. Complacency is not simply a lack of concern for safety, it also includes a belief that safety management systems are so robust a major event could not occur. In many cases complacency occurs when an organization or location has better than industry average safety outcomes. When complacency is present there is a belief that the rules do not apply and there is a lack of critical self-evaluation.

Production pressure was only identified three times and it was never a unique cultural threat. This is surprising as perceived production pressure is frequently identified as a cause of occupational injury and is included in many safety culture perception surveys.

Given the nature of safety culture is difficult to demonstrate a causal relationship between it and safety outcomes. There is good evidence that safety culture perceptions are associated with occupational injuries. The review of public inquiry reports provides some evidence that safety culture is a causal factor in offshore disasters. It is important to note that it is possible that these culture threats may not have been contributory factors and may simply be present in all organisations. Also the nature of public inquiry reports increases the likelihood of hindsight bias, as those conducting the investigation are looking to identify system weaknesses.

Key Points:

- Safety culture influences safety outcomes as it determines the extent to which an organization lives its management systems.
- There is good evidence that safety culture perceptions are related to occupational injury.
- There is some evidence that safety culture was a causal factor in the majority of offshore disasters reviewed.
- There is also growing evidence that employee perceptions are associated with how effectively major hazards are being managed.

ⁱ Beus, J. M., Payne, S. C., Bergman, M. E., & Arthur, W. J. (2010). Safety climate and injuries: An examination of theoretical and empirical relationships. *Journal of Applied Psychology, 95*, 713-727.

ⁱⁱ Clarke, S. (2006). The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology 11*, 315-327.

ⁱⁱⁱ Morrow, S., Koves, K., and Barnes, V (2014) Exploring the relationship between safety culture and safety performance in U.S. nuclear power operations. *Safety science 69*:37-47.

^{iv} Fleming, M. and Scott, N. (2012) Cultural disasters: Learning from yesterday to be safe tomorrow. *Oil and Gas Facilities*, Vol. 1, No 3. 24-26.