Assessing Employee Attitudes towards Behavioural Approaches to Safety Management within UK Reactor Plants

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Abstract

This paper considers the implementation of a programme of behavioural safety within the nuclear industry. The focus of the investigation is to describe how employees within reactor plants view behavioural approaches to safety management. In particular it addresses the perceived strengths and weaknesses of behavioural approaches to safety management and identifies the contribution of such approaches towards organisational learning. A questionnaire was developed by the research team to investigate the embeddedness of the behavioural safety process within the organisation.

1 Introduction

Learning is a hypothetical construct i.e. it cannot be directly observed but can only be inferred from observable behaviour. Learning usually implies a fairly permanent change in a person's behaviour or behavioural potential that results from direct or indirect experience (Hulse *et al*, 1992). Within the realms of workplace safety these observable behaviours are directly related to task performance and accident reduction. Behavioural safety therefore provides individuals with an opportunity to learn in a 'safe' and trusting environment (Cox, *et al*, 2002).

The concept of learning is a broad one. Early learning theorists focused on behaviours, covering both informal (unintentional) and formal (deliberate) learning. Watson (1924) applied classical conditioning to human behaviour and concluded by suggesting that the process of learning involved the learner passively responding to events within the environment. Skinner (1938) however, believed learning to be an active process suggesting reinforcement strengthens behaviour whilst punishment tends to weaken behaviour. Thus, in operant conditioning the stimulus makes the behaviour more likely to occur; however, this is not inevitable as it is in classical

conditioning. Bandura (1965) emphasised observational learning suggesting that mere exposure to a model is sufficient for learning to actually occur. However, whether the learning is actually revealed in the individual's behaviour seems dependent on the consequences of the behaviour for both the model and the learner.

The link between individual and organisational learning occupies a critical position within many theories of organisational learning. Many theorists believe that organisational learning begins with the individual; Simon (1991) rejected the notion that organisations themselves learn, claiming that 'all learning takes place inside individual human heads' and organisations learn through the learning of their members. While some theorists argue that organisations themselves actually learn. Such theorists view organisations as 'systems of interpretation and just as individuals have brains and beliefs they suggest that organisations have cognitive systems and memories…worldviews and ideologies' (Hedberg, 1981).

Learning plays an important role within high-reliability organisations. In particular, organisations within the nuclear sector, are required to 'manage safety as a major component of operations, and must therefore learn from precursors and near misses rather than exclusively by trial and error' (Carroll, 1998). Research suggests that failure is an effective means of pursuing learning (Sitkin, 1992). Even within high-reliability organisations were the spectre of catastrophe makes failure difficult to routinise, it is essential that large-scale problems be reduced to more manageable levels to permit experimentation (Leary, 1988). Within the UK nuclear industry behavioural approaches to safety management have been implemented, which not only inform employees the safe way to perform an act but also provide information to individuals on unsafe behaviours and their consequences.

Researchers have suggested that unsafe behaviours both directly and indirectly account for between 80-90% of all workplace accidents and incidents (HSE, 2002; Hollnagel, 1993). Behavioural approaches to safety management have a proactive focus, encouraging employees to 'consider the potential for accident involvement, and their own behaviour as safe versus unsafe before somebody gets hurt' (Sutherland *et al*, 2000.) The behavioural approach focuses on observable behaviour rather than on attitudes, with the assumption underlying the approach being that once a person's behaviour has changed a change in attitudes will soon follow. The process involves trained employees observing their colleagues at work and feeding back information related to the behaviours observed.

Recognition of the importance of behavioural patterns in the accident process has led to an increasing number of safety improvement programmes focused on individual behaviours (Cooper *et al*. 1994; Cox and Cox, 1996). Behavioural approaches to safety management have thus acquired increasing popularity in recent years. However, the implementation and sustainability of such programmes have been variable and many successful programmes that have reportedly improved health and safety performance have seemingly lost momentum (HSE, 2002).

The current study, undertaken as part of the European funded project 'LearnSafe' (FIKS-CT-2001-00162), considers the development and implementation of a programme of behavioural safety within the nuclear industry. Building upon previous work, this paper focuses on the impact, sustainability and embeddedness of the process within the study organisation. The objectives of the study are thus, (1) to assess employee perceptions of and commitment to

behavioural safety, (2) to appreciate how individuals see opportunities for learning through engaging in the initiative and (3) to assess the embeddedness of the process within the study organisation.

2 Methods

Personnel from three representative nuclear power plants within the UK participated in the study. A questionnaire was designed to assess employee attitudes toward the study organizations behavioural safety process (BSP). The questionnaire was based on the findings of a previously reported study (Cox *et al*, 2002), which involved the researchers conducting a series of interviews with key personnel (n=9). The key concepts uncovered from the interviews (see Table 1) via content analysis formed the basis for the questionnaire. The researchers examined the internal scale reliability of the BSP questionnaire and the scale was found to have good internal consistency (Alpha = 0.8357). The questionnaire was also tested for face validity with an expert panel, and was subsequently amended and cleared for distribution at three representative nuclear power plants.

Table 1. Output generated from the content analysis of the interview transcripts (adapted from Cox *et al*, 2002).

Perceived Strengths	Perceived Pitfalls	Learning potential/ outcomes
Builds safety into culture Increases safety awareness Promotes communication Increases interaction between employees and supervisors Encourages sharing of knowledge and learning from mistakes Highlights a direct link between behaviour and consequences Development of employee skills Safety is everyone's responsibility	Unreal expectations Needs foundation of trust Can be used negatively as a 'weapon' More feedback needed Reluctance to be observed Certain teams/ groups deliberately undermined approach Difficulties of maintaining enthusiasm Management of consequences Slows other work/ procedures	Vehicle for organisational learning Opportunities for communication/ knowledge sharing Source of valuable knowledge for local learning Allows and reinforces learning from mistaken actions Direct link between behaviour and consequences Problem identification and employee driven solutions Praise given for safe behaviour

The Site BSP co-ordinators at each of the participating nuclear plants agreed to distribute the BSP perception questionnaires during site safety meetings. BSP Observers (n=83) and employees who have been observed as part of the programme (n=74) were asked to complete the questionnaire. Participant's involved at this stage in the data collection process reflected a cross section of plant employees including members of the plants lead teams and individuals from a number of functional areas on site e.g. maintenance, operations, etc. Once questionnaires had been completed they were posted directly to the researchers.

Using the BSP perception questionnaire information was gathered on each participant's role within the behavioural safety process and reactor site location. Participants were asked to indicate their agreement with each of the 28 items included in the BSP perception questionnaire (0 = I do not understand this

statement, 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree and 5 = strongly agree).

3 Results

Quantitative methods were selected to analyse the data generated from the questionnaire study. Completed questionnaires were returned by post and then subjected to analysis using SPSS. An independent-samples t-test was conducted to compare the BSP perception scores for BSP observers and the observed. There was no significant difference in scores for the observers [M=107.42, SD=11.604], and the observed [M=105.76, SD=9.063; t(155)=-.993, p=.322] (see Table 2). The magnitude of the differences in the means was small (eta squared=0.026).

Table 2. Output generated from the independent-samples t-test.

		t-test for Equality of Means			
		T	df	Sig. (2-tailed)	Mean Difference
TOTAL	Equal variances assumed	-.993	155	.322	-1.66

A one-way between-groups analysis of variance was conducted to explore the impact of reactor site location on BSP perception scores, as measured by the BSP perception questionnaire. Participants were divided into three groups depending on the location of their reactor site (Group 1: Reactor Site 1; Group 2: Reactor Site 2; Group 3: Reactor Site 3). Results of the analysis showed no statistical significance between reactor site location and BSP perception scores [F(2, 154)=0.124. p=.906] (see Table 3). The size effect, calculated using eta squared, was 0.0016. Post-hoc comparisons using the Tukey HSD indicated that the mean score for Group 1 [M=107.19, SD=12.105] was not significantly different from Group 2 [M=106.61, SD=10.910]. Group 3 [M=106.37, SD=9.755] did not significantly differ from either Group 1 or Group 2.

Table 3. Output generated from the between-groups ANOVA.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.497	2	13.748	.124	.884
Within Groups	17118.809	154	111.161		
Total	17146.306	156			

4 Discussion

The results of the quantitative data analysis highlighted participant's positive attitude and commitment toward the behavioural safety process. The highest mean score (4.55) was calculated for question 2 of the BSP perception questionnaire, 'A proactive approach to safety should be utilised within nuclear power plants', highlighting the importance attached to the use of the behavioural safety process within the reactor sites involved in the current investigation. While, the lowest mean score (3.12) was calculated for question 13 'When sponsors, co-ordinators

and observers move within the organisation or leave their position it is difficult to sustain the behavioural safety process'.

Participants were encouraged to make additional comments when completing the BSP perception questionnaire. A number of employees commented on the importance of the behavioural safety process becoming part of the organisations culture and encouraging continuous improvements on site i.e. 'behavioural safety is not about paperwork, it is about talking to each other and improving safety one step at a time (constant improvement)'. Participants seemed concerned regarding the difficulties of using the data management system and the feedback provided as part of the process i.e. 'I know nothing about the behavioural safety data management system. What does happen to the information gathered from behavioural safety observations?' This comments suggests that more needs to be done regarding the use of the observation data and the feedback of findings to employees working on site.

Findings from the quantitative analysis of the questionnaire data suggest that there is a positive commitment towards the behavioural safety process at the participating reactor sites. Employees taking part in the questionnaire study reported that the behavioural safety process is important in improving safety on site. Participant's suggested that utilising a behavioural safety approach increased both awareness of safety issues and communication between employees working on site. The majority of the employees at the participating plants felt that the BSP was not a fad that would die out over time. Participant's highlighted that effective leadership is essential for the success of the BSP, whilst also reporting that the process must be built upon a foundation of trust. The data generated from the questionnaire study also highlights the belief that safety should be the responsibility of everyone on site and the majority of participant's felt that everyone had an opportunity to become involved in the behavioural safety process. Finally, participant's reported that behavioural safety acts as a motivator, as well as assisting in the changing of employee attitudes.

Using an independent-samples t-test participant's scores on the BSP perception questionnaire were inspected in terms of the individuals role within the behavioural safety process. Analysis of the scores uncovered that there was no significant difference in the scores for observers and the scores of the observed (see Table 2). Thus, whether individuals are BSP observers or have their work observed as part of the process their attitudes of the behavioural safety process appear to be positive.

A one-way analysis of variance was also conducted to explore the impact of reactor site location on BSP perception scores. Analysis of the BSP perception scores showed no significant difference between individual's scores at the participating reactor sties (see Table 3). Thus, all three of the participating reactor sites appear to have a positive attitude towards the behavioural safety process.

The results from the statistical analyses of the data indicate that the behavioural safety process is deeply embedded within the study organisations culture as there appears to be no differences in the attitudes expressed by individuals at different levels of employment, within different roles or at different locations across the country.

Dixon (1999) believes that each member of the organisation has the capability to learn and an organisation learns through the capability of its members.

Behavioural safety could therefore be viewed as a vehicle for mobilising such capability. The behavioural safety process helps to build and maintain a learning organisation by providing opportunities for individuals to learn and thus add value to the organisation. The process also offers opportunities for capturing and sharing knowledge amongst individuals and encourages employee driven problem solving. The process can also be considered to be a useful tool for encouraging the development of a learning organisation as it promotes teamwork and creates collective meaning towards issues related to safety i.e. creating 'a shared vision'. Behavioural safety records organisational experience and provides feedback to employees in that it 'closes the loop' for learning. Finally, the process helps to develop and strengthen individual skills and creates a climate focused upon learning.

5 Conclusion

The investigations findings indicate a positive commitment to behavioural safety within the study organisation. The analyses of the data generated by the questionnaire indicate that the behavioural safety process is embedded at all levels and within all representative sites participating in the current study.

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