

PROMOTING BEST PRACTICE IN BEHAVIOUR-BASED SAFETY

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ABSTRACT

Promoting safe behaviour at work is a critical part of the management of health and safety, because behaviour turns systems and procedures into reality. Good systems on their own, do not ensure successful health and safety management, the level of success is determined by how organisations 'live' their systems. Behaviour based safety programmes aim to improve safety by promoting critical health and safety behaviours. There is evidence that these programmes are effective in improving safety, but only when they are implemented effectively. Four offshore case studies are presented to highlight how behaviour safety programmes can be implemented effectively. To date behaviour-based safety programmes focus on the behaviour of frontline employees and behaviours that prevent individual accidents as opposed to major hazards. A behavioural safety intervention strategy to promote any critical risk control behaviour including management behaviour is described.

INTRODUCTION

Over the past few years, there has been a dramatic increase in the use of behavioural safety programmes in the UK. They are now routinely used in a wide range of industry sectors, from construction to food processing. Behavioural safety techniques are based on a large body of psychological research into the factors that influence behaviour. This research has led to the development of a range of techniques to influence behaviour. Behaviour modification is the psychological term for these techniques. Within a health and safety context, behaviour modification techniques are used to increase the frequency of behaviours that enhance safety and decrease the frequency of unsafe behaviours.

The majority of behavioural safety programs concentrate on front-line employee behaviour, and do not take into account the behaviour of managers. Given the known impact of visible management behaviours on safety, it is important to investigate how behavioural safety techniques can be used to increase the frequency of safety critical management behaviours. .

This paper presents the results of two research projects supported by the Health and Safety Executive:-

1) a joint industry / HSE project[1], part of the UK offshore oil and gas industry's Step-Change in Safety Initiative, which (a) examined best practice in behaviour-based safety, including barriers and enablers to effective implementation and (b) documented four different types of offshore behaviour-based safety initiatives, each appropriate for different circumstances

2) an ongoing HSE-funded project which builds upon the first project, to describe strategies to promote critical behaviours that support health and safety management.

WHAT IS BEHAVIOURAL SAFETY?

Behavioural safety techniques improve safety by identifying and promoting critical safety behaviours. Critical safety behaviours are promoted by altering the consequences of these behaviours to reduce or eliminate unsafe behaviours and to increase the frequency of safe behaviours. Safety and risk control improves as the frequency of "at-risk" behaviour decreases and the frequency of safe behaviours increase.

Behavioural safety is also known by other terms, including

- behaviourally-based safety
- behaviour modification
- behavioural safety management systems
- safety observation systems.

HOW TO PROMOTE CRITICAL HEALTH AND SAFETY BEHAVIOURS

Behavioural modification is based on an ABC model of behaviour[2]. This model states that behaviour is triggered by a set of antecedents and the likelihood that a behaviour is repeated is dependant on the consequences following the behaviour. By examining any behaviour, it is possible to identify the antecedents and the consequences. For example, the behaviour of 'lifting receiver on a telephone when it rings' would reveal that sound of the telephone ringing is the antecedent and speaking to another person on the other end is a consequence. This ABC model of behaviour can be used to understand why people behave in a specific way and how to influence their behaviour.

Behavioural safety programmes typically seek to arrange antecedents (A) and consequences (C) around the behaviour to be changed (B) in such a way as to maximise the reduction of at–risk behaviour, and increase safe behaviour. By using this ABC model of behaviour change, at-risk behaviour is reduced or eliminated, accident rates drop and safety improves. For example, ABC analysis could be conducted to investigate why workers do not wear their ear defenders in noisy environments (see table 1).

Table 1 Example of an ABC analysis

Antecedents	Behaviour	Consequences
Ear defenders supplied by company Required by company to wear ear defenders in specific areas Knowledge of potential damage to hearing if ear defenders are not worn Signs highlight areas where defenders are needed Noisy environment	Wearing ear defenders in noisy environments	Reduces the likelihood of hearing loss in the future Less likely to get into trouble with management for not wearing ear defenders Difficulty hearing their radio Discomfort of wearing ear defenders
Peers do not wear ear defenders Knowledge that rules on wearing ear defenders are not enforced	Not wearing ear defenders in noisy environments	Impaired hearing in the future Avoid discomfort of wearing defenders Able to hear better in the noisy environment

Before the above analysis can be used to identify interventions to increase the use of ear defenders, it is necessary to understand that consequences can either increase or decrease the likelihood of behaviour being repeated and that some consequences have a greater impact on behaviour than others.

CHANGING BEHAVIOUR

The likelihood that a behaviour will be repeated is dependant on the consequences. If the consequences are reinforcing for the ***individual*** then they will repeat the behaviour. If they do not find the consequences reinforcing then they will not repeat the behaviour. Therefore, it is possible to change behaviour by altering the consequences. The frequency of a desired behaviour can be increased by providing consequences after the behaviour that an individual finds reinforcing. It is important to note that, it is what the individual finds reinforcing that drives their behaviour and that what people find reinforcing can sometimes seem counter intuitive. For example, sometimes disciplining children can reinforce the undesired behaviour, as the discipline is the only attention that they receive.

There are three main types of consequences that influence behaviour. These are positive reinforcement, negative reinforcement and punishment. Positive and negative reinforcement, increase the likelihood that a behaviour will be repeated, while punishment reduces the likelihood.

Table 2 Types of consequences*

Consequences that increase behaviour

Positive reinforcement	Negative reinforcement
Receive something that you want	Avoid something you do not want

Consequences that decrease behaviour

Punishment	Punishment
Receive something you do not want	Loose something you have or want

***Adapted from Daniels[3]**

The above consequences can be used to separately or together to change behaviour. For example, the frequency of managers conducting site tours could be increased by:

Positive reinforcement: superiors praising manager after they conduct tours
Negative reinforcement: peers remove disapproval for not conducting tours
Punishment: managers' bonus is reduced if tours are not conducted.

There are three major factors that influence the impact that consequences have on behaviour change and these are described in the table 3 below.

Table 3: Factors influencing impact of consequences on behaviour

	Timeframe	Predictability	Significance
Large impact on behaviour	Soon	Certain	Important to individual
Limited impact on behaviour	Distant	Uncertain	Unimportant to individual

Consequences that have the greatest impact in determining an individual's behaviour occur soon after the behaviour, the individual is certain that they will occur and the consequences are important to the individual. Consequences that delayed or distant, that the individual is uncertain whether or not they will occur and are unimportant will have limited impact.

EFFECTIVENESS OF BEHAVIOURAL SAFETY PROGRAMMES

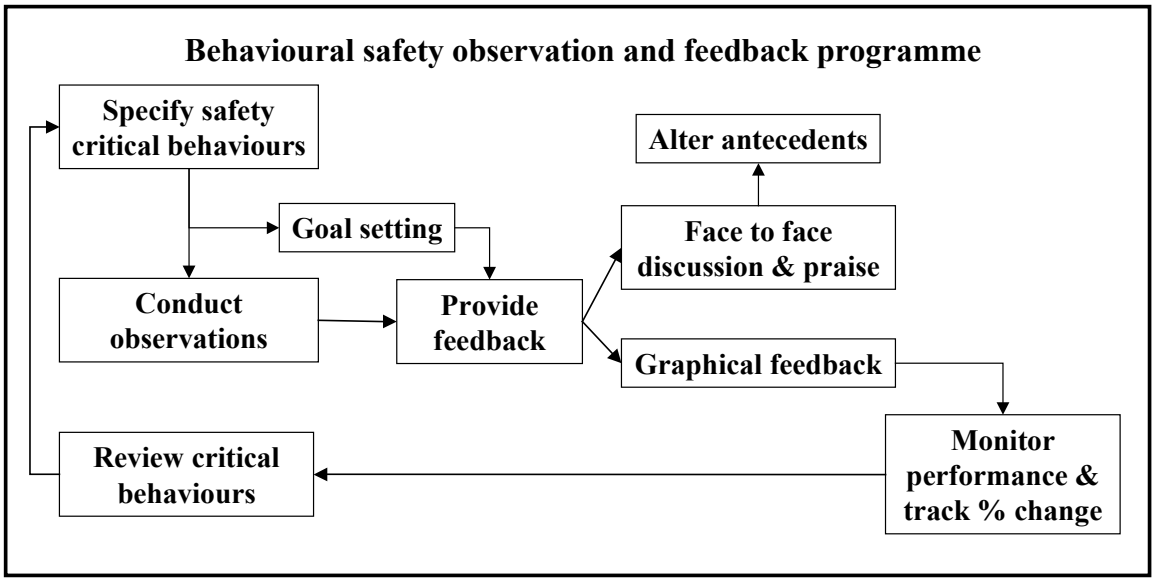
A large number of studies have been conducted to evaluate the effectiveness of behavioural modification programmes in improving workplace safety. These studies have focused on establishing (a) their ability to decrease accidents / injuries, (b) their ability to increase safe behaviour and (c) which components in a behavioural safety programme are most important in changing unsafe behaviour and reducing accidents and injuries.

A literature review[4] investigating the effectiveness of behaviour based safety programmes in reducing accident rates identified 33 published studies that reported accident data. Of these studies, 32 reported a reduction in injuries, although the reporting format varied. The level of improvement varied widely with one study reporting a 2% improvement with another reporting an 85% improvement. In addition, very few of the studies conducted statistical analysis to establish the significance of the change in accident rates. In spite of the limitations of these data presented in published studies, this review concluded that there was sufficient evidence to demonstrate that behavioural safety programmes improve safety when implemented effectively.

Strong research evidence exists from a range of industries on three continents that behaviour modification techniques can lead to safer behaviour[5]. A recent literature review[6] compiled for the UK HSE concluded that behavioural safety programmes are effective in altering employee behaviour. The review identified twelve methodologically sound research studies, which investigated the effectiveness of behavioural safety programmes in changing behaviour. All twelve studies demonstrated that behavioural safety programmes are effective at changing employee behaviour.

A number of research studies have been conducted to investigate the relative importance of the component parts (see Figure 1) of a behavioural safety programme, in order to establish how they can be optimally combined[6]. Use of a training-only component achieved mixed results, and where successful only modest improvements. The addition of graphical feedback, goal-setting and support from management and peers produced significant additional gains. Although theoretically and intuitively important, the added impact of immediate face-to-face feedback has not been systematically demonstrated. Management's commitment to supporting programme implementation was also identified as a critical success factor.

Figure 1: Behaviour based safety programme



Since 1978, a large number of studies have been conducted to evaluate the effectiveness of behavioural modification programmes in improving workplace safety. The majority of these studies have concluded that behavioural safety interventions are effective.

OFFSHORE CASE STUDIES

Recently a joint oil industry and HSE funded study[1] was conducted to identify best practice in implementing behaviour modification programmes. Four case studies were carried out to provide information about the range of programmes currently being used in the UK Offshore Oil and Gas Industry. The project aimed to identify barriers and enablers associated with these behaviour modification programmes. The four programmes included: Time Out For Safety (TOFS), Advanced Safety Auditing (ASA), STOP and Care Plus.

Each case study involved interviewing both onshore and offshore managers and installation employees. The interview schedule was structured around the principle features of behaviour modification programmes identified by a literature review, to ensure that all the important features were discussed and the results could be placed in the context of a theoretical framework. The results of the interviews were analysed to produce an overall picture of the elements and features of effective behaviour modification programmes and the organisational requirements to increase the likelihood of success. Accident statistics were reviewed to assess the impact of these programmes on safety.

TOFS was developed by the drilling crew on the bp's Andrew platform, in response to some of the challenges they were facing. Over time, it has been adopted by the entire platform and more recently by other installations. TOFS is effective because it is designed to modify an important behaviour of frontline employees, namely stopping the job if they have any concerns. It is simple, as it does not require employees to complete forms, which also reduces anxiety about colleagues being reprimanded for their actions. The successful introduction of TOFS on the Andrew was partially due to the installation's high level of safety cultural maturity.

ASA has provided an additional means for management on bp's Miller platform to make a visible, tangible commitment to safety. They do this by conducting ASA's themselves, providing ASA training for most of their workforce, and opening up their own managerial work practices by inviting all staff to conduct an ASA on them. What began as a management tool has been widened to include all core employees, and ownership of ASA has thus been extended.

Conoco management regard the re-launch of STOP as a success. Managers and supervisors' participation in the programme has been enhanced, and they believe they have now enlisted the core crew's acceptance of STOP. Core crew now understand that via STOP they can make a real difference to safety with very little additional time and effort.

Care Plus is a complex behavioural intervention, which includes all the major features of behaviour modification. There appears to be a strong sense of ownership for the programme among the workforce. The programme seems to have a momentum and life of its own because it has endured, even though many of the initial volunteers and champions have left the platform. The acceptance of Care Plus by the majority of the workforce has been a major achievement. At the time of the case study, the programme had been fully in operation for less than 12 months, yet there had already been a reduction in frequency rate of first aid cases. The criteria for the success for this type of intervention are management commitment, trust between all staff and employees who are interested in safety and willing to take ownership of their own safety behaviour.

The four case studies included very different types of behaviour modification programmes. The case studies are representative of the type of programmes currently being used in the offshore oil industry. General conclusions that can be drawn from the four case studies are outlined below.

- All the interviewees were convinced that the behavioural intervention they were using was having a significant positive impact on safety.
- Only one of the four case studies could demonstrate a significant reduction in accident rates following the introduction of the programme.
- The success of all four programmes was dependent upon management support and commitment.
- Employee involvement in the process from the beginning increases the likelihood of success.
- Setting quotas for the number of observation cards to be submitted is likely to be counter productive and may lead to fictions cards being submitted.
- The success of programmes aimed at frontline employees requires a pre-existing level of trust between management and workers.
- It is important to control people's expectations for early reductions in accident statistics.
- The interpersonal skills (e.g. non-threatening questioning) of installation staff need to be developed in order for the behaviour modification programme to be effective. It is important to note that although some proprietary programmes do not include interpersonal skills training, employees still requires these skills to ensure programme effectiveness.

PROMOTING CRITICAL HEALTH AND SAFETY BEHAVIOURS THAT SUPPORT THE SMS

Current behavioural safety observation and feedback programmes only target a limited proportion (approximately 25%) of critical health and safety behaviours[7]. Health and safety can be dramatically improved, if behaviour modification is used to promote even a proportion of the remaining 75% of critical behaviours.

Figure 2 Health and safety behaviours categories

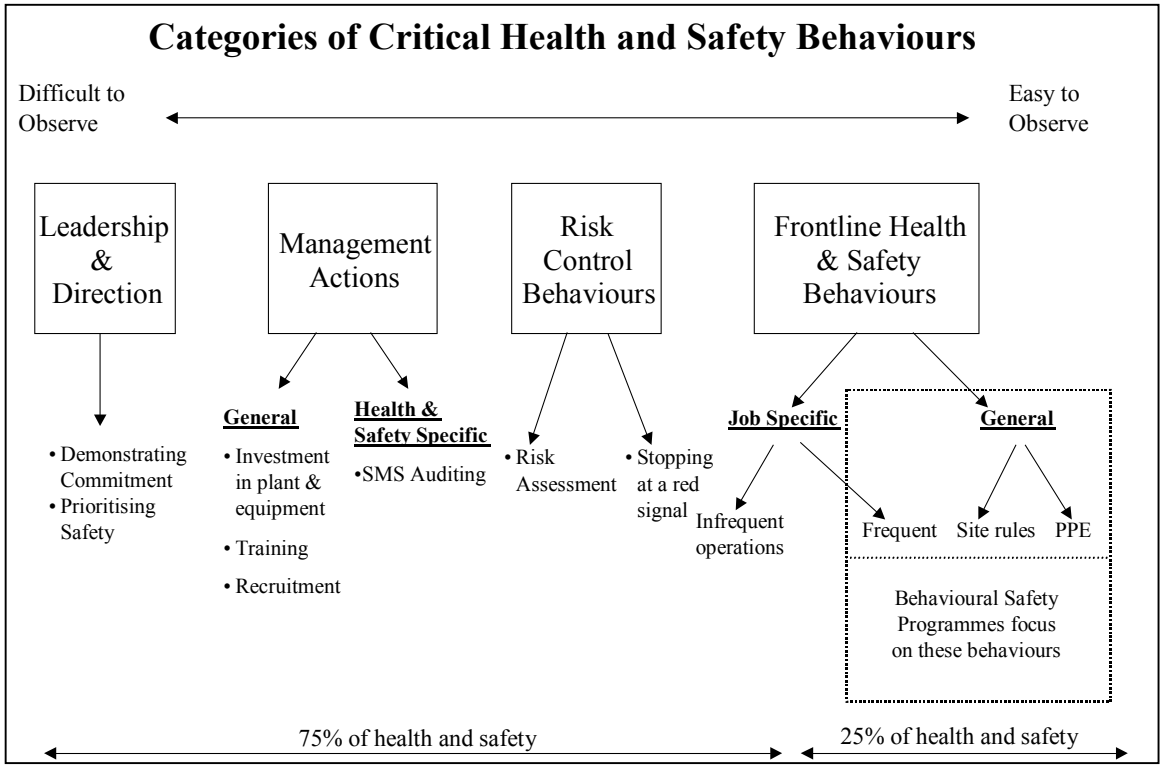


Figure 2 describes four main categories of critical health and safety behaviours, including: frontline health and safety behaviour, risk control behaviour, management actions and leadership and direction. The majority of behavioural safety programmes currently in use within the UK focus on general safety behaviours of frontline personnel including compliance with site rules and procedures (wearing light eye protection, adhering to speed limit) or frequent job specific activities such as correct manual handling behaviours.

Since there are no published examples of behaviour modification being used to promote the entire range of critical health and safety behaviours, it is necessary to develop an intervention from first principles.

DESIGNING A HEALTH AND SAFETY BEHAVIOUR MODIFICATION INTERVENTION

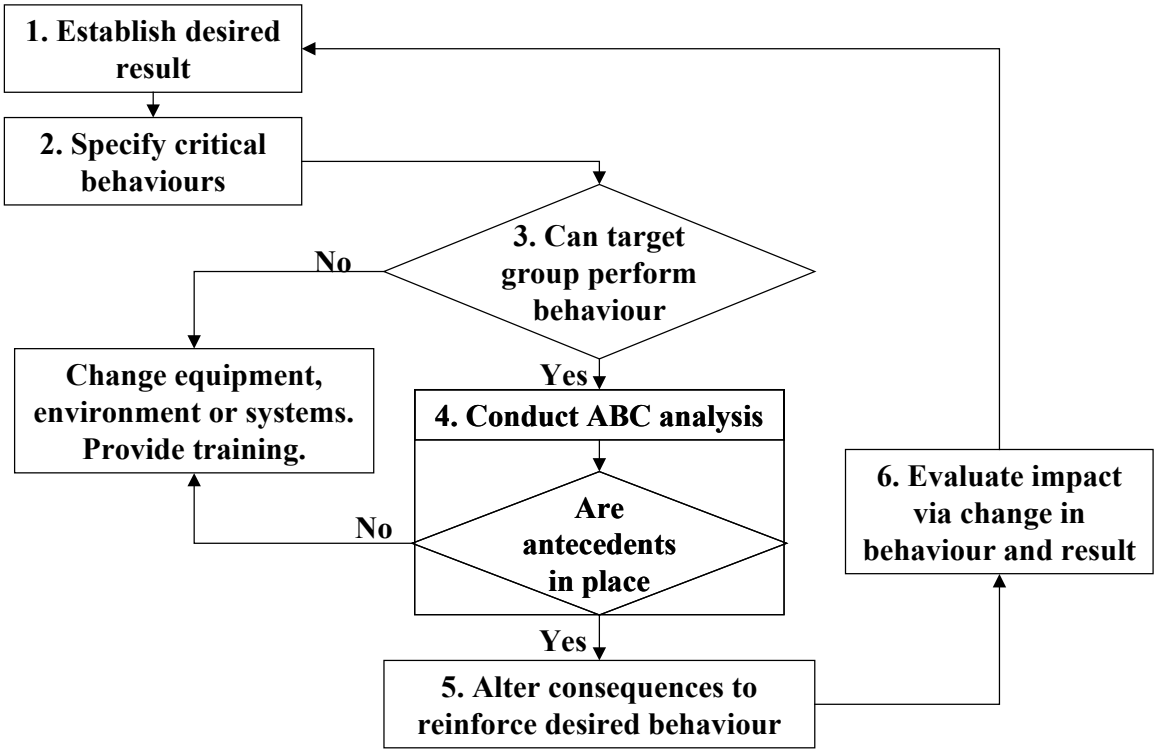
This section describes how to design a behaviour modification intervention to promote critical health and safety behaviour not included in current programmes. Initially the core elements of behaviour modification interventions are described, followed by a six-step guide to behavioural change. Finally, an example to illustrate how to used the six-step guide to promote critical health and safety behaviours is provided.

Behaviour modification interventions vary depending on the organisational setting, the target population and the behaviours to be changed. The core elements of behaviour modification form a six-step intervention process:

1. Establishing the desired result or output of the activity or the individuals under examination
2. Specifying critical behaviours that influence performance of the area to be improved
3. Ensuring that the individual(s) can perform the desired behaviour
4. Conducting ABC analysis on the current and desired behaviour
5. Altering the consequences immediately following the desired behaviour
6. Evaluating the impact of altering the consequence on the behaviour and on the desired result.

These six main steps are represented diagrammatically in figure 3.

Figure 3: Six-step behaviour modification intervention strategy.



This six-step process can be used to analyse and promote any critical health and safety behaviour.

Establish the desired result

The first step in any behavioural change process is establishing the desired results or outputs from the group of individuals in question. It is important to be clear about what you are trying to achieve because if you do not know this, it is not possible to judge success. In the context of health and safety, an example of desired result is increased compliance with SMS procedures and rules, which would be demonstrated through improvements in independent SMS audit results.

Specify critical behaviour

Once the desired result is specified, then the behaviours necessary to achieve this result need to be established. When specifying the desired behaviours it is important to remember that behaviours are tangible and observable, they are not beliefs, attitudes or subjective[3]. These behaviours need to be defined precisely, statements like: 'demonstrates that they are committed to safety' are too general. It is necessary to specify the actual behaviours required to demonstrate commitment to safety. It may be necessary for organisations to investigate this topic further before they can specify the behaviours. One useful way of identifying critical behaviours is to examine what behaviours differentiate effective employees from those who are less effective in the area where improvements are sought.

These behaviours need to be stated as positive actions, as opposed to a lack of action e.g. 'adheres to all rules and procedures' instead of 'does not violate procedures'. Although this may seem like a difference of semantics, it is a critical difference, as it is possible to achieve the latter by doing nothing, which means it is not a behaviour. This pitfall can be avoided by applying the 'dead man test' developed by Dr. Lindsley, which states, "If a dead man can do it, it is not behaviour and you should not waste your time trying to produce it"[3]. Although this may seem like common sense, it is surprising how many common goals violate this rule. For example, a common safety goal is zero accidents, which violates the dead man test, as dead men never have accidents. It is important to specify behaviours that positively enhance safety, because it is possible for organisations to achieve zero accidents in the short term by reducing their levels of maintenance, yet the safety of the organisation may in fact be deteriorating drastically.

In addition to being positive actions, behaviours must be observable, measurable, and reliable. It is sometimes argued that many important behaviours are not observable, but this cannot be the case, as by definition all behaviours are observable, even if the behaviour is only observed by the actor. If it is not something that can be observed then it is not a behaviour. In situations where the actor is the observer, it is possible to use self-observation, combined with graphical presentation in public to encourage honest reporting.

Once something can be observed then it can be measured, even if a behaviour is not happening it can be measured, "the measure is zero"[3]. It is important that the behaviour can be measured reliably if behaviour change is going to occur. The most effective way of testing reliability is to compare the results of two observers who are observing the same behaviour. If they come up with the same result, then the behaviour is reliable. These three criteria (observability, measurability and reliability) can be achieved through detailed description of the specific critical behaviour.

Establish that the target group can perform the behaviour

The target individual or group must have control over the critical behaviour for a behavioural intervention to work. If the behaviour is not within their control, then it will not be possible for them to alter their behaviour. If they are not able to perform the behaviour then changes will be required to the environment, systems, equipment or the individual through training (see HSG48 for further details).

Conduct ABC analysis

ABC analysis is conducted on the desired behaviour and the current behaviour to identify the antecedents and consequences of the behaviour. If this analysis reveals

that the antecedents for the desired behaviour are not in place then this will need to be addressed. These are necessary to enable the individual to perform the behaviour; therefore, all individuals that may be required to perform this behaviour will require these antecedents. For example, following a fatality an organisation mandated that all employees working above six feet had to wear a safety harness. In effect, this meant that all process operators would need to wear a safety harness on occasion, but they had not received training in how to use a safety harness. A subsequent incident revealed that process operators were not using the harness correctly and it was providing limited protection.

The analysis involves rating the consequences of the desired and undesired behaviour in terms of their timeframe, predictability and significance (as described above). An effective way of ensuring that the consequences for the individual are identified is to involve individuals who perform the behaviour in the analysis. The process of identifying consequences needs to be conducted in an open environment where participants can highlight negative consequences (punishments) for performing the desired behaviour.

Alter consequences to reinforce desired behaviour

The ABC analysis identifies the consequences that are driving the current behaviour, which highlights the areas requiring change. The intervention will involve providing more soon, certain and positive consequences for the desired behaviours or removing these consequences from the undesired behaviour. In reality, a mixture of both will be required.

Evaluate impact of intervention

Assessing the effectiveness of the programme requires establishing the level of behavioural change and change in the desired result following the intervention. In practice, this involves comparing the output and the behaviour of the target group following the intervention with the baseline measure to establish the degree of change.

USING BEHAVIOUR MODIFICATION TO PROMOTE MANAGEMENT BEHAVIOURS

The above outlined the six stages of a behaviour modification intervention. The following section illustrates how this six-step process can be used to promote any critical health and safety behaviour through an example of promoting management behaviours.

Step one: Define the desired result of the management activity

The desired result of effective safety leadership is a positive safety climate, indicated by at least 70% of employees perceiving that senior managers are committed to safety.

Step two: Specify the critical behaviours

Specifying the critical behaviours required for effective safety leadership involved reviewing the literature on safety leadership. The identification of company specific leadership behaviours could be established by holding discussion groups with employees and interviews with managers who are perceived to be committed to safety. The literature review identified behaviours that were consistently associated with effective safety leadership. One of these behaviours was selected for the current example. The critical behaviour is:

- Meeting with employees frequently to discuss safety issues.

Step three: Establish that the managers can perform the behaviours
Managers have control over their time and meet frequently with subordinates and therefore are able to meet with employees frequently to discuss safety issues. Pressures from other commitments sometimes make it difficult for managers to meet with staff frequently.

Step four: Conduct ABC analysis on the desired behaviours
The critical behaviour was analysed using the ABC process described above. The ABC analysis for meeting and not meeting with employees to discuss safety issues is presented in table 4 below.

Table 4: ABC analysis of meeting with employees frequently to discuss safety

Antecedents	Behaviour	Consequences	R/P	T	P	S
Awareness of the benefits of discussing safety with subordinates Holding safety discussions is a part of job	Meeting with employees frequently to discuss safety issues	Perceived by subordinates as committed to safety	R	D	U	U
		Recognition from senior management	R	D	U	I
		Increased workload	P	S	C	I
		Receive a list of problems to resolve	P	S	C	I
Other managers do not meet with staff to discuss safety	Not meeting with employees frequently to discuss safety issues	Continue working uninterrupted	R	S	C	I
		Avoid negative interactions with subordinates	R	S	C	I
		Perceived as not committed to safety	P	D	U	I

R/P =Reinforcement/ Punishment. T= Timeframe (Soon / Distant). P= Predictability (Certain/ Uncertain). S= Significance (Important/ Unimportant).

The ABC analysis in table 8 reveals that the antecedents are in place for the desired behaviour to occur.

The analysis of consequences indicates that the reinforcing consequences for meeting with staff to discuss safety issues are distant, uncertain and unimportant, while the punishments are soon, certain and important. In addition the reinforcing consequences for not meeting with employees are soon, certain and unimportant, while the punishment is distant and uncertain. It is therefore not surprising that managers do not meet with staff frequently to discuss safety. The frequency of the desired behaviour will be increased by providing more reinforcing consequences that are soon, certain and important and removing the punishments for the desired behaviour.

Step five: Alter the consequences
The ABC analysis of the critical behaviour revealed that this behaviour could be promoted by introducing additional consequences to reinforce the desired behaviour. An effective way of doing this is to introduce an observation and feedback programme to promote this behaviour.

Designing an observation and feedback programme targeted at managers, professional and technical staff presents a number of difficulties. For example, the relatively low number of managers within an organisation means that there is less opportunity to observe managers displaying these behaviours. Therefore, even if managers are meeting with subordinates frequently to discuss safety issues they may not be observed. It can also be difficult to observe managers behaviour as they can be conducted behind closed doors. It is unlikely that a random observation programme would be able to collect meaningful data on this behaviour and therefore it is unlikely to work. This suggests that a self-observation of the critical behaviours would be more effective.

Consultation with the target group of managers is required before introducing a self-observation and feedback programme. The consultation needs to explain the rationale behind observation and feedback, the theory underpinning behaviour modification and how the information collected will be used. Managers will also require training in how to conduct the observations and record their data.

Observation and feedback programmes require a list of clearly defined behavioural measures. The list of behavioural measures is drawn up in consultation with the target group of managers. The following is the list of behavioural measures to promote the critical behaviour.

- The number of interactions per week with frontline staff where safety is the main topic of conversation and the member of staff rates as positive. (Employee to complete card evaluating quality of interaction and submit it anonymously)
- The number of safety concerns raised by employees per week that are responded to, actions agreed and a completion date mutually agreed within 12 working hours.

Once the behavioural measure is agreed, a set of initial observations provides a baseline measure of current performance. The management team set a group target for each behavioural measure using the baseline results. Individual managers conduct self-observations, with confirmatory information drawn from frontline staff through their evaluation of discussions, safety concerns raised and safety suggestions made. Managers use an individual behavioural matrix to record their performance. The results are shared with the manager's team and the results for the management group are presented graphically to the entire workforce.

The managers also identify the consequences of the desired behaviour to ensure that they find them reinforcing. The consequences for performing the desired behaviours for the managers include praise from colleagues and superiors, positive feedback and success at reaching target.

Step six: Evaluate the impact of the intervention

The effectiveness of the programme in changing behaviour is evaluated by comparing results with the baseline measure to establish the degree of behavioural change. The effectiveness of the programme in improving the safety climate is measured by repeating the safety climate survey to identify the degree of change in employee perceptions.

CONCLUSIONS

Behaviour is a critical aspect of all activities conducted within every organisation. Therefore, the behaviour of all staff has a dramatic impact on safety. Behaviour modification techniques can be used to promote the effective use of risk control strategies and to analyse the at risk behaviours to ensure that the risk is minimised.

There is strong research evidence that behaviour modification is effective in changing a range behaviours within organisational settings. Within a safety context the research shows that behavioural safety programmes can alter frontline employees behaviour and reduce incident rates. Surprisingly there were a limited number of publications demonstrating the effectiveness of a behavioural intervention in promoting critical risk control behaviours or safety leadership behaviours.

In the absence of published description of interventions designed at promoting critical risk control behaviours, first principle were used to describe how behaviour modification could be used to promote these behaviours. The approaches described could be used to promote critical behaviours, such as managers ensuring that manpower levels are adequate for the workload or frontline staff monitoring the status of machinery to ensure it is functioning effectively.

It is widely accepted that human behaviour is a contributory factor in approximately 80% of accidents. This statistic has lead to confusion about how to improve health and safety at work, as many people have concluded that further improvements in safety will occur by changing the employees in some way to make them ‘safer’ or to make them adhere to safety rules and procedures. Perceiving the problem as a within the employee prevents the identification of effective solutions. Behavioural change is not brought about by changing the person, but by changing their environment. Further improvements in safety require changes systems and engineering that facilitate behavioural change. This document describes strategies to promote critical health and safety behaviours, implementing these strategies involves introducing new systems and or changing existing systems and engineering controls. The strategies described in this document will not change the employees, only their behaviour.

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