

MANAGING THE RISKS OF CHANGE

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The process industry has always had to deal with changes to plant and equipment, and since Flixborough and other major accidents, the need to manage these changes has been recognised. More recently, the process industry has been more affected by people and organisational change. The systems needed to manage these changes are not so well understood.

This paper will examine the types of change that the process industry now has to deal with, almost continually. Based on experience of change programmes affecting staffing levels, supervision, control room arrangements and shift patterns; the author will demonstrate how the potential risks can be identified and managed. The paper will demonstrate that the underlying process is the same for any type of change, including human, organisational, equipment and plant; and that understanding this process should allow companies to develop simple yet effective change systems.

INTRODUCTION

We know from bitter experience that accidents often happen during, or shortly after a period of change. The explosion at Flixborough in 1974 was a particularly graphic example. 28 people lost their lives because of a poorly executed change to the design of the plant.

Change happens all the time and, given the safety concerns, it is important we understand the risks. This is becoming more important as the rate of change for most organisations is greater now than it ever has been in the past. This paper examines the types of changes being experienced in the process industry, and considers what needs to be done to manage the risks.

DRIVERS OF CHANGE

Change either occurs as a response to an event or condition; or as a proactive intervention to capitalise on an opportunity that arises. For any organisation the expectation must be that any change will result in a benefit to some or all of its stakeholders. This may be a financial benefit achieved through improved productivity or reduced costs; or avoiding regulatory intervention to maintain the business. Other drivers for change, including those related to safety, the environment or reputation can be equally strong, although they have less direct financial benefits (at least in the short term).

As with all things in life, there is usually a cost associated with any change. This includes the obvious resource requirements to plan and implement a change. Also, change often introduces the possibility for less tangible and unintended consequences to arise. This is especially the case where people perceive that a change will affect them

directly or indirectly. A fear of change appears to be a natural human reaction that can significantly affect the cost and/or benefit of implementing change.

The introduction of new technology is a major driver of change. In the process industry the result has been more automation and safety protection. This has in general improved productivity, quality and safety; but, it has also resulted in people loosing their jobs and significant changes in the jobs that have remained. It is also fair to say that the actual benefits arising from new technology can sometimes be rather disappointing, especially considering the cost.

THE RISKS OF CHANGE

A key objective for any organisation is to manage the risks of its activities. In simple terms, risk management is a continuous process involving the following stages:

1. Identify hazards;
2. Determine what harm may be caused and the likelihood of such events (i.e. assessing the risks);
3. Identify suitable controls, balancing risk with cost;
4. Implement risk controls;
5. Review to ensure risks are as low as reasonably practicable.

The question is where does change fit into this process?

CHANGE IS A HAZARD

OHSAS18001 [BSI 1999] defines a hazard as a “source or substance with the potential to cause harm”. Given the observation that accidents often occur during or shortly after a period of change, it seems reasonable to consider change to be a source with the potential to cause harm. Therefore change is a hazard, leaving us to consider the risks of any change so that we can be sure that sufficient controls are included when managing the change.

MANAGING CHANGE

All changes have potential consequences. Some of these are intended, so one purpose of a change management system is to make sure the benefits are achieved. Other consequences are unintended, so another purpose is to avoid negative outcomes. The problem is that the full impact of change is not always easy to predict.

MANAGEMENT SYSTEMS

The quality cycle provides us with a generic model for management systems. Applied to managing change, the stages are:

- Plan – design the new system, identify what needs to be done to achieve it and plan how it is to be done;

- Do – modify the system;
- Check – confirm the change has been implemented and evaluate the results;
- Review – consider whether the change has been successful and whether any further intervention is required.

EXISTING CHANGE MANAGEMENT SYSTEMS

Having experienced the Flixborough disaster, the industry is very well aware that changes to process plant need to be properly managed. The result has been that most companies now have a plant change system of some description.

For simple changes to plant and equipment, management systems usually consist of a form on which the details of the proposed change are recorded. The form is then circulated between ‘competent people’ who assess the plans and, if satisfied approve the change. The change can then be implemented.

For more complex or risky changes the six-stage hazard study program (or equivalent) is often used. This provides a method of assessing conceptual and detailed design (including Hazard and Operability or HAZOP studies) through to commissioning, start-up and subsequent review. This works well with the more general concepts of project management.

PROBLEMS WITH EXISTING SYSTEMS

There is little doubt that the existing systems represent a significant improvement on how change was managed in the past. However, there are recurring problems. For example, it is easy for people at the sharp end of the system to see it as a form filling exercise, and that signatures are needed to get the job done. This can detract from the risk management objectives. Ultimately people can become frustrated with the bureaucracy and be tempted to take short cuts.

There is the tendency to close-out changes once they have been implemented, which means the ‘check’ and ‘review’ stages of the quality cycle are often missed. This reflects a natural human trait to focus on what is considered to be the main objective of any activity, placing less importance on ‘additional’ tasks. Also, there is often little incentive for people to review the changes they have been involved in as that review may highlight failures. Much better to accept the credit for getting the job done, especially if it was on time and on budget, and to bury any bad news that may emerge in the future.

However, a problem with many of the change systems currently in use across the process industry is that they have only been designed to address the technical aspects of plant and equipment changes, and do not cover other knock on effects, or changes that are not related to plant and equipment. This means organisational and human factors are not well catered for. Also, most systems are more focussed on change control rather than change management.

CHANGES THAT NEED TO BE MANAGED

The HSE refer to the 'four P's' as elements of work to be considered when managing risks. This provides us with a structure from which to identify changes of concern. The elements are:

- **Premises** – buildings and other infrastructure. Any change to the structure is of concern.
- **Plant and substances** – the equipment and materials involved in the activity. Modification, addition, removal and change of use are all of concern.
- **Procedures** – written and unwritten methods of work. Any change to the way tasks are performed is of concern, which is not always directly related to what is written.
- **People** – individuals and teams. Changes to the people involved in work or the way they are organised is of concern.

The challenge is to be able to identify the changes that take place, assess their risk and implement suitable controls. In an environment where change is almost continuous, this is not straightforward.

GUIDANCE RELATED TO CHANGE MANAGEMENT

A Google search of the term 'change management' will generate a great number of links to web pages. However, most of these are related to the human resource implications of wide-scale or global organisational change, or the process of controlling and documenting changes (e.g. as part of project management or development of computer software). Although much has been written since the Flixborough accident about controlling engineering changes, little has been written about organisational change or the wider implications of change management in the process industry.

In order to better understand the guidance available, the few documents relating to managing organisational change in the process industry have been reviewed [HSE 2000, HSE 2003a, Sanders 1993]. None of these appears to provide the definitive review of the requirements. However, taken as a whole it can be concluded that the basic requirements of a change management system include:

- Companies with safety critical operations must have systems in place that ensure any change taking place does not increase risk to the operation;
- The system must ensure people involved in planning and implementing the change are aware of the risks;
- The system must ensure that the people reviewing the change are competent to assess the potential risks and identify the necessary controls;
- The amount of resource required to manage individual changes must be commensurate with the risk;
- Whilst recognising that low risk changes require less onerous management than higher risk changes, the system must also account for the fact that multiple minor changes over time can introduce higher levels of risk;

- Arrangements must be made to ensure good communication by informing and involving people likely to be affected by change, particularly across organisational boundaries;
- Details of changes must be recorded in a transparent and auditable fashion, including decisions made during planning;
- The system must recognise that change involves uncertainty, and this must be built into the risk assessment.

Overall, change management systems must provide a systematic and structured approach to managing change. They must reflect the fact that there will always be risks, so that the principles of ‘inherent safety’ should be core to the system. In this context any change should be used as an opportunity to remove hazards, or reduce quantities; and improving safety should be one of the intended outcomes. They should assist in creating an appropriate cost-benefit relationship, ensuring the potential benefits outweigh the risks. Also, there is the requirement to ‘sell’ changes to people who may be affected, and to monitor the positive and negative effects after implementation.

MANAGING PEOPLE CHANGES

HSE have recently published guidance regarding organisational change [HSE 2003b]. It provides useful ideas about how to address changes to the organisation at the operational level, including changes of key personnel, new methods of team working and changes to reporting relationships. Risk assessment is a key element of the suggested approach to be taken. Two complementary approaches are proposed:

- **Task analysis** – to understand the impact on how tasks are performed in changing from the old to the new organisations;
- **Scenario assessment** – ensuring the new organisation will be able to cope with high demand situations.

The guidance is very useful in outlining what is expected where major hazards are present, although it gives little detail about what companies will need to do to manage change in practice.

EXAMPLES OF CHANGES HAPPENING IN THE PROCESS INDUSTRY

In order to illustrate the issues related to change management that are currently affecting the process industry, a number of examples are described below. In each case the drivers of change are examined, the potential risks identified and risk controls proposed.

CONTROL ROOMS

There are two key drivers that are resulting in changes to control rooms at process sites. The first is the move towards digital computer control systems, with the latest innovation being windows based interfaces. The second is the location of the control room further from the plant to reduce the risks of external events.

A study [HSE 2002] has confirmed that the changes to control rooms are having a significant affect on plant operations. Examples of the impact include:

- Modern control system interfaces reduce the area of plant 'visible' to the control room operator at any time (i.e. the operator needs to 'page through' displays);
- There is less opportunity for control room and field operators to communicate face-to-face, meaning use of radios and phones is increasing;
- The control room operator loses any direct perception of what is happening on the plant (i.e. they cannot hear, see, smell or feel what is happening);
- There is a bigger difference between the control room and field operator role than there was in the past.

There is no doubt that locating the control room further from the plant provides increased protection to the occupants. However, it must be recognised that there are potential negative consequences. In particular the relationship the control room operator has with other members of the team and with the plant itself must be maintained. This may not be a problem in the short term as the people involved will retain their prior knowledge and experience. However, over time the divides are likely to widen unless action is taken to avoid them. One option is to implement a job rotation programme, whereby operators perform both control room and field roles on a regular basis. This has many benefits, including flexibility within the team to fill roles, but can have the negative effect of diluting experience, and results in situations where the best person for a particular job may not always be in that position.

A further complication regarding changes to control rooms is that they are often seen as an opportunity to introduce additional changes, often implemented at the same time. Examples include centralising operations (i.e. one control room is used to control a number of plants across a site), increasing levels of automation and/or reducing manning levels. These issues do have potential benefits for the business in improving efficiency and reducing costs, but can be perceived negatively by the operators. Therefore, as well as complicating the change process, such multiple changes can increase the resistance from the people affected. Where possible, changes should be introduced in stages. At present many companies do not have the systems in place to evaluate changes of this nature, and so proceed with implementation without a full consideration of the likely impacts and risks.

STAFFING ARRANGEMENTS

A key driver for changes in staffing arrangements has been the reduction of costs through 'down-sizing.' This has been enabled by new technology and working practices, but the result is often in substantially smaller operating teams and/or less people available to support operations.

The HSE recognised reductions in staffing levels across the process industry and were concerned that in many cases the changes were being implemented with little consideration of the potential risks. They have subsequently published the 'staffing assessment

methodology' [HSE 2001] which assists organisations in confirming that staffing arrangements are adequate to at least detect, diagnose and respond to emergencies and other high demand situations. The methodology has been widely used across industry, and a number of recurring themes have been identified.

One of the ironies of improved safety is that emergencies occur less frequently. Therefore it is particularly difficult to predict the demands likely to be placed on people dealing with the emergency, taking into account the extra demands caused by stress and confusion that is inevitable in these situations. From using the staffing assessment methodology it has been possible to show that in some cases smaller teams would not be able to respond to events in the same way that they have done in the past. In some cases the additional risk may be unacceptable. However, in others it does not affect the key safety related actions, but can prevent some of the more peripheral actions taking place (e.g. answering phones, writing logs). The conclusion in those cases is that emergency procedures need to be updated to ensure activities are prioritised properly.

The methodology often identifies 'softer' issues with proposed changes to staffing arrangements, whereby operators may feel they will be under more pressure and held more accountable. This can have an immediate impact on morale (which can be a significant distraction and cause of stress), and highlights how easy it is to have negative impacts on an organisation's culture. It is important to recognise that perception of change can create major problems, and this needs to be addressed by the change management programme.

In considering staffing arrangements it is important to realise that it is not only the number of staff that is the issue. For example, it is clear that 3 competent people who work well as a team can be more effective than 5 people who are less well organised. Equally, the negative consequences of reducing staffing can often be counteracted by good use of technology and automation.

TEAM SUPERVISION

There is a general trend across industry to 'delayer,' moving from large hierarchies to flatter organisations through the adoption of multi-skilled and/or self-managed teams. The result is often a change away from the traditional supervisor or foreman role; replaced by a team leader, coach or mentor.

A study of supervision in the process industry has been published [HSE 2004] that highlights how important supervision is in ensuring safety, and that it is often overlooked by companies as they change their working arrangements. Reference is made to one study [Bomel 2003] that suggested that accidents are often the result of supervisors being overloaded as a direct result of new working practices, meaning they are less able to monitor how tasks are performed or deal with bad practices and violations.

The reality is that different methods of delivery supervision have inherent strengths and weaknesses. Traditional hierarchies ensure responsibilities are clearly defined and understood, resulting in strict control on how work is carried out. Conversely, self-managed teams are weak in these areas but achieve better communication and decision

making within the team, resulting in improved job satisfaction and commitment from the team members.

Given the important role supervision plays in safety, it is vital that the people with supervisory roles have the necessary competency. This includes their knowledge of the jobs and associated hazards that they supervise, as well as their ability to supervise. As organisations become 'flatter,' more people become involved in the supervisory activity, and this leads to higher levels of competency requirements and more complexity in managing the delivery of supervision. Ultimately, the effectiveness of supervision is affected by the personality of supervisors, the people they supervise and the organisations' managers. In some cases, a change to an individual in a key role (e.g. supervisor or manager) can represent a significant change to the organisation as a whole.

SHIFT PATTERNS

Most organisations in the process industry employ some people who work shifts. In the past the default was an 8-hour shift, but over time more teams have moved to 12-hour shifts. Also, there are many different shift patterns (both for 8 and 12-hour shifts), and companies often implement changes with the intention reducing fatigue, improving communications or often as a result of requests from the workforce.

The HSE has published a fatigue index [HSE 1999] that provides a tool for predicting the fatigue levels experienced by people working shifts. It takes into account the duration of shift, time shift starts and the provision of breaks. Clearly these are all factors that can be varied when a shift pattern is being changed.

The fatigue index is useful for evaluating fatigue, but does not cover all important aspects of a shift pattern. For example, it is fairly obvious that people will be more tired after 12 hours at work than they would be if they had only worked 8 hours. However, on a continuous operation, 12 hours shifts can improve communication by reducing the number of shift handovers that take place, and increase the scope for covering absence and times of high workload. Also, the fatigue index is only applicable to the set shift pattern, which is not what individuals necessarily work all the time (i.e. if overtime or shift swaps take place).

Changing a shift pattern can have a major impact on the individuals affected, and this must not be underestimated. As well as their time at work, the number and frequency of days off may change, and this affects family and friends. Therefore, any change has to be sensitively managed. Equally, it can sometimes be the case that employee led change can result in the selection of shift patterns that can be detrimental to the business. With the number of variables, it is clear that good change management systems are required.

CONCLUSIONS

This paper has attempted to demonstrate that change can be a source of harm, and that organisations need systems that manage the risks of all types of change. It is acknowledged that most companies have systems that address changes to plant and equipment, although

many of these have their faults, but that far fewer have adequate systems for other types of change. Also, that the emphasis is more on change control than change management.

As a result of compiling the information covered by this paper it is proposed that all types of change can be managed under a single, over-arching management system. That system can then be supplemented by specific procedures (that may be presented as forms, as is already the case for many plant change systems) for different types of change. The elements of the system would be as follows:

- Arrangements that ensure changes are identified at the planning stage of any activity or intervention;
- A method of achieving approval for change from people competent in evaluating the potential risks;
- Controls over work to ensure changes are implemented as intended;
- Checks to ensure the changed state is safe to operate;
- Procedures for restarting or commissioning following a change, that reflect the potential risks and uncertainties that can occur as a result of change;
- Reviews following change that are suitable for identifying and addressing problems arising.

As with any management system, the degree of rigour applied should be appropriate to the risk. Assessing those risks is a key competency requirement for an organisation, considering all types of change that may occur. The level of risk in this context ranges from being negligible, where an exact replacement is being put in place, through to an appreciable risk where the functional goal remains the same but the way it is achieved changes, to a high risk where multiple components are changing and/or where the way the system functions is being affected. This should be reflected in an organisation's change management system to ensure it is practical and avoids unnecessary bureaucracy. Implementing effective change management systems not only avoids potential negative consequences occurring, but increases the likelihood that success is achieved.

REFERENCES

- Bomel Consortium. 2003. The factors and causes contributing to fatal accidents 1996/97 to 2000/01. Summary Report. (For HSE)
- BSI. 1999. Occupational health and safety management Systems – specification. (OHSAS 18001)
- HSE. 1999. Validation and development of a method for assessing the risks arising from mental fatigue. (Contract research report 254.)
- HSE. 2000. Plant modification/change procedures – a 'technical measures document'. (Available from the HSE web site.)
- HSE. 2002. Human factors of remote operation process plant. (Contract Research Report 432.)
- HSE. 2003a. Management of change – process plant modifications. (Circular from HSE Hazardous Installation Directorate.)

HSE. 2003b. Organisational change and major accident hazards. (Chemical information sheet CHIS7.)

HSE. 2004. Different types of supervision and the impact on safety in the chemical and allied industries. (Research Report 292.)

Sanders, RE. 1993. Management of change in chemical plants. (Published Butterworth Heinemann.)