Organisational Change Management – Making a Change, Managing Hazards, Protecting People

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In today's challenging commercial environment, organisations face constant pressure to remain competitive and to survive must regularly adapt to meet dynamic market conditions. Organisational change management processes are implemented across a wide range of sectors to allow businesses to achieve change effectively. These processes are followed through planning and implementation of change to allow a business to move from their existing state to a new desired state successfully.

Organisations in high hazard industries such as nuclear, oil and gas, and rail are no exception. However, they have additional responsibilities to ensure commercial results are not achieved at the expense of safety. Successful operation of high hazard installations hinges both on the ability to maintain normal operations and respond appropriately to incidents. As installations upgrade technologies, automate plant processes and find cost saving initiatives, it is critical that understanding of the plant lies with the operators and they remain sufficiently skilled to recognise deviations from normal operating conditions.

Unfortunately there are a number of examples where failure of organisational change management has contributed to the realisation of devastating consequences:

- Esso Longford gas plant, fire and explosion – Relocation of plant engineers and inadequate training of personnel on site considered a possible contributing factor (Dawson, 1999).
- Nimrod Aircraft, in-flight fire and subsequent crash – Organisational drift and Ministry of Defence funding cuts resulting in extensive organisational complexity identified as an underlying cause (Duhon, 2016).
- Tokaimura nuclear facility, criticality accident – Organisational restructure one year prior to the incident which drastically increased workloads, and brought about significant changes in working conditions (NRC, 2000).

Are we failing to learn from past experience and share knowledge across industries?

Whilst all business have a legal duty of care to employees and the public (HSWA, 1974), only the nuclear industry follows a strict regulatory framework for organisational change management. In the UK for example, guidance is provided by the HSE (HSE, 2003) to employers responsible for major hazards on managing the impacts of organisational change. This covers oil, gas, and chemical installations, but no strict regulatory framework is in place. The nuclear industry however, must legally comply with a series of license conditions (ONR, 2016), one of which requires licensees to "... make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety."

This paper will review organisational change management processes across high hazard industries, and assess incidents where erosion of organisational capability has led to devastating consequences. It will identify how other industries can learn from the strict nuclear regulatory framework, providing a view of how the model works and may be utilised outside of the nuclear context.

Introduction

Changes in business often arise as a result of financial pressures, arising technologies or market changes / opportunities. In high hazard industries previous incidents, a desire to improve safety and environmental impacts, and boost reputation within these areas may also provide drivers for change.

Regardless of the business need, companies implement change with the expectation that it will benefit them in the future. However, managing and implementing change presents both a cost and a hazard *(something with the potential to cause harm)* to the business. High hazard industries are no exception, with the potential to cause harm only intensified by the pre-existing hazards of the plant / operation. As such, they have an additional responsibility to ensure financially driven changes do not come at the expense of safety.

Organisational change management is a structured approach for planning and implementing changes to individual teams, functions or operations. Organisational change management processes are implemented across a wide range of sectors to help manage and implement change, in particular how people, teams and operations may be affected and what measures can be put in place to mitigate against risks which may arise as a result.

In high hazard industries, where successful operation hinges on the ability to manage normal operations, anomalies and arising incidents, it is critical that organisational changes do not result in the removal or dilution of operational / plant expertise, skills and knowledge. Whilst businesses in high hazard industries in the UK have a legal duty of care to employees and the public (HSWA, 1974), only licensees in the nuclear industry are required to comply with a strict regulatory framework for organisational change management. Guidance is provided by the HSE to high hazard industries on how to implement organisational change, and some companies may adopt their own formal change management processes.

This paper reviews the nuclear model and explore the possibility of its application to other high hazard industries.

Learning From The Past

Unfortunately there are a number of past incidents which demonstrate significant consequences from failures in organisational change management. These are discussed in further detail in the sections below.

Piper Alpha

On July 6th, 1988, the North Sea offshore platform Piper Alpha suffered from fire and a series of explosions following a major gas leak resulting in 167 fatalities and 61 survivors. The subsequent Cullen enquiry into the incident made a staggering 106 recommendations for changes to the industry (Cullen, 1990).

Several factors led to the event, but arguably failings in safety management were at the centre. The safety culture at the time was superficial, known problems and issues raised were not appropriately addressed, and negative attitudes and behaviours at a corporate level filtered right down to site level (Mannan, 2005). Poor practices on site were generally tolerated, including failings in the provision of necessary and adequate training and ensuring systems and processes put in place were effective in practice. There was a complete lack of coherence of safety management which manifested itself to serious failures in communication across the company, often leading to conflicting or contradictory responsibilities between production and safety. Many physical and organisational changes were not appropriately assessed prior to implementation.

The company introduced a system of temporary promotion to allow available employees to replace those off-duty (including operational teams and the Operations Installation Manager (OIM)). At the time of the incident the OIM was not sufficiently competent to deal with the situation, failing to give the appropriate orders or coordinate an appropriate evacuation. Meanwhile operators became quickly overburdened as a result of a lack of staffing levels and inadequate training (Pate-Cornell, 1991). The system had not undergone any appropriate risk management and allowed individuals who were simply under-qualified and insufficiently trained to perform a role within a critical function.

Esso Longford Gas Plant

On 25th September 1998 at the Longford gas plant in Australia, a vessel fracture led to a major release of hydrocarbon gases resulting in subsequent fire and explosions. The incident resulted in two fatalities and several injuries, the supply of natural gas was halted for two weeks and the overall commercial impact was estimated at over one billion Australian dollars (Dawson, 1999).

The inquiry found that the real cause of the incident was due to lack of knowledge and inadequate training of operators and supervisors on the Longford site, and concluded that Esso, the operating company, were at fault. Professor Andrew Hopkins released his findings from Longford in 2000. Hopkins explored why the Royal Commission did not attribute blame for the incident to the individual operators but instead to a series of organisational failures. Hopkins concluded that, although training was supplied, there was a lack of competency based training which tested individuals' understanding of plant operations (Hopkins, 2000).

In addition, the complexity of the plant required experienced staff to deal with anomalies. The relocation of experienced engineers from site as part of a cost-cutting exercise alongside the redefinition of the roles and responsibilities of supervisors, both of which were completed without adequate risk assessment or evaluation, then exposed the plant to an unacceptable level of risk. The incident was deemed completely avoidable. Esso had failed to manage changes to their operating site whilst considering the potential impact on safety and were held accountable.

Tokaimura Nuclear Criticality Accident

On 30th September 1999, a criticality accident occurred in the conversion building of the JCO uranium processing plant in Tokaimura, Japan, caused by an amount of enriched uranium solution several times above the specified mass limit being poured directly into a precipitation tank. By pouring the solution directly into the precipitation tank, a dissolution tank and buffer column intended to avoid criticality were bypassed, breaching legally approved criticality control measures. As a result, the three workers in the vicinity suffered acute radiation syndrome, and a number of members of the public received radiation doses (IAEA, 1999).

The root causes of the accident were identified as managerial and organisational in nature (NRC, 2000):

- Inadequate regulatory oversight;
- Lack of an appropriate safety culture;
- Inadequate training and qualification.

One key contributor to the above was poor management of the JCO organisational restructure which had been carried out one year prior to the accident in response to severe commercial pressures originating from electricity deregulation in Japan. The restructure resulted in an increased work load for the special crew working in the conversion building, and changes in working conditions such as the introduction of night shifts.

As a result of the changes in working conditions, the special crew suffered the loss of their most experienced worker due to a health problem. The team were left with a number of inexperienced members who had a desire to complete the work in as short a timescale as possible in response to management pressures, playing an important role in the decision to bypass procedures (Tsuchiya, 2001).

Hatfield Crash

On 17th October 2000, the derailment of a train at Hatfield led to the deaths of 4 people and injuries to over 70. The incident was caused by metal fatigue, fracture and subsequent fragmentation of a rail line.

In the events leading up to the incident problems with metal fatigue were known and recognised, however replacement rails were not installed. The privatisation of British Rail led to the split of roles into several different companies. One company owned the track, signalling and stations, a separate group of companies operated the tracks, and further separate companies owned the trains. Meanwhile maintenance tasks were managed and undertaken by independent contractors. This drastic change within the British Rail network led to complex interfaces within the sector and communication problems between the various companies, all with varying priorities. Further investigation highlighted that although there were comprehensive maintenance procedures, the working staff in these roles lacked sufficient knowledge and experience and did not match the written requirements for the roles (HSE, 2001) (ORR, 2006).

Paks NPP Fuel Cleaning Incident

On 10th April 2003, a fuel cleaning incident occurred during a scheduled maintenance shutdown of Unit 2 reactor at Paks NPP in Hungary. Thirty fuel assemblies were removed for cleaning and placed in a tank below the water level of the adjacent spent fuel pool to remove crud build-up. Due to inadequate cooling of the cleaning tank the assemblies overheated within a few hours and upon opening the lid of the tank, cold water entered resulting in a thermal shock and significant damage to all 30 fuel assemblies (Reiman, 2006).

The IAEA's review into the root causes of the incident found the responsibility for operation of the fuel cleaning system had been contracted out in 2000, but the scope of work in 2003 was much more extensive. As a result of the outsourcing of the work, the fuel cleaning procedures were not developed, reviewed or approved by the relevant reactor operations personnel. The review also highlighted communication issues between the Paks organisational units, as well as timetable pressures, and uncertainty over the safety significance of the work being done. Ultimately, the lack of integration of the fuel cleaning operation within the organisation was a key contributing factor to the incident and a prime example of how poor management of organisational change can lead to significant safety consequences (IAEA, 2003).

Nimrod XV230 Aircraft Crash

On 2nd September 2006, RAF Nimrod XV230 was on a routine mission over Afghanistan when a fire caused the plane to crash killing all 14 service personnel on board. The subsequent RAF Board of Inquiry (BOI) found that shortly after air-to-air refuelling, a leak of aviation fuel came into contact with an ignition source causing a fire that was not accessible or able to be remotely suppressed (Duhon, 2016).

An independent review into the broader issues surrounding the loss of the RAF Nimrod (Haddon-Cave, 2009) found that there were a number of managerial and organisational causes, including poor management of organisational change. The 1998 Strategic Defence Review had called for a 20% reduction in budgets which led to a period of extensive organisational change in the RAF, with significant focus placed on achieving the required reduction in spending. This period of intense, major organisational change, involved movement from a function-based organisation to a multi-discipline project-focussed organisation, creation of larger management structures, and a focus on outsourcing of work. With so much change and with the increased complexity of the organisation, there had been a dilution of accountability and responsibility.

In particular, the Nimrod Review identified that organisational change management factors such as a shift from safety culture to a business culture focused on cost cutting, increased tendencies to self-preservation management and regulation and the distribution of engineering personnel to non-specialist leadership roles were contributing factors.

Common Root Causes

The events described above span a range of industries and all have one common factor: preceding failures in management of organisational change. Some common issues resulting from the organisational changes in the examples discussed above can be identified:

- Vagueness of responsibility surrounding important safety matters;
- Loss of competence;
- Employee factors such as increased workload, stress, deteriorating morale and motivation;
- Loss of safety culture.

What High Hazard Industries do to Manage Organisational Change?

In the UK, guidance is provided by the HSE to employers responsible for major hazards on managing the impacts of organizational change. This covers offshore and onshore oil, gas, and chemical installations, and also applies to railway operators and nuclear installations (HSE, 2003).

The guidance is mainly focused on change at an operational and site level, including changes to roles and responsibilities, organisational restructure, staffing levels, staff disposition in relation to change, or any

other organisational change that may (either directly or indirectly) affect the control of the hazard. The guidance however can also be applied to organisational change at a corporate level which may have a significant impact on safety at the operational tier.

The HSE guidance identifies the common downfalls experienced by high hazard employers and subsequently sets out a three-step framework for the management of organisational change:

Step 1. Getting organised for change

Step 2. Assessing risks

Step 3. Implementing and monitoring the change

All UK employers have general legal duties to protect their employees and members of the public, including compliance with the HSWA 1974, and the Management of Health and Safety at Work Regulations 1999. Whilst following the HSE guidance means that employers in high hazard industries are complying with their general legal responsibilities, there are also some key sector-specific requirements to be taken into consideration.

Offshore Industry

In accordance with the Offshore Installations (Safety Case) Regulations 2005 (SCR 2005) for oil and gas activities in internal waters and Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 for oil and gas activities in external waters, subject to transitional arrangements all offshore installations operating, or to be operated, in British waters and in UK designated areas of the continental shelf, must submit a safety case for acceptance by HSE.

The SCR are integral to the management of offshore health, safety and environmental hazards, requiring the duty holder to demonstrate their ability and means to manage and control major accident hazards effectively. This includes demonstrating that arrangements are in place to achieve compliance with the other relevant offshore-specific regulations, including the Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995, Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER), Offshore Installations and Wells (Design and Construction etc) Regulations 1996 (DCR), and other regulations, alongside the HSWA.

As part of their Safety Case, duty holders are required have a documented Safety and Environmental Management System (SEMS), which includes "the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the corporate major accident prevention policy". Any organisational changes that have the potential to impact the SEMS must be considered. This includes arrangements for ensuring safe operation under the other relevant offshore-specific Regulations. The Safety Case must be revised in response to any significant organisational change, but there is no regulatory requirement related to the management of that organisational change. This is considered to be addressed as part of the risk assessment process undertaken during Safety Case amendment.

COMAH Sites

The Control of Major Accident Hazard Regulations 2015 (COMAH) apply to onshore major hazard sites that have, or anticipate having, threshold quantities of dangerous substances (not including nuclear licensees). The regulations place a duty on operators to take "all measures necessary" to prevent and mitigate the consequences of a major accident, and to implement a Major Accident Prevention Policy (MAPP) including appropriate procedures and management systems. The COMAH Regulations are enforced by a joint Competent Authority (CA) comprising HSE, the Environment Agency (EA), and the Scottish Environmental Protection Agency (SEPA).

For 'top-tier' establishments that use or store dangerous substances exceeding the thresholds set out in the COMAH Regulations, a safety report must be submitted to the CA to demonstrate that a MAPP and Safety Management System (SMS) to implement that policy is in place. As part of these requirements, the SMS must "include within its scope the general management system including the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the MAPP".

Organisations must then consider whether any changes to the SMS may have a significant impact on their ability to implement the MAPP and subsequently revise their safety report to reflect the change. This includes changes in use of contractors, management structure and workforce numbers and competences in relation to the operation or maintenance of the establishment. However, similar to offshore installations, there are no stringent regulations placed specifically on the management of organisational change. Instead, the responsibility is placed on the organisation to ensure that risks have been adequately assessed.

Railway Industry

Railways and Other Guided Transport System (Safety) Regulations 2006 (ROGS) sets out the regulatory regime for rail safety and implements the requirements of the European Railways Safety Directive (2004/49/EC) in the UK. Its aim is to establish a common safety approach for rail safety and other methods of guided transport (e.g. trams, heritage railways).

The 2006 regulations place a requirement on transport operators to maintain a Safety Management System (SMS) to demonstrate to the Office of Rail and Road (ORR) that a management system is in place that is effective, fit for purpose and protects employees, passengers and others from harm So Far As Is Reasonably Practicable (SFAIRP). Without the appropriate safety certificate or authorisation of the SMS from ORR no one is allowed to operate vehicles or manage infrastructure on UK railways.

Under these regulations mainline transport operators must comply with the Common Safety Method (CSM) for risk evaluation and assessment. The CSM is a framework which describes a common mandatory European risk management process for the rail industry and must be complied with when any significant change (technical, operational, organisational) is proposed (ORR, 2015). This ensures a sufficient assessment for the proposed change has been undertaken. Should the change be deemed not significant enough to qualify for risk assessment, a record of why this is the case must be made. The significance of change is determined using expert judgement, based on the following set of criteria:

- Failure consequence: credible worst case scenario in the event of a failure of the system under assessment, taking into account the existence of safety barriers outside the system;
- Novelty used in implementing the change: this concerns both what is innovative in the railway sector, and what is new just for the organisation implementing the change;
- Complexity of the change;
- Monitoring: the inability to monitor the implemented change throughout the system life-cycle and take appropriate interventions;
- Reversibility: the inability to revert to the system before the change;
- Assessment of the significance of the change taking into account all recent safety-related modification to the system under assessment, including those which were not judged as significant.

The CSM does not identify how the criteria should be applied and does not give weighting to any specific area. However, a proposed approach to applying the criteria is given as part of the CSM. This includes a proposed approach to applying criteria for organisational change management.

Nuclear Industry

Under the Nuclear Installations Act 1965, any organisation that operates a nuclear installation requires a Nuclear Site License as granted by HSE. Attached to the site license are a number of License Conditions (LCs) (ONR, 2016), which define areas of nuclear safety to which a licensee should comply to ensure safe operation of the site. The LCs provide the main basis for regulation of nuclear sites by the Office for Nuclear Regulation (ONR), the independent regulator of nuclear safety and security across the UK. The ONR reviews the Licensee's LC compliance arrangements to ensure they are clear and unambiguous, and address safety issues adequately.

LC 36 refers specifically to organisational capability and management of organisational change, placing a requirement on Licensees to *"...provide and maintain adequate financial and human resources to ensure the safe operation of the licensed site" and "... make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety"*. As such, operators of nuclear facilities are legally required to ensure that nuclear safety implications from proposed changes are fully considered as part of a set of Management of Change (MoC) arrangements, and risks arising from inadequate assessment and implementation of the change are recognised and suitably controlled. These arrangements should form part of the Licensee's management system.

LC 36 further requires that changes be categorised according to their safety significance, on the basis of unmitigated risks arising from the change in the event it is poorly implemented. The arrangements place a requirement on Licensees to ensure sufficient documentation is in place to justify the safety of any proposed change. This may include outlining how such changes will be implemented and reviewed during the implementation phases.

The Safety Assessment Principles (SAPs) provide ONR inspectors with a framework for making consistent regulatory judgements on the safety of activities on nuclear sites. The SAPs detail some broad principles which underpin the ONR's expectations of a Licensee's MoC arrangements (ONR, 2014):

1. *The arrangements should be robust, incorporated as part of the licensee's management system and applied to all activities that have the potential to impact on nuclear safety;*
2. *The Board of the licensee should own and support the MoC arrangements and ensure that they are embedded throughout the organisation;*
3. *The arrangements should reference the nuclear baseline and include a process for updating it on a regular basis;*
4. *The arrangements should include an initial screening assessment to identify the potential safety significance of a change proposal and establish a suitable categorisation for determining the level of analysis and justification;*
5. *The licensee should assess and justify the safety of a proposed change commensurate with its potential impact on safety, and monitor its implementation;*
6. *The licensee should periodically review the effectiveness of the overall arrangements and the changes that have been implemented.*

Further to LC 36, licensees must demonstrate that existing financial and human resources are in place to ensure safe operation. This is done through the construction of their 'Nuclear Baseline' (NB), which aims to demonstrate that there are suitable and sufficient organisational structures, staffing and competences in place to effectively and reliably carry out activities which have the potential to impact nuclear safety. This, together with a 'Safety and Environment Management

Prospectus' (SEMP), may be considered as the safety case for the organisation. Whilst the principal purpose of the NB is to provide evidence of nuclear safety capability, it also provides a useful organisational reference point against which the impact of proposed organisational changes on nuclear safety can be assessed. ONR guidance on assessment of the NB and arrangements to provide and maintain adequate human resources is presented in T/AST/065 'Function and Content of the Nuclear Baseline' (ONR, 2013a).

Licensees are encouraged by the ONR to consider the Nuclear Industry Code of Practice (NICoP) 'Nuclear Baseline and the Management of Organisational Change' (NSCWG, 2014) when implementing MoC arrangements. Where licensees are able to demonstrate that their arrangements are consistent with the guidance in the NICoP, this is regarded as sufficient for compliance with LC 36 (ONR, 2013b). The NICoP sets out a nuclear capability framework, covering core organisational capability, definition and justification of capability requirements for new and existing organisations, management of capability through analysis of shortfalls and vulnerabilities, and management of organisational changes.

Learning From the Strict Nuclear Regulatory Framework for Managing Hazards

Similar to many other high hazard industries the nuclear industry is regulated by an independent authority, who must be satisfied that all hazards associated with the plant / operation are identified and the associated risks are reduced to As Low As Reasonably Practicable (ALARP). The nuclear requirements for managing and monitoring organisational capability and the associated risks however are much more complex than for other industries, with the significant difference lying with the need to comply with LC 36.

Across the Nuclear sector the MoC process should govern the registration, production, assessment, categorisation, approval and post-implementation review of any proposed change to the organisational structure or resources that have the potential to impact safety. This includes the following (NSCWG, 2014):

- Changes that permanently alter or have a significant impact on NB posts or roles;
- Changes to posts or roles, competencies or training requirements as a result of new programmes or processes;
- New projects requiring the introduction of new posts, roles or processes;
- Changes that have the potential to significantly increase individual workloads;
- Long-term vacancies that may impact on nuclear safety arrangements;
- Changes to core capabilities, whether detailed in the NB or not, that may affect the organisation's ability to maintain safe operation;
- Outsourcing of work to contractors.

The NICoP sets out guidance for compliance with regulatory requirements for demonstrating a nuclear baseline and managing organisational change. In accordance with the NICoP, an overarching change proposal should be produced to manage organisational change at nuclear facilities. This proposal should define not only the end point, but the phases and hold points during change implementation, links to change governance, dependencies between different aspects of the change, and arrangements for cumulative impact assessment, with avoidance of 'salami-slicing' to allow for consideration of the overall consequence of the change on safety.

Other high hazard industries could choose to adopt a similar method to that laid out within the guidance as it provides a stringent and coherent method for ensuring all risks are considered, shortfalls or vulnerabilities for the change are identified, and organisational changes are managed appropriately.

There have been a number of improvements in health and safety across high hazard industries since the realisation of the disasters discussed in Section 2. However, an example as recent as 2010, the BP Macondo well blowout, demonstrates there is the potential for similar mistakes to be repeated. The root causes of this incident were found to include flawed decision making processes, a poor safety culture and poor risk assessments. The decision making process did not adequately ensure that personnel fully considered the risks associated with time and money saving decisions, and a change in BP's culture from engineering excellence to cost cutting placed a reliance on external consultants. In addition, poor risk assessments for decision making processes were undertaken, and no formal MoC processes were in place (DHSG, 2011). Common root causes can be found between the incidents in 2010 to the 1980s and 1990s, although the challenges faced by organisations during these periods is very different.

In today's digital age, new technology is a major driver for change and in recent years high hazard industries have become increasingly reliant on digital computer control systems, automation, improved offsite communications, and removal of workers from hazards where reasonably practicable. Automation often leads to reduced workforce and a decrease in manning levels, whilst changes to safety protection have seen the movement of control rooms as far away from the hazard as is reasonably practicable.

However, these types of changes bring their own challenges to safety. For example, moving a control room away from a hazard can result in operators having reduced visibility of the site. In some cases this type of change may lead to control room operators performing different roles to field operators, roles which in the past were performed by the same individuals (HSE, 2002). It is important for companies to really understand safe manning level requirements, the roles essential for the continued safe operation of a process before changes are made, and the impact that loss of local knowledge may have on the safe operation of a plant. By understanding whether organisational changes could result in removing key expertise and

experience required to respond to emergency situations and process anomalies, it is possible to identify at what point a reduction in numbers and capability could lead to an increased level of risk.

It is also important to recognise that in today's economy we are faced with increased financial pressures, which have resulted in the requirement for many organisations to undertake cost cutting exercises and streamlining processes. Under these types of pressures, change management processes can be seen as a barrier to success rather than an important risk reduction measure, and therefore have the danger of becoming 'box-ticking exercises'. This kind of attitude to change management processes is one that can result in shortcuts, and salami-slicing of changes, providing one of the main contributors to the examples discussed within this paper.

With entry into a digital age resulting in significant advancements in technology it is more important than ever to understand the risks associated with organisational change management. Whilst there have inevitably been improvements in attitudes towards organisational change processes and health and safety over recent years, organisations in these industries now face different challenges, and where there is an opportunity to learn from experience to avoid repetition of mistakes made a number of years ago, this should be considered.

Change Management Process Model

The following sections provide an overview of how an organisational change management process model similar to that applied in the UK nuclear context could be applied to other high hazard industries to ensure changes are managed appropriately, and the impact on safety is considered. A diagrammatical representation of the model is provided in Figure 1, and further description of the requirements of each step provided in the subsequent sections.

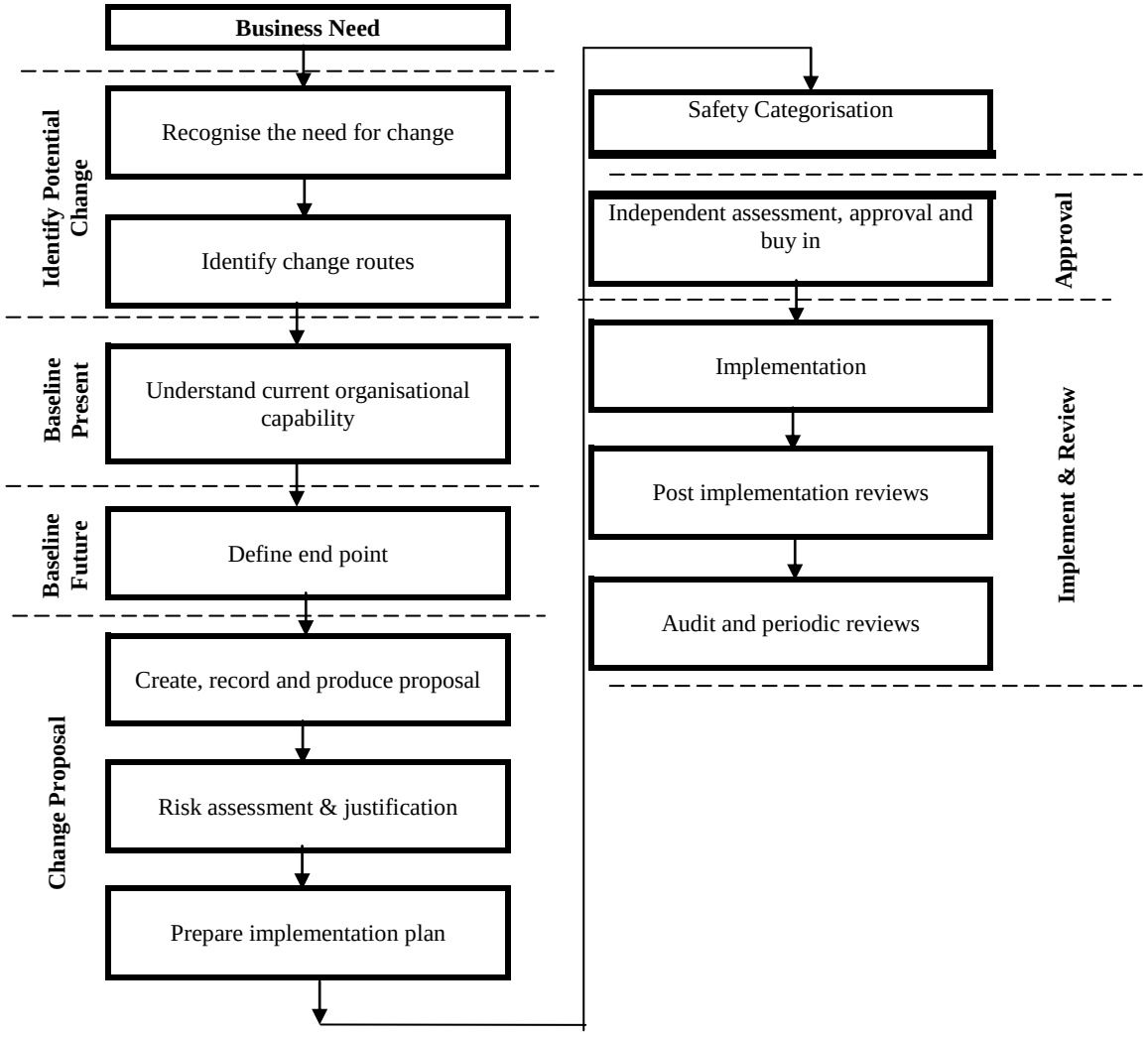

Figure 1: Organisational change management process model based on the nuclear regulatory framework

Step 1 – Identify Potential Change

Change is an essential part of business improvement which allows businesses to remain competitive in dynamic market conditions. Organisational change prevents complacency from stagnation which can develop over periods of time with no change, stimulates development, and is often essential when changes to legislation are introduced.

Prior to any implementation of organisational change businesses must:

1. Recognise the need for change;
2. Identify potential change routes

Step 2 – Understand Current Organisational Capability

In order to define future organisational capability and design it is first important to understand their current state. This can be achieved through a review of the current organisation activities and functions, and corresponding hazards. This review will allow for an understanding of how the current organisation is set up to manage and control their current activities and functions so they remain safe and in line with legislation and company guidelines. In some cases this review may highlight key weaknesses or areas for development, (e.g. poor organisational structure) and hence highlight a requirement for organisational change.

This organisational review should consider, but is not limited to, the following:

- Organisational structure: Existing organisational charts are a useful tool for providing a quick and easily understood schematic of current activities and functions;
- Roles and responsibilities: Current roles and responsibilities can be reviewed in line with organisational structure. This review should include any authorities assigned to decision making, leaders, teams and individual accountabilities and responsibilities of each post to provide a complete picture. It is important that both internal and external resources are reviewed as part of this;
- Span of control: Span of control should be determined by the nature, variability and complexity of the work and capabilities of direct reports;
- How capability is maintained: Authorities accountable for maintaining organisational capability should be identified including demonstrating who is responsible for strategic day to day control;
- Safety functions: This review should provide a clear understanding of the key roles held by individuals across the organisation responsible for safety functions. To help identify these key roles organisations may wish to consider identifying who is responsible for the following:
    - Having a clear understanding of the product or service being supplied through current activities;
    - Having an understanding of the design intent and safe operating envelope;
    - Internal and independent challenge and audit functions;
    - Operating and maintaining safety to defined standards;
    - Maintaining a strong safety culture.

This review provides organisations with a baseline to compare against the proposed change end point.

Step 3 – Define End Point

Before any change proposal can begin the desired end point must be defined i.e. how will the organisation look, behave and operate at the end. Defining an end point helps define the future ‘baseline’ of the organisation and a comparison against existing capabilities and functions can be made.

To define the end point it is essential to revisit the requirement for change and consider the following:

- What does the organisation want to achieve with this change?
- What are the consequences of not changing?
- What are the options for the change?
- Which of the options are the simplest?
- Which of the options would minimise risk?
- Who might be affected by the change?
- Who should be consulted before and during the change (both internal and external)?

This review may be both qualitative and quantitative, and will help to provide an early identification of the enormity of the change, who is likely to be impacted (direct and indirect effects) and the potential associated risks.

Organisations may wish to consider strategies for change implementation. In particular, consideration as to the phases of the change, any potential risks during the change and the initial categorisation of the change in terms of its impact on safety. All of this is key information required for the production of a change proposal and will provide an early indication of the level of risk.

Step 4 - Production of a Change Proposal

Once the change has been confirmed and agreed, a Management of Change (MoC) proposal should be produced. The proposal should outline the start and end points, justification for and benefits of the change, and details of how the change will be achieved. An outline of the organisational change management proposal production process is provided in Figure 2.

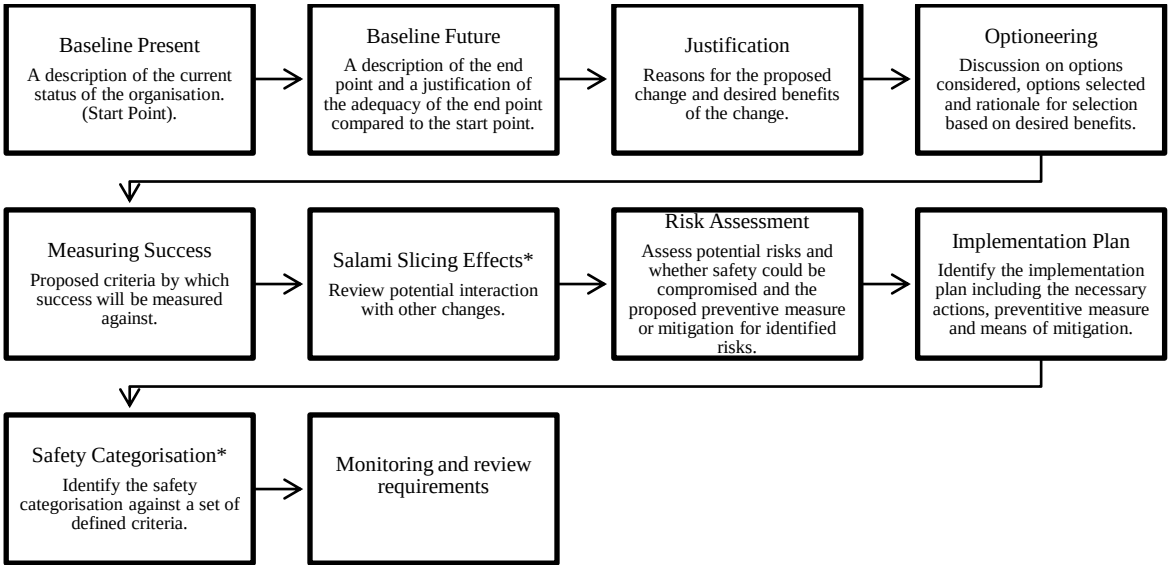

Figure 2: Production of an Organisational Change Management Proposal

**Salami Slicing Effects:* It is important that the full implications of a proposed change or a series of changes are assessed prior to their implementation. This is to guard against a failure to consider all relevant factors and potential dependencies between related changes, and the potential for 'salami slicing' in which a major change is decomposed into a series of lesser changes which are treated independently.

**Safety Categorisation:* Changes should be categorised by their safety significance. An example of a safety categorisation is given in Table 1 below and is based on guidance given within the NICoP (NSCWG, 2014).

Table 1: Safety Categorisation Table for an Organisational Change Proposal

Category	Definition	Review & Approval	Approval Level
A Major effect	Change with a major safety impact - Large scale downsizing - Outsourcing of safety significant functions - Change that affects the legal basis of the licensee/ operator	- Independent assessment by a suitably qualified and experienced person - Relevant committee for endorsement of the change - Regulator for agreement *(Note: this may depend on the industry)*	Licensee/ director/ board member
B Significant effect	Change with a significant safety impact - Wide ranging change resulting in significant transfer or responsibilities and accountabilities	- Independent assessment by a suitably qualified and experienced person - Relevant committee for endorsement of the change - Regulator scrutiny *(Note: this may depend on the industry)*	Functional director
C Minor effect	Change with a minor safety impact - Change within a business unit Change within a business unit - Change that has a minor impact of the company's emergency response organisation	- Independent assessment by a suitably qualified and experienced person - Relevant committee for endorsement of the change	Sponsor
D Insignificant effect	Change with negligible safety impact - Change in a function/ department/ individual post with little or no impact on safety	- Line manager of MoC coordinator - Independent review of categorisation	Line Manager

Step 5 – Approval and Buy-In

Once the organisational change management proposal is complete, review and approval should be conducted both internally and externally (independent review) to ensure all risks have been highlighted and addressed, and there is reasonable justification for the proposed change.

The impact of the change on stakeholders should also be considered, recognising that change can often be resisted by involved parties. Key stakeholders may include internal and external staff, safety representatives, regulators and even customers. Engaging with stakeholders before implementation of any change can help manage the transition and ensure its success. This level of engagement may consist of holding initial consultations and engagement meetings to explain the need for change and its rationale. It may be necessary to conduct this step earlier in the process to gain appropriate buy in, i.e. from senior managers or regulators. Regardless, it is important this is conducted before the implementation phase to ensure that all relevant views are properly considered before final decisions on the change are made.

Step 6 – Implementation

Implementation of a change should follow the change control process as laid out within the change proposal, which provides a timeline for the change, contingency plan to mitigate against arising risk and monitoring requirements for transition periods. It is important that the rigour of the control process is sufficiently proportionate to the safety category of the change and this should be transparent as part of the timeline of the change. This helps to avoid the potential for managers striving for unrealistic timescales leading to poor implementation.

Implementation plans may be included as part of the MoC proposal, or may be a supplementary standalone document. Whichever is chosen, a defined implementation plan should be put together and agreed, and should identify pre-actions, i.e. activities to be completed prior to implementation, and post-actions, i.e. activities to be completed post implementation. Where necessary a number of hold points may be introduced during implementation to ensure the change is working to plan and a set or criteria is met in each phase before moving on to the next.

Step 7 – Monitor and Evaluate

Following implementation it is essential that continuous monitoring and evaluation of the change is undertaken. This should be identified as part of the change implementation timeline, either within the MoC proposal itself or within the standalone implementation document. The methods that will be used to monitor and evaluate the change should be identified, as well as proposed timescales i.e. monthly / quarterly / annual review.

The type of post implementation monitoring and evaluation techniques should also be specified to ensure there is a sufficient baseline / benchmark to monitor against. Typical safety performer indicators include overtime, sickness, safety significant event reports, and business critical events, reviews of which will provide an indication of how the organisation is functioning post-implementation.

Conclusion

In today's economic environment there is a constant need for organisations to adapt to dynamic market conditions to remain competitive. Companies regularly change their organisational structure and activities to improve business performance and respond to commercial pressures. Regardless of the business drivers, companies implement change with the expectation that it will benefit them in the future. Change however presents both a cost and hazard to the business, and as such it is of benefit to organisations to adopt a stringent risk management process before implementing any organisational change.

Companies in high hazard industries, where there are pre-existing plant and operational hazards, have additional responsibilities to ensure commercial results are not achieved at the expense of safety. Unfortunately there are a number of examples where neglecting organisational change management has led to realisation of tragic consequences, namely Esso Longford, the Nimrod Aircraft crash, Piper Alpha and Tokaimura amongst others. Whilst these incidents are safety significant they have also come at great commercial and reputational losses to the business.

All UK organisations have a legal duty of care to employees and the public, however only the nuclear industry follows a strict regulatory framework for organisational change management. Guidance is provided by the HSE to high hazard industries on how to implement organisational change, however businesses in these industries, with the exception of the nuclear industry, are not governed by a specific organisational change requirement.

The nuclear industry places a requirement on Licensees to ensure that nuclear safety implications from proposed changes are fully considered as part of a set of MoC arrangements, and risks arising from inadequate assessment and implementation of the change are recognised and suitably controlled. The absence of similar requirements across other high hazard industries has been identified as part of this paper along with the need for knowledge sharing across these industries on managing organisational change. The method adopted within the nuclear industry is effective at ensuring all risks are considered, shortfalls or vulnerabilities for the change are identified, and organisational changes are managed appropriately. This paper reviews the method applied in the nuclear industry and provides an outline of how this may be adopted outside of the nuclear context.

Whilst there have been improvements in health and safety and attitudes to organisational change management across high hazard industries since the realisation of the disasters discussed in this paper, it is recognised that the challenges faced by organisations in a modern society are constantly changing. In particular, with entry into a digital age resulting in significant advancements in technology it is more important than ever to understand the risks associated with organisational change

management. As such, where there is an opportunity to learn from experience to avoid repetition of mistakes made a number of years ago this should be acknowledged and considered. By adopting a similar stringent and coherent method the potential for safety significant incidents as a result of erosion of organisational capability has to potential to be reduced.

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