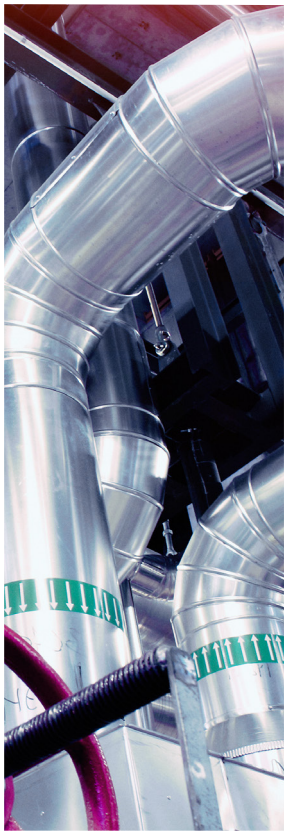
IChemE Safety Centre

Management of Change (MOC)

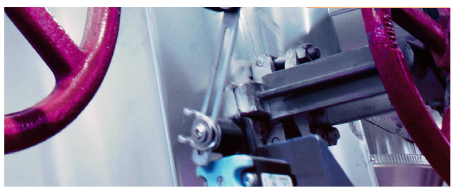
Initiate | Screen | Review | Approve | Implement | Capture and Close-out









Issue 10

Disclaimer

The content of this document is provided by the Institution of Chemical Engineers (IChemE) and the IChemE Safety Centre (ISC) in good faith for general informational purposes only. It does not constitute legal, technical, or professional advice and should not be relied upon as such. Users are solely responsible for assessing the suitability and applicability of the information to their specific operational, regulatory, and jurisdictional contexts and must always ensure alignment with applicable laws. IChemE, ISC, and all contributors to this document – including Working Group members – expressly disclaim any and all liability in contract, tort (including negligence) or otherwise, in any jurisdiction, for any loss, damage, or harm (whether direct, indirect, consequential, or otherwise) arising from the use of or reliance on this document by any party. IChemE, ISC, and all contributors to this document do not accept any responsibility for the consequences of any errors, omissions or inaccuracies in this document. No guarantees, conditions or warranties, express or implied, are given regarding the information in this document being up to date, accurate, complete, or fit for purpose. Nothing in this disclaimer shall or shall be deemed to limit IChemE or ISC's liability which cannot be excluded or limited under applicable law.

Contents

Acronyms

ALARP	As Low As Reasonably Practicable
DCS	Distributed Control System
HSE	Health, Safety (including occupational safety and process safety), and Environment
ISC	IChemE Safety Centre
KPI	Key Performance Indicator
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
LPB	*Loss Prevention Bulletin* (IChemE publication)
LOPA	Layer of Protection Analysis
MOC	Management of Change
OMOC	Organisational Management of Change
PLC	Programmable Logic Controller
PHA	Process Hazard Analysis
PSM	Process Safety Management
P&ID	Piping and Instrumentation Diagram
PS	Process Safety – note that in this document Process Safety is considered under the umbrella of HSE
PSSR	Pre-Startup Safety Review
SDS	Safety Data Sheet
SCR	Safety Critical Role
SFAIRP	So Far As is Reasonably Practicable
TA	Technical Authority

Acknowledgements

The IChemE Safety Centre (ISC) sponsored this discussion document to promote ongoing improvement in Management of Change (MOC) by offering practical solutions to common challenges seen globally and across industries.

ISC would like to thank Laurence Ledrut for her leadership of the Working Group and acknowledge the efforts of the following companies and people:

Management of Change Working Group

- Origin Energy – Laurence Ledrut – Working Group leader
- Air Services Australia – Tim Durkin
- Arup – Nigel Cann
- Aurecon Group – Aneeza Qazi
- BP – Vicente Mares Guzman
- ERM – Chris Israni
- Enquest – Ross McCormack
- Fujairah Oil Industry Zone (FOIZ) – Aissam Bouadjel
- Gexcon – Mhairi Sellar
- GHD Advisory – Rajesh Maharaj
- Jemena – Sheila Wujanto-Haew
- Methanex – Franco Branca
- Orica – Mick Gill, Aaron Mooney
- PRSG – William Giang, Seckin Gokce, Aaran Green, Ajaykumar Kakkanattu, Idil Osmanli
- Safety Solutions Limited – Paul Feltoe
- Santos – Kim Pullon
- Sherpa Consulting – Stuart Chia, Giles Peach
- SUEZ Recycling and Recovery – Paul Kilgour, Bianca Reginaldo, Chris Ridley
- Vanguard Solutions – Okky Goh
- Viva Energy – Paul O'Byrne
- Woodside Energy – Celeste C Savanyo

Additional Independent Reviewers

- Hussain Alabduljabbar
- Andy Brazier
- Eamon Chandler
- Ashley Hynds
- Andrea Longley
- Richard Mundy
- Vincent Mares
- Peter Marsh
- Carolyn Nicholls
- Ken Patterson
- Anar Valiyev

The ISC recognises the contribution of past and present IChemE Safety Centre staff for assistance in commissioning the project, with special thanks to those who produced this final version of the report:

Kris Ellenthorpe – Process Safety Consulting

Lyzanne Cox – Graphic Designer, IChemE

Tracey Donaldson – Editor, *Loss Prevention Bulletin*, IChemE

Professor Fiona Macleod – University of Sheffield

1. Introduction to MOC

A change is anything that is not like for like. Every change requires appropriate assessment.

If not properly managed, change can lead to increased or unforeseen risks to Health, Safety (both occupational safety and process safety) and the Environment (HSE).

There are multiple demands on resources in any operating environment. Change is often much more complex and resource intensive that it appears at first sight. Like an iceberg – under the peak (of visible change) is a great hidden mass (of invisible work) which it is dangerous to neglect.

Management of Change (MOC) is a key part of any Safety Management System. A formal MOC process is used by organisations to manage the risks associated with plant, process, procedural, or organisational changes – whether temporary or permanent – to avoid impacting safe operation.

A good MOC system requires active involvement from many different departments and disciplines. The weaknesses are often to be found at the interfaces, the points of handover from person to person or team to team. Even in organisations with mature change management systems, common inefficiencies can undermine effectiveness and elevate HSE risk.

A key role of leadership is to ensure that the right changes are prioritised, and sufficient resources are made available to manage safely from start to finish.

1.1 Background

The objective of this guideline is to help improve the effectiveness of an existing MOC process by:

- Highlighting commonly experienced MOC process issues.
- Sharing practical recommendations from diverse industry experience.

Who this guide is for

The guide is aimed at helping people at operating sites, from front-line operations and maintenance personnel, through engineering, human resources and procurement, to senior management.

What this guide does

- Records an industry collaboration aimed at identifying the challenges and pain points associated with change management in practice.
- Provides a refresher on the key concepts of Management of Change (MOC) processes common across a wide range of industrial sectors.
- Shares examples and practical recommendations to help improve the effectiveness of change management.
- Provides a set of self-assessment, audit and troubleshooting checklists.

What this guide does not do

- Does not cover the steps required to implement a new MOC process where there is none.
- Does not advise on choice of risk assessment tools or mandate all the specific studies which could apply when evaluating a change proposal. Risk assessment is used here as the generic process of identifying and assessing risk which could include multiple studies.
- Does not make recommendations on specific team roles.

1.2 Preconditions

Technical information

'If you do not know the existing hazards of the system, chemical and physical; don't understand its acceptable operating envelope and operational limits; if you have no accurate P&IDs and equipment specifications; then you cannot properly assess whether any proposed change is acceptable.' (Patterson and Wigham)[1]

Agreement on what constitutes a change

A change is anything that is not like for like – including the introduction or removal of equipment – and every change requires appropriate assessment.

Access to competent and experienced technical expertise

Underlying any technical management of change process there need to be competent people applying safe engineering practices.' (Mundy)[2]

In addition to understanding the hazards of the proposed change, the consequences of engineering and administrative control failures need to be considered to assess the wider impact of the proposed change.

1.3 Overview

Management of Change (MOC) is a structured, formal process to identify and manage the risks associated with change to prevent harm to people or the environment.

The key generic, high-level, steps of a typical Management of Change (MOC) process are as follows:

- Initiate
- Screen
- Review
- Approve
- Implement
- Capture and Close-out

1.4 Common concerns

The IChemE Safety Centre Working Group identified several recurring concerns that impact the effectiveness of the MOC process, based on their own experience.

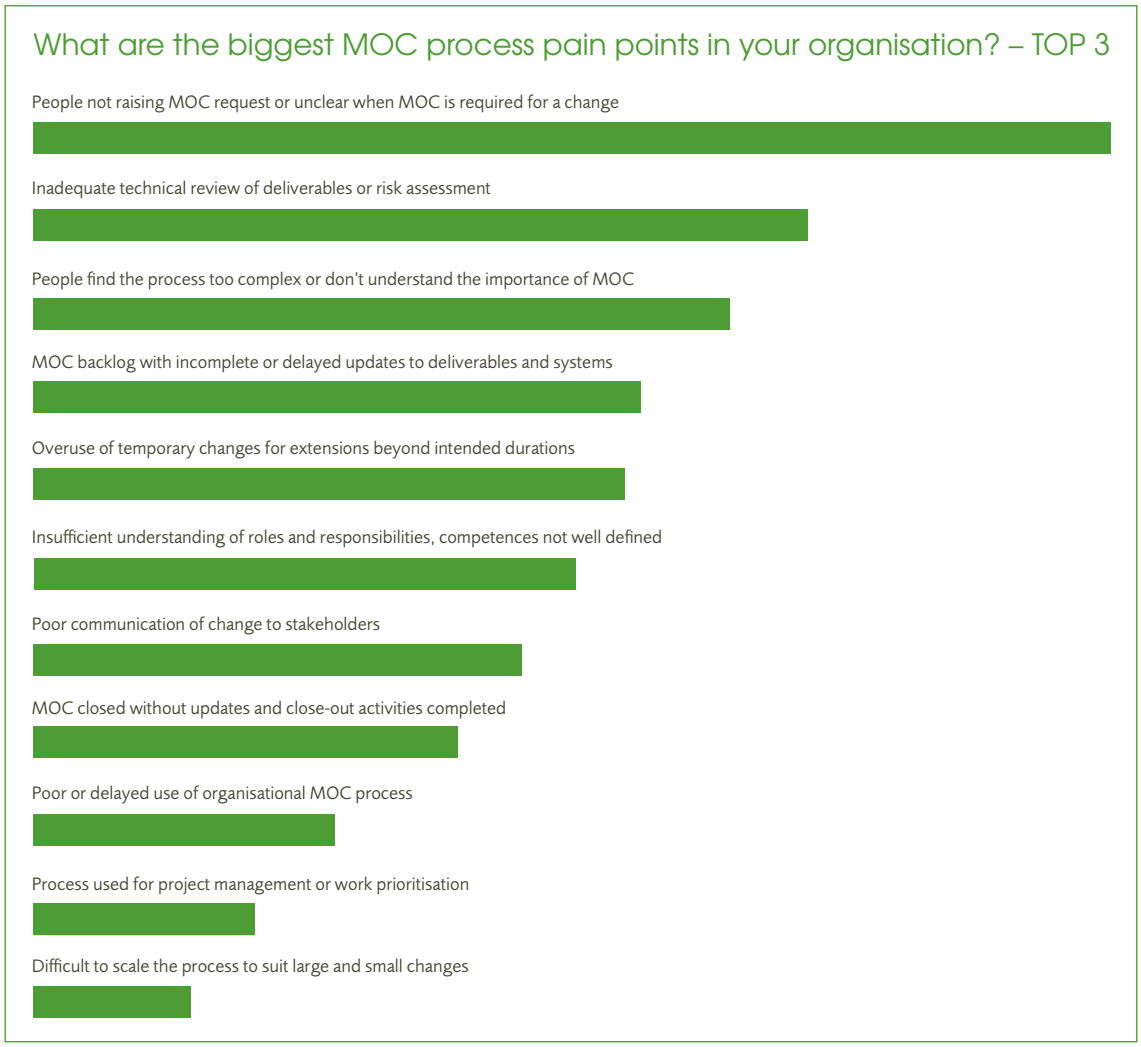
1. People not raising MOC or unclear when MOC is required for a change.
2. Inadequate technical review of deliverables or risk assessment.
3. People find the process too complex or don't understand the importance of MOC.
4. MOC backlog with incomplete or delayed updates to deliverables.
5. Overuse of temporary changes or extensions beyond approved durations.
6. Insufficient understanding of roles, responsibilities, competences not well defined.
7. Poor communication of change to stakeholders .
8. MOC closed without updates and close-out activities completed.

9. Poor or delayed organisational change MOC.
10. Process is used for project management or work prioritisation.
11. Difficult to scale the process to suit large and small changes.

Voting at the *Hazards Australasia* Conference in September 2025 identified the top concern as failure to identify a change or raise an MOC when one was needed.

This is covered in detail in:

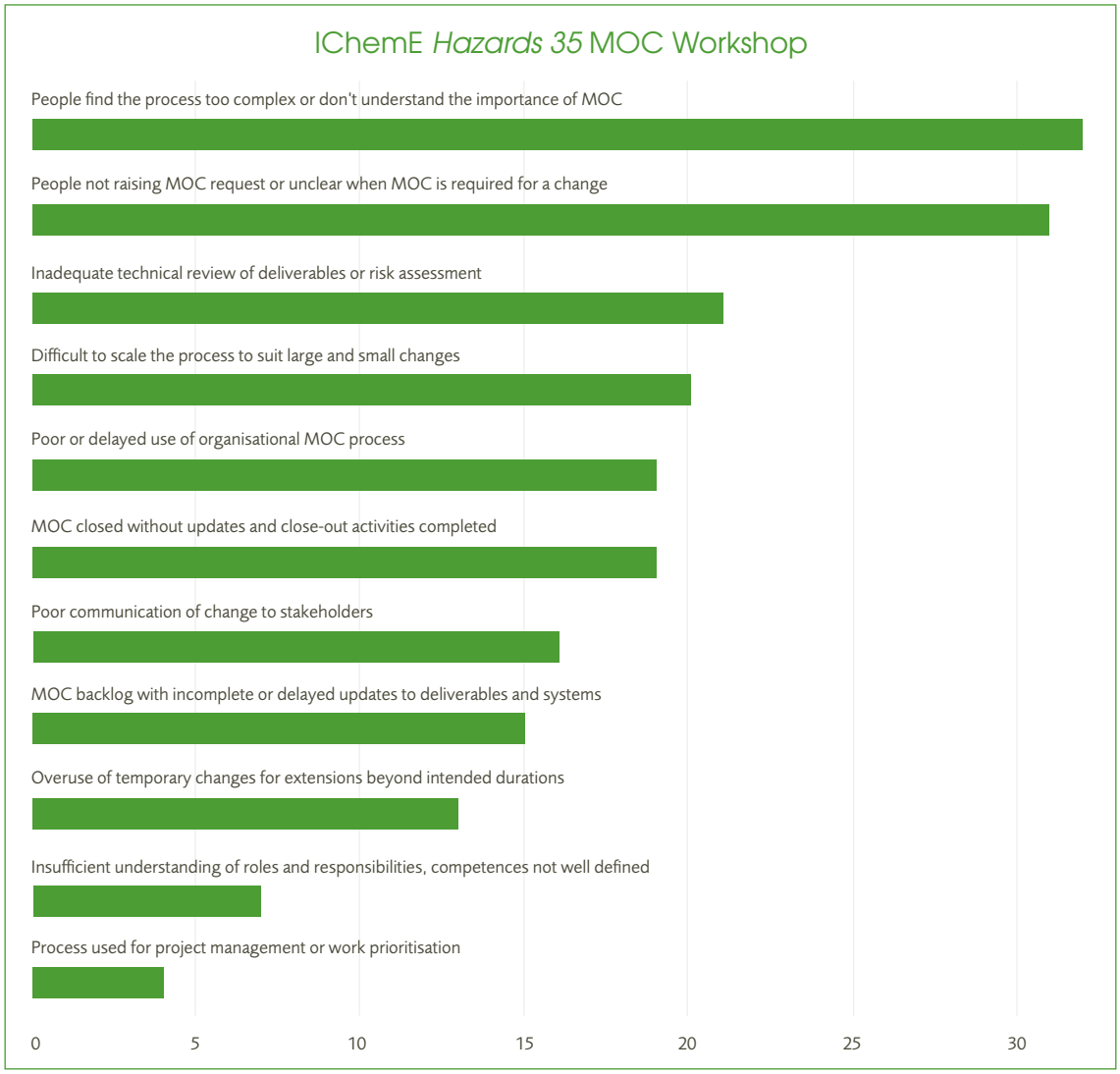
- Section 2: Defining and categorising change
- Self-assessment B: How good are people in your organisation at recognising a change?
- Audit D



This was echoed at the *Hazards 35* Conference in December 2025 where over 50% of workshop respondents identified the failure to identify a change or raise an MOC as one of the top 3 challenges. The top concern was related – people find the process too complex or don't understand the importance of MOC.

This is covered in detail in:

- 8.3: Examples of failure to recognise a change
- Self-assessment A: How well is change managed in your organisation? and Self-assessment C: Leadership accountability and commitment
- Audit D



1.5 Self-assessment, audit and troubleshooting

The Annexe contains real life examples, troubleshooting guides as well as self-assessments and audit questions that can be used to identify and improve specific weaknesses in any change management process.

The following can also be downloaded as editable excel documents:

A. Self-assessment: How well is change managed in your organisation?

B. Self-assessment: How good are people in your organisation at recognising a change?

C. Self-assessment: Leadership accountability and commitment

D. Audit: Change recognition

E. Audit: Initiating MOC

F. Audit: Screening MOC

G. Audit: Reviewing MOC

H. Audit: Approving MOC

I. Audit: Implementing MOC

J. Audit: Capturing and closing-out MOC

K. Audit: Organisational change

L. Audit: Temporary change

M. Audit: System

2. Defining and categorising change

2.1 What is Management of Change?

Management of Change (MOC) is a structured, formal process designed to evaluate and manage the risks associated with changes to equipment, processes, procedures, or organisational structures (critical roles). Its primary purpose is to ensure continued safe operation, to protect people from harm, and to avoid damage to the environment by ensuring that all potential hazards introduced (or existing hazards aggravated) by a proposed change are identified, assessed, and controlled before the change is implemented.

In the context of process safety, MOC is essential for maintaining the integrity of safety critical systems and preventing incidents that could result in damage to assets, harm to people and the environment. It applies to both permanent and temporary changes that could impact the safe operation of a facility.

2.2 What is a change?

A change is anything that is not like for like and every change requires appropriate assessment.

Any modification, adjustment, or alteration made to plant and equipment, processes and substances, systems and procedures, or organisational arrangements must be managed to prevent or minimise HSE risks.

In scope

Operating companies must set their own scope for their management of change procedure. Some common examples are provided below.

Plant (hardware) changes:

- Changes to equipment
- New/replacement equipment
- Decommissioning or removal of equipment
- Equipment relocation or service changes
- Material changes (eg metallurgy, coatings)
- Modifications to process systems (eg vessels, piping, relief)
- Installation or removal of temporary equipment
- Changes to utility systems (eg steam, air, nitrogen)
- Facility siting changes
- Changes to HSE protection (eg tank bunds, wastewater systems, fire suppression, gas detection)

Process (control and condition):

- Raw material or chemical substance changes
- Introduction of new process streams or blending operations
- Changes in process sequence (eg order of raw material addition, new intermediate steps)
- Changes outside of the established Safe Operating Envelope (eg temperature, pressure, flow)
  - Changing instrument setpoints or alarms
  - Control system changes (eg logic, interlocks, PLC/DCS programming)
  - Changes to batch sequences or timing
- Changes to safety critical systems such as safety instrumented systems (eg detection systems, protection systems, shutdown system...)
- ESD (Emergency Shutdown) trip setpoint changes, bypass or disablement of safety interlocks or alarms

Organisational, people or procedural changes:

- Changes to safety critical operating procedures such as startup, shutdown or emergency response
- Modifications to maintenance, inspection, testing, or calibration procedures for safety-critical equipment
- Updates to isolation or lockout/tagout procedures, permit-to-work systems
- Introduction of new work methods, systems or tools that could affect process safety
- Organisational changes impacting Safety Critical Roles or Safety Critical Activities
- Changes to Human-Machine Interface (HMI) designs and control room layouts

Any changes that will require an update to one or more key technical documentation.

Key technical documents include, but are not limited to:

- Safety critical equipment list
- Hazard Identification (HAZID), Hazard and Operability Study (HAZOP), Layers of Protection Analysis (LOPA), Bowties
- P&ID, cause and effects diagrams, single line diagrams
- Hazardous area classification drawings
- Pressure relief calculations
- Reaction chemistry
- Occupied building assessments, temporary refuge assessments etc.
- Quantitative risk assessments such as fire and explosion risk assessment; escape, evacuation and rescue analysis etc
- Operating instructions
- Maintenance routines
- Major accident prevention plans, safety case, emergency response plan
- Regulatory reports
- Safety critical management processes
- Process safety management systems
- Other

A benefit of any rigorous MOC process is to maintain accurate documentation (including process safety information) reflecting the actual 'as built' state of the plant. This makes troubleshooting, incident investigation, HAZOP revalidation, and future engineering changes more efficient.

Out of scope

- Like-for-like replacement where the replacement is identical to the original. Any like-for-like change must fully meet the original design intent and must not introduce any new hazards or increase risk from existing hazards.
- Changes in process control and tuning parameters within a defined safe operating envelope.
- Routine document control and revision procedures.
- Major capital projects until design approval (so long as all necessary HSE reviews are incorporated into the applicable project management procedures before design approval). Note that:
    1) Major capital project changes after design approval must follow the same MOC principles to ensure that any change to design is reviewed, risk assessed and approved. Although this is not specifically addressed in the guideline, the core principles apply.
    2) Major capital project interfaces that impact the operational asset must also go through the operational MOC process. Project interfaces extend beyond physical tie-ins and can include equipment installation, ownership of maintenance responsibilities, and the update or creation of operating procedures – points where operational MOC and project governance overlap.

In addition, some organisations choose to use a different process for inhibited or impaired safety critical elements and some organisations also use their MOC process to help manage and prevent wider risks such as to product quality or asset reliability.

2.3 Categories

Depending on time frames, facility requirements and the type of changes, there can be several different MOC categories. This document covers only:

- Permanent: a change intended to remain in place long-term, such as installing a new piece of equipment on an existing system.
- Temporary: a reversible change with a defined time limit. This includes trials and short-term operational changes.

Other organisations may choose to categorise further, but it is important to recognise that the size or urgency of the change is not a good predictor of the potential risk or scale of unintended consequence.

Each organisation must make its own decisions and set its own rules about exceptional situations where a change is made and the MOC process is completed after the fact. These could include emergency modifications where immediate action to prevent escalation to a major hazard accident was required or the discovery of an undocumented change during an audit. However undesirable, a pragmatic response ensures that such situations remain exceptional, and ALL changes are fully documented and have the correct level of risk assessment.

CCPS has published useful guidelines on Key Principles of Process Safety for Management of Change[3] which includes a section on 'Emergency' changes, Key principle #4 – Use emergency MOCs sparingly (P15-19).

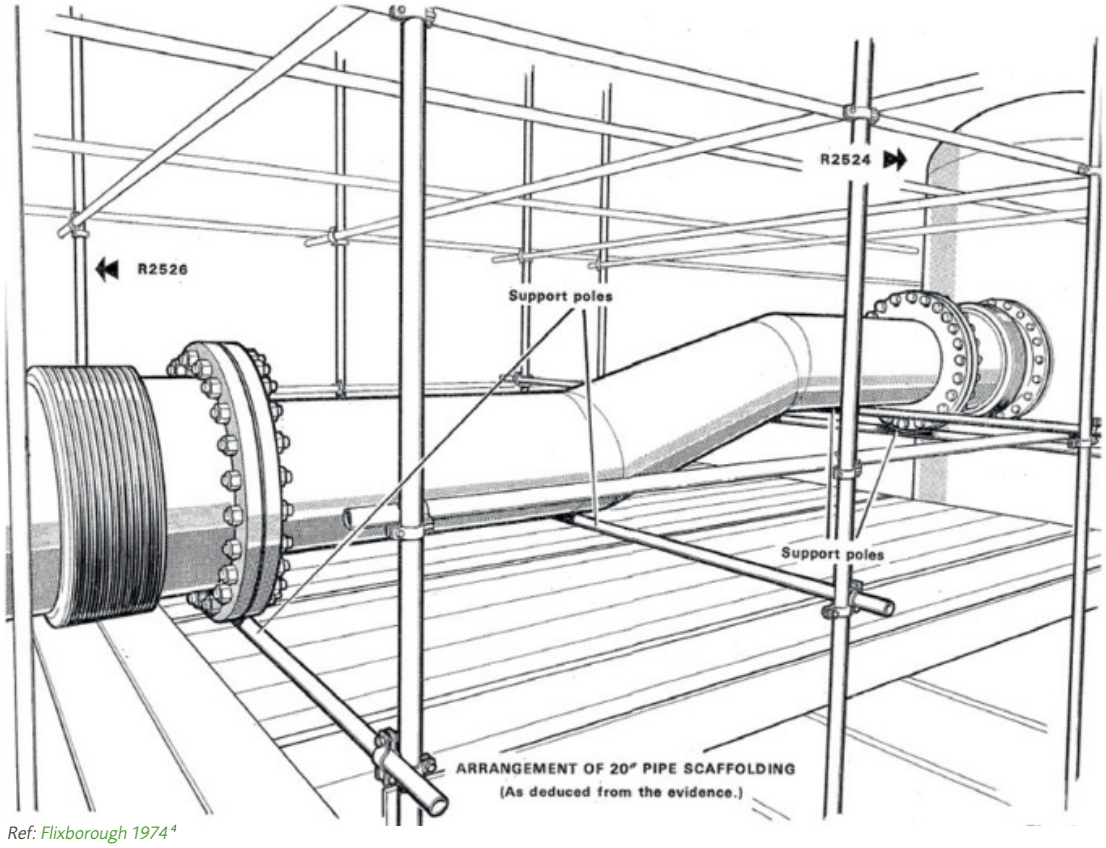
3. MOC key steps

A good Management of Change (MOC) process will ensure changes are formally identified, assessed, and controlled (or rejected) before implementation, to ensure that they do not inadvertently introduce new hazards or unknowingly increase risk of existing hazards.

While some organisations may use the MOC system to support internal processes such as prioritisation, budgeting, or scheduling, the working group emphasised that these are secondary applications. The core purpose of the MOC process is to identify and manage HSE risk for a proposed change, not to serve as a project or resource management tool.

Sometimes, due to incomplete analysis of a problem, the wrong change is proposed. Ideally this should be rejected BEFORE the MOC process is initiated. However, it may take a multi-disciplinary team to find the flaws and work with the change proposer to find the right solution to an operational issue.

What looks simple to the change proposer may horrify a subject expert.



Ref: Flixborough 1974 [4]

The working group identified the following key steps in any MOC process. The six step approach is deliberately simplified and does not include the many intermediate steps or the reject/recycle routes.

3.1 Initiate

Anyone in the organisation should be able to propose a change but an initial problem statement, option analysis and cost/benefit sense check may be required before the MOC process is initiated.

Key requirements for the Initiate step include:

- Create a unique entry in the MOC register
- Define the scope of the proposed change clearly and accurately
- Identify the facility and equipment impacted
- Reference the source of the change, explaining why it is required and what it will address (eg incident investigation actions, assurance activity actions or an improvement opportunity)
- Define the time validity period for temporary changes
- Capture all changes – whether in electronic or paper format – for traceability and accountability
- Assign a unique identifier to each MOC, enabling historical reference, traceability and auditability, even if the change is later withdrawn
- Provide sufficient initial detail to allow subject matter experts to evaluate the change effectively during subsequent formal review steps (eg redline drawings highlighting the proposed change, Basis of Design etc)

The audit and troubleshooting guides for initiating an MOC can be found in the Annexe.

3.2 Screen

The screen step in the MOC process is a first check of the scope of the proposed change and its potential impact before it can progress further. It is usually completed by the MOC owner, or MOC coordinator, in collaboration with key stakeholders and subject matter experts, using a checklist or structured prompts. It typically follows MOC initiation and may be referred to as a Change Impact Assessment.

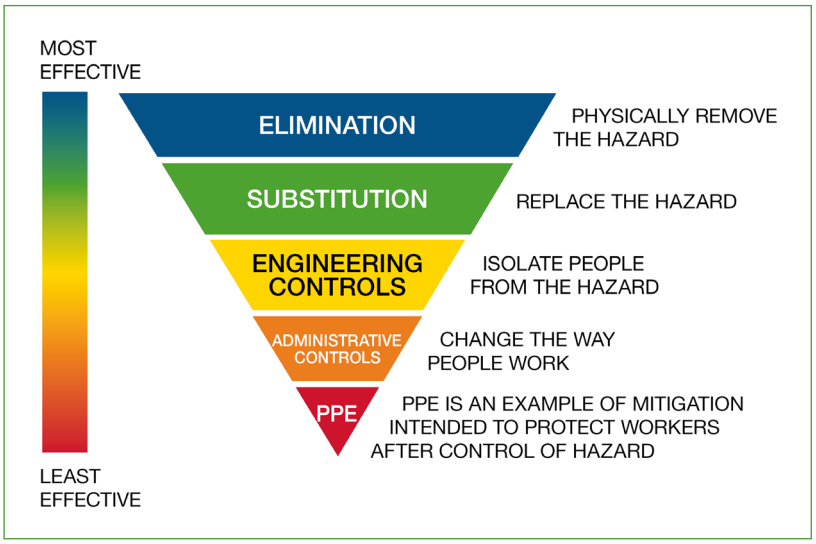
Key requirements for the Screen step include:

- Identify affected stakeholders
- Define the type of MOC and required risk assessment level
- Determine if the change requires (and is ready to proceed to) engineering design
- Define a list of deliverables (engineering, construction, maintenance, operations)
- Define the required review and approval disciplines
- Reject proposed changes that are impractical or unsafe

The audit and troubleshooting guides for screening an MOC can be found in the Annexe.

3.3 Review

The review step ensures that all the design studies (including engineering) have been done correctly and reviewed by the right people. It relies on delivery of drawings, specifications, and other documents developed to the correct engineering standards, adopting good practices, with proper consideration of Inherent Safety by Design and Hierarchy of Risk Controls.



Andy Brazier, Reference 12

At this step, the details of the proposed change have been reviewed by relevant disciplines, and suitable and sufficient risk assessments have been performed to ensure risks are understood and reduced to ALARP/SFAIRP.

This technical review step – also known as engineering assurance or design assessment – may vary between organisations. In some cases, detailed design, engineering and risk assessments are part of the MOC process; in others, they are separate, with MOC serving as a checkpoint to confirm all required deliverables and assessments are complete. The MOC process is not a project delivery tool – it is an assurance mechanism to verify that all safety and technical standards have been met.

Key requirements for the Review step include:

- Consideration of unintended knock-on consequences of change
- Consideration of resource requirements to implement change
- Consideration of human factors (eg ergonomics, workload, fatigue, shift patterns, safety critical task analysis)
- Consultation with all affected stakeholders and subject matter experts
- Completion of all design reviews
- Independent review and approval of all deliverables (including detailed design) at the right level of expertise and authority
- Performance of suitable and sufficient risk assessment to judge whether risks are ALARP/SFAIRP
- Completion of all hazard review actions due in this step
- Pre-Startup Safety Review (PSSR) requirements identified

The audit and troubleshooting guides for reviewing an MOC can be found in the Annexe.

3.4 Approve

The approval step is where the proposed change is formally reviewed and then rejected or authorised for implementation.

Approval requirements depend on the potential risks introduced by the change – the higher the risk, the higher the level of experience, expertise, authority and number of approvers required.

The final approver must be satisfied that the correct procedures have been properly followed, that the people who have approved the component parts are suitably qualified and experienced.

Key requirements for the Approve step include:

- All documentation is complete, current, and reviewed
- Relevant discipline approvals (eg mechanical, electrical, instrument and control, civil and structural) are in place – often referred to as the 'workpack'
- Additional sign-offs (eg for organisational changes) are in place
- The company MOC process has been followed to the extent required for the type, complexity, and risk, of the change
- Where the change is not approved, engage with the change team and then formally document the reasons

The audit and troubleshooting guides for approving an MOC can be found in the Annexe.

3.5 Implement

The purpose of this step is to implement the approved change safely and efficiently, ensuring it is built and commissioned according to the agreed scope. This includes completing construction, updating as-built drawings, preparing operational documentation, completing training, and verifying readiness through a Pre-Startup Safety Review (PSSR).

Some organisations treat implementation as a single step covering construction, commissioning, and handover to operations. Others break it into multiple steps, including pre-implementation actions (eg training, PSSR, risk assessment actions), formal authorisation, and post-implementation actions that can only be completed after commissioning. Such variation reflects different organisational internal workflows and levels of process detail.

The PSSR is a key deliverable in the implementation step, used to confirm that all safety and operational requirements are met before starting up equipment affected by the change. It typically includes verifying correct installation, updating procedures, completing training, and notifying relevant personnel. The PSSR is often guided by a detailed checklist and tailored to the complexity of the change.

Key requirements for the Implement step include:

- Communicate the change to all affected internal and external stakeholders
- Ensure operational documentation is updated and relevant training is completed
- Conduct an appropriate pre-startup safety review (PSSR) before energising or commissioning any equipment
- Implement the approved change safely
- Complete formal handover to operations, with all agreed actions closed out

3.6 Capture and close-out

The main purpose of the capture and close-out step is to verify that all the documentation, systems and processes associated with the change have been updated and approved by appropriate personnel, including communication of the change to affected stakeholders. This should be done in a timely manner so that operation without up-to-date Process Safety Information (PSI) is not unduly prolonged.

In MOC documents, 'capture' refers to updating documents such as procedures and drawings, as well as systems, after implementing a change. 'Close out' involves reviewing and finalising the change record once all tasks are complete, ensuring the change was properly implemented, documentation updated, risks managed, and any necessary follow-ups addressed. This step may also include evaluating the change's effectiveness and documenting lessons learned for future reference.

Key requirements for the Capture and close-out step include:

- Change has been implemented (commissioned and handed over to operations). This can be supported by a checklist
- MOC is aligned with approved scope and risk assessment
- Required drawings are updated and As-Builts are retained in the document management system
- Required documents and procedures are updated and issued and retained in the document management system
- Process Hazard Analysis (PHA)/risk assessment actions are closed out
- The maintenance system is updated, and the maintenance strategy is in place
- Any other impacted processes/systems are updated
- Change has been communicated to stakeholders and training delivered
- For temporary changes – the change has been removed and all documentation returned to its original state

In some companies there is another step in the MOC lifecycle which is scheduled for 3-6 months after the close-out step to address the Check/Act aspects of the Plan/Do/Check/Act (PDCA) cycle and drive continuous improvement in the MOC system.

The audit and troubleshooting guide for capture and close-out of an MOC can be found in the Annexe.

4. Organisational changes impacting safety critical roles

Organisational changes that affect Safety Critical Roles – whether held by employees or contractors – must be subject to a formal change management process. This ensures that any potential impact on the performance of safety critical activities is assessed, and appropriate risk mitigations are implemented to prevent an increased risk of major accidents.

Such changes may arise from re-organisations, workforce reductions, or operational restructuring. A change management process must be initiated when changes could affect the capacity, capability, or availability of Safety Critical Roles. Examples include:

- Changes in staffing levels
- Reallocation of responsibilities
- Geographical relocation of roles
- Alterations to shift patterns or working hours
- Organisational restructuring
- Introduction of new technologies or systems
- Changes in training or competency requirements
- Outsourcing, or insourcing, of functions
- Changes in operational scope or asset coverage
- Implementation of new operating models or business strategies or ways of working

While many elements of the change management process are similar for both technical and organisational changes, it is essential to recognise and address the distinct challenges posed by organisational changes – particularly those affecting Safety Critical Roles. Under these circumstances, a structured Change Impact Assessment is required to evaluate the proposed change's impact on safety critical activities, role(s) clarity, skill requirements, competence levels, and operational interfaces.

(See Ref 5 for The UK HSE guide **Organisational change and major accident hazards**, CHIS7 (HSE 2003)).

The audit and troubleshooting guide for organisational management of change (OMOC) can be found in the Annexe.

5. Temporary change

A temporary change is a change which is reversible and is time bound. Temporary change may also cover trials which affect operating conditions.

Any extension to the defined time limit must be escalated: new risk assessment and higher level of approval.

Temporary changes should be managed with the same rigour as permanent changes and follow the same process steps, with the following additional considerations required:

- Agreement on temporary changes: the need for a change to be temporary should be agreed upon upfront, with clarity on whether it may become permanent.
- Correct resourcing: identify appropriate resources and processes at the outset to support temporary changes, and the potential for them to become permanent.
- Ensure that quality of engineering and risk assessment is adequate for the scope of the change, regardless the intention for it only to be in place for limited time.
- Risk assessment review step: implement a risk assessment review of the temporary change at designated intervals, in order to assess its ongoing necessity, and whether the risk profile has changed. This includes a risk assessment of any extensions to the time bound due date.
- Visibility of temporary change/reporting: maintain a formal reference to the change in operational meetings, to monitor the status of these changes and determine any other necessary actions.
- Maximum duration for temporary status: establish a maximum duration for a change to be classified as temporary.
- For proper control, temporary changes should be entered into the MOC register together with their end date.
- Be wary of accumulating a list of temporary changes that will all revert to normal at a forthcoming turnaround – these must be protected from any turnaround scope challenge.
- Ensure there is a decommissioning plan for the temporary change to prevent leaving temporary equipment in situ when it should have been removed.
- Document the process to either make permanent, or decommission, the temporary change.

The audit and troubleshooting guide for management of temporary changes can be found in the Annexe.

6. Assurance and reporting

Management of Change (MOC) is a key element of any Safety Management System. This section outlines a structured assurance and reporting framework.

6.1 Auditing

Auditing a MOC system is typically done by looking at the MOC system records and assessing them against the MOC procedure, but any good MOC audit should also involve a field visit and conversations with front-line personnel to identify any changes that haven't been subject to the MOC process, either because they haven't been recognised as a change or because the MOC process is ill designed to address them.

In the 'Three Lines of Defence' framework, each line of defence serves a specific function in verifying and enhancing the MOC process:

Focus	Purpose	Outcome
First line of defence: Self-verification/self-assessment **Conducted by:** Site or asset personnel	Ensure changes are properly recognised, screened, risk assessed, implemented and documented, while promoting operational ownership and enabling timely identification and correction of issues.	■ Improved MOC procedures. ■ Early detection and correction of non-conformities. ■ Enhanced operational awareness and continuous improvement.
Second line of defence: Assurance **Conducted by:** Independent internal personnel or teams	Provide independent oversight of change management to identify systemic issues and ensure consistency with organisational standards across all sites.	■ Identification of cross-site or systemic weaknesses. ■ Improved process integrity and consistency. ■ Organisational-level improvements and standardisation.
Third line of defence: External auditing **Conducted by:** External auditors or corporate-level teams	Assess the overall effectiveness of the MOC process by evaluating compliance with internal and regulatory standards, ensuring alignment with organisation safety culture and strategy, and validating the performance of the first and second lines of defence.	■ Strategic insights for senior leadership. ■ Identification of long-term risks and cultural challenges. ■ Strengthened governance and accountability across the organisation.

Other audit frameworks can be used depending on the procedural and cultural requirements of the organisation.

6.2 Performance and metrics

Metrics can offer useful insights into how effectively the MOC process is working and help organisations monitor key areas of concern, ensure compliance with regulatory and company standards, and drive continuous improvement.

However, metrics achieve nothing in themselves unless an effective MOC review is incorporated into regular management control and reporting meetings at which operational performance is discussed, decisions are taken and actions assigned.

Such operational meetings should also be the place for leaders to prompt questions relating to use of the MOC process such as:

"Do we need an MOC for that situation/approach/change we have just identified?"

"Have we completed all of the actions identified by the relevant MOC before we start-up that unit/make that change live?"

"What resources are needed to complete and close the MOC records still open?"

Face to face meetings also act as forums for discussion/approval of potential MOCs as they pass through the various stage-gates of the process.

These reviews should be used to create a performance feedback loop that supports proactive risk management, operational excellence, and a stronger safety culture.

A guideline to developing process safety performance indicators (HSG254)[6] recommends that:

"A small number of carefully chosen indicators can monitor the status of key systems and provide an early warning should controls deteriorate dangerously."

Traps to avoid include:

- Reporting metrics that are easy to measure but potentially drive wrong behaviours (eg time to closure without considering completeness of capture);
- Complex measures that tie key people up with reporting what's wrong instead of doing the work to fix it.

Below are potential areas of focus (to audit or measure) aligned with the MOC process:

Focus	Purpose	Examples
Effective risk assessment process during MOC	Ensure all hazards associated with a change are identified, evaluated and corresponding risks managed/controlled before changes are implemented.	■ Every MOC has a risk assessment. ■ Quality and type of risk assessment is appropriate for nature of change. ■ Multidisciplinary team involved in hazard identification ■ Number of MOC related incidents once MOC has been implemented.
Execution and proper closure of MOCs	Verify that all steps of the MOC process are completed satisfactorily.	■ Every change is properly captured before MOC closure. ■ Percentage of MOCs closed within the designated timeframe. ■ Percentage of MOCs implemented without issues. ■ Frequency of post-closure reviews confirming intended outcomes.
Prevention of unauthorised or incomplete change implementation	Prevent changes from being made without necessary reviews or approvals.	■ Number of unauthorised changes implemented without an MOC. ■ Number of cases where changes were approved but not implemented as planned. ■ Number of audits to verify whether all steps were properly completed (and their outcomes).
Timeliness of MOC process (no stagnation)	Ensure the MOC process is completed promptly without delays.	■ Average time taken to complete each step of the MOC process. ■ Number of MOCs in progress for more than a set duration. ■ Time lag between identification of need for change and initiation of the MOC.
Closure rates and backlog management	Monitor closure rates to prevent a backlog of open MOCs.	■ Number of MOCs closed each month. ■ Percentage of MOCs with overdue closures. ■ Total backlog of open MOCs by priority or risk level.
Proper use of emergency change protocol	Ensure emergency changes are used only when necessary and documented fully.	■ Number of emergency changes versus planned changes. ■ Percentage of emergency changes that meet all procedural requirements. ■ Number of reviews of closure documentation to ensure completeness (and their outcomes).

Focus	Purpose	Examples
Effective temporary MOC process	Ensure temporary changes are not forgotten or extended without appropriate due diligence and risk management.	■ Number of active temporary MOCs. ■ Number of overdue temporary MOC. ■ Number of temporary MOC extended. ■ Quality of temporary MOC extension.
Effective organisational structure MOC process	Ensures appropriate management of the risk introduced by organisational changes.	■ Number of Organisational changes completed with an MOC. ■ Quality of Organisational changes completed.

7. Leadership

A strong safety culture relies on leadership commitment and active support for the Safety Management System (SMS), including the MOC process. This means setting clear expectations, ensuring that individuals have the correct resources, competence and training to carry out their assigned roles, monitoring compliance, and ensuring accountability at all levels.

Best practice includes leadership support for:

- Regular practical training using a clear, up-to-date MOC procedure.
- Reinforcing positive behaviours.
- Ensuring MOC reviews are conducted in face to face meetings where possible.
- Establishing specific, quantifiable performance indicators.
- Appointing a specific individual with accountability for the overall MOC system on at each unit or site.

The Self-assessment: Leadership Accountability and Commitment can be found in the Annexe.

7.1 Resources

A key role of leadership is to ensure that the right changes are prioritised, and that sufficient resources are made available to manage changes safely to completion and closure.

7.2 Competence

As well as a basic understanding of how the company MOC process works, competent individuals must have the technical skills and operational experience to identify the potential hazards of any change as well as knowing when to bring in additional expert advice.

See IChemE Safety Centre Competence Framework documents:

- **Process Safety Competency guidance, 2nd edition, April 2018**[7]
- **Process Safety Competency guidance, supplementary guide – how to build and develop process safety competence**[8]

7.3 Awareness and promotion

Employee awareness of the risks linked to change is vital in understanding the importance of the MOC process, how it safeguards people, and each person's role in its success.

Senior management must champion this awareness by consistently promoting the importance of the MOC process, highlighting its value in forums, meetings, and organisational communications. Leadership should ensure that the MOC process is not viewed as merely a compliance requirement, but as a key driver for safety and success.

A safety-conscious culture is one where employees feel informed, involved, and empowered so that everyone believes the MOC process adds value and works together to achieve an effective system.

7.4 Role models

Leadership must demonstrate their commitment to the Safety Management System (SMS) including the MOC process by consistently following it themselves and setting the same standard for all employees. This includes adequately prioritising their responsibilities reviewing changes, holding themselves accountable for compliance, embracing the MOC framework, and making it visible through their actions ('walking the talk').

Facility leadership should respond decisively to any deviations identified in self-verifications or assurance activities, congratulating honest reporting and addressing the root causes rather than symptoms – for example, has the process become too slow and bureaucratic and can it be simplified or better resourced or better communicated?

By modelling these behaviours, leaders establish a culture where MOC compliance is integrated into everyday practices, and accountability is demonstrated at all levels.

7.5 Approval and decision-making

Leaders are involved at various key points from change initiation through to closure, not just at the approval step. When leadership is engaged with the whole process, they ensure that changes cannot proceed without a proper MOC review, showing that the organisation is serious about safety.

Financial or operational approvals are withheld until a change has been reviewed, confirming that it is necessary and has been properly vetted. This demonstrates that the MOC process is driven from the top and that leadership actively prevents 'shortcuts' in safety and procedural standards.

Where approval of major capital projects is managed in a separate system, the resources required to manage all the interfaces with the operating assets (utilities, infrastructure, process equipment, control system, Process Safety Information (PSI) etc) must also be considered and a plan presented for integration with the MOC system of the operating asset.

Leadership engagement in change approvals ensures that they are implemented with a clear understanding of associated risks, establishing a 'safety-first' mentality throughout the organisation.

7.6 Accountability and engagement

Leaders are responsible for ensuring that their teams understand why changes require risk assessment and that they adhere to the MOC process. This involves regularly discussing changes in team meetings, operational reviews, or risk management forums and challenging any planned or ad-hoc changes that may not have an MOC in place.

Leaders establish the standard that MOCs are mandatory for changes – not discretionary – ensuring that no significant change occurs without proper evaluation.

This accountability creates a work environment where teams recognise the value of MOC, regularly engage in discussions about process changes, and maintain compliance as an organisational standard.

7.7 Auditing safety management Systems

Leadership is included in audit rosters, which cover elements of the Safety Management System (SMS), including MOC. This hands-on involvement by senior leaders reinforces their commitment to operational safety and gives them direct insight into the effectiveness of MOC practices.

Through active audit participation, including site visits, leaders gain a firsthand understanding of potential gaps in the MOC process, demonstrating their investment in continuous improvement and setting a tone of accountability for the entire organisation.

7.8 Establishing consistency

Leaders support the adoption of a standardised MOC process by ensuring that procedures are clear, consistent, and aligned with corporate standards. This includes organisation-wide MOC training and clearly defined roles and responsibilities for all relevant personnel.

A standardised approach fosters uniformity in MOC application, reducing confusion, and enhancing adherence to safety and operational integrity across all teams.

7.9 Empowering line management

Leaders empower line managers to stop or delay changes if risk assessments reveal concerns or procedural non-compliance. This sends the message that safety concerns take priority, and that the organisation supports line managers in making decisions to protect it.

Empowered managers are more likely to intervene when necessary, ensuring that MOC standards are followed and risks minimised at the operational level.

7.10 Continuous improvement

Leaders promote continuous improvement of the MOC process by supporting regular reviews, identifying improvement areas, and applying lessons learned. This commitment ensures the MOC process can adapt to meet new challenges, maintaining a proactive approach to change management.

7.11 Resource allocation

Leadership ensures that sufficient resources (personnel, training, time, and financial support) are allocated to manage change effectively. This includes ensuring that individuals responsible for managing change have the necessary training and skills to execute the process correctly.

Proper resourcing enhances the MOC process effectiveness and reduces the risk of change-related incidents due to understaffing or inadequate training.

7.12 Leadership culture and accountability

Leaders must emphasise the importance of the MOC process in managing HSE risks. Any MOC violations, complaints or incidents should be investigated to seek out and address the root cause (eg resource constraints).

When compliance is valued, employees understand that safety and integrity is a priority, fostering a culture of ethical and diligent MOC practices.

7.13 Close-out and recognition

Leaders ensure that MOCs are not closed out until all necessary documentation, approvals, and deliverables are completed. They visibly recognise teams or individuals who demonstrate thorough and compliant MOC close-outs.

Ensuring proper MOC close-out sets the expectation that documentation and procedural completion are non-negotiable. Recognition reinforces positive behaviour, encouraging employees to uphold high standards.

7.14 Organisational change

Leaders accept that significant organisational changes (eg restructures, policy shifts) must also follow some form of MOC process, demonstrating their stewardship by applying the MOC process to any type of change that affects operations.

This reinforces transparency and comprehensive management, ensuring that all impactful changes, not just physical or technical ones, are carefully considered.

Annexe – Contents

8. Self-assessment

8.1 How well is change currently managed in your organisation?

A Self-assessment: How well is change managed in your organisation?

Think about your current change management practice. Give yourself a score between 0 and 10 (where 0 is worst and 10 is best) – the table below sets out what ratings of zero, five and ten might typically look like.

This is best carried out as a team activity with discussion!

Self-assessment scoring

Score each element from 0 to 10

>75% (and no zeros) Very Effective

Now try the full audit in Section 9. If your high scores truly reflect current practice, then you are doing well. It takes constant effort to maintain such great performance. Look wider, across all the elements of your process safety management system and identify further opportunities for improvement.

50-75% (and no zeros) Effective

Development is needed in some areas. Try the full audit below to pinpoint the weaknesses. Prioritise what you want to work on first. Make an action plan. Track progress.

25-50% (or one or more zeros) Need to improve

Improvement required immediately. Start with the foundations. List the urgent and important matters to work on. Make an action plan. Track progress.

< 25% Need to start

Top marks for honesty. Urgent action is needed. Discuss your findings with senior management. No one says it is easy, but your goal should be good practice.

A	Overview	My Score (0-10)	Reason for score and key gaps	0	5 – not applicable	10
1	Process safety information (eg P&IDs)			Does not exist	Exists but sometimes out of date or hard to access.	Accurate and up to date information readily available 24/7.
2	Change identification			No understanding why a change process is required	Uncertainty or confusion outside own discipline.	Thorough understanding across disciplines.
3	Change process (how we do things)			No defined process	Process exists but is not understood by all.	Clearly defined process that is complied with 24/7.
4	Change procedure (how we document what we do)			No documented procedure	Procedure exists but is not followed by all.	Well documented procedure with regular review.
5	Awareness that changes may introduce new hazards (or worsen existing risk)			No site level awareness of hazards or how they can be introduced (or worsened) by changes	Limited awareness.	High site-level awareness across discipline/department/unit boundaries.
6	Technical assessment			No technical team	Sometimes too superficial (fast) or unnecessarily detailed (slow).	Optimal balance of speed and thoroughness.
7	Financial approval process			Does not exist	Change management often halted late in process by budget holder.	Change management process is focused on minimising risk. Separate (but linked) financial approval process with early consultation at screening stage.
8	Project management process			Does not exist	Exists but only used for large projects. MOC process used for small projects.	Separate tool – well defined and resourced for both large and small projects.
9	Work prioritisation tool			Does not exist	MOC process used as the prioritisation tool.	Separate tool – well defined and resourced.
10	Complexity			Just do it	Perception that the MOC process is overly complex and too slow.	Optimal balance of speed and thoroughness.

A	Overview	My Score (0-10)	Reason for score and key gaps	0	5	10
11	Time pressures			Act first and – if caught – do the paperwork afterwards	Perception that the MOC process takes too long.	Optimal balance of speed and thoroughness.
12	Cross referencing previous change requests			Nothing to cross reference against	Cross referencing relies on manual searching of register.	Automatic cross referencing produces a list of all related MOCs and status (eg by location/ equipment tag or type).
13	Metrics			No metrics	Some metrics but time-consuming to collect data and of limited net positive use.	Good set of auto-generated metrics used to proactively improve MOC effectiveness.
14	Audits			No audits	Internal audits of documents.	Internal, external and independent audits extend to site visits and interviews with front-line staff.
15	Risk assessment of change			Risks introduced by change are not assessed	Level of risk assessment required for a change is unclear, personnel unsure how to assess risks and who is competent to assess risks.	Well defined risk assessment requirements for each type of change with competent risk assessors.
16	Close-out			Change requests that are never raised don't have to be closed out	Incomplete or delayed updates to documentation and lengthy close-out activities.	Well-resourced close-out process based on process safety risk priorities.
17	Temporary changes			No risk control of temporary changes	Many temporary changes continue beyond intended duration.	All temporary changes are either reversed or superseded by a permanent change request before agreed duration expires.
18	Organisational change			No risk control of organisational changes	Organisational changes with clear process safety implications are reviewed through change management process retrospectively.	All organisational changes are screened for process safety risk and significant changes are risk assessed through change management process prior to implementation. Some proposals are rejected, others have additional controls introduced.
19	Leadership support			No leadership support for MOC process	Leaders have some basic understanding of MOC requirements.	Leaders understand the importance of the MOC process, and are a positive role model supporting competence and continuous improvement.
20	Consistent, repeatable and reliable			Chaotic/whimsical	Depends on a few experts.	The change processes is robust, layered and flexible enough to be used for many different situations. Change history is easy to access.
	Sub total (score/200)					

B Self-assessment: How good are people in your organisation at recognising a change?

Consider using this as part of MOC training.

Take some real life examples relevant to your own organisation or industry sector and ask a range of staff to decide for each example Management of Change (MOC) is required. Alternatively, adapt the examples in 8.3: Examples of failure to recognise a change. Further examples are available in Section 10: References and Further Information.

Do I need to initiate the Management of Change (MOC) process?	Yes/no	Reason
Is it an emergency change?		
Is it a temporary change?		
Is it a physical (hardware) change?		
Will equipment be added or removed or modified?		
Will piping or cabling or a utility be added or removed or upgraded or downgraded or rerouted?		
Will there be a change in equipment supplier?		
Could there be a change in design or materials of construction?		
Could there be a change in capacity? (eg higher or lower flowrate)		
Could vents or pressure relief systems be affected?		
Could access be affected? (Emergency escape routes, working at heights, separation of pedestrian and vehicle routes)		
Could there be a change in structural requirements? (eg foundations, supports, stresses)		
Is it a process change?		
Will new substances be added to or removed from the process?		
Will the order or place of addition/removal of existing substances be changed?		
Will there be a change of supplier? (eg for raw materials, solvents, gases, utilities, catalysts, waste disposal)		
Could the safe operating envelope of the process be altered?		
Could process waste (air emissions, liquid effluent, solid waste) change?		

Do I need to initiate the Management of Change (MOC) process?	Yes/no	Reason
Is it a software change?		
Will an alarm or interlock or safety instrumented function be added or modified?		
Will an alarm or interlock or safety instrumented function be removed or bypassed or overridden?		
Will a process set point be changed outside of normal limits?		
Could process parameters stray outside the defined safe operating envelope?		
Could there any change to cyber security risk?		
Is it an organisational change? (eg supervision, shift pattern, team numbers, trainees)		
Could the organisational change have an effect on process safety (eg: critical tasks, incident prevention or response)?		
Is it a change which needs to be documented?		
Will operating procedures, instructions or checklists need to be updated?		
Will maintenance procedures, schedules, calibration or spares holdings need to be updated?		
Will internal or external emergency plans need to updated?		
Will any of the following key Process Safety Elements be affected:		
■ Reaction Chemistry?		
■ Pressure Systems (PSSR)?		
■ Safety Instrumented Systems (SIS)?		
■ Fixed Fire Protection (FFP)?		
■ Other?		

Do I need to initiate the Management of Change (MOC) process?	Yes/no	Reason
Will any Process Safety Information need to be updated:		
■ Piping and Instrumentation Diagrams (P&IDs)?		
■ Hazardous Area Classification Drawings (HAC)?		
■ Pressure Systems Written Scheme of Examination or other Registers?		
■ Pressure Relief Calculations?		
■ Piping Stress Analysis?		
■ HAZID, HAZOP, LOPA etc?		
■ Regulatory Reports (eg Safety Report, Major Accident Prevention Plan)?		
■ Other		
Will any other Health Safety Environmental or other Regulatory Requirements have to be considered:		
■ Lifting regulations, portable equipment, regulations, control of hazardous chemicals etc?		
■ Fatigue management?		
■ Other		
If you answered YES to any of the above, then initiate the MOC process		

This check list is intended as an example – feel free to modify and add your own questions.

For emergency changes – the MOC process must be initiated to ensure the change is reviewed and documented retrospectively.

For temporary changes – the MOC process must be initiated to ensure the change is reversed within the agreed time-period, or replaced with new, permanent change.

For capital projects – the change should be managed though a separate formal project process with stage gate approval, but the MOC process may still be required to assess process safety risks at the interfaces with operating units (eg equipment and control system tie-ins, knock-on effect on common utilities, infrastructure and personnel).

For software (control and instrument, DCS and PLC) changes – the software revision control, approvals and cyber security risks may be managed in a separate process, but management of change may still be required to assess the wider process safety risks of change implementation at the interfaces between hardware and software – eg loss of communication or software version or network incompatibilities that could cause an unexpected process upset.

For organisational changes – the changes may be managed through a separate process, but process safety risks (eg emergency response) must be properly assessed.

C Self-assessment: Leadership accountability and commitment

C	Topic		Yes	No	Unsure	Measure (how will I know?)	Action (what will I do?)
7.1	Resources	Adequate resources are made available to assess the risks of change and manage changes safely to closure and completion.					
7.2	Competence	The right individuals with the right competence (technical skills/operational experience) and authority identify the potential hazards of any change. Additional specialist advice is always sought where necessary.					
7.3	Champion	The MOC process is effective and a key driver for safety and success.					
7.4	Role Model	I demonstrate my commitment to change management. I ask questions, walk the talk, congratulate honest reporting, and help to address root causes rather than reacting to symptoms of non-compliance.					
7.5	Decision Making	I make time to engage with change approvals and ensure changes cannot proceed without a proper review or be completed without the right closure activities.					
7.6	Engagement	My teams understand the MOC process and we regularly discuss changes in team meetings, operational reviews, risk management forums and challenge any planned or ad-hoc changes that may not have an MOC in place.					
7.7	Accountability	Accountability starts at the top. Senior leaders are familiar with the MOC process, understand it's importance and how it fits into the overall Safety Management System. They set the standard that no change can occur without proper risk evaluation.					
7.8	Auditing	I am actively involved in auditing, including site visits, to gain a first hand understanding of how our MOC process operates in practice.					
7.9	Consistency	Our organisation-wide training ensures that the individual roles and responsibilities in the MOC process are understood by all, including contractors and other third parties.					

D Change recognition audit

Carry out an audit on what is actually happening today. Make a field visit – pick something that looks like a change – find out how it was managed. Always begin in the field with the real problems. Are changes always recognised and documented?

D	Audit	Number of changes without MOC?	Improvement opportunities
1	Review out of hours call outs where emergency changes were likely made.		
2	Review unusual purchases/withdrawals from stores likely connected with a change.		
3	Review maintenance work orders where a change may have been made.		
4	Review historical changes of suppliers of raw materials etc.		
5	Review historical changes of suppliers of equipment etc.		
6	Review alarm/interlock override history.		
7	Review shift swap approval process – can changes to the emergency response/critical task capability slip through unnoticed?		
8	Walk around the plant – does anything look new? If so, attempt to trace this back through the management of change system.		
9			
10			
	Sub-total		

8.2 Common challenges and recommendations in recognising what is a change

Common challenges	Recommendations and tips
Failure to recognise what a change is.	■ Provide awareness level MOC training for all staff. ■ Introduce the topic of MOC into site discussions, meetings and toolbox talks. ■ Provide clear procedures with definitions of a change. ■ Consider the use of an MOC decision tree/flow chart. ■ Consider including company relevant worked examples. ■ Provide a pre-screening/filtering process outside of, but tied into, the MOC system. ■ Simplify the MOC initiation process to promote easier raising of potential changes into the system. ■ Share previous industry incidents involving poor management of change.

8.3 Examples of failure to recognise a change

A. A change can be defined as anything that is not 'like for like'. Like for like means that the parts, materials or chemical components are exactly the same. What about a change of supplier or manufacturer? The key lies in the details. For example, a replacement 4" full bore ball valve may have the same design pressure, materials of construction and flange dimensions as the original. However, we need to go further and ask is it a floating or trunnion mounted type? Are the seats the same material? Is there a degassing hole in the ball? Anything that is not the same must go through a change process.[9]

B. An I&E technician received a work order to replace a faulty solenoid operating a block valve. The permit was issued and the technician went to the store to collect a new part. The correct size was out of stock but the next size up was available. This was issued and installed. Unfortunately the valve in question was on the outlet of a pressure vessel and part of an emergency de-pressuring system (EDP). The larger solenoid caused the outlet valve to close faster than the inlet valve thus compromising the depressuring system.[10]

C. Following a debottlenecking exercise, a control valve was running 95% open. It was decided to change the trim thus increasing the flow coefficient of the valve. Unfortunately, the fail open condition of this valve was the basis for sizing a downstream relief valve so the change compromised the plant's overpressure protection. If it had been identified as a change and sent through a change process then the question should have been raised, resulting in an action to confirm the sizing basis and impact on downstream relief.[10]

D. A new cheaper corrosion inhibitor was introduced to replace the existing chemical. Tests confirmed that the new chemical was compatible with the fluid and other injected chemicals. However, when a crude oil pump seal leak occurred several months after the new chemical was introduced, it turned out that the pump seal was not compatible with the inhibitor. This was not previously identified as an issue as the team assumed the inhibitor, injected in ppm, was not significant in terms of volumetric flow.[11]

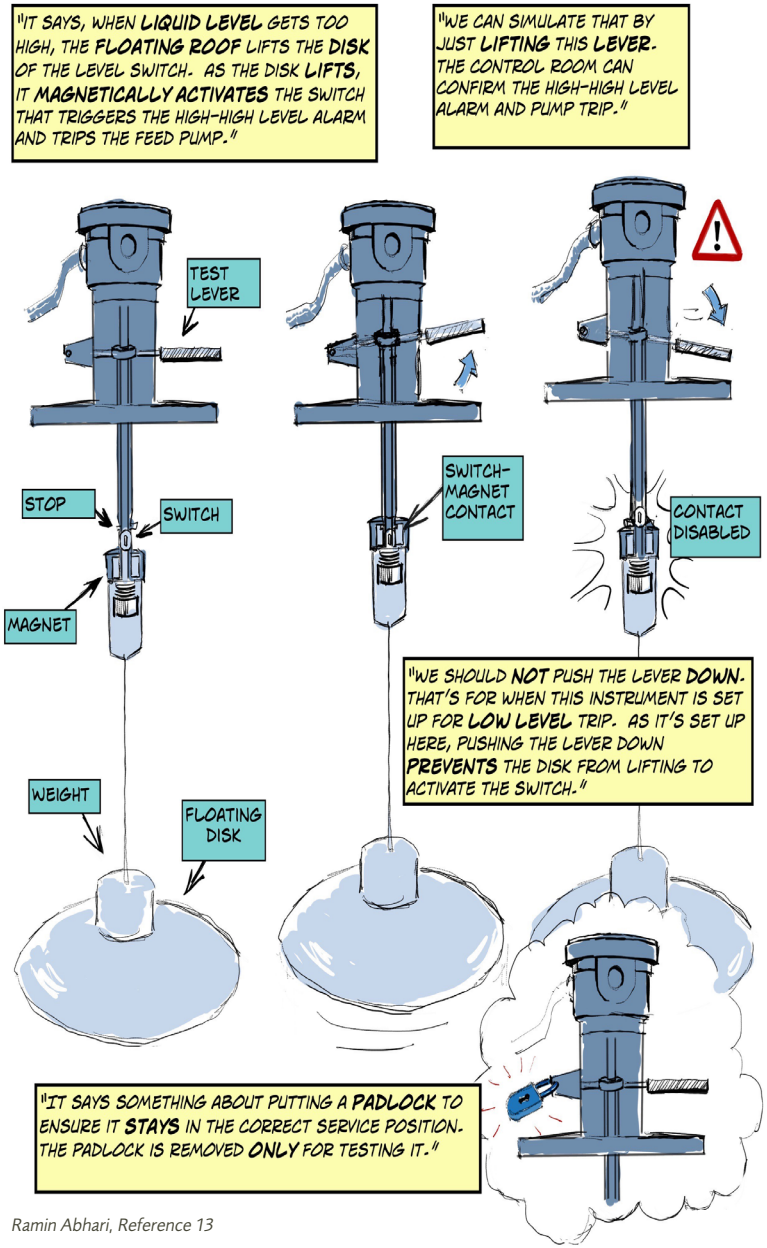
E. A company's purchasing department found a cheaper supplier for a high hazard liquid raw material. It would be delivered to the site's dedicated delivery point in the same type of ISO tank with the same connections. The plant was not consulted, and the purchasing team did not highlight this as a change. The first delivery demolished the delivery gantry leading to a loss of material to the environment and a significant loss of production. The new supplier had a different haulier who used a higher trailer to carry the ISO tank.[1]

F. Spraying cooling water onto the outside of a vessel to control a leak (Flixborough).[4]

   'A prior small leak had been dealt with for a period by diluting it with cooling water sprayed onto the outside of the reactor shell. The cooling water had been treated with an additive, making it nitrate-rich and leading to nitrate stress corrosion cracking the shell.'

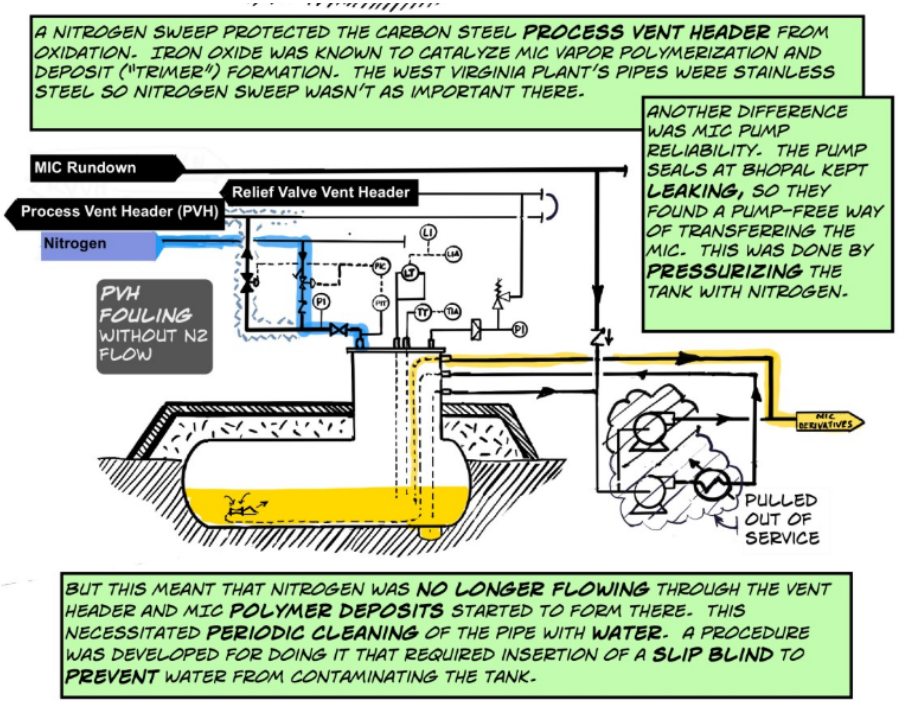
   'If the use of cooling water had been subject to an MOC process, is it even certain the potential for the additive to cause stress corrosion cracking would have been spotted? This points us to another key facet of effective MOC: the importance of broad multidiscipline review. This change may have needed team risk assessment and/or change review including both a chemist (with an understanding of the water chemistry) and an integrity engineer (with an understanding of potential corrosion mechanisms) to identify the cracking threat.'[2]

G. Changing the design of an independent high level switch on a bulk petrol tank (Buncefield).[13]



Ramin Abhari, Reference 13

H. The storage tanks had been designed and built with pumped circulation and transfer, but the pumps had proved dangerously unreliable, with highly hazardous material leaking from pump seals. An alternative transfer method, pressurising the tank with nitrogen, was developed (Bhopal).[12]



Ramin Abhari, Reference 12

I. Many companies are significantly reducing building ventilation levels because of energy costs. However, in some situations, a high level of ventilation may afford protection (eg safeguard against asphyxiation from nitrogen).[14]

J. It was decided to relocate engineers from a remote production site to a central office. The loss of local specialist experience on site contributed to an operational failure to recognise the risk of low temperature brittle fracture, resulting in a serious accident (Longford).[15]

9. Audit – is the change management process effective?

E Audit: Initiating MOC

F Audit: Screening MOC

G Audit: Reviewing MOC

H Audit: Approving MOC

I Audit: Implementing MOC

J Audit: Capturing and Closing-out MOC

K Audit: Organisational Change

L Audit: Temporary Change

M System Audit

Auditing a MOC system is typically done by looking at the MOC system records and assessing them against the MOC procedure.

Any good audit should also attempt to identify any changes that haven't been subject to the MOC procedure, either because they haven't been recognised as a change or because the MOC process is ill designed to address them.

Where changes are recognised, is the Management of Change process effective? Select the following:

- One completed emergency change (verbal approval, change made and documented afterwards)
- One completed temporary change
- One completed hardware (piping/equipment/instrumentation) change
- One completed software change
- One completed organisational change

Randomly select five change requests which are currently stuck at each step (1-6) of the process (a different five each time). Use the detailed audit forms for each step of the change management process (E to L) and collect the totals in the system audit (M).

Did anything surprise you? The scores are far less important than the improvement opportunities you identify.

9.1 MOC Step 1 – Initiate

Common challenges and recommendations – Initiate

Common challenges	Recommendations and tips
Wrong solution proposed to real problem or wrong problem being addressed.	■ Initial ideas may benefit from a high-level feasibility review – sometimes the real problem needs further analysis to get the right solution.
Lack of site engagement: Change is initiated without consultation.	■ Ensure communication between different site teams is sufficient to prevent duplication. ■ Cross reference previous changes that are similar to the one being raised. ■ Consider appointing an MOC champion to coordinate the overall MOC process.
Insufficient understanding of why the change is proposed.	■ Reference the source of the change (incident, assurance audit etc) along with the preventive benefits. ■ Use prompts or checklist to clearly describe the scope and purpose of the change. ■ Identification of the scope of the change before the MOC is entered in the system. ■ Avoid using the MOC process as option assessment tool.
Initiating change too early, generating an MOC backlog.	■ Conduct regular screening meetings for initiated MOCs to allow system performance monitoring, early termination and/or progression within the system. ■ Provide personal communication from the initiator to ensure cross department awareness, and that the organisation does not solely rely on electronic workflow. ■ Maintain a separate system for work prioritising and budget approval. ■ Maintain visibility on MOCs raised – for example through an MOC dashboard.
Insufficient information or documents attached within the 'Initiate MOC' step.	■ Provide training to staff to ensure they are competent in raising of MOC requests and that they are aware of the minimum standards required for initiating an MOC. ■ Use prompts or checklists to clearly describe the scope and purpose of the change. ■ Consider having an engineer or a gatekeeper to check through the change before progressing to the next step.

E Audit checklist – Initiate

Tick yes or no (including notes) according to your organisation's MOC process.

E	Initiate Phase 1	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	A unique reference number is allocated			Unique number auto-generated and reserved.	No numbering system
2	Description (title) of the proposed change is clear			Location, process, equipment, etc clearly identified.	No description
3	Name and role of initiator provided			Clear identification of the person driving the change.	No name or contact details
4	Purpose, benefits and reason for proposed change are clear			Clear justification and benefits.	No explanation
5	Definition of scope of proposed change is clear			Sufficient information to allow an initial screening review and impact assessment.	No definition
6	Evidence of team and other stakeholder engagement			Prior engagement and consultation with team and other stakeholders.	No engagement
7	Realistic capacity to deliver proposed change			Previous MOCs are implemented and closed in a timely manner and the backlog is manageable.	Wishlist No capacity
Total					
Total %					

9.2 MOC Phase 2 – Screen

Common challenges and recommendations – Screen

Common challenges	Recommendations and tips
Screening takes too long.	■ Ensure the right stakeholders and team members are involved during the screening step to enable prompt decision making. ■ Encourage triage – multi-discipline and cross department discussion at screening step in order to quickly progress good proposals but reject change proposals that are unsafe, impractical or need full option assessment.
Screening is superficial – fails to identify all the change impacts (including identifying stakeholders, deliverables and risks of unintended consequences of change).	■ Ensure that the next steps in the process are rigorous enough for this to be rectified.
The wrong process is used to manage the change (eg MOC vs Project Process).	■ Consider the use of a decision matrix/decision tree. ■ Provide MOC training and competence assessment for critical roles in the MOC process. ■ Use case studies and real-world examples within the training to highlight examples and outcomes of MOC errors.
The wrong level of risk assessment (RA) is used.	■ Choose risk assessment level proportionate to maturity of proposal (eg do not attempt a HAZOP without a design). ■ Ensure that the risk assessment rigour increases at each step in the MOC process and any shortcomings at the screening step are rectified at the review step.
More change requests are raised and pass screening than can possibly be actioned (limited site resources and budget).	■ Consider categorising and prioritising at the screening step (eg regulatory requirement, HSE improvement, cost saving/efficiency improvement etc) with initial cost/benefit estimate – **remember to include cost of technical reviews and updating drawings and procedures.**

F Audit checklist – Screen

Tick yes or no (including notes) according to your organisation's MOC process.

F	Screen Phase 2	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Screening effective			Dedicated change coordinator/ engineering gatekeepers review change request before rejecting or progressing to the next step.	Inadequate screening
2	Key stakeholders identified			All key stakeholders identified (including budget holder and the engineering and other disciplines to be involved in delivery).	Incomplete identification
3	Deliverables reviewed			Deliverables defined (operations, engineering, maintenance, HSE etc) .	No review
4	Basic HSE check			Regulatory check including Safety Data Sheet (SDS) review for any new chemicals.	No review
5	Classification of change reviewed			The change has been correctly categorised.	Incorrectly classified
6	Level of further risk assessment defined			The right level and types of risk assessment are specified with the right people available (mix of expertise and experience) to identify hazards (including potential unintended consequences of change).	Ill defined
7	Initial impact assessed			Level of impact assessment proportionate for screening stage (reject/progress).	Poor assessment

9.3 MOC Phase 3 – Review

Examples – Review

Modifications were made to an elevated platform during a shutdown to improve maintenance access. These were properly engineered and met all relevant codes and standards. On startup, a nearby large high pressure steam line, which had been cold during the maintenance shutdown, expanded on heating and impinged on the platform. This stressed the pipework causing it to crack resulting in extended downtime, repair and testing. What type of review would have identified this hazard?[10]

A small process change was made due to a pump failure, which meant that a solvent and a process reactant were mixed for an extended period inside a drum. The change was evaluated according to the organisation's management of change (MOC) procedures and no significant hazard was identified. A runaway reaction later occurred which resulted in a drum burst.

Fortunately, there were no injuries as a result. Data showing that the mixture between the reactant and the solvent could exhibit dangerous behaviour was available but would not be widely known beyond experts in the field, who may not be systematically involved in assessing small process changes during operations.[15]

Flixborough

On 1 June 1974, 28 people were killed, 36 injured after an explosion at the Flixborough site of Nypro, UK. A temporary bypass pipe had been installed because a reactor vessel had developed a crack[2]

'It was decided to remove the reactor and to install a bypass pipe in its place'

"…no-one appears to have appreciated that the connection of No.4 Reactor to No.6 Reactor involved any major technical problems or was anything other than a routine plumbing job, and the possible design problems and design alternatives were not discussed. Even the fact that the inlet and outlet of the by-pass pipe were at different levels was not appreciated at the meeting."

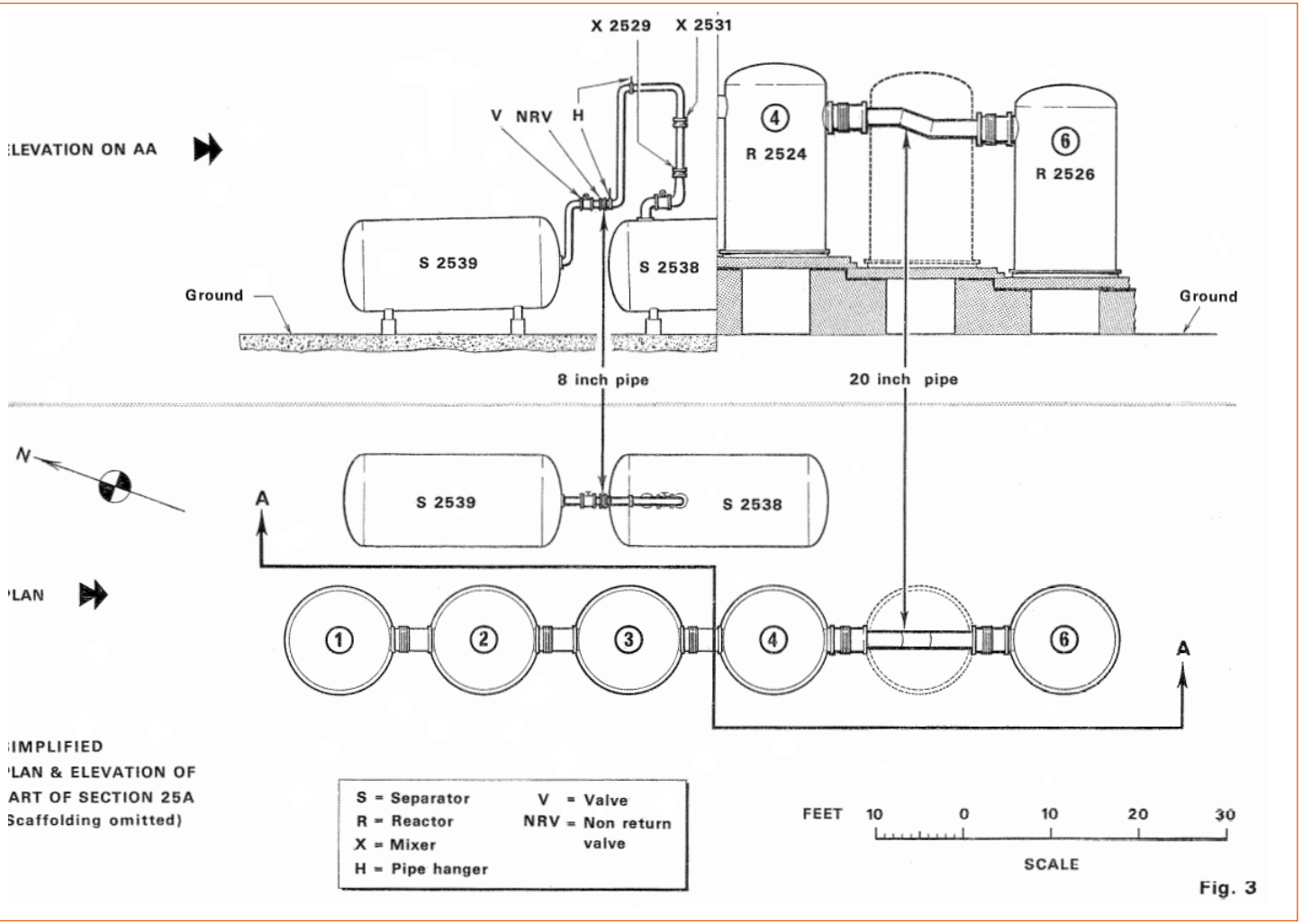
"…the emphasis at the meeting was directed to getting the oxidation process on stream again with the minimum possible delay."

"Although the openings to be connected were 28-inch openings, the largest pipe which could be found on site and which might be suitable was 20-inch diameter. Calculations were made to determine whether this pipe was large enough… No calculations were made for a dog-leg pipe as the exact shape of the pipe was not appreciated at this time."

"No calculations were done to ascertain whether the bellows or pipe would withstand these strains; no reference was made to the relevant British Standard or any other accepted standard; no reference was made to the designer's guide issued by the manufacturers of the bellows; no drawing of the pipe was made, other than in chalk on the workshop floor; no pressure testing either of the pipe or the complete assembly was made before it was fitted."

"…no thought appears to have been to the question of desirability of support under such conditions, save by Mr Blackman who at the 'design' stage provided…his assistant with a sketch for supports… This support was not, however, provided and Mr Blackman did not take any steps to insist upon its installation."

"There was no overall control or planning of the design, construction, testing or fitting of the assembly nor was any check made that the operations had been properly carried out."



Sketch showing the bypass pipe that was installed in place of the reactor which cracked.

Common challenges and recommendations – Review

Common challenges	Recommendations and tips
Lack of documented or inappropriate level or quality of risk assessment.	■ Use technical and subject matter experts and experienced site team members to support the risk assessment. ■ Provide clear and documented guidelines on levels of risk assessment required for the types of changes. ■ Standardise risk assessment documentation and templates. ■ Define minimum risk assessment requirements relative to the perceived risk of the change. ■ Provide sufficient risk assessment criteria, prompting reviewers to consider all potential hazards and risks. ■ Provide clear guidelines on ALARP demonstration. ■ Standardise hazard criteria for the risk assessment to act as an aide-memoir. ■ Implement a peer review of similar risk assessments.
Poor quality of technical and operational documentation, or missing documentation. Training and procedural update requirements not adequately identified.	■ Implement a structured document template containing the desired requirements. ■ Agree and establish a list of deliverables for the change during the screening/change impact assessment. ■ Use technical and subject matter experts. ■ Ensure that the required resources/disciplines are notified early and aligned on priorities. ■ Provide up to date engineering documentation and procedures to enable quality deliverables. ■ Early identification and engagement of technical reviewers as per internal technical authority framework. ■ Implement a peer review or validation process.
Difficulties in engaging all the technical reviewers and disciplines involved or affected areas; resulting in delays to the technical review step.	■ Establish a clear technical review workflow. ■ Implement automated notification and set deadlines. ■ Consider the use of MOC co-ordinators and champions. ■ Ensure early engagement and consultation with all affected stakeholders, reviewers and approvers. ■ Agree working priorities between departments. ■ Ensure sufficient resources are dedicated to organising and supporting the development and review of change documentation. ■ Implement specific department reviews (face-to-face where possible) throughout the current process – eg weekly department MOC meetings between accountable parties. ■ Allocate sufficient time for resolving concerns during the review step. ■ The hazard and risk assessment must be in tune with the magnitude and initial risk ranking of the need for change. Often the process is too arduous for simple change, or not deep enough when a new risk is being taken on.

Common challenges	Recommendations and tips
Time allowed for quality discipline reviews. Limited opportunity to influence change design properly, as there is time pressure with items procured, work crews mobilised etc.	■ Ensure early engagement and clear communication about the upcoming review requirements, so that reviewers can be involved earlier and prioritise their inputs. ■ Provide a hierarchical review and sign off process to mitigate the cost of additional company time and resources. ■ Provide a process to require technical discipline involvement before any procurement. ■ Consider preliminary MOC reviews or screening during the design phase. ■ Implement a parallel review process so that multiple disciplines can simultaneously review, if necessary. ■ Provide automated notifications to alert reviewers when their input is required.
Technical designs are not subject to close enough scrutiny.	■ Have a competent individual available to carry out the review and verification meeting, when required. ■ Implement a design review checklist. ■ Assign dedicated technical reviewers.
All relevant stakeholders not involved. Potential impacts of the change underestimated.	■ Identify stakeholders and impacts during screening step, together with appropriate disciplines. ■ Ensure early engagement and consultation with all affected stakeholders and technical reviewers to surface any issues earlier. ■ Identify and communicate with impacted stakeholders.
Assumptions by reviewers that others have completed all the correct checks and will then approve on that basis.	■ Provide a design review process and/or a squad check where a team reviews the engineering.
Incomplete engineering.	■ Identify an MOC owner or coordinator to 'coordinate' the completion and review of all deliverables; this person will act as a 'project engineer'.
Volume of reviews and sign-offs required to proceed versus cost of the change.	■ Conduct a cost benefit analysis before an MOC is raised, to ensure the right change is progressed. ■ Agree work priorities and resources required to progress change between departments. ■ Block-out calendars of key personnel to allow reviews and sign-offs to happen within a reasonable timeframe. This could be addressed through use of a standing agenda item at a weekly review meeting.

G Audit checklist – Review

Tick yes or no (including notes) according to your organisation's MOC process.

G	Review Phase 3	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Stakeholders consulted			All stakeholders potentially affected by change are consulted.	No consultation
2	Technical review			Competent subject matter experts (eg mechanical, structural, control and instrumentation (C&I), electrical, process, HSE, process safety) review the change.	No review
3	Design activities completed (calculations and documentation for risk assessment and implementation)			All design deliverables completed (including calculations, drawings etc required for risk review).	No design
4	Risk assessment effective			The right level of risk assessment has been carried out with the right people (mix of expertise and experience) to identify hazards (including potential unintended consequences of change) and controls necessary to meet residual risk criteria (eg As Low as Reasonably Practicable (ALARP)).	No risk assessment
5	Detailed design activities completed (incorporating recommendations from risk assessment)			All design deliverables completed (including scope of works, specifications, calculations, drawings etc required for implementation) and reviewed.	No detail design
6	Pre Startup Safety Review (PSSR) considered			Pre Startup Safety Review (PSSR) requirements fully defined in consultation with the operations team.	What's a PSSR?
7	Technical assurance			Independent technical review and approval.	No assurance
8	Documentation			Adequate documentation is attached to explain the proposed change (eg redline P&ID).	No supporting documentation

9.4 MOC Phase 4 – Approve

Common challenges and recommendations – Approve

Common challenges	Recommendations and tips
Approver lacks understanding of the change – seeing the process as a 'tick-off' (including over-reliance on other reviewers).	■ Ensure that approvers understand their responsibilities to maintain a sense of informed vigilance and curiosity when an MOC comes to them for approval. ■ Define competence for approving an MOC. ■ Ensure approval is understood as a critical role.
Incorrect sign off level or authority selected.	■ Develop clear guidelines that link risk, complexity, and type of change with the level of approval requirements. ■ Ensure that the right MOC risk review is completed with a competent risk assessment lead. ■ Identify and engage the approver(s) early on to ensure they are suitable and available for this step. ■ Pre-select groups of people in approval roles on defined parts of the change process (design limitation).
Approval requirements not satisfactory (eg documentation /risk assessment lacking resulting in approval rejected.	■ Identify level of documentation and risk assessment required early on during the screen/change impact assessment process. ■ Engage the approver in advance to ensure they are comfortable/familiar with the scope and able to provide feedback before it goes to them for approval.
Late engagement of operations resulting in approval delays.	■ Involve operational teams early at the screening stages rather than wait until the MOC approval step.
Lack of independence of approver.	■ Approval by committee (eg using a mix of operations/production superintendent/HSE committee members), making sure later roles are clear in terms of final approval. ■ Provide procedures with clear guidance on independence rules, with separation of powers built in.
Insufficient approval process used with the 'path of least resistance' selected to get a change through the system.	■ Consider implementing a sign off register using a hierarchical leadership approach, to resist following the path of least resistance.

H Audit checklist – Approve

Tick yes or no (including notes) according to your organisation's MOC process.

H	Approve Phase 4	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Approval process is tiered			Higher risk changes require additional higher levels of signatory authority.	Single approver
2	Approver checks that correct process has been followed			Process is proportionate for the type, complexity, and risk of the change.	No check
3	Approver checks that all technical reviews have been completed			All relevant discipline documentation and approvals are completed.	No check
4	Approver has more than one rejection option			Evidence that approver can reject the change request (eg risk/benefit disproportionate) or can send request back to earlier stage (eg if technical review is not thorough enough).	Approve or reject
5	Approver checks that appropriate level of risk assessment has been completed and risks reduced to ALARP			Evidence that approver can check level and type of risk assessment conducted and demonstration of how the risk has been reduced to ALARP.	No check
6	Written approval by the manager accountable for operation and budget of the asset			The approver understands that they are signing for the risks that are being taken in constructing and operating the change. They are also signing to confirm the MOC process has been correctly followed.	Delegation of MOC sign offs lower in the operations organisation (according to risk).

9.5 MOC Phase 5 – Implement

Examples – Implement

A simple example of not communicating a change is provided in Trevor Kletz's publication *ICI Newsletter Series'* – see figure 3. A plant used small amounts of sulphuric acid and caustic soda, supplied in similar plastic containers. These were initially stored on opposite sides of the plant. Someone decided that it would be more efficient to have a container of both stored on the same side. This change was not communicated to all staff. Upon returning to shift, and without checking the labels, an operator poured excess acid into a container of caustic and was sprayed in the face due to the resulting reaction.[6]

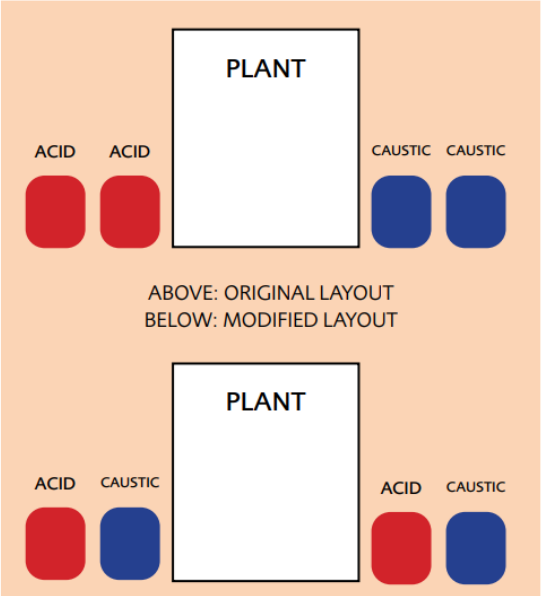


Figure 3: Plant modification not communicated

Common challenges and recommendations – Implement

Common challenges	Recommendations and tips
Delays with startup/commissioning/energisation (PSSR process).	■ Gather, review and sign-off on all critical actions and deliverables needed before the change is commissioned. ■ Start the PSSR process and engage stakeholders early – provide guidance to when PSSR needs to be started (depending on complexity of the change).
As-building documentation not available/poor quality.	■ Develop quality workpack for construction/implementation. ■ Identify competent parties for implementation on-site. ■ Communicate requirements for quality as-building completion and for storing.
Unavailability of resources/unclear implementation party leading to delays.	■ Ensure that the party responsible for implementation is clearly defined and is informed/engaged in sufficient time. ■ Ensure that resources available to implement the change are identified and planned for early.
Re-prioritisation of activities on site leading to MOC on hold or delays in implementation/poor planning.	■ Active/early engagement and consultation of site operational planning staff to understand impacts and make them understand why the MOC might be important. ■ Planning the change taking into account operational constraints/outage windows.
As-built scope is very different to agreed MOC design.	■ Verify that change implemented has not stretched beyond the original scope (or at least without a dedicated review). ■ Minimal deviation/change from agreed design and if they occur, well documented and agreed by all parties before proceeding (eg design change notice recycling workflow back to sign and risk assessment.
Scope of work is not clearly defined upfront leading to delays whilst resolving on site.	■ Prepare a quality workpack for implementation. ■ Identify and ensure that the implementer has sufficient technical background expertise for the change in question.

I Audit checklist – Implement

Tick yes or no (including notes) according to your organisation's MOC process.

I	Implement Phase 5	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Change executed			Change is safely and promptly executed to agreed scope with no surprises.	Endless delays
2	Documentation updated			Documentation (drawings, procedures etc) required before startup is updated and approved in good time.	No updates
3	Training			Training completed before startup.	No training
4	Communications			Good communication to all potentially impacted (eg consider not just operations but maintenance, laboratory, logistics, contractors, upstream/ downstream facilities, customers, neighbours, etc).	No communication
5	Risk assessment			All risk assessment actions closed before startup.	No risk assessment
6	Pre-Startup Safety Review (PSSR)			PSSR thorough and successful and equipment verified as safe to take chemicals and handed over for commissioning.	No PSSR
7	Commissioning			Commissioning completed with no surprises.	
8	Handover			Formal handover process documented.	No handover

9.6 MOC Phase 6 – Capture and close

Examples – Capture and close

During a PSM audit of thirteen oil and gas, power, and petrochemical sites in Indonesia it was found that:

'Document update may be one of the most challenging aspects of MOC implementation. Most of the MOC open more than two years that we encountered during the audit were pending a document update. As an auditee stated, "We don't have a permanent drafter here in our engineering department. Typically, we wait until there is a significant number of drawings that need to be updated before temporarily hiring a drafter to update them". … We always argue that having a slightly messy but accurate red-line marked up drawing is significantly safer than using a beautifully drafted drawing that is not accurate. They can then wait until a significant number of drawings need to be updated and procure a proper drafting service to make the drawing change 'permanent'.[11]

Common challenges and recommendations – Capture and close

Common challenges	Recommendations and tips
MOC tasks not completed (drawings not as built, open actions remain).	■ Engage accountable persons for the post implementation actions to ensure they complete their assigned tasks and upload the evidence required to enable MOC close-out. ■ Prioritise actions based on change criticality. ■ Raise tasks as actions for document updates to allow for MOC close-out and provide increased visibility. ■ Enable efficient drawing update system with quick turnaround. ■ Provide recognition for person(s) closing out the MOC (not just the implementation step). ■ Align priorities between teams and agree on which MOCs are most important.
MOC close-out held up by other processes or systems updates, taking longer than required.	■ Raise request in impacted systems/process as early as possible to allow for updates to occur without delaying MOC. ■ Consider close-out of MOC based on request raised to update system/MOC rather than delivery of the full update scope (depending on risk – could apply for low risk categories).
MOC close-out delays due to lack of priority.	■ Establish visibility over MOC close-out by having a metric/KPI reviewed by site operations as part of their HSE cadence, to highlight issues with close-out and drive refocus/reprioritisation.
Changes not communicated to site personnel.	■ Ensure communication plan is included as a specific task when developing MOC (should plan to occur early). ■ Ensure training is rolled out before startup.
Request submitted to drawing office and action 'ticked off' in the system.	■ Verify that drawing/documentation has been updated in the system (witnessing evidence) and not closed-out on good intent, thereby ensuring due diligence. ■ Acknowledging time pressures.
Finding defects or issues with scope at close-out.	■ Performance check during commissioning prior to handover to operation/separate check point to ensure MOC is checked for defects. ■ Raise an incident for learnings report.

J Audit checklist – Capture and close

Tick yes or no (including notes) according to your organisation's MOC process.

J	Close Phase 6	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Change implemented and commissioned			Fully documented handover with all outstanding actions assigned and tracked.	No formal handover
2	Training and communication			Change communicated to stakeholders and appropriate training delivered.	No training or communication
3	Scope			Agreed scope of approved change request has been.	No formal scope
4	Drawings			Updated, reviewed and approved as-built revisions now available in document management system.	No updates
5	Documents			Updated, reviewed and approved and incorporated into appropriate system.	No updates
6	Procedures			Updated, reviewed and approved and incorporated into appropriate system.	No updates
7	Maintenance system			Updated preventative maintenance/ calibration/inspection strategy in place.	No updates
8	Other systems (eg Lab)			All impacted processes/systems are updated.	No updates
9	Risk assessment actions			All reviewed and closed out.	No action tracking or actions still open
10	Temporary change reversed			All documentation updated with temporary change has been returned to original state.	No record kept of temporary changes
11	Review			Full evaluation of the effectiveness of the change and lessons learned documented for future reference and acted on.	No review

'Capture' refers to updating key documents (such as drawings, procedures, calculations and risk assessments) and systems (such as Computerised Maintenance Management Systems (CMMS)) – capturing all information after implementing a change.

'Close out' involves reviewing and finalising the change record once all tasks are complete, ensuring the change was properly implemented, documentation updated, risks managed, and any necessary follow-ups addressed.

9.7 Organisational changes impacting safety critical roles

Examples of organisational changes

Adding fire and gas detectors to normally non-manned platforms may increase the visit frequency to the platform, significantly increasing transportation risk and exposure to personnel instead of reducing overall risk. All of these are examples of why a change needs to be thoroughly reviewed by a multi-discipline team and why properly communicating to all affected personnel is critical.[11]

K Audit checklist – organisational change

Tick yes or no (including notes) according to your organisation's MOC process.

K	Organisational change	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Information on current organisation structure			Information on safety critical roles/responsibilities/activities is included in organograms or other controlled HR documents.	Not available or out of date
2	Organisational changes screened for process safety risks			Potential risks associated with changes to organisational structures, personnel, or procedures (eg shift pattern, staffing levels, role modifications, or operational restructuring) are reviewed for process safety risks (eg impact on safety-critical operations or emergency response capability).	What risks?
3	Organisational change process			Well defined process exists to manage organisational changes, separate from (or complementary to) process for technical and engineering changes.	No process
4	Organisational change procedure			Well documented procedure exists to manage organisational changes, separate from (or complementary to) process for technical and engineering changes.	No procedure
5	Organisational change risk assessment			The impact and risk assessment methodologies are suitable for assessing organisational changes.	No risk assessment
6	Organisational change risk assessment team			The right people (with the right blend of experience/ expertise/ authority) assess the potential process safety risks of organisational change and define controls, mitigation strategies, clear documentation, and communication to ensure continuity in safety-critical roles and adherence to established safety standards.	No team
7	Organisational change post-implementation review			Review carried out.	No review

Challenges and recommendations – organisational change

Common challenges	Recommendations and tips
Using a technical change process workflow for organisational changes.	■ Develop a dedicated Organisational Management of Change (OMOC) process. ■ Tailor impact and risk assessment tools to suit organisational change scenarios. ■ Train relevant personnel on the differences between technical and organisational MOC.
Business change is not well defined, so roles and responsibilities are not clear.	■ Define the scope and objectives of the change early in the process (eg before starting the MOC). ■ Establish and communicate a clear organisational structure with defined safety critical roles before and after the change. ■ Involve HR and operational leads in early planning stages.
Insufficient buy in from a senior enough level in organisation to enact the change.	■ Ensure organisational changes are driven by senior management/leadership rather than by isolated individuals. ■ Secure formal approval from senior management before initiating changes. ■ Embed leadership accountability into the OMOC process. ■ Ensure leadership visibly supports and communicates the change.
Insufficient time to identify and manage the requirements and change.	■ Embed leadership accountability into the OMOC process. ■ Allocate adequate time and resources for planning and implementation. ■ Include organisational changes in long-term planning cycles. ■ Use project management tools to track timelines and dependencies.
Unclear understanding of tasks; impact on teams (tasks not getting done).	■ A clear organisational structure must be established, with well-defined safety critical roles and responsibilities both before and after the change. ■ A structured review should be conducted after the change is implemented to evaluate its effectiveness. ■ Map all formal and informal tasks performed by affected roles. ■ Conduct task impact assessments to identify gaps and mitigation needs. ■ Engage frontline staff to validate task mapping.
Inadequate risk assessment: relevant stakeholders are not involved; actions are not identified and closed out.	■ Use a structured risk assessment process involving all relevant stakeholders and subject matter experts. ■ Track and close out all actions with clear ownership and deadlines. ■ Audit the process to ensure completeness and effectiveness. ■ A structured review should be conducted after the change is implemented to evaluate its effectiveness.
Lack of communications	■ Understanding and communication of the need for change, the benefits and effects of change and the expected outcomes. ■ Establish a good communications protocol. ■ Develop a communication plan outlining the purpose, benefits, and impacts of the change. ■ Communicate regularly and transparently with all affected parties. ■ Provide updates on progress, timelines, and next steps.

Common challenges	Recommendations and tips
Lack of engagement or unavailability of key stakeholders/SMEs/authorities.	■ Identify and secure commitment from key stakeholders, early on. ■ Schedule regular check-ins and decision points. ■ Escalate delays or gaps in engagement to leadership.
Undocumented process	■ Clarify requirements for organisational changes impacting safety critical roles within your MOC and safety critical activities/roles/procedures. ■ Integrate organisational change requirements into existing MOC and safety critical activities procedures. ■ Maintain clear documentation of all changes, decisions, and reviews. ■ Regularly review and update procedures to reflect lessons learned.
Post implementation review	■ Evergreen succession plans for replacing personnel in key safety-critical roles to prevent backsliding in organisational capability. ■ Also to better identify impact on safety critical activities, a database of names and roles against safety critical activities or responsibilities is a helpful tool to reference.

9.8 Temporary change

Examples of temporary change

Some changes are not intended to be permanent. Temporary MOC are those that are raised when a temporary solution needs to be implemented or a certain modification is temporarily required. Temporary changes (eg, adding bypass line, bypassing instrumentation and control schemes, temporary loss of safety equipment function, and pilot trial of new equipment or chemicals) require special attention because the facility may tend to tolerate greater short-term risk for a certain short duration. This risk may not be tolerated if the changes are made permanent or are in place for a longer duration.[8]

A facility had a proper temporary MOC procedure but 'worked around' the system to delay implementing a permanent solution.

A small leak occurred on a pipeline that required shutdown to replace. The decision was made to seal the leak with temporary sealant until the next shutdown opportunity. Shutting down and depressurising large and long pipeline is costly and when the time for the annual facility turnaround came around, the facility decided not to replace the gasket. However, the MOC had reached its maximum 'temporary changes' duration of one year based on the company standard.

The company standard required a higher level of approval for any extension to a temporary MOC. (senior management at corporate level or independent to the first approver). Instead of following the procedure, the auditee decided to close the existing MOC and raise a new one with a slightly different title, just enough to avoid the internal audit finding out about it. With the new MOC they had another year accepting the risk of the leak, without needing to answer to higher level management on why they did not replace it when the opportunity came.

There is a cultural issue when an organisation unanimously agrees to bypass the proper MOC procedure and it highlights a weakness in the company's temporary MOC standard.[11]

L Audit checklist – temporary change

Tick yes or no (including notes) according to your organisation's MOC process.

L	Temporary change	Yes	No (include notes)	Yes (guidance)	No (guidance)
1	Temporary change process			Temporary changes follow the same change management process and procedure as permanent changes.	Temporary changes not documented
2	Justification			Clear justification for why the change is to be temporary instead of permanent is required and reviewed.	No explanation required
3	Time limit			A clearly defined time limit is set.	No time limit required
4	Communication			The temporary change is communicated to everyone who could be affected by it.	No communication
5	Monitoring			The status of the temporary change is monitored and mitigating actions taken.	No monitoring
6	Time limit extension			Any extension(s) beyond the initial time limit is risk assessed again and escalated for a higher level of approval.	Uncontrolled extensions permitted
7	Process for making temporary change permanent			If the temporary change is to become permanent, a new change request is raised and the risks re-assessed with clear records of the temporary change for traceability.	No defined process
8	Clear process for reversing temporary change			The process to decommission the temporary change (and return any updated drawings, documents, procedures, systems etc, to original state) is well understood and followed.	No defined process
9	Clear process for communicating temporary change reversal			The reversal of the temporary change is communicated to everyone who could be affected by it.	No communication

Challenges and recommendations – temporary change

Common challenges	Recommendations and tips
Risk exposure increased due to temporary changes becoming permanent or forgotten. Temporary changes remain in place too long due to unclear scope and lack of resource allocation.	■ Minimise the number of temporary changes implemented. ■ Define the maximum timescale (fixed expiration date) for any temporary change, along with the maximum number of times it can be submitted for extension (ie establish a limit on the total duration of a temporary MOC). ■ Escalate so any change extension up the chain of management to avoid indefinite extension. ■ Prohibit duplication with another temporary MOC to circumvent the maximum extensions, (reword). ■ Periodically revisit justification for the temporary change. ■ Monitor the dashboard/assurance plan. ■ Be wary of accumulating a list of temporary changes that will all revert to normal at a forthcoming turnaround – these must be protected from any turnaround scope challenge.
Temporary change process not well managed or not treated equivalently to a permanent MOC, so documentation etc is not kept up to date or the quality is not as good.	■ Temporary changes follow the same MOC review process as permanent changes. ■ Restrict the scope of the temporary change. ■ Update documentation as required by the MOC process or justify by exception which documents will not be updated (eg where time to update the P&ID will take longer than the temporary change timescale and alternative methods for communicating the temporary change to everyone who needs to know).
Original state of the system is not properly reinstated and/or communicated, leading to confusion.	■ Ensure process for decommissioning/reinstatement is clearly documented and followed. ■ Provide regular updates beyond the formal review period to all the parties required.
Unclear process/process not well documented.	■ Clarify and document temporary changes in one workflow from start to due date, with the following three options selecting further workflow: – Prior to the end of the agreed timescale (expiration date), the temporary change should be either: – Restored to its original condition and the temporary MOC closed. – Made permanent through either a new authorised permanent MOC or the continuation of the workflow through its implementation (depending on design of the system). – MOC extended on, or before, the expiration date.
Temporary MOC closed before permanent MOC in place.	■ A temporary MOC should not be closed until either the permanent MOC has been authorised/implemented, or the change restored to the original condition.
Converting temporary change when used as a trial to permanent.	■ If a decision is made that the change should become permanent, a new MOC should be raised and re-assessed. ■ Ensure that planning and resources start early to convert the MOC.

9.9 System

M Audit checklist –system

M	Audit	Pass/Fail (10 change forms)										Pass/Fail Rate	Improvement opportunities
Phase	MOC	1	2	3	4	5	6	7	8	9	10		
1	Initiate												
2	Screen												
3	Review												
4	Approve												
5	Implement												
6	Capture and Close												
	Sub-total												

10. References

1. Patterson and Wigham (2019), *Management of Change – what does a 'good' system look like?*, *Loss Prevention Bulletin* (267), 7-9*:*
   www.icheme.org/media/11514/lpb267_pg07.pdf
2. Richard Mundy (2024), *Flixborough 50 Years On, The Chemical Engineer*:
   www.thechemicalengineer.com/features/flixborough-50-years-on-how-management-of-change-failures-contributed-to-the-disaster/
3. CCPS – Key Principles of Process Safety for Management of Change MOC final Jan 2024.pdf
   www.aiche.org/sites/default/files/html/ccps/3028311/V1/files/downloads/MOC%20final%20Jan%202024.pdf
4. Health and Safety Executive, *The Flixborough Disaster: Report of the Court of Inquiry*, HMSO, ISBN 0113610750, 1975:
   www.icheme.org/media/17752/the-flixborough-disaster-report-of-the-court-of-inquiry.pdf
5. HSE's guidance *Organisational change and major accident hazards* CHIS7 (HSE 2003):
   humanfactors101.com/wp-content/uploads/2015/10/hse-guidance-organisational-change-and-major-accident-hazards-chis7.pdf
6. HSE guide to process safety performance metrics Reference HSG254 – *Developing process safety indicators*:
   www.hse.gov.uk/pubns/books/hsg254.htm
7. IChemE Safety Centre (2018):
   Process Safety Competency guidance, 2nd edition, April 2018 0007_18-competency_brochure-update.pdf
8. IChemE Safety Centre (2020):
   Process Safety Competency guidance, supplementary guide – how to build and develop process safety competence
9. Michael Godrey (2025), *Management of Change made simple – get the basics right, Loss Prevention Bulletin* (302), 13-17:
   www.icheme.org/media/28272/lpb302_pg13.pdf
10. Colin Feltoe (2014), *Recognising small plant changes, Loss Prevention Bulletin* (239), 9-11:
    www.icheme.org/media/2205/lpb239_pp09.pdf
11. Adam Musthafa (2020), *Common weakness in MOC implementation from PSM audit*, *Loss Prevention Bulletin* (274), 18-22:
    www.icheme.org/media/14341/lpb274_pg18.pdf
12. Various (2024), Special Issue *Remembering Bhopal 40 years on*, *Loss Prevention Bulletin* (299):
    www.icheme.org/media/27533/lpb299online.pdf
13. Various (2025), Special Issue *Bunefield 20 years on*, *Loss Prevention Bulletin* (306):
    www.icheme.org/media/29515/lpb306online.pdf
13. Roger Casey (2025), *Accidents of the future – part 15*, *Loss Prevention Bulletin* (303), 14:
    www.icheme.org/media/28640/lpb303_pg14.pdf
14. Kenney, Boult and Pitblado (2001), *Lessons for Seveso II from Longford, Australia*, *Loss Prevention Bulletin* (158), 17-24:
    www.icheme.org/media/4998/lpb_issue158s9.pdf
15. Alexis Pey (2018), *Drum burst due to runaway reaction and the limits of MOC*, *Loss Prevention Bulletin* (259) 8-12:
    www.icheme.org/media/1999/lpb259_pg09.pdf
16. Ramin Abhari, Nylon Years:
    www.icheme.org/media/26138/nylonyearslpbcompletenew.pdf

Further information

- Inherent Safety by Design and Hierarchy of Risk Control: Andy Brazier – *Flixborough and inherent safety – inspired by Trevor Kletz*
  www.icheme.org/media/26776/lpb297_pg13.pdf

IChemE Safety and Loss Prevention SIG – Lessons Learned Database

- Buncefield 11 December 2005:
  www.icheme.org/media/14090/buncefield-incident-summary-11-dec-05.pdf
- Camarupim 11 February 2015:
  www.icheme.org/media/14087/camarupim-incident-summary-11-feb-15.pdf
- Flixborough 01 June 1974:
  www.icheme.org/media/14091/flixborough-incident-summary-01-jun-74.pdf
- Geismar 13 June 2013:
  www.icheme.org/media/14093/geismar-incident-summary-13-jun-13.pdf
- Grimsby 04 January 1992:
  www.icheme.org/media/15363/grimsby-incident-summary-04-jan-92.pdf
- Humber 16 April 2001:
  www.icheme.org/media/14108/humber-incident-summary-16-apr-01.pdf
- Lac Megantic 06 July 2013:
  www.icheme.org/media/14597/lac-megantic-incident-summary-06-jul-13.pdf
- McKee 16 February 2007:
  www.icheme.org/media/14215/mckee-incident-summary-16-feb-07.pdf
- Moerdijk 03 June 2014:
  www.icheme.org/media/14217/moerdijk-incident-summary-03-jun-14.pdf
- Port Wentworth 07 February 2008:
  www.icheme.org/media/14102/port-wentworth-incident-summary-07-feb-08.pdf

CCPS Process Safety Beacon

- Can you recognize a change?
  ccps.aiche.org/resources/process-safety-beacon/archives/2016/september/english
- Management of Change:
  ccps.aiche.org/sites/default/files/ccps-beacon/2017/7/2017-07-Beacon-English.pdf
- Manage Temporary Changes!
  www.aiche.org/sites/default/files/beacon-article/202207beaconenglish.pdf

Get in touch...

www.ichemesafetycentre.org

safetycentre@icheme.org

www.icheme.org

LC 0106_25