

Safety practice

Management of Change – what does a ‘good’ system look like?

Dr Ken Patterson & Gillian Wigham

Summary

The process industries have a history littered with the consequences of not managing change carefully and safely. Despite these lessons and a great deal of good practice, globally we continue to struggle to get it right. As time passes, our memories of the human tragedies linked to Flixborough (a temporary change) and Hickson & Welch (a series of non-assessed changes) fade and fall out of our common experience. However, we still need to learn the lessons – properly – and ensure that they are embedded in our industries' everyday practice.

So, what is it that makes a good system for change management? At heart it is a combination of a robust assessment, especially risk assessment, and appropriate management, ensuring any change has the correct authorisation. That's a start but not sufficient to answer to the question "What does a good Management of Change (MoC) system really look like?" The rest of this paper attempts to answer that question, especially from the viewpoint of someone auditing an MoC system. Both authors are experienced process safety and occupational health & safety auditors, having worked on sites from the Americas to the Far East. We do not claim in any way that what follows is the only or the right answer, but it does draw on our experience both of systems that are working well and those that were clearly failing.

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MoC as part of a system

ICHEM's *Fundamentals of Process Safety* course defines process safety (in part) as "A systematic framework for managing the integrity of hazardous processes". Any change to a process, the plant it runs in, or the human team who run the process, potentially affects the integrity of the process, perhaps seriously. Therefore, good systems for change management do not stand alone. They are an integrated and essential part of an overall Process Safety Management System (PSMS), both feeding into that system and depending on it. Change management cannot properly exist outside a good process safety system – which will always consider health and the environment equally with safety.

The MoC system needs to be kept in a formal document, normally as a procedure in the overall PSMS. The procedure will be up to date and will set out both the way the MoC system works and those responsible for its operation. The MoC system depends on the effectiveness of the rest of the PSMS for much

of the information it needs to carry out its assessments. 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. Equally, at the end of the change – which will have depended on the PSMS for effective permit to work, maintenance and contractor management – the change itself will need to be fed back into revised plant procedures, scheduled maintenance and P&IDs and the MoC will not be finally complete until all of that has been done.

An audit of an MoC system will examine the MoC system itself and will have a view to the effectiveness of the surrounding PSMS. It will ask:

- Does the PSMS of which the MoC system is part, appear effective?
- Is the MoC system set out in a formal, up to date procedure, clearly showing the way each proposed change will be handled and who is responsible for both individual changes and the MoC system?
- Are there clear, specified links from the PSMS to the MoC system and vice versa?
- Is there evidence that the links between the PSMS and MoC system are working satisfactorily?

Management of the MoC system

A good management of change system only functions with almost constant attention, which needs to be provided by a system manager. The system manager must have clear oversight of the system as a whole, the changes currently within the system, and how those changes are progressing through the system. The manager needs to be accountable for the system, with the clear right and indeed duty to alert senior management if there are problems. The manager needs to provide oversight of the assessment process, ensuring the right people are involved and have approved the change; and that the assessment is appropriate for the change proposed. They will need to ensure the system provides effective monitoring, audit, effectiveness review and improvement opportunities (discussed below).

The system will have a periodic (probably monthly) review meetings to ensure that all MoC are being assessed and progressed, thoroughly and effectively. The meeting will be guided by well-chosen company- and system-specific leading and lagging indicators, such as: number of MoC more than twelve months old; number not progressed in the last month; number failing to achieve desired outcome. These metrics, used with care, should indicate

if the system is healthy and improving – or not. The indicators and the outcome of the review meeting will be reported up through the Company's management system and made visible inside the company, as one way of assessing and demonstrating the health of the MoC system.

An audit will ask and require demonstration that there is:

- A system manager, accountable for the operation and integrity of the MoC system, who has the authority to exercise effective control;
- A series of scheduled MoC meetings which review all the live MoC, checking that they are being dealt with in accordance with the MoC procedure and are progressing through the system;
- Appropriate leading and lagging indicators which are reviewed at the MoC meetings; with the minutes of the meeting, including the indicators, being reported to the site management and into the site's reporting system with other key information.

Scope and coverage

It is essential that the MoC system works across the operational areas of a site, and that it covers every change and every type of change. The MoC system should define a change as IChemE does: as "anything which is not a like-for-like replacement". Any change, even those brought in to improve safety, may well produce new or altered hazards and therefore needs to be assessed and managed. The system must cover all types of change, all areas of operation, and changes introduced by anyone for any reason.

Example

Purchasing 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 Purchasing did not raise an MoC. The first delivery demolished the delivery gantry leading to a modest loss of material to the environment but a significant loss of production. The new supplier had a different haulier who used a higher trailer to carry the ISO tank.

The MoC system needs to cover control systems and software, abatement and utilities, as well as production plant and all staff who can influence the safe operation of the plant. It should cover the organisational structures or hours of operation of all or part of the site, or site functions like laboratories or warehousing. The MoC system must cover any change which could affect the safe operation of the site – and the way you find out if a possible change could affect the safe operation of the site is by doing the assessment required by the MoC system!

Temporary changes must also be included in the system. There is always a danger that a temporary change will be rushed through outside the system because "it won't be in place for long". This has led to accidents with multiple fatalities. The other danger is that temporary changes actually last for much longer than intended – sometimes years – and are either never finally completed and made permanent, nor removed. Temporary changes should be assessed to the same standard as any other MoC. They should be given a time-span, after which any change still in place must be reviewed

and reassessed for continuation for another specified period, or confirmed as permanent, or removed.

Some "emergency" MoCs may need to move through the system quickly, to deal with safety or operational problems. When this happens, it should always be done by mobilising site or company resources to enable the process to be completed in the shortest possible time. It should never be done by short-circuiting the assessments or making the change operational before the MoC process has been properly completed. Emergency MoC will still be covered by the rest of the PSMS for, for example, PTW and pre-startup safety review and when completed must still be reflected in (as examples) the plant P&IDs, training, and operational instructions.

An audit will ask and require demonstration that:

- The MoC system covers all changes, no matter how small;
- The MoC system covers all types of change including plant, process, people and control systems;
- The MoC system covers all areas, including (for example) laboratories, warehouses, utilities, engineering; and all groups including (as examples) quality, design and drawing offices, purchasing, personnel; who can initiate changes which could affect plant operation;
- The MoC system includes temporary changes and "emergency" changes, and a system to keep implemented temporary changes under review.

Assessment and authorisation

At the heart of the MoC system will be the process by which changes are assessed. The assessment will cover both hazard and risk and will be appropriate for the change proposed. The assessment can only work if the change is properly described, making the paperwork and supporting information crucial to the operation of system. The assessment will be tailored to the change proposed, though many will follow a similar path. Assessments will cover all possible outcomes and consider health effects and possible environmental consequences as well as safety and plant integrity. The system manager is crucial in this part of the process, ensuring that the assessment is referred to and carried out by the appropriate people, with the right knowledge and experience. Note however that the system manager cannot be responsible for the accuracy of every assessment, that remains the responsibility of those carrying out the assessments.

Small changes with limited possibility to do harm will only require a simple assessment: "This changed schedule of pipe is documented to be capable of containing the full range of materials which will pass through it, copy documents attached: 1) pipe schedule, including corrosion resistance table; 2) list of materials which could enter the pipework; 3) laboratory corrosion test for material xx not listed in the schedule, confirming resistance." Larger changes will require assessment in much greater depth and may require, for example, a full Hazop and LoPA, backed up by calculations as required.

If the changes are to shift patterns, ergonomics and workload demands may need to be assessed. If changes to control systems are involved, possible conflicts will be considered, alongside the information supplied to operators and the likely – and unlikely – effects of control system failure. The assessors will be aware of the importance of considering human factors: the possibility of human error in the assessment, implementation or operation of the

change. The assessments will consider possible downstream and upstream effects, together with the possibility of effects outside the immediate area.

The key is a system which looks at the change proposed, identifies possible effects and side-effects, documents the likely consequences and hazards, assesses the severity of any hazardous outcomes, incorporates the required safeguards, and then provides the appropriate risk assessments showing the change is acceptably safe – all completed before the change goes ahead.

After the proposal has been assessed, the assessment will become part of the MoC documentation which will be discussed and agreed in the MoC meetings, essentially a system of peer-review. Once the MoC meeting has accepted the proposed MoC it should go to the senior operational manager for final authorisation (some may need to go further up the management chain). The authoriser should certainly use their experience to question the MoC before they approve it and certainly never sign one that they do not feel is satisfactory. However, as before, responsibility for the accuracy of the assessments lies with those who did them, the final authoriser is signing to say they are happy that the appropriate assessments have been carried out by appropriately qualified and experienced people.

An audit will ask and require demonstration that:

- All proposed MoC are subject to an assessment, carried out by people with the required experience and knowledge, which is appropriate to the change proposed;
- The assessment is peer-reviewed by the MoC meeting before authorisation;
- All MoC are approved at a senior level before they are implemented.

Implementation

All projects have to be implemented and this is an area where the rest of the PSMS strongly interacts with the MoC system. It will nearly always involve Permit(s) to Work and Pre-Startup Safety Review. It may require formal training and will almost always call for staff familiarisation with the changes. The MoC system should always incorporate some effectiveness monitoring to ensure that each MoC has achieved its purpose. The monitoring should include both measurement against the expected outcome of the MoC and problems or incidents which have occurred. The implementation and monitoring should be discussed at the MoC meeting and reported to senior management to ensure any learning is shared and understood. Monitoring the success of MoC is often a fruitful area for use as a Process Safety Performance Indicator, indicating the effectiveness (or otherwise) of the MoC system and the parts of the PSMS which support it

An audit will examine:

- How projects have been implemented and commissioned;
- How the success of MoC is monitored, and how that monitoring is reported back to the site and more senior management.

Training and staff authorisation

Like all systems, to be effective the MoC system will require staff to be trained in the importance of the system and how it operates. The training should give all staff at least awareness training covering why the MoC system exists, what it covers and what

their role in it might be. They should understand that the system is essential to plant safety and that they need to make sure it is used for any change they are involved in. They should also understand that they must not make any changes outside the system.

For staff more directly involved, especially production management and engineering staff, the training will cover the details of the system and how it operates; their responsibilities for assessment and authorisation; and their duty to prevent changes being made outside the MoC system. Refresher training will be part of the overall training system, as will awareness training following any changes made to the system.

The best training systems will include some sort of validation of understanding, especially for those who will give authorisation for a change to be implemented, and the overall system records will show who is authorised for which type of change, in which area(s) of the site.

An audit will examine:

- How staff have been trained in the MoC system and that the training was appropriate for different degrees of involvement in the system;
- How records of staff training are kept and that those who give authorisations in the system have themselves been appropriately trained and authorised.

Management review of the MoC system and its management

Finally, like all parts of the PSMS, the MoC system requires periodic, probably annual or bi-annual, review. This review should be carried out by senior site management and needs to take a view about the appropriateness of the system, the health of the system and the resources the system takes up. The aim will be to ensure that the system works effectively for the site or plant in question. A system which is so onerous it impedes required change is not helpful and will encourage people to (try to) circumvent it. Equally one which has too little rigour won't give the required safety. The management review will use all the MoC indicators, the results of any system audits, and the MoC system manager's views, to come to a balanced view of the system and how it is performing.

An audit will ask and require demonstration that:

- The MoC system is subject to periodic management review to ensure it is fully effective and continues to be appropriate for the site and its hazards.

Conclusion

The 'good' MoC system we strive for is not impossible to achieve, but it does take relentless effort from all the stakeholders, all working together towards our ultimate dream . . . that perfect Process Safety Management System.

About the authors

Dr Ken Patterson was Group SHE Manager for Synthomer plc until his retirement in 2016.

Gillian Wigham is a Group SHE Auditor, specialising in management systems and Occupational Health, for Synthomer plc.

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