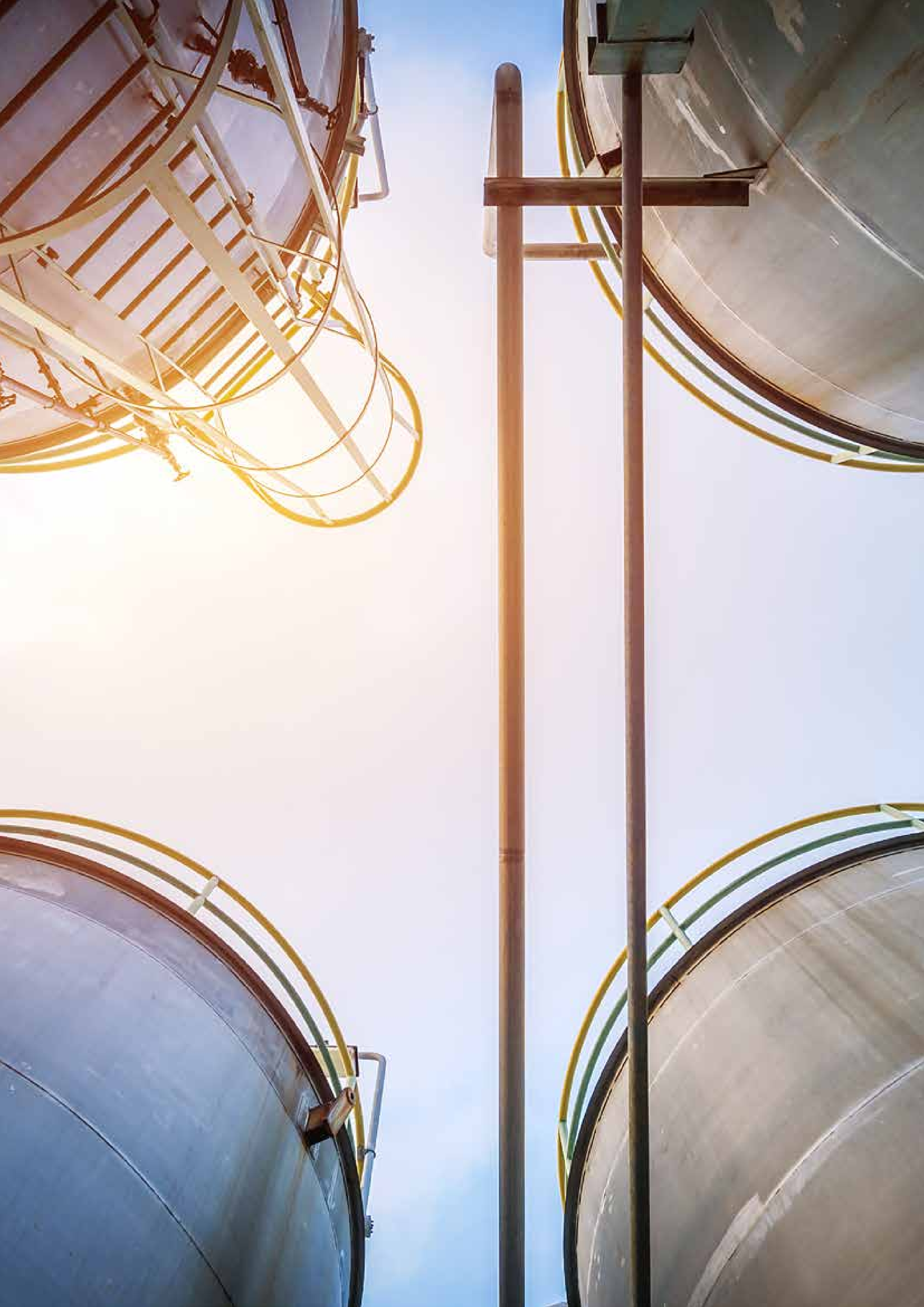
Marsh

Marsh Specialty

Management of change

Risk engineering position paper



Contents

Background

During the lifetime of a site operating process plant, many changes will occur. These could be changes to the physical hardware of the plant, the control systems, the business processes used, or to the organisation running the plant.

Each one of these changes has the potential to increase the risks involved in operating the plant, for example, through:

- Inadequate identification or evaluation of the risks of making the change.
- Inadequate physical design or execution of the change.
- Inadequate communication and documentation of the change.

It is well-documented that poor control of plant changes has contributed significantly to large loss events in industry. A number of these examples are given throughout this paper. The need to avoid such incidents and maintain good process safety management is the reason why all sites operating process plant need a robust management of change (MoC) process.

In a number of regions, change management of process plant is also embodied in guidance and expectations from government and statutory regulators, for example, the Health and Safety Executive (HSE) guidance within the UK, the Seveso II Directive in European law (Annex III section (c) (iv)), and Occupational Safety and Health Administration (OHSA) 1910.119 (l) in the United States.

Objective

The objective of this position paper is to define the key attributes that would be rated by Marsh as very good for a MoC system in the oil, gas, and petrochemical industry. These attributes reflect those in the Marsh energy risk ranking criteria. They can be used to support and define risk improvement recommendations, and also to provide detailed advice to clients seeking to improve their management systems.

Scope

The scope of this position paper includes the development and application of a system for the management of changes to the plant and systems surrounding it.

Although some reference is made to corporate standards, this document is aimed primarily at operating site application rather than corporate policy-making.

Also note that although reference is made to the application of MoC processes to organisational change, this document is intended primarily as a reference for changes made in relation to process plant and its operation. In our experience, it is typical that the management of organisational change is carried out using a standalone process.

Note that throughout this paper, the word "site" is used to refer to the part of the organisation using the MoC process. Depending on the nature of the organisation, this could be a single plant, multiple plants on the same site, or multiple sites. In addition, it has become common practice for sites to use the term "MoC" not just to refer to the change process but to an individual change. That convention is used on occasion within this document.

INCIDENT SUMMARY #1

The 1974 flixborough explosion

This incident resulted in 28 fatalities, destroyed the local process plant and caused significant offsite damage and impact. It occurred on a plant producing caprolactam, with one of the key intermediates being cyclohexane. When the incident occurred, one of six reactors in series had been replaced by a dog-leg shaped bypass line. It is generally accepted that a bellows in the bypass line failed, giving rise to a release of approx 30 t (tonnes) of cyclohexane which formed a vapour cloud and exploded. The subsequent fire burned for three days. The total cost of the loss has been estimated at over US$100 million (1974 basis).

It is understood that no formal or structured MoC process occurred for the installation of the reactor bypass. The design and physical supports for the bypass line did not take account of the mechanical stresses present on the line due to the flow of the hydrocarbon vapour through the line. This has been cited as one of the significant root causes of the event.

4 Specific requirements

There should be a comprehensive, written, local policy, and procedure governing MoC. Any corporate expectations for MoC should be available to member sites and incorporated as appropriate into the site documents.

The policy should clearly define:

- When it is applicable (see section 4.1 below).
- The roles and responsibilities of the key people who operate the MoC process (section 4.2).
- What the key steps in the process are (section 4.3).

Certain infrastructure is also required to make an MoC system operate properly, most notably a system of documentation and a way of training the key people who operate the process. This is covered further in section 4.4.

4.1 Definition of a change

The MoC procedure must clearly define when it is and is not applicable. The site MoC procedure could be applicable to any change involving:

- **Plant:** adding or removing plant hardware.
- **Processes:** changing the plant control.
- **People:** changes to the organisation supporting the plant.
- **Procedures:** changes to operating procedures.

The types of change that may be excluded from the site MoC process are:

Replacements in kind (rik):

Where an item is replaced with an identical item, usually in the course of routine maintenance, it is a direct like-for-like replacement.

THOSE COVERED BY ALTERNATIVE PROCESSES:

Where other specific and documented processes exist on site to manage specific changes, the MoC process will not be applicable. Common examples of these are:

- Larger projects or modifications, usually where designed and executed by a projects function.
- Certain (defined) changes in feedstock to the site or defined changes to operating modes.
- Instrument or control system changes within defined parameters.
- Changes or updates to operating procedures.
- Organisational changes.

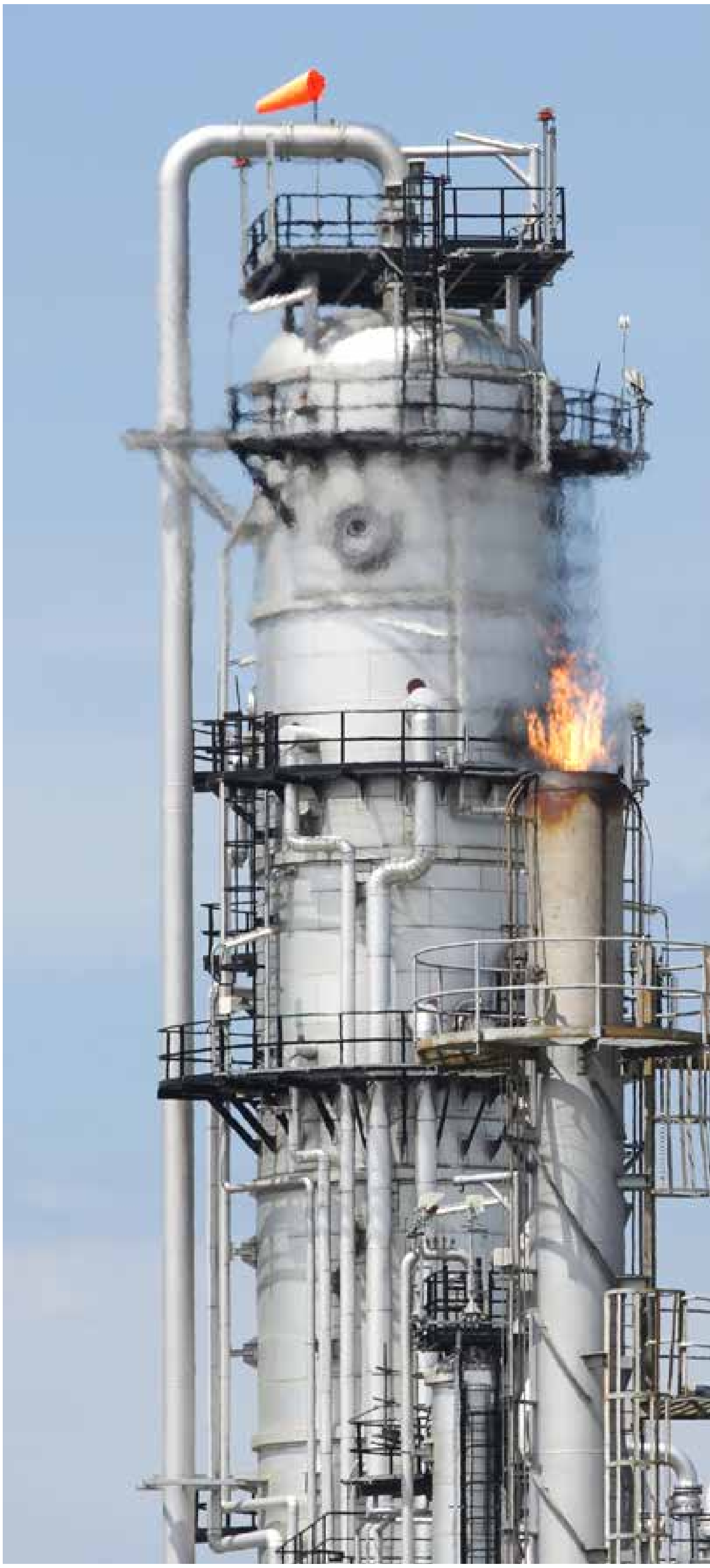
The MoC process should apply equally to both permanent and temporary changes. In the case of temporary changes, the process must ensure that a clear time limit for the validity of the change is defined. After this time, the change should be properly reviewed and either granted an extension, be managed as a permanent change, or reverted to original condition.

The MoC process must apply to the removal of plant items or safeguards as well as their addition.

For plants that operate on a continuous basis, the process must define how emergency changes are managed – often known as emergency management of change (emergency MoC) – and how it is followed up by the days-based organisation.

Although this list is not exhaustive, some typical changes that should be covered by the site MoC process unless covered by another process are:

- Any alteration to the plant that makes a change to the piping and instrumentation diagrams (P&IDs).
- Physical changes in the piping configuration, whether or not a P&ID change occurs.
- Changes in materials of construction.
- Changes to relief valve type or manufacturer, whether or not a setpoint/size change occurs.
- Changes to pump type, manufacturer, or impeller size or speed.
- Additions or removals to insulation or change of insulation type.
- Changes to plant structures, such as platform types, materials of construction, or fireproofing.
- Electrical hardware changes in zoned areas.
- Alterations in control system hardware, such as changes to valve manufacturer, type, or trim.
- Changes to process control software, ESD logic, and alarm and trip settings.
- Changes (new supplier, type, increase, or decrease in rate) to process control chemicals or changes to process gases.
- Feedstock source, supplier, and quality changes.
- Product quality changes, including changes to product additives.
- Changes to operating modes, operating conditions, or operating envelopes.
- Changes to key spares suppliers (maintenance spares, lubricants, and so on).
- Suppliers of spares, lubricants, chemicals, and consumables.



4.2 Key roles required to operate the MoC process

Each site will have its own organisational structure and may have different titles for the key job roles within the organisation. However the following key roles in the MoC process must be fulfilled in some way on each site.

MoC Owner:

The process requires a person who takes overall ownership for driving the change through the MoC process. This person will also typically:

- Produce a written proposal for initial approval.
- Ensure that the key people are involved at the right times.
- Ensure that the process has been followed properly.

The owner may not be a fixed role within the organisation – it often varies depending on the nature of the change.

Although the most common owners will probably be members of the operations staff, it may be from a discipline appropriate to the type of change being proposed. For example, a piping change would typically be owned by mechanical engineers, a process or relief change by process engineers, and so on.

Discipline Engineers:

Depending on the nature of the change, a number of different disciplines may input into the MoC process. As highlighted earlier, one of the discipline engineers may also be the owner of that change.

Discipline engineers may need their input to the MoC process to be checked or verified by the corresponding technical authorities on site, depending on their level of seniority or experience.

Risk Assessment Authority:

As described later, an MoC process requires risk assessment processes appropriate to the size and nature of the change to be selected and executed. Sites require a person or person(s) who are capable of taking this view and supporting the execution of these processes to be appointed.

It is considered good practice that the risk assessment authority is independent of the change being made.

MoC Approver:

There are a number of approval steps in the MoC process. The precise number of signoff steps will be site specific and may involve budget-related approvals in addition to safety and hazard evaluation type steps.

The MoC approver on site must be an appropriate, competent (often senior) person relevant to part of the site which the change affects. MoC approvers are often senior members of the operations staff.

INCIDENT SUMMARY #2

The 1987 Grangemouth refinery explosion

This incident resulted in one fatality, caused significant plant damage, and was heard offsite 30 km away. It occurred on the hydrocracker unit, which converts heavy hydrocarbons to diesel and lighter products by a process operating at up to 180 barg. A 10 metre long, 3 metre diameter cylindrical vessel failed catastrophically when high pressure gas (significantly in excess of its maximum design pressure) was introduced to it. The failure caused pieces of the vessel weighing up to 3 tonnes to be scattered over a distance of over 1 km and a subsequent fire, which burned for over six hours. The total cost of the loss was estimated by the owners to be over US$100 million (see reference 10).

It is understood that one of the low liquid level indicators on the high pressure drum had been electrically disconnected a significant time prior to the incident with no MoC or other risk assessment process performed to evaluate the change. This was identified by the owners as one of the significant contributing factors to the incident, as the maintenance of a liquid level in the high pressure drum would normally have prevented the high pressure gas breakthrough.

4.3 Key steps in the MoC procedure

The MoC procedure on each operating site will be different. The local procedure may combine or further subdivide the sections below, or call the steps by different names. However, it is expected that each of the key elements below would be included in some way in the local process.

The site may mandate the use of routine or scheduled meetings to manage the key aspects of the site MoC process. This is sometimes done both for efficiency and to promote direct discussion between the key participants. If this is not a part of the site process, the risk assessment authority needs to assess which changes merit the need for face to face discussions and meetings for key stages.

MoC initiation, initial approval and registration

When an applicable change is required on a site, a written summary of the proposed change should be produced for review and initial approval and authorisation by one of the MoC approvers on site.

Once approved, this initiation step then requires:

- Assignment of an owner/coordinator for the MoC (the MoC owner).
- Registration of the change within the site MoC system.

Production of a design

The purpose of this step is to ensure that a suitable design is made by a competent person. This initial design then forms the basis of the risk assessment processes that are performed.

The MoC owner should ensure that a suitable design has been made, bearing in mind the following practices:

- Checking that the design satisfies the fundamental requirements of the MoC.
- Consulting with all appropriate disciplines.
- Documentation of all calculations, referring to appropriate standards.
- Following the site internal technical processes for approval of the design.

Choice and execution of risk assessment processes

The risk assessment element is central to the whole MoC process. It ensures that all of the consequences of the change are fully understood, with all risks appropriately managed.

The first step is to determine which risk assessment processes will be used for the specific change under consideration. It is normal that different levels or types of risk assessment processes can be used within the MoC procedure, appropriate to the size and / or significance of the change being made.

Good practice is that the selection of risk assessment processes must be done by the identified risk assessment authority. Sometimes a structured approach, such as a complexity test, is used to assist the selection of the appropriate risk assessment process.

Sites should have at least two levels of process available:

Short Form/Checklist Methods:

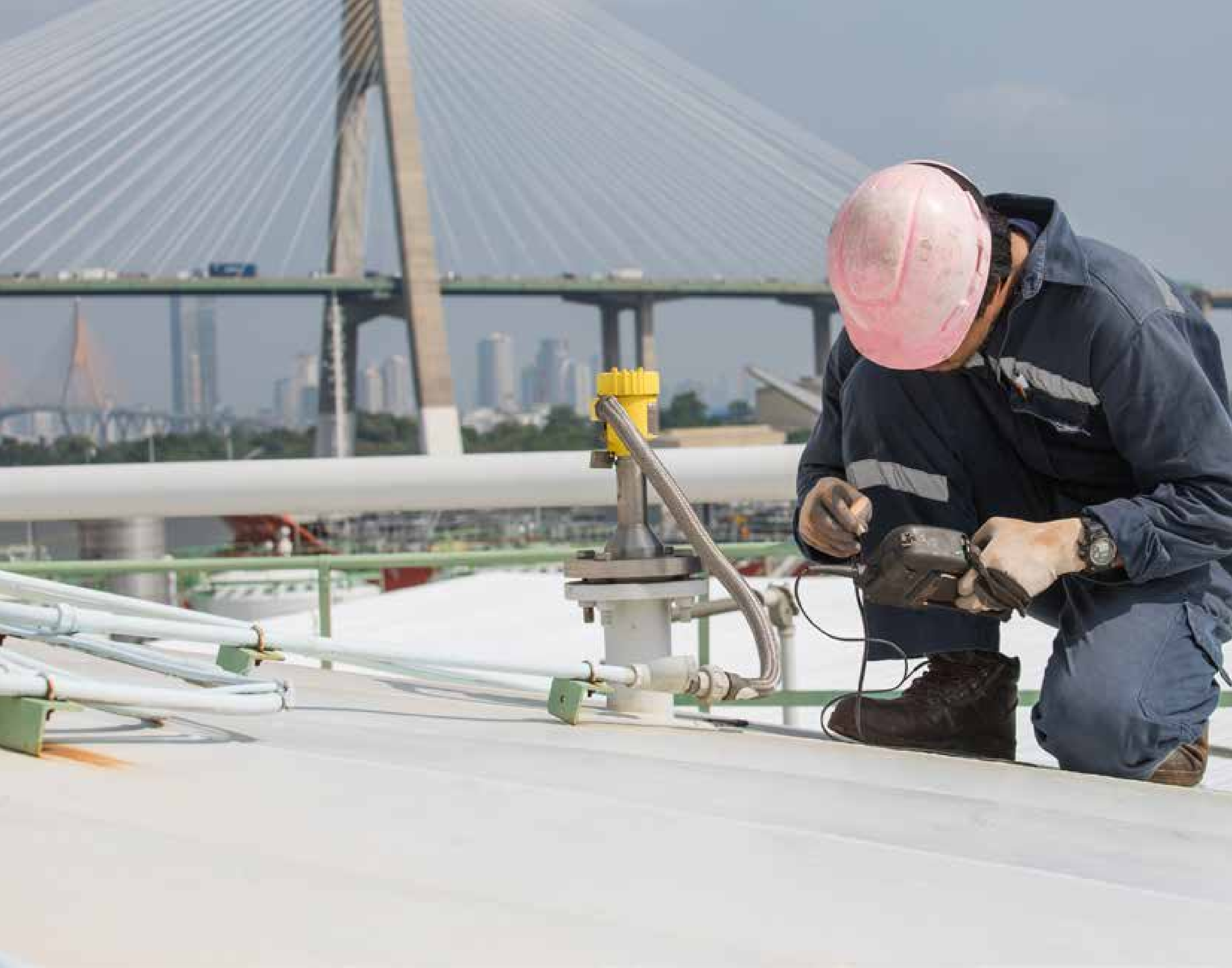
These can either be paper or software based. In order to use this methodology, sites should have a suite of checklists available to be used for different types of change. Note that:

- The risk assessment authority discussed earlier should approve which checklists are applicable to the change in question.
- Actions from the checklists must be recorded in the MoC documentation system.
- Each checklist must be formally signed/authorised when it is completed.
- An example of a checklist structure can be seen in appendix A.

Full Hazard Analysis:

It is expected that for larger and more complex changes a more in depth, rigorous method of hazard analysis will be performed. In many cases, the HazOp process will be the most appropriate one to use. This technique is recommended by Marsh and is well known within industry. Many texts exist to cover the subject detail. Some key points are:

- That the HazOp is based on a fixed/frozen design (it is not a design process).
- That the HazOp team leader is trained and competent to lead a HazOp study.
- That the HazOp team leader is independent of the change owner or site.



- That the appropriate disciplines are included in the HazOp team and that they have appropriate knowledge of the plant and the change.
- That the team has all of the appropriate documentation and enough time to perform the HazOp study.

All of the changes required by the risk assessment processes must be incorporated into a new fixed design and the appropriate MoC documents updated. This may require the risk assessment processes to be repeated.

Where the nature of the proposed change is large enough that more fundamental risk assessment processes are appropriate, the risk assessment authority needs to consider if a major project type process is more appropriate to manage the change instead of the MoC process.

Engineering design, construction, and installation

Progression to the design, construction, and installation of the change should only occur after the appropriate completion of the risk assessment processes.

This is often a stage where the site may also have formal steps in the process relating to budgetary approval for the change. The delegation of authority in a financial sense is not in the scope of this position paper and is different from approval from a risk management perspective.

The site should have access to the appropriate capability to design the modification to the relevant codes and standards, either through its own organisation or the use of third parties.

Depending on its nature, the physical installation of the change may require the appropriate practices to be followed in plant isolation and other aspects of safe control of work. These are outside the scope of this position paper.

Pre commissioning

Prior to the commissioning of the change, a number of check steps must be performed. Together these are often called a PSSR or pre startup safety review. The PSSR could consist of a number of different elements depending on the nature and complexity of the change.

As a minimum, it is expected that the PSSR will cover:

- Verification that the change has been properly installed according to the design. This usually involves the act of punchlisting the change in the field.
- Completion of the writing of, or changes to, any operating procedures required by the change.
- Training of relevant personnel appropriate to the change and any changes to the operating procedures.
- Notification of any other personnel as required.

Final authorisation and commissioning

The authorisation step ensures that all of the key prior steps have occurred properly prior to commissioning the change. Typically the designated MoC approver performs a review of all of the MoC steps and checks that the process has been followed and the correct individuals involved. This person then approves or rejects the change as suitable for commissioning.

Good practice for the commissioning step will involve a summary version of the MoC documentation being taken to the local operations personnel. The role of the local operations personnel is to verify that the change has been fully authorised and check that any training and updates to procedures still appear appropriate to the final change being implemented. The change can then be commissioned.

Once commissioned, the MoC documentation should be signed as such to confirm its status. This often constitutes a formal handover of the change to the operations team.

Close-out

The close-out part of the process involves ensuring that all of the follow-up actions after commissioning of the change are completed. This should include (but not be limited to):

- Update of the drawings, data sheets, and other key documents to "as built" status.
- Identification of new required spares and the addition of these to stock.
- Any performance testing being completed and documented.
- Registration of new plant items in the maintenance management and inspection systems.

- Any changes to operating procedures required after commissioning made and appropriately communicated.
- Completion of any incomplete actions associated with the change (from the risk assessment processes, from pre-commissioning punchlisting, and so on).

The close-out processes required are often themselves identified on a checklist of potential actions and steps. They will be different depending on the nature of the change.

For temporary changes (handled under a temporary MoC), one of the key and final actions is the return of the plant to the original design.

The MoC Owner should retain formal ownership of the change, and the MoC documentation should remain at "open" status within the tracking system until all of the close-out processes are completed.

4.4 Required infrastructure for the moc system

System of documentation

An appropriate system is required to register, track, and manage changes within the site. The system can take a number of forms but it is often integrated with the site records process and maintenance management system.

The system needs to be able to:

- Assign each change a unique number.
- Provide overview information – type of change, reason for the change, description.
- Document the key individuals involved in the MoC (owner, discipline engineers, authoriser) for this change.
- Store the key documents generated during the process (design, hazard analysis, and so on).
- Track the status of all actions associated with the change.
- Track key MoC dates (required by date if urgent, expiry date if temporary, and so on).
- Track the overall status and approvals of the change (often using a master control sheet).

The system must also be capable of producing key performance indicators (KPIs) which describe its operation and performance, as described in section 5 of this document.

System of training

It is important that all of the key personnel involved in the operation of the site MoC process are trained in the reasoning behind the procedure, the way it works, and their specific responsibilities in its operation.

Those to be trained should include:

- MoC owners.
- All discipline engineers who might contribute to MoC.
- Risk assessment authorities.
- MoC approvers.
- Operations and maintenance supervisors and safe work permit issuers (to assist recognition of when the MoC process should be followed).

The site may also choose for a wider group within the organisation to have an outline understanding of the MoC process and procedure in addition to detailed training for the roles listed above. This is so the broader organisation can recognise when a change requiring the application of the MoC process occurs.

The training system should train people when they move into the key roles for the first time, and also deliver refresher training to those individuals with an appropriate frequency.

If the site has a role within the organisation which takes overall responsibility for MoC, this individual will often perform the training for the other key roles in the MoC process.

5

Stewardship of the MoC process

The performance of the MoC process should be regularly monitored and assessed using both a routine review of KPIs and also a periodic audit. These steps help assure the site management team that the system is actually being used in the way it is designed and intended. An operating site would also typically have a specific individual or job position that has ownership for the MoC process and takes a lead role in operating and monitoring the system.

5.1 Key performance indicators

Each site should routinely produce KPIs to monitor the performance and health of its MoC system. The KPIs should be produced monthly and be reviewed at an appropriate site forum, such as the site process safety management committee.

Routine KPIs would typically include:

- Total number of open MoCs, with some details showing when they were originally raised.
- The number of MoCs raised in the review period.
- The number of emergency MoCs raised in the review period.
- The number of temporary MoCs, and identification of any which are overdue.
- The number of completed MoCs with open and with overdue close-out actions.
- The number of incidents and near miss reports attributable to failures in the MoC process. It is expected that the discovery of any change that was not handled using the MoC system would be raised as a near miss report.

In the case of overdue temporary changes and overdue actions, it is often useful to identify which MoC owners the overdue items are associated with.

5.2 Audits

Each site should audit its MoC process in some way on a periodic basis, with audits typically being completed annually. The audit should be performed by a small team knowledgeable in the application of the MoC process. Consideration should be given to including people from outside the immediate local site in the audit process. Findings from the audit should be reported to site management, possibly through forums such as the site process safety management committee.

An audit process would typically include:

- **Initiation of the MoC:**
  - Are changes being identified and raised at the correct times?
  - Are work orders raised and carried out for plant changes without appropriate MoC processes being used?

- **MoC process:**
  - Review a selection of MoC dossiers – are the key steps being followed?
  - Are the approvals being made at the right stages, and before commissioning?
  - Are the MoCs being closed out, with actions completed appropriately?
- **Risk assessment processes:**
  - Are the appropriate risk assessment processes being selected?
  - Are the processes being followed properly/thoroughly?
- **Personnel related:**
  - Do the key personnel understand the process?
  - Do they understand their roles and responsibilities?
  - Have they been trained?

In addition to these two stewardship steps, as is the case for most key site processes, the understanding and support of senior site leadership is critical to its success and effectiveness. Management emphasis that MoC must always be applied in all appropriate circumstances, whatever the circumstances on the day, is key.

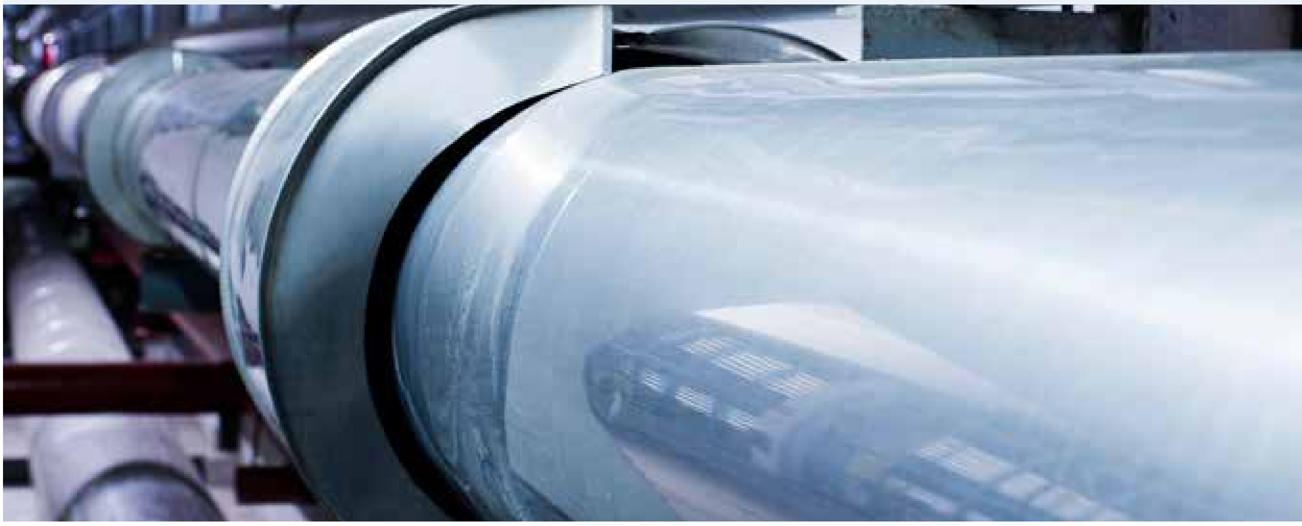
INCIDENT SUMMARY #3

A 2012 process plant incident

A filter on the suction of a pump frequently plugged, and because of this, the pressure needed to be monitored, both in the field and at the control panel. To minimise installation time for a pressure transmitter, it was decided to install a tap on the existing connection for the local pressure gauge and connect a pressure transmitter to this tap, and because of the rush and the temporary nature of the change, it was decided to use tubing for the change.

The installation, though accepted as a temporary installation, did not follow appropriate design codes or engineering standards, and no MoC review was done.

Approximately three years after this "temporary change" was made the tubing ruptured and combustible material at a temperature of 360 °C leaked to the atmosphere. The leaking material ignited and started a major fire which destroyed the plant.



6

References

The following references have been used when writing this document, and may provide further guidance to the reader:

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2. OHSA 1910.119 (i) (pre startup safety review) - United States of America.

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6. “Guidelines for the Management of Change for Process Safety”, CCPS, Wiley (2008).

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8. “Minor Mods & the Management of Change”, IChemE Loss Prevention Bulletin 122 p19.

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10. “Integrity Management – Learning from Past Major Industrial Incidents”, BP Safety Series #14.

11. “Managing Change in Manufacturing Facilities”, HarrisonC, ASSE By Design 12 p6.

12. “Eight Common Misperceptions of Management of Change”, McNair S, RxToday July 2012.

13. AICE CCPS Process Safety Beacon, October 2012.

14. Coryton Refinery MoC Process and supporting documentation, 2012.

Appendices

7.1 Appendix A – Hazard identification checklists

The use of appropriate checklists is considered the minimum level of risk assessment when carrying out MoCs. Each site must decide which checklists are appropriate and put them into place. Some examples of the kind of areas covered by checklists are given below, but it should be noted that this is not an exhaustive list:

General (may apply to all changes):

- Environmental concerns checklist.
- Safety related concerns checklist (including emergency systems and management).
- Operations/operability review.
- Maintenance/maintainability review.

Buildings related:

- Permanent occupied buildings change.
- Temporary building siting or change of siting.

Control and alarm systems related:

- Control loop hardware change.
- Control or shutdown system change.
- Control valve failure mode change.
- Critical alarm change.
- Distributed control system (DCS) change.
- Electrical change.

Misc equipment related:

- Analyser sample loop change.
- Piping change (outside battery limit).
- Piping change (inside battery limit).
- Rotating equipment change (pump manufacturer, type, seal type, bearing type, speed etc.).
- Temporary pump installation.
- Change of tank service.
- Vessel or equipment pressure/ temperature rating change.

Relief Device related:

- Relief system change.
- Temporary safety device bypass.
- Alternative relief path provision.

Miscellaneous:

- Process catalyst change.
- Process technology change.
- Process chemical treatment change.
- Process chemical clean for equipment access.
- Documentation checklist (a check of what document updates are required by the change).

Each checklist contains a list of items which must be considered as a minimum when making a change for which that checklist is relevant. The checklists should be updated by the site as learning occurs from incidents on site or in the industry.

It is for the risk assessment authority to decide which checklists should be used for the change in question. Note that it is usual for certain checklists to be mandatory for all types of MoC – for example, the safety, environmental, and operability checklists.

Administratively, each completed checklist should document which MoC it was for, when it was completed, who contributed to the review, and what actions were determined to be required resulting from the review. The actions from each checklist must then be entered against that MoC in the MoC documentation system.

To illustrate the principle, an example of a checklist covering a piping system change can be seen overleaf.

Example hazard analysis checklist – piping system change

		Y	N	N/A
1.	**Are the piping specifications compatible with;**			
	a. the process fluid or gas?	☐	☐	☐
	b. the maximum temperature of the stream? (max -__)	☐	☐	☐
	c. the minimum temperature of the stream? (min -___)	☐	☐	☐
	d. the pressure of the system up to relief setpoints?	☐	☐	☐
ACTION REQUIRED:				
2.	**Are the gasket, valve seat, packing specifications compatible with;**			
	a. the process fluid or gas?	☐	☐	☐
	b. the maximum temperature of the stream? (max -___)	☐	☐	☐
	c. the minimum temperature of the stream? (min -___)	☐	☐	☐
	d. the pressure of the system up to relief setpoints?	☐	☐	☐
ACTION REQUIRED:				
3.	**Are hydrogen, low temperature, caustic, wet H2S, amine, or tight shut off valves/piping required?**	☐	☐	☐
ACTION REQUIRED:				
4.	**Does the metallurgy or process material require special treatment prior to opening such as passivation, neutralisation or complete flushing?**	☐	☐	☐
ACTION REQUIRED:				
5.	**Can the system be vented and drained properly for startup?**	☐	☐	☐
	a. shutdown/maintenance?	☐	☐	☐
ACTION REQUIRED:				
6.	**Is freeze protection required?**			
ACTION REQUIRED:				
7.	**Are there low points or dead-end sections where water could accumulate and freeze?**	☐	☐	☐
ACTION REQUIRED:				
8.	**Are valves orientated such that their position, open or closed, is readily apparent?**	☐	☐	☐
ACTION REQUIRED:				
9.	**Have check/non-return valves been mounted in the horizontal position?**	☐	☐	☐
	Note: A vertical location can adversely affect the response of some types of check/non-return valves and should be avoided. For vertical upward flows, there are certain types of check/nonreturn valves more suited to the duty, such as vertical/globe/angle lift check valve and tilting-disk check valve.			
ACTION REQUIRED:				
10.	**Are control valves and controllers reasonably accessible for calibration and maintenance?**	☐	☐	☐

ACTION REQUIRED:

11. **Are manual valves that could potentially be needed to respond to an emergency situation readily accessible?** ☐ ☐ ☐

ACTION REQUIRED:

12. **Are utility connections adequately protected against backflow of the process into the utility supply?** ☐ ☐ ☐

ACTION REQUIRED:

13. **Are there any safety consequences if the process flows backwards through the piping system?** ☐ ☐ ☐

ACTION REQUIRED:

14. **Can the process material be misdirected into an adjacent piping system and potentially create a safety problem?** ☐ ☐ ☐

ACTION REQUIRED:

15. **Has the piping and support design considered the required allowances for expansion and contraction?** ☐ ☐ ☐

16. **Has the piping and support design considered sources excess vibration that could lead to mechanical failure (e.g., critical flow conditions/flashing of liquid, mechanical vibration, etc.)?** ☐ ☐ ☐

17. **Is this piping subject to stress corrosion cracking (caustic in carbon steel, chlorides in stainless steel)?** ☐ ☐ ☐

18. **Is this piping affected by contaminants such as steam, nitrogen, etc., that can be introduced during startups or shutdowns?** ☐ ☐ ☐

ACTION REQUIRED:

19. **Are the gaskets, valve seats, packing, etc. affected by contaminants such as steam, nitrogen, etc., that can be introduced during startups or shutdowns?** ☐ ☐ ☐

ACTION REQUIRED:

20. **Is the piping subject to corrosive environments due to:**

a. Carryovers? ☐ ☐ ☐

b. Contaminants? ☐ ☐ ☐

c. Process upsets? ☐ ☐ ☐

d. Reduction in velocity due to low flow/dead end? ☐ ☐ ☐

ACTION REQUIRED:

21. **Can dense corrosive material (e.g. sulfuric acid) accumulate in valve seats or drain nipples?** ☐ ☐ ☐

ACTION REQUIRED:

22. **Do any portions of this system require cathodic protection?** ☐ ☐ ☐

a. If yes, have inspection procedures been updated? ☐ ☐ ☐

b. If yes, do written procedures exist for working on this system? ☐ ☐ ☐

ACTION REQUIRED:

23. **Will portions of this piping be installed in the vicinity of cathodically protected systems?** ☐ ☐ ☐

a. If yes, do written maintenance procedures exist for this system and should it be bonded to a cathodically protected system? ☐ ☐ ☐

ACTION REQUIRED:

24. **Is the system adequately protected against over-pressure:**

a. is the piping/equipment affected by the change adequately protected against over-pressure? Consideration should also be given to piping/equipment connected to the system being changed. ☐ ☐ ☐

b. have the required RV (relief valve) files been updated with supporting calculations? ☐ ☐ ☐

ACTION REQUIRED:

25. **Has this change disabled, bypassed, or compromised:**

a. a safety system? ☐ ☐ ☐

b. a relief system? ☐ ☐ ☐

c. a critical alarm? ☐ ☐ ☐

d. a shutdown/interlock? ☐ ☐ ☐

ACTION REQUIRED:

26. **Have the materials of construction been identified (Positive Material Identification (PMI)) and PMI documentation meets Inspection requirements?** ☐ ☐ ☐

ACTION REQUIRED:

27. **Do the spare parts inventory records need to be updated?** ☐ ☐ ☐

ACTION REQUIRED:

28. **Is pressure equipment directive relevant?** ☐ ☐ ☐

ACTION REQUIRED:

29. **Construction and equipment is in accordance with the design specifications?** ☐ ☐ ☐

ACTION REQUIRED:

30. **Safety, operating, maintenance, and emergency procedures are in place and adequate?** ☐ ☐ ☐

ACTION REQUIRED:

31. **Any further actions required?** ☐ ☐ ☐

ACTION REQUIRED:

7.2 APPENDIX B – SELF ASSESSMENT CHECKLIST

The following checklist is a quick tool a site can use to test its existing processes against this good practice guide.

	Y	N	PARTIAL
Setup and applicability			
• Does the site have a formal, written MoC procedure?	☐	☐	☐
• Does it clearly define when it is and is not applicable?	☐	☐	☐
• Does it cover temporary as well as permanent changes?	☐	☐	☐
– Are temporary changes given a formal time limit within the process?	☐	☐	☐
• Does it cover emergency changes?	☐	☐	☐
Staffing			
• Does the process define which organisational positions perform the key roles of:			
– MoC owner?	☐	☐	☐
– Discipline engineers?	☐	☐	☐
– Risk assessment authority?	☐	☐	☐
– MoC approvers?	☐	☐	☐
Key steps			
• Is an approval step required when initiating an MoC?	☐	☐	☐
– Is a written summary of the change required to gain this approval?	☐	☐	☐
• Does the process require a formal, written design of the change to be made?	☐	☐	☐
• Does the process contain a formal risk assessment stage?	☐	☐	☐
• Does the site have appropriate capability to perform formal engineering design, construction, and installation of the change?	☐	☐	☐
• Does the process include formal pre startup safety review (PSSR) activities?	☐	☐	☐
• Does the process require senior level approval prior to commissioning?	☐	☐	☐
• Does the process include a rigorous documentation close-out stage?	☐	☐	☐
Risk assessment specifics			
• Does the process contain different levels of risk assessment based on the nature of the change?	☐	☐	☐
• Are the risk assessment processes used approved by a competent person independent of the change?	☐	☐	☐

Supporting infrastructure

- Does the site have a structured way to individually number and track changes? ☐ ☐ ☐
- Can the system produce KPIs to describe how the MoC system is being used? ☐ ☐ ☐
- Does training exist for the key people involved in operating the MoC process? ☐ ☐ ☐
- Have all of the key people had this training, and are they still considered competent, or is refresher training required? ☐ ☐ ☐

Stewardship and governance

- Are KPIs describing the operation of the MoC system routinely generated? ☐ ☐ ☐
- Are they reviewed by senior level staff at an appropriate forum? ☐ ☐ ☐
- Is an audit of the MoC procedure operation performed at least annually? ☐ ☐ ☐
- Are the outcomes of annual audits reviewed by senior level staff at an appropriate forum? ☐ ☐ ☐

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Marsh Risk Engineering has been established for over 25 years and is uniquely qualified to provide risk managers and underwriters with the essential information they need to determine the right limit and scope of cover and the right price.

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