Keys to Avoid Making A Dog's Breakfast Out of Your MOC System

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Abstract

When thinking about MOCs on a case by case basis it is easy to forget the overall role of a change management system. Think of the MOC system as an umbrella protecting the plant's current process safety design. The MOC system helps to validate the adequacy of the proposed process changes based on the plant's current design. This means the MOC system needs to ensure that any impacts of the change to other PSM elements' implementation are identified and addressed. This requirement makes an MOC system inherently complex, requiring extra care to design the MOC workflow for ease of use and efficiency across the organization. If key components are not addressed, an MOC system can quickly become a dog's breakfast. The MOC system must address many aspects of change, specific circumstances and nuances that if unchecked can weaken an organization's perspectives on MOC and override the discipline to carry out day to day change management. Therefore, an MOC system's workflow must be designed to identify and address how the proposed change can affect implementation of other PSM elements and be constantly monitored and assessed. For sustainability and accountability, associated key performance indicators must also be established, reported and communicated.

1. Introduction

This paper discusses how to ensure the MOC system addresses a change's effect on implementation of other process safety management systems and discusses common MOC workflow weaknesses that can undermine implementing an efficient, compliant and effective MOC system. This will be illustrated based on the recent eMOC system rollout at Irving Oil, New Brunswick, Canada.

MOC is often considered the most important element of a Process Safety Management program, because it can prevent the undermining of safeguards provided by the other elements. Poorly managed changes can degrade the quality of Process Safety Information, introduce new risks in plants which have already undergone a Process Hazard Analysis, and / or reduce the mechanical integrity of equipment, to mention a few.

An effective MOC process must facilitate the review, approval, and documentation of many complex changes at a time. This can become an administrative nightmare leading to MOC process failure, without a robust tracking system. An electronic tracking system has the functionality to manage a large number of MOCs at one time. That is why Irving Oil implemented an electronic MOC (eMOC) system in 2011.

Also, examples of common MOC system weaknesses discovered throughout audits across small and large sized facilities and a variety of chemical processes will be presented, such as updating Process Safety Information (PSI) and other documents, managing temporary changes, quality of risk reviews and the MOC process work flow.

How to ensure the MOC system addresses a change's effect on implementation of other elements of PSM will be accomplished by:

- Presenting the relationship between Process Safety Information (PSI) and MOC and how together these elements influence the implementation of all process safety elements
- Discussing Irving Oil's eMOC system
- Discussing how simple changes can require revising many documents that support day-to-day implementation of many PSM elements.

How common MOC workflow weaknesses can undermine implementing an efficient, compliant and effective MOC system will be illustrated based on the recent eMOC system rollout at Irving Oil, New Brunswick, Canada.

2. Relationship Between Process Safety Information and Management of Change

2.1 MOC Protects PSI

Process Safety Information is an element of PSM which documents the process safety design. It is the foundation for process safety. Ninety-nine percent of changes are changes to PSI (others being organizational changes, some facility changes and stand-alone procedural changes).

Management of change is the umbrella, protecting the process safety design **(Figure 1)**. Not only is current PSI needed to evaluate the technical basis and evaluate the risk of the change, the PSI that is changing due to the process change must be identified and must be updated to reflect the change.

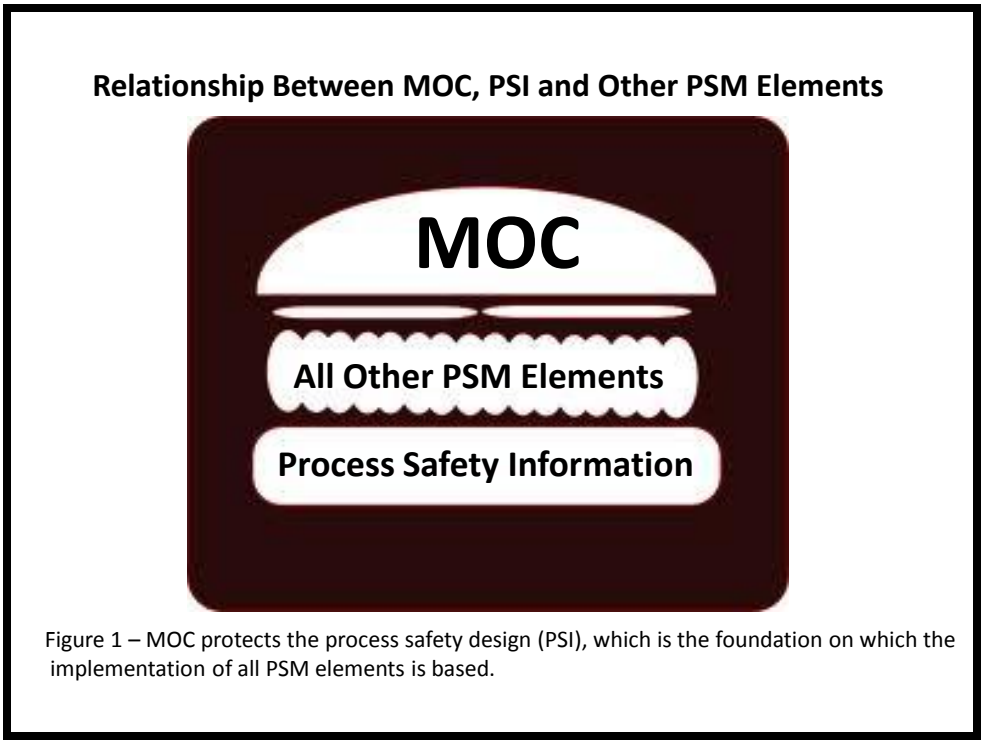

Figure 1 – MOC protects the process safety design (PSI), which is the foundation on which the implementation of all PSM elements is based.

2.2 MOC Protects Other PSM Elements

When a process change is proposed and evaluated, the quality and thoroughness of the MOC review extends beyond the change itself. The implementation of a change will require identifying other elements of PSM that must be changed/updated. For example, if a new instrument is added to a process:

- Operating procedures must be updated with instructions for operating, monitoring, and troubleshooting the instrument, and should have a description of its process safety function
- Mechanical Integrity program must be updated. The instrument data sheets must be filed properly, inspection, testing and preventive maintenance program established and entered into the Computerized Maintenance Management System (CMMS) and spare parts ordered
- Training guides must be updated to include the instrumentation, safe operating limits, consequences of deviations, and troubleshooting guidelines
- All related design and specifications of the instrument must be filed properly in the specific PSI documents such as loop sheets, P&IDs, etc.

2.3 Day-to-Day Use of PSI

On a day-to -day basis plant staff relies on the PSI documents to make decisions concerning process changes. Therefore, if documents are not updated to reflect changes as they occur, eventually the process safety design documents will be out of date and future process change decisions will be made on outdated information. PSI is the basis for implementing all elements of PSM. Some examples where PSI is used:

- SOP content
- Training materials for operators
- Emergency response plans
- Training for contractors and mechanics
- Establishing ITPM for equipment and instrumentation
- Conducting Process Hazards Analyses (PHAs)
- Conducting incident investigations
- Evaluating MOCs

2.4 MOC Procedural Step to Protect PSI

To keep PSI updated and accurate, a critical step in the MOC process is to identify all the documents associated with elements of PSM that require updating, to reflect the process change with respect to the PSI. Many companies' MOC systems lack a mechanism to help the MOC owner identify all documents that contain PSI to be updated. **Figure 2, "Documentation Checklist,"** is how Irving Oil identifies all the documents related to PSM implementation that may need updating to reflect a process change. However, identifying the documents is only the first step. Not creating an action plan, and tracking these actions to update PSI and other PSM documents to completion, are common MOC system weakness which will be discussed below, along with other MOC workflow challenges.

3. MOC Workflow Weaknesses

MOC process workflows have some variations and commonalities across companies. Irving's workflow has 8 major steps **(Figure 3):**

1) Initiate the change
2) Initial Approval and assign a change owner
3) Change-specific Form and Change Type Selection
4) Assign Functional Reviewers
5) Functional Review Completion
6) Develop Action Plan
7) Final Approval
8) Complete Change Request

Irving has found weaknesses in the implementation at several steps of the process, which can compromise the effectiveness of the overall MOC implementation. Each is discussed along with solutions Irving is implementing.

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Documentation Checklist

NOTE: This list is NOT all-inclusive; consult your plant/function library to determine if any other records and/or documentation will need to be updated as a result of this change request.

Processing
- ☐ Operating Manuals
- ☐ Training Material
- ☐ Standard Operating Procedure(SOP)
- ☐ Standard Job Procedure (SJP)
- ☐ Asset Operating Procedure (AOP)
- ☐ Operating Best Practice (OBP)
- ☐ Operating Instruction (OPI)
- ☐ Department Policies
- ☐ Quality Manual
- ☐ Training records
- ☐ Process Description
- ☐ Product Specifications
- ☐ Refinery Energy Model
- ☐ Refinery Utility Capacity Report
- ☐ Loss of Utility Emergency Procedures
- ☐ Shift Log / Turnover Log
- ☐ Shift Schedule for Plant
- ☐ Shift Personnel List

Piping
- ☐ Steam & Trap Docs
- ☐ Pipe Specs
- ☐ Pipe rack drawings
- ☐ LX drawings
- ☐ Piping isometrics

Organizational
- ☐ Corporate and Refining Phone List
- ☐ Organizational Charts
- ☐ Outlook Distribution lists
- ☐ On-Call Schedule
- ☐ Vacation Schedule
- ☐ Cintellate Hierarchy
- ☐ Oracle Hierarchy

Technical-PTS
- ☐ Process Flow Diagrams (PFDs)
- ☐ Piping and Instrument Diagrams (P&ID)
- ☐ Safe Upper and Lower Limits
- ☐ Maximum Intended Inventories
- ☐ Evaluation of the Consequence of Deviations
- ☐ Material and Energy Balances
- ☐ Description of the process materials and process chemistry
- ☐ Hazard Effects of mixing two chemicals
- ☐ Design basis
- ☐ Control Narratives

Health, Safety & Environment
- ☐ Evacuation Routes and Strategies
- ☐ Emergency Response Manual (ER)
- ☐ Health & Safety Instructions (HSI)
- ☐ Process Safety Instructions (PSMI)
- ☐ Environmental Instruction (EMSI)
- ☐ Training database
- ☐ OH Manual
- ☐ C. of A. records
- ☐ Waste Characterization
- ☐ Disposal Permit
- ☐ Process Hazard Analysis Report
- ☐ MSDS

Civil
- ☐ Equipment Plot Plans
- ☐ Underground drawings

Instrumentation
- ☐ SIS Instrument Check Procedures
- ☐ JX,PX drawings
- ☐ Loop diagrams
- ☐ Instrument Datasheets
- ☐ AMS Files

Reliability
- ☐ Materials of Construction Drawings and Datasheets
- ☐ Design Codes and Standards
- ☐ Equipment Datasheets
- ☐ Vessel Drawings
- ☐ Fire water system drawings
- ☐ Underground Drawings
- ☐ Lubrication records
- ☐ Vibration Database Records
- ☐ Spare Parts
- ☐ PD-18
- ☐ Equipment specification sheets
- ☐ CMMS records
- ☐ Vendor information
- ☐ Asset Criticality Assessment (RELI 138)
- ☐ Design Calculations
- ☐ EWO/TWO
- ☐ Reliability Instruction (RELI)

Maintenance
- ☐ Repair Procedures
- ☐ Open Issue List
- ☐ Basic Equipment Maintenance Plan
- ☐ Materials Mgt. Instruction (MMI)
- ☐ Maintenance Instructions (MNTCI)
- ☐ Repair Procedures

Document Control/Management
- ☐ All *IOR Instructions, Policies & Standards*

Documentum:
- ☐ Bill of Material
- ☐ Breaker Testing Records
- ☐ Calculations
- ☐ Canadian Registration Number (CRN)
- ☐ Certificate of Compliance
- ☐ Data Sheets
- ☐ Drawing (Engineering Drawing, Isometric Loop, P&ID, PFD, Plot Plan, Sketch)
- ☐ Drawing (Above Grade Piping, Absorber, Boiler, Building, Column, Compressor, Concrete, Contractor, Cooling Tower, Design Data, Drum, Electrical, Exchanger, Fin Fan Coil, Foundation, Furnace, Grading, Insulation, Misc. Mechanical Equipment, Paving, Piping Isometric, Pump & Driver, Reactor, Stripper, Structural Steel, Tank, Vessel, Underground Piping
- ☐ eAM Equipment Data
- ☐ Emergency Procedures
- ☐ Engineering Equipment Summary
- ☐ Engineering Work Order (EWO)
- ☐ Feed Package
- ☐ Forms
- ☐ Inspection Record
- ☐ Inspection Test Plan
- ☐ Install Op Maintenance Manuals
- ☐ Instructions
- ☐ Instrument Index
- ☐ Isometric
- ☐ Line List
- ☐ Manufacturers Data Reports
- ☐ Material Testing Report (MTR)
- ☐ Parts List
- ☐ Performance Curves
- ☐ Principles & Philosophies
- ☐ Process Design Data
- ☐ Project PEP, PPM

FIGURE 2 – Documentation Checklist used to help identify all documents impacted by a process change

3.1 Step 1 – Initiate the Change

In step 1, the change originator is responsible for initiating a request for a change, and follows through to submission of the change request to the initial approver. The MOC procedure contains a list of process/physical change and Replacement in Kind (RIK) examples. This reference helps the change originator correctly recognize a process change. With approximately 500 MOCs generated every quarter (typical for refineries the size of Irving Oil's), the refinery staff identifies process changes and recognizes the need to manage change.

3.1.1 Weaknesses

The refinery has not established a formal monthly audit mechanism to monitor how many uncontrolled changes are occurring, such as auditing work orders, operation's log books, etc. This performance indicator, when used properly, can help personnel to better recognize change. Also, communicating the root causes of incidents related to MOC system weaknesses, such as failure to properly evaluate and approve process changes, helps to educate employees and change the culture.

One of the most challenging MOC issues is overlooking changes in leadership roles, especially in the wake of an organization change or restructuring. Much accountability can fall through the cracks if the MOC system is not utilized for organizational changes. Not only for leadership roles, but if the roles and responsibilities are not examined for individuals throughout the organization, the implementation of PSM elements can be affected. For example, Irving's role profiles do not always reflect PSM responsibilities. An operator may be familiar with the Incident Reporting software on his shift and is designated as responsible for entering incidents. If he is moved to another unit, retires, or resigns, it is not always identified that this role needs to be filled or that another employee needs to be trained. Recently a person retired who was the "Warden" for their department and floor in the event of an Emergency. This personnel change was not evaluated and the Area Warden role was not reassigned. When an emergency drill occurred, head count for the area was not conducted. This resulted in some personnel being unaware of their muster point location.

Because some individuals do not understand what constitutes a true "emergency" change, some changes are classified as emergency changes to allow expeditious approval. This increases the chance that these changes are not evaluated properly or timely, possibly resulting in intolerable process safety risk. It is difficult for staff to stop a change that is already in the process of being executed. There is a KPI for the number of emergency changes. While there is no predicted number of emergency changes a facility should experience, reporting the trend of this KPI can alert the MOC coordinator to investigate the emergency MOCs and intervene if the system is being misused.

3.2 Step 2 – Initial Approval

Step 2 is carried out by the initial approver. The initial approver reviews the justification for the proposed change. If the initial approver does not understand the existing risk of making the change, or if he knows the risk is high, he can require that a formal assessment be performed. A document is available in the eMOC system to aid in determining if a formal assessment should

be performed. This ensures that the proper information is supplied to the Functional Reviewers and Final Approvers. The initial approver needs to be aware of their responsibilities as they are "Approving to Develop," not approving to implement the change. The initial approver assigns the Change Owner per the MOC procedure. The initial approver completes the initial risk assessment and determines if a formal risk assessment is required (note: in the United States, OSHA 1910.119 requires safety and health risk reviews for all process changes).

3.2.1 Weaknesses

Often, the Initial Approver does not use the Formal Assessment Requirements checklist to determine if a formal assessment is required, resulting in failure to request a formal assessment when needed. Additionally, the refinery has insufficient resources available to conduct these MOC formal risk assessments. Only a select number of individuals are trained to lead multiple types of risk reviews i.e., HAZOPs, What-Ifs. Many individuals choose discipline- related training over other training. Currently, consultants are hired to facilitate the formal risk assessments. The long-term objective is to develop and deliver an in-house PHA training package for technical members of the area teams, to lead the analyses for MOCs in their own areas.

3.3 Step 3 – Form and Change Type Selection

The change owner selects the specific change types and selects and completes the Change Specific Forms. If a formal assessment was requested, it is completed at this step before proceeding to the functional review (this is not clear on our chart **Figure 3**).

3.3.1 Weaknesses

The change owner often does not select the correct (or only one of multiple) specific change type(s), which makes it difficult to determine the required functional reviewers. Typical change types include equipment changes, chemical changes, process control changes, facility changes, material management or logistics changes, analytical changes, tool changes, work process and personnel changes, and changes to standards, policies and administrative controls. The assigned change owner must be aware of the proposed change's scope, otherwise the proper functional reviewers may not be selected and the risk associated with the change may not be fully identified and evaluated. There are currently 28 different "discipline" functional reviewers, with the opportunity to add functional reviewers if the change owner deems necessary. One of the most stringent responsibilities of the functional reviewers is to "crosscheck" with the subject matter experts to determine if a formal risk assessment is warranted. As mentioned under Step 2, not enough staff is sufficiently trained to conduct risk reviews. Additionally, for some types of changes, specific forms are required such as the Temporary Facility Form or the DCS Change Forms. Often these forms are not selected and completed, resulting in critical information missing for Functional Reviewers to perform their assessment. Also, if the specific change type is incorrect, then accurately trending the specific types of changes implemented is impossible. While there is no set expected percentages for types of changes, PSM managers often trend this data to possibly alert staff of procedural problems, mechanical integrity issues, etc.

3.4 Step 4 – Assign Functional Reviewers

The change owner selects reviewers based on the specific change type and a Functional Review Matrix which identifies the subject-matter experts (SME) who should review the change based on the scope and type of change.

3.4.1 Weaknesses

As a result of the deficiency at Step 3 (not selecting the specific change type), the change owners may not select the correct required functional reviewers. In some cases, personnel have deliberately not sent MOCs to certain personnel they know may not support the change. To manage this issue the MOC coordinator monitors compliance with the MOC procedure and communicates through the Health Safety and Environmental (HSE) meeting to Refinery Leadership Team (RLT).

Another issue is that certain personnel are the SMEs for the majority of the MOCs. This work overload can cause "rubber stamping" (improper review of important MOC issues), and also an MOC backlog.

3.5 Step 5 – Functional Review Completion

The reviewers review the proposed change, identify potential risks, develop the mitigation plan, complete the review form and attach supporting documentation.

3.5.1 Weaknesses

Not all reviewers use and complete the functional review form's checklist, which is a tool to help guide the reviewer through the review process. Because it is not mandatory, there is no minimum required documentation of what the reviewer considered in their review and pertinent information is rarely attached in the software's File Link/Attachment section. If the reviewers determine the change will present an intolerable risk, often the supporting information, such as the risk consequence and likelihood, are omitted. There is a field to check whether the risk is tolerable or not, but this does not record the consequence nor the probability of risk, which leaves the change owner uncertain. Some functional reviewers are unsure of their roles and believe they are approving the change, not reviewing the risk. A mandatory checklist is being implemented which should help clarify what was considered, improve the review process and provide critical information needed for final approval. There is the risk that the functional reviewer who is the subject matter expert can overlook a potential hazard ("silo effect"). The change owner should be aware of this and consider all functional reviews for assessing this risk.

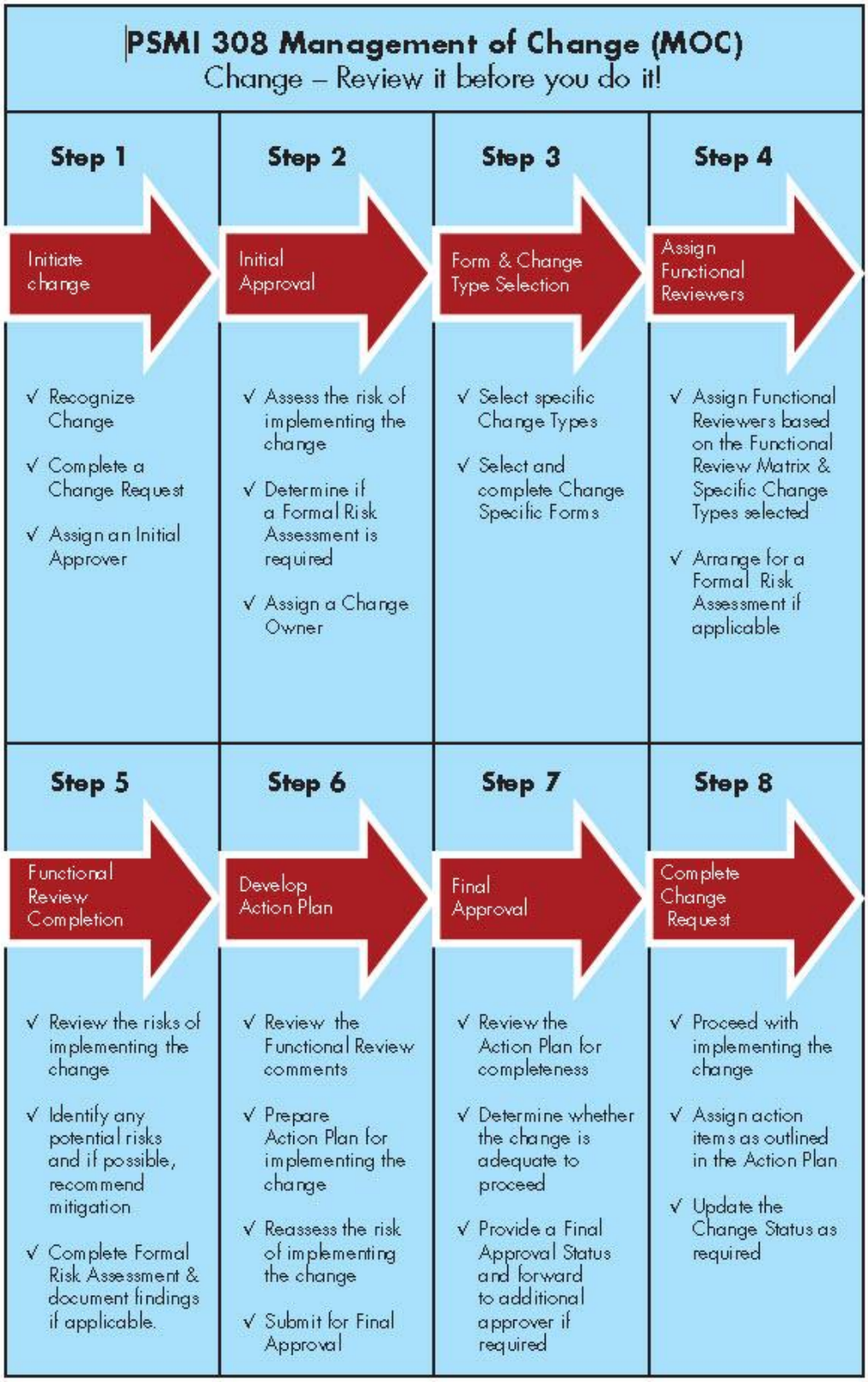

Figure 3 – Irving's MOC Process Workflow

3.6 Step 6 – Develop Action Plan

The MOC owner reviews the Function Reviewers' comments, prepares the action plan, reassesses the risk and submits for final approval. The change owner should now be aware of the requirements (identified by functional reviewers) to address in order to implement the change safely. The action plan is developed using functional review information along with the document/training checklist.

3.6.1 Weaknesses

This part of the process has been very challenging. Change owners are not completing their action plan, which includes all steps required to completely implement the change. In many cases, they are not addressing concerns raised by functional reviewers, and are not reassessing the risk of implementing the change correctly. As a result, the change owner may not select the appropriate final approver. The MOC software (Cintellate) does not require the creation of the action plan, and many change owners ignore this part of the process, which can result in the identified risk remaining unmitigated and critical PSM documents required for day-to-day implementation of PSM elements not being updated **(refer back to Figures 1 and 2)**.

3.7 Step 7 – Final Approval

Final approvers review the action plan for completeness, determine if the change is adequate to proceed, and provide final approval status.

3.7.1 Weaknesses

Final approvers are sometimes approving changes that were reviewed by the wrong reviewers, changes that have intolerable risks, and changes without action plans attached as discussed under Step 6. Selecting the wrong reviewers is discussed under Step 4. Many changes are approved even when the change owners fail to document adequate mitigation for the identified intolerable risk associated with the implementation (discussed in Steps 3 and 4). Additionally MOCs are being cancelled or closed because the process change was implemented before MOC approval. These changes still need to be reviewed for adequacy and approved to ensure hazards have been identified and addressed and to ensure all PSI and other documents/systems used daily for PSM implementation are updated to reflect the change.

3.8 Step 8 – Complete Change Request

The change owner proceeds with the implementation, assigns action plan items, and updates the Change Status as required. This step also consists of:

1. Proceeding with installation/PSSR
2. Completing documentation updates
3. Ensuring all assigned action items are completed
4. Proper closure of the MOC in a timely manner which includes replacing temporary changes with a new MOC or returning the change to its original state.

3.8.1 Weaknesses

Change owners are not consistently assigning actions to the individuals responsible for completing the various tasks required for change implementation. This means there is no tracking to ensure the tasks are completed, and to indicate when the change has been completely implemented and processed for closure. Even when action plans are developed, the timely completion of action items is not occurring consistently.

Installation and PSSR – Some change owners are unaware of the PSSR requirement or choose not to execute one, a vital part of the PSM cycle to help ensure MOC requirements have been met. The PSSR helps ensure changes are implemented as described in the MOC, the action plan is developed and items that must be addressed before start-up are flagged.

Not completing action items/not properly closing out the MOC – Change owners fail to assign actions for each aspect of the change i.e., drawings and procedures. For those action items assigned to staff, the items are not being completed. Some of the resulting outcomes include improper updating of Process Safety Information, insufficient information (or incorrect information) used to conduct a PHA, outdated or incorrect operating procedures and other document updates associated with PSM implementation. The PSSR process, if conducted properly, should catch those omissions related to action plan development and implementation. When the MOC coordinator reviews the implemented MOCs and notes missing PSSRs when required, the change owner and area managers should be notified and a PSSR conducted. This is the best way to quickly flag any installation omissions and action plan deficiencies that could increase the risk.

Timely MOC Closure – Currently there is no maximum time limit for closing permanent MOCs. The eMOC system is great at tracking action items, if the action items are assigned, which is not the case for the majority of the MOCs. There is currently no KPI to publish the status of MOCs. Temporary changes expiring and remaining so for extended periods is also a problem. The number of temporary changes is reported as a KPI however, the number of days late is not published as a KPI.

4. Lessons Learned

As mentioned above, Irving has implemented or is in the process of implementing steps to strengthen weak points in the MOC workflow. With the integrity of the MOC system being compromised, it is prudent to address these anomalies in a timely fashion, project management style. To avoid these MOC weaknesses, consider the improvements summarized below:

- The discussion of the weaknesses in the workflow steps highlights MOC software inadequacies
- MOC Training inadequacies
- Additional Key Performance Indicators
- Miscellaneous MOC weaknesses

4.1 MOC Software Inadequacies

The MOC program is managed through an electronic EHS software system. The system has proven reliable with regards to '"uptime." However during times when the system is unavailable, a paper-copy version of the MOC process is available. The MOC coordinator and Systems administrator manage MOCs during those times on behalf of the organization. The software is easy to use and is very customizable despite software speed issues and occasional bugs. The electronic system is open to the organization (with permissions), so that all changes, regardless of status, can be viewed through a number of search operations. One of the greatest advantages of the eMOC system is tracking the status of MOCs and implementation action items. The MOC system is easier to execute and manage when staff knows where the MOC is in the workflow versus laying on someone's desk. The MOC coordinator is responsible for monitoring the system, both from a process execution and approval point of view. Monitoring the action item execution is especially important.

Currently the eMOC system does not require certain steps to be completed before advancing to the next MOC workflow step. To address these software weaknesses:

- Make sure the mandatory workflow steps and completion of mandatory forms are not skipped, by designing the electronic MOC system so that users cannot advance in the eMOC workflow process until these permissives have been met. The lagging solution is to rely only on the approvers and PSM staff to catch omissions and require corrections.
- The MOC software also needs mandatory fields for selecting the specific change types. Irving is currently working with the MOC software vendor to make these fields mandatory. This will allow auditing of the change requests to ensure the proper functional reviews are being completed.
- The MOC software currently allows the assignment of Functional Reviewers before the Formal Risk Assessment is completed. The software workflow is being changed so that, when a Formal Risk Assessment is required, assignment of the Functional Reviewers will not be enabled until the assessment is complete and associated documentation is attached to the change request.
- Functional Reviewers currently have an electronic "considerations checklist" to remind them of specific items to consider when reviewing the proposed change for risks. This checklist is not mandatory, and not utilized the majority of the time. These checklists are being updated and will be made mandatory. PSM staff will now be able to audit what each reviewer considered. Mandatory completion of the Functional Review Form would improve the review process and provide critical information needed for final approval.
- The MOC software currently does not require Functional Reviewers to indicate the potential consequence and likelihood of the risk when the risk is identified as intolerable. This information is required to enable the Change Owner to develop actions to mitigate the risk to an acceptable level. A new section will be added to the Functional Review form forcing the Functional Reviewer to document the potential consequence and likelihood of the risk associated with the proposed change. The highest risk identified by

the Functional Reviewers will then be transferred to the Action Plan form at Step 6 of the process.

4.2 Training Inadequacies

The initial training for the new eMOC process was extensive, and made all employees aware of the need to manage changes, and provided an overview of the MOC process and electronic system. However, it should have been followed by role-specific training for the Change Owners, Functional Reviewers, and Final Approvers.

When the switch was made from the paper-based MOC to electronic, only a few minor changes were made to the MOC process. Additional tools thought to be missing to implement MOC correctly were established and it was mistakenly assumed these tools would be used and the organization would become exceptional managers of change. In retrospect, it wasn't the lack of tools that made the paper-based system inadequate, but the lack of accountability and enforcement. Additional training will occur to address the following:

- **The infrequent use of the formal assessment form** (to evaluate the risks), prior to being sent to the Functional Reviewers is being addressed two ways. First, Functional Reviewers are being advised not to review any change request which does not have sufficient information to identify risks. In these situations, the Functional Reviewers are to contact the Change Owner, and request the completion of a formal assessment. Secondly, the organization will be training additional hazard review facilitators in each process area, to conduct the required formal assessments (risk reviews).
- **Change Owners are not documenting an action plan at Step 6**, outlining the tasks required to properly implement the change. Irving is stressing the importance of completing this section to the Change Owners, as well as with the Final Approvers, through the role-specific training.
- **The requirement for a Pre-startup Safety Review is not being recognized by the Change Owners.** The PSSR Coordinator will be tasked with reviewing all MOCs as they are approved, to determine if a PSSR is required as part of the change implementation, and then contact the Change Owner to initiate the PSSR.
- **Final Approvers are not reviewing the Functional Reviews, and the Action Plan, prior to approving the change.** This is being addressed through role-specific training.
- **Change Owners are not assigning actions for tasks to be completed** as part of an approved MOC. This in turn provides no indication as to when the change is completely implemented, and prompting the Change Owner to complete / close the MOC. Again, this is being addressed through role-specific training.
- **Irving is currently developing role-specific training** and rolling it out to the impacted roles. This training will provide individuals with the knowledge they require to properly complete their part of the process. Their MOC accountabilities will also be spelled out in

the "PSM Duties and Accountabilities Templates," which are part of the "awareness" training.

The MOC coordinator's role is to conduct training sessions, personal training, and continuously look for ways of improving and streamlining the process. With respect to rolling out an MOC program, management support is needed to ensure all levels in the organization are educated on their roles and responsibilities, and those of others.

4.3 Key Performance Indicators

KPIs communicate issues with MOC and therefore the first step in the improvement process. Initially, Irving established only one KPI for MOC, that being the number of expired Temporary and Emergency Changes. Currently Irving tracks three MOC performance indicators:

- # of temporary MOCs
- # of emergency MOCs
- # of expired MOCs – those temporary and emergency MOCs that have exceed their time limit. Temporary MOC's must be returned to their original state within the time period approved for the specific temporary MOC. Emergency MOCs are rare in occasion and are supposed to either be completed to satisfy all normal MOC requirements or returned to the original state within 24 hours.

Irving is currently developing these additional KPIs:

- The number of MOCs approved with an intolerable risk identified
- The number of MOCs approved without an action plan
- The number of MOCs closed without actions being assigned. More KPIs will be developed to monitor the system changes proposed previously

Several additional KPIs would also help address several weaknesses discussed in this paper:

- The number of permanent MOCs that are late for closure expressed as a number and percentage of overall MOCs
- The number of permanent MOCs that are late for closure reported as less than 30 days late, greater than 60 days, greater than 90 days
- The number of temporary MOCs that are late for closure reported as less than 30 days late, greater than 60 days, greater than 90 days
- The number of incident root causes related to inadequate MOCs
- "Look Ahead" metrics for temporary MOCs that will expire in 14 days, 30 days, 60 days
- Establish KPI to show specific steps in MOC workflow that were not performed properly
- Number of unreviewed/unapproved implemented changes

4.4 Other MOC Improvement Areas

- Require that when unapproved changes are discovered, staff ensure an MOC is initiated to properly review, approve and document the implemented change and any corrections to the installed design are identified and corrected
- Train and coach staff on PSSRs as PSSRs are integral to ensuring the MOC system is properly followed
- Establish time limit for closing MOCs to help ensure documents are updated as soon as possible
- Additionally, MOCs are being cancelled or closed because the process change was implemented before MOC approval. These changes still need to be reviewed for adequacy and approved to ensure hazards have been identified and addressed and to ensure all PSI and other documents/systems used daily for PSM implementation are updated to reflect the change

5. Common MOC Weaknesses Observed During Audits

- Not conducting a safety review for procedural changes – All process changes require an evaluation of the safety and health impacts. Changes to procedures should be reviewed to ensure all pertinent information is included and all parts of the procedure are updated. A good technique is to use a checklist composed of questions to help evaluate the procedural change and use of What-If or Procedural HAZOP technique where skipping steps and performing the steps incorrectly are evaluated to ensure that safeguards are in place and adequate to mitigate the consequences and prevent the causes of the procedure being performed incorrectly.
- When procedures are required to be updated as a result of operating limit changes, equipment additions/deletions, piping configurations (adding/deleting valves/adding instruments), etc., often the redline SOP is not part of the MOC scope and therefore, not reviewed and approved as part of the scope. Often the MOC owner may flag that an SOP needs updating however, the SOP is redlined and updated after the MOC is approved, either through a separate MOC or only through a document change notice. The problem is procedural changes are changes that must meet the minimal requirements for MOCs (OSHA and industry standards), which includes evaluating the safety and health impacts of the procedural change. Many MOC systems do not require a safety review for procedural changes or if the SOP change is handled separately from the main change, there is opportunity to overlook a safety issue since the overall change is evaluated separately.
- Procedures for jumpers (bypassing a safety system) and other temporary changes may have special forms and systems to manage the change and may not be tracked. Often individual production areas manage jumpers through a paper system due to their intended short duration. There must be oversight through auditing and reporting to ensure jumpers are

consistently managed properly since most jumpers are bypasses of safety systems and therefore the risk is greatly increased when these safety systems are unavailable.

- MOC of programming changes or removing equipment from service are types of changes that once done, the change is implemented. This can lead to changes being implemented prior to affected personnel knowing about the change. Special PSSRs for these changes are necessary to ensure training occurs and staff on-shift when the change is made know exactly when the change is implemented.
- Not updating PSI for temporary changes – Temporary changes can last for a short duration or for up to 6 months or a year. If PSI is not updated for temporary changes, process change evaluations completed while the temporary change is in effect, may not consider the temporary change in the process.
- Not having a system to check out P&IDs – for large facilities with project and process engineering groups this can help ensure that proposed design changes are not based on P&IDs that will change in the near future as other MOCs or projects that are in progress are implemented.

6. Conclusion

To avoid making a dog's breakfast out of your MOC system the electronic or paper based system must require certain tasks in the workflow. Development and delivery of initial and ongoing staff training are critical to ensure responsibilities and accountability are understood and that personnel have the skills to execute their responsibilities to carry out the MOC tasks. Constant monitoring by PSM staff and reporting implementation throughout the organization via KPIs are keys to achieving and sustaining an effective MOC system.