



PDHonline Course P231 (3 PDH)

Management of Change, aka MOC

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MANAGEMENT OF CHANGE, aka MOC

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BACKGROUND

"The only constant here is change" is a common feeling if not a fact in many manufacturing facilities. Controlling the process of those changes can become a complex and costly endeavor in a large facility, however failure to control change may be even more expensive.

All industries and businesses experience change and change may be technical, mechanical (equipment), process, or administrative. Controlling change so that the results are beneficial should be a goal regardless of the type of business involved. Banks, credit card companies, grocery store chains, manufacturing facilities and service companies all experience changes of one type or another. Change is inevitable and can be linked to facility growth, new products or improved technology. The material presented will concentrate on manufacturing facilities.

Probably most employees resist change and formalizing the process frequently can bring these people on board. If the employees who will have to work in the "changed" environment do not buy into the change then chances are good the results of the change will not be as beneficial as possible. Sometimes obtaining this critical buy-in can be accomplished as a beneficial side product of the Management of Change process.

Change may be as simple as replacing a pump motor or as complex as a redesign of a major portion of the facility. A key to the future effects of change depends on how the change is controlled as it occurs. Maximum benefit comes from managing the change process.

The proper management of change offers the following benefits:

- Maintains facility safety
- Controls costs of the change
- Limits the action of the Law of Unintended Consequences
- Limits the number of surprises experienced during and after the change process
- Helps to ensure the understanding of all affected parties
- Meets legal requirements as needed
- Provides a forum for input from all affected facility departments
- Maintains facility documentation
- Helps ensure employee buy-in
- Keeps unrelated activities out of the process

THE CONCEPT OF CONTROL

Some changes occur naturally; for example as a pump impeller wears the pump's output changes, as boiler tubes foul the boiler's output drops, as tower water lines accumulate deposits flow drops off. All of these naturally occurring changes receive attention in a corrective or preventative manner.

Plants spend money and labor to correct or attempt to prevent these changes from causing deterioration of the facility's output, in other words we attempt to stop the changes from happening. We prepare detailed work instruction papers in part to prevent changes from occurring in our production processes. These are generally designed to prevent operating personnel from making unauthorized changes to batch recipes which would alter product chemistry or quality in some manner. Management of change involves similar logic; we provide detailed instructions on how changes are to be managed in order to control the process.

When we plan for intentional changes we have the opportunity to have complete control of the change process; this means if we have done our jobs properly there will be no unintended consequences or surprises when the job is complete. This ideal situation generally means the lowest cost to the facility and the maximum show of "control" to management and any regulatory group involved.

MOC is a proactive activity similar to Preventative Maintenance as opposed to a reactive process similar to putting out a fire.

REASONS FOR CHANGE

Reasons for change range from the simple replacement of a failed item of equipment to something as complex as changes in piping because of changes in or additions to the process. Consider the following items:

Change	MOC Process Suggested
Piping change to process	YES
Controls change to process	YES
Build new freestanding production unit	NO
Introduce improved technology	YES

Where legally required the idea of MOC is to demonstrate that the facility is under control and that all changes affecting the regulated portions of the facility are approved by individuals with the proper knowledge and authority.

TYPES OF CHANGES

Areas in which changes occur and need to be controlled are limited only by the imagination. Likewise the degree of seriousness of changes is also very broad. Generally the degree of seriousness is not part of

the change documentation; that is an important factor but usually doesn't alter the process. For example in a PSM (OSHA Process Safety Management) facility changing a control valve to a similar unit from a different manufacturer is handled in the same change control manner and with the same paper work as the complete redesign of a piping system handling hazardous chemicals. The first change is handled quickly and by a minimum number of people whereas the second may require input from all facility departments and take multiple weeks of discussion.

Typically in a manufacturing facility we can expect changes requiring management in the following areas:

Process	Testing	Controls
Equipment	Shipping	Utilities
Product	Administrative	Maintenance
Work environment	Training	Waste Treatment
Safety	Environmental	

NOTE: Some changes in PSM or FDA regulated facilities do not require the detailed MOC process since they do not affect either the pharmaceutical (FDA) or PSM (chemicals) regulated processes.

For example a modification to a steam boiler which provides building heat to administrative offices only would generally not affect the regulated processes so those changes would not require MOC coverage but for consistency your plant might require an MOC for the change anyway.

A change in kind (identical replacement) for a component usually does not require the full MOC process but does generally require some notes made in the equipment file.

The following table offers some guidance to assist in deciding when an MOC process is required and when it is not. Depending on the nature of the facility these guidelines will change.

REGULATORY BODY FOR THE FACILITY	AREA IMPACTED by the CHANGE	MOC REQUIRED
FDA	PRODUCT SAFETY, QUALITY, EFFICACY, PURITY	YES
FDA	SUPPORT UTILITIES	NO
OSHA	OPERATIONAL SAFETY	YES
OSHA	SUPPORT UTILITIES	NO

In the end it is sometimes simpler to just do MOC's on all changes since they can usually save money and prevent problems.

MOC TOOLS

The purpose of MOC tools is to:

- assist in completing the process

- to ensure no critical steps are left out
- to ensure that all essential inputs are considered
- to ensure that all the necessary approvals are received.
- to limit the introduction or unrelated activities
- to keep the process on track

The MOC tools take the shape of a guiding form to be completed during the MOC process. There are as many Management of Change forms to guide the process as there are companies using formal processes in this area.

Generally the best approach to this process is to review some of the available tools and then create one specifically matching the organization and needs of your facility. Above all the process of management of change needs to be practical, logical and done in such a way that extraneous items do not side track the change under consideration. Almost without fail no meeting is completed without some minor and frequently unrelated item surfacing to side track the meeting agenda. Part of the reason to use a facility standardized MOC form is to prevent these unrelated subjects from entering the process.

Attachments A and B give two options for managing the process, these should be modified to match the facility. For example if the facility handles extremely flammable materials then the addition of a section on investigation of how the change impacts fighting of the potential fires would be appropriate.

A critical part of the MOC process is the selection of the appropriate individuals as part of the process for the specific change under consideration this selection process is aided by the use of “Impact” questions. Remember the individuals involved in the process are also those who will sign the MOC documents and may be some of the individuals involved in the mechanical aspects of the change. In most cases the department supervisor should be selected or a representative with written authorization to act on behalf of the supervisor. Individuals on the MOC team need to have both applicable experience with the area of the proposed change and the authority to approve the change.

AN EXAMPLE FOLLOWS:

Situation: ACME Chemicals is a specialty chemical company manufacturing various soaps, detergents, car wash products and industrial cleaners for use in high pressure washers. As a side line they also manufacture windshield washer fluid, automotive bug spot remover, tar remover and vinyl cleaner for cars.

Problem: ACME uses steam heated vessels in its manufacturing processes and has three cooling towers to cool the vessels when the various chemical reactions are complete. All three towers are the same size. One of these towers was severely damaged in a recent storm. A replacement tower has a delivery of six weeks.

Change: The actual replacement of the tower will be handled by a Capital Project, in the interim some piping changes will be required to maximize use of the two remaining towers while maintaining the maximum production.

The following table lists the normal MOC startup steps .

Step	ACTION	RESULT
1	Define the problem	Insufficient cooling capacity to allow for full production; expected duration of the problem is six weeks minimum
2	Determine what departments are affected	Production, sales, shipping, scheduling, maintenance, cost control, quality control, engineering
3	Secure the necessary documents to allow all parties to understand the problem and envision the proposed solutions	P&ID's* of cooling towers and utility systems, drawing of existing tower, cooling tower pipe routing drawings
4	Create a list of individuals needed from the affected parties as part of the process	Usually a choice made by the MOC coordinator and confirmed at the first MOC meeting
5	Select an individual to lead the process	MOC Coordinator

*Process or Piping and Instrumentation Drawings

Once Steps 4 and 5 above are complete the MOC process can begin. The completion of this table is usually the responsibility of the facility management team, this team has the authority to spend the necessary money on the MOC process and generally would be part of the final approvals process.

RECORD KEEPING

Depending on the industry keeping records of change ranges from an inconvenience to a legal requirement. In most chemical plants replacing a pump motor can just be noted on the maintenance cards for the pump while in the pharmaceutical industry this same activity may require multiple signatures and addition of various documents to the Validation and Equipment History files.

In processes falling under OSHA PSM (Occupational Safety and Health Administration Process Safety Management) rules state that all P&ID's (Process & Instrument Diagrams) affected by the change must be updated to reflect the change unless the pump motor above is essentially identical to the original.

Consider the following extract:

"OSHA1910.119(I)

Management of change.

1910.119(I)(1)

The employer shall establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures; and, changes to facilities that affect a covered process."

A properly completed MOC process form usually provides the necessary documentation when coupled with the supporting documents used in the process. A side benefit with the form is that all necessary authorization signatures are present on the document and this document usually substitutes for a formal report to management.

Note that the MOC process does not generally provide cost data for the changes to be made. This action follows completion of the MOC and is generally the responsibility of engineering.

DEFINITION: “Replacements in kind”, “Essentially identical”, “Functionally equivalent”

Back to the OSHA statement for a moment.

Care needs to be exercised here as the drive to make something essentially identical can cause delays and costs to escalate. It is not necessary that the replacement be “absolutely identical” only the essential characteristics need to be identical. The goal here is that the replacement part will bring the equipment back to its original operational characteristics.

As an example a replacement motor should turn in the same direction and at the same revolutions per minute (rpm) as the original. Even if the replacement motor has a different voltage it can still have the same effect on the process involved since rpm and horsepower available are all that generally affect the process. Horsepower only affects the process if the motor is too small and cannot maintain equipment speed or stops on electrical overload.

Continuing with that example the average electrical motor may list the following on its name plate, to the right of each “characteristic” I’ve placed either a √ or an X, the √ meaning this characteristic should be matched if possible, the X means this is generally not critical to “in kind” replacement.

MOTOR CHARACTERISTIC	CRITICAL	PROCESS IMPACT
RPMs	√	√
Horsepower	√	Maybe
Frame	√	No
NEMA Class (TEFC, Open, TENV, XP, etc.)	√	No
Torque	√	Maybe
Serial number	X	No
Manufacturer	X	No
Insulation class	X	No
Temperature rise	X	No
Model	X	No
Voltage / Phase / Hertz	√	No

Several of the “√d” items if changed would require other changes but might not impact what the process is doing; for example an 1800 rpm TEFC (Totally Enclosed Fan Cooled) motor and an 1800 rpm Open (Open Drip Proof) motor could be exchanged unless it introduced a safety

hazard. The third column shows these items and indicates that only rpm’s actually impacts the process.

A GE NEMA frame 225 3600 rpm motor rated for 440/3/60 has the same critical dimensions (shaft diameter, extension and height, bolt holes, etc.) as a Marathon motor of the same NEMA frame size and horsepower. So expending effort to locate a specific GE motor when the same frame size is available from a different manufacturer could waste time and money.

Essentially identical really refers to “an essentially identical effect” on the process. Keeping this in mind can save time and money. Properly completed MOC documents would detail any variations and explain the impact of those changes from the original. That still represents management of change.

APPROVALS

In most small facilities the approval for a change is local, as the facility size increases the range of approvals usually expands beyond local control.

In facilities with strong regulatory control (OSHA, NRC and FDA) approval may be required from technical and several non-technical groups. For example in a pharmaceutical plant the Regulatory Affairs officer is part of the MOC approval process.

In strongly unionized plants the shop steward may be part of the approval process. In a typical facility manufacturing a mechanical or chemical product the following individuals may need to be considered as “appropriate input”:

Operations	Maintenance	Traffic	Contractors
Safety	Warehousing	Quality Control	Utilities
Engineering	Environmental	Research	Sales
Regulatory Affairs	Shop Steward	Management	Waste Treatment
Human Resources	Purchasing	Scheduling	Emergency Response
Security			Team

A properly structured MOC Tool will trigger selection of the appropriate individuals using “impact” questions.

IMPACT QUESTIONS

To help determine which departments need to be represented at the MOC meeting we use “impact questions”; if a department’s operations are impacted by the change then their input is essential.

Impact questions are facility specific but some general examples will offer guidance for creating this section for any facility; we'll stay with our friends at ACME Chemicals and their cooling tower.

Situation: ACME Chemicals is a specialty chemical company manufacturing various soaps, detergents, car wash products and industrial cleaners for use in high pressure washers. As a side line they also manufacture windshield washer fluid, automotive bug spot remover, tar remover and vinyl cleaner for cars.

Problem: ACME uses steam heated vessels in its manufacturing processes and has three cooling towers to cool the vessels when the various reactions are complete. All three towers are the same size. One of these towers was severely damaged in a recent storm. A replacement tower has a delivery of six weeks.

Change: The actual replacement of the tower will be handled by a Capital Project, in the interim some piping changes will be required to maximize use of the two remaining towers while maintaining the maximum production.

Typical types of questions follow:

Engineering	Will this change require additional effort from your group?
Environmental	Will this change affect existing permits or increase the potential for chemical spills?
Human Resources	Will this change require hiring or temporary layoff of employees?
Maintenance	Will this change affect your group's workload?
Management	Will this change require additional staffing for your group?
Operations	Will this change require additional staffing for your group or significant rescheduling of production?
Purchasing	Will this change require significant effort from your group?
Quality Control	Will this change require additional testing for your group?
Regulatory Affairs	Does this change conflict with any regulatory requirements?
Research	Will this change require additional effort for your group?
Safety	Will this change introduce additional safety issues in the facility?
Sales	Will this change affect our customers?
Scheduling	Will this change require rescheduling of our production?
Shop Steward	Will this change require additional people for your group?
Traffic	Will this change cause additional traffic flow in the plant?
Utilities	Will this change require work load changes for your group?
Warehousing	Will this change require modifications to present warehouse activities?
Emergency Response Team	Will this change require additional training, equipment or techniques?

Security Does this change introduce any security concerns?
 We'll check for impact in each facility department:

DEPARTMENT	REQUIRED ACTIVITY FOR THE CHANGE	COMMENTS
Contractors	As requested	
Engineering	Design necessary re-piping, confirm maximum capacities of remaining towers	
Environmental	Work on any required permits	
Human Resources	Probably none	
Maintenance	Verify remaining towers are up to date on maintenance	
Management	Finances and approval of plans	
Operations	Provide personnel, re-train as necessary, work on production needs	
Purchasing	Get necessary materials and labor on hand for re-piping	
Quality Control	Probably none	
Regulatory Affairs	Provide for temporary approvals as needed, approve MOC documents and add explanation of effort in validation files	Only in a FDA facility
Research	Probably none	
Safety	Inspect piping modifications	
Sales	Inform customers of problems and work to shift delivery dates to lessen load on plant	
Scheduling	Rework production schedules as needed	
Shop Steward	Shift operators as needed	
Traffic	Probably none	
Utilities	Ensure pipe rework doesn't create new problems, monitor remaining towers for overload	
Warehousing	Probably none	
Emergency Response Team	Probably none	
Security	Probably none	

MOC COORDINATOR

At least one individual in the facility should be assigned the task of maintaining the MOC file system and keeping the process updated as legal requirements change. This individual also needs to be available to provide guidance and if necessary manage the MOC process each time it is used. Although the process itself is simple and can be handled by most individuals from the supervisor level and up having one point of final responsibility is usually a good thing. This is the go-to person when problems arise with the MOC process; the best situation is that this person can answer questions about the process but not necessarily about the change itself.

For example the benefit of having a non-technical manager as the MOC coordinator is that he / she will not generally try to force a specific MOC approach on a technical change. The coordinator is there to keep the process on track not to force the change in a specific direction. The MOC coordinator should act as a facilitator not as the person in charge.

Where multiple individuals are involved in the MOC process the goal is to come to a consensus on how the change is to be managed; care must be taken to ensure equal weight is given to all appropriate opinions on the change under consideration.

Generally it is advisable to have at least two individuals in the facility trained in the MOC process this will usually mean there will be no vacation or illness gaps in being able to move forward with needed changes.

SAFETY

A key piece of the MOC process is to ensure that facility safety is not compromised; this part might require a second and independent analysis such as a PHA (Process Hazards Analysis) or other safety oriented process around the proposed changes.

When the MOC committee deems this is necessary it is probably best to have a second group perform the analysis and report back to the MOC group. Using a second group for the safety analysis helps keep the MOC team focused to concentrate on its own function. A copy of the PHA paper work should be attached to the MOC documents.

DEFINED CHANGE

Management of Change varies plant to plant and industry to industry. Taking the maximum complexity of change in a facility we need to accomplish several steps to be in control of the process. In a small facility many of these steps are accomplished by a single individual.

MOC Steps

- Identify the problem, concern or need
- Define the change needed to eliminate the problem, concern or need
- Identify those departments affected by the proposed change
- Develop sufficient details of the intended change so that all affected understand
- Plan the change including start and completion dates
- Obtain approvals
- Assign responsibilities for action and documentation
- Assign someone to verify that the change corrected the original problem

Both OSHA and the FDA want to see that the process of change in their respective areas of concern is under proper control of the correct individuals. A written procedure is required for these two entities, other facilities still need to control the process and can do so in a less formal manner.

Management of Change procedures are one of those items which receive good points in the event of a facility incident such as a fire or explosion. Demonstrating that the facility has control of all aspects of its operations is essential if the incident goes to court.

The Management of Change goals are:

- Define the change to be made
- Determine which groups are impacted
- Determine who needs to have input to the change
- Determine whose approvals are needed for the change
- Assign responsibility for completing the documentation
- Assign responsibility for completing the actual mechanical change
- Obtain approval for the change
- Obtain approval for the completion of the change

TWO SIZES OF THE PROCESS

We've looked in some detail at our friends at the ACME facility which represents the larger extreme of MOC. The simplest management of change is usually the mechanic talking with the maintenance supervisor about what he is preparing to change. Notes made on the equipment file cards in Maintenance generally represent the total of record keeping required.

A simple example

Mechanic "One of the motors on the tower water pumps has burned out. I'm going to install the spare and I'll put in new belts while it is down. The installed spare will keep the tower operating while I make the change."

Maintenance Supervisor "Okay, put in a requisition for a new spare motor and belts. I'll mark the change on the equipment card, we'll scrap the old motor and belts. Tell Operations what you're doing and when so they can keep an eye of temperatures."

This whole interchange may last five minutes since every person responsible for the results and knowledgeable of the effects of the change is present in these two people.

This last sentence is critical because it defines what we must do with the worst case situation. We need all those sharing responsibility and all those having knowledge of the effects of the change represented during the MOC process. Note it says "represented during the process" and not "present at the meetings". For example the plant Safety Department may elect to have the Plant Engineering Department represent them and then Safety will sign off on the paperwork at the conclusion of the process.

As simple as it is this still represents MOC.

DOCUMENTATION

Attachments A and B are representative of the various MOC tools and MOC process record formats in use. In the most formal systems a variety of attachments generally go with these documents into the facility files including marked up P&IDs, equipment sketches and the final drawings to be used for construction along with purchase orders for equipment.

On occasion there may be very complicated explanations of the process or effects of the change. Because someone in the future will probably refer back to these files it is best to include as much explanation, including calculations and chemistry for example, as possible. This "scientific proof" of the work is critical for future understanding of complex issues.

FINAL APPROVALS

The final operation in the MOC process is to obtain approval of the actual physical change. This approval should be signed by all those taking part in the MOC process and represents acceptance of the change and includes some statement indicating that the change accomplishes the original goals.

Example Statement

“The changes accomplished during MOC (identification number or name) have corrected the original problem or will allow our department to continue to function in a temporarily satisfactory manner.

Signature of Department Representative

Date”

REFERENCES

OSHA1910.119(I)Management of change.

CONCLUSION

Management of Change, whether required by local management, corporate management or regulatory bodies (FDA, OSHA, etc.), is essential to contain costs and ensure minimal effects from the Law of Unintended Consequences.

Proper understanding of the need for the change, what the change actually will entail and the planning of the change actions are essential elements similar to those found in any capital project.

Unplanned activities tend to lead to surprises and surprises generally lead to complications and to an escalation of costs. By following well run Management of Change processes the engineer can avoid many of the negatives related to change.