MANAGEMENT OF CHANGE

NPC TRAINING PROGRAM

STUDENT HANDOUT

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COURSE OBJECTIVE

Course Objective

The objective for this course:

- To understand the keys to a successful Management of Change (MOC) program, and learn ways to develop and implement an effective and complete MOC procedure.

INTRODUCTION

Any facility or operation is subject to continual change. Changes often are made in equipment, materials and processes to increase productivity or to correct hazards. In some cases, temporary adaptations, connections, bypasses or other modifications are made to the facility or process. System administrators may decide to move employees within a specific process, which could eliminate or create positions within the facility or process. All of these changes have the potential to create new workplace hazards, some of which are not immediately recognizable. Although some changes are more critical than others, each modification should be analyzed for inherent hazards that may result from the change. Although change usually is proposed for a good reason, changes made to improve one aspect of an operation actually may increase the potential for hazards in other areas of the same operation. To assess the impact of change and to monitor its implementation, it is essential to have a policy and procedure for Management of Change (MOC).

MOC seems deceptively simple, but it can be one of the most difficult elements of HSE management to implement effectively. MOC invariably impacts other elements of a Health, Safety and Environment Management System once it is implemented. Therefore, to be truly effective, MOC needs to be integrated into all aspects of the system, and the involvement of everyone in a facility needs to be encouraged. Commitment from company management creates a climate that empowers people to initiate needed change, and provides a supportive structure for the implementation of change. Employee participation is essential. Those on the line often are the first to notice problems, and involvement in the design of the MOC program fosters commitment and ownership. Commitment at all levels is crucial. No matter how well designed an MOC program is, it will be ineffective if it is not used.

It is impossible to describe a single, uniform method for managing change. The unique circumstances and needs of each facility require that a system be designed specifically to meet those needs. This course is not offering to teach a generic MOC program; it is

designed to look at the elements of effective MOC and present ideas that can be used to design a facility-specific program that works.

The course begins with a video that dramatizes the Piper Alpha disaster, which can be directly attributed to poorly managed change and management's lack of commitment to safety. We will use the video as our reference point for discussion of the theoretical aspects of MOC and its relationship to other elements of HSE management. Next, we will build a model for an MOC program that addresses all the issues relevant to initiating, evaluating and implementing change. This model will be one that easily can be adapted in the development of your own MOC program.

ACKNOWLEDGEMENT

With thanks to Ian Sutton for the use of the information contained in his book, *Management of Change*, in the development of this material. More information about his publications is available at www.swbooks.com

DEFINITIONS

Change

Is the result of a conscious decision to exchange, substitute, convert, alter, add, modify or vary a component of an existing process, its equipment and/or control and management systems. Change can be administrative, organizational and/or technical.

Administrative Change

Administrative changes are modifications to work procedures. An example might be decreasing the frequency of inspection or maintenance in one section of an operation. The section involved may not view the change as significant; however, the consequences of this change may seriously affect other parts of the operation.

Organizational Change

Modifying the structure of an organization, regardless of its size, is a major change, and requires appropriate impact analysis. Typical organizational changes include:

- decreasing or increasing the number of supervisors
- decreasing or increasing the number of hours that employees work
- contracting instead of using company personnel
- changing operating philosophies

Technical Change

Technical changes affect the operating process. Adding or deleting equipment or materials, or renovating or changing process techniques are examples of technical change. Technical changes often are implemented to increase production and profits or to decrease hazards. Yet they can increase the potential for hazards.

MOC Policy

A public statement of the company's commitment to implement change in a safe manner. The company needs to communicate its MOC Policy to all its workers. The MOC Policy provides a values-based framework for addressing change in the company's facilities and operations. The MOC Policy must be applied to all activities that fall under the umbrella of change.

MOC Program

A component of an HSE management system. A systematic program is necessary to ensure that changes are managed in such a way that they do not compromise the safe design and operation of a facility.

MOC Procedure

The approved sequence through which changes are initiated, evaluated, authorized, implemented and followed up. The intention of an MOC procedure is to ensure that changes are reviewed and approved by people with appropriate knowledge and experience. These people will then be accountable for effective implementation of the changes.

SPIRAL TO DISASTER VIDEO

From a Management of Change perspective, we will look at the events leading up to the tragic and avoidable loss of the Piper Alpha offshore drilling rig and the lives of more than two thirds of those on board.

What was the root cause of the accident?

How could an effective MOC program have changed or mitigated the outcome?

If you had been in charge of their HSE system, what might you have done differently?

"Spiral to Disaster" Synopsis

- Piper Alpha was originally designed to be safe. The design of four fireproof modules placed hazardous areas as far away from sensitive areas as possible. However, some time later Piper Alpha is modified to extract both gas and oil. The modification places gas compression equipment close to living quarters, the helicopter landing pad and the control room.
- The addition includes two gas compression pumps, A and B.
- A work permit has been completed for a routine two-week overhaul for gas extraction pump "A," but it has not yet begun.
- On July 26th, the same gas extraction pump, "A," is taken out of service because a pressure relief valve needs maintenance. Pump "B" continues to pump.
- The pressure relief valve is removed, but the shift crew does not have time to finish the work, so the open pipe is sealed with a blank flange.
- The shift engineer fills out the appropriate work permit, and brings it to the control room. The supervisor is busy, so the shift engineer signs off on the permit himself. He does not inform the supervisor of the status of pump "A" or file this permit with the other work permit for the routine overhaul on pump "A". No one on the next shift knows about the potentially hazardous condition.

WORK PERMIT SYSTEM HAS DEGRADED.

The work permit system is treated as a formality only. Risks and possible consequences are not being thought through before permits are filled in.

- Firewater pumps were designed to work automatically but, because divers sometimes work near the pump intakes, the system is routinely switched to manual operation. This means that, in the event of a fire, the fire suppression system can be activated by hand only.
- Gas extraction pump "B" unexpectedly trips off-line and the crew unsuccessfully attempts to restart it. Delay will cause the rig to lose power, endangering the drill system – a very difficult and expensive situation.

- Because the only work permit on file for pump "A" is for the overhaul that has yet to be started, the supervisor orders it to be started. No one knows about the removed pressure relief valve, and its location is too high for the crew to see the blank flange replacement.
- Pump "A" is started. Gas pressure blows out the blank flange replacement.
- The emergency shutdown closes all the valves, which ordinarily would isolate the fire, but the blast blows out the walls in the oil separation area, which results in a huge fire.
- The fire suppression system fails because the firewater pumps are switched to manual, and are inaccessible because of the fire.

RISK ANALYSIS HAS NOT BEEN PERFORMED.

Risk analysis has not been performed on the risk of not installing expensive blast walls between the gas compression area and the oil separation area.

- Emergency procedures have collapsed and the radio room is extensively damaged, so fire-fighting coordination also falls apart. The rig has to be abandoned.
- Rig supervisors have not informed Emergency Services on shore how they are planning to evacuate the workers.
- Workers have not been informed about, or trained in, procedures for abandoning the rig. Because of the fire, they cannot go to their lifeboat muster stations, so they go to the fireproof accommodation block to await evacuation by helicopter. However, unknown to them, the wind is blowing flames over the landing pad, making evacuation impossible.
- The fire would burn itself out because the oil and gas valves into the facility have been shut down; however, oil and gas from surrounding rigs continue to flow in from pipes ruptured in the explosions.
- Personnel on the Claymore rig hear the first distress calls from the Piper Alpha rig. However, because the manager on the Claymore rig does not have the authority to shut the rigs down, he tries to reach higher level management on shore for direction.

SAFETY AS A PRIORITY

Managers need to be given the clearly mandated authority to make difficult and potentially costly decisions, if they believe the situation warrants. Corporate and management commitment to safety as a priority must be communicated to personnel.

- The oil fire causes adjacent gas lines to heat and burst in another massive explosion. Management has known about this danger for two years, since a report identified the potential for a catastrophic incident, but nothing has been done about it.
- The blast knocks out communication between the other rigs and Emergency Services, further isolating the Claymore manager. Too afraid to make the decision to shut down, he tries to reach shore through a secondary satellite system. Claymore continues to pump oil.
- In the meantime, a fire fighting ship that has been called in turns on its water pumps too quickly, tripping the system. Before the pumps can be restarted or the painfully slow evacuation equipment can be set in place, another explosion generates so much heat that the fire fighting ship has to withdraw.
- If the other rigs had shut down the flow of oil as soon as they heard the first distress call from Piper Alpha, the gas lines may have been saved and the oil fire controlled.

COMMUNICATION BREAKDOWN

Clear lines of communication need to be established and communicated to all levels. Everyone should know what to do and how to do it with confidence.

Discussion Questions

What was the root cause of the accident?

How could an effective MOC program have changed or mitigated the outcome?

If you had been in charge of their HSE Management system, what might you have done differently?

BENEFITS OF MOC

Safety

Safety is the most important reason for implementing an MOC program. An effective program will result in fewer incidents in the following areas:

Fewer hazardous releases

As we have seen from the Piper Alpha disaster, uncontrolled releases of hazardous materials will have the most serious and sometimes catastrophic Health, Safety and Environmental consequences.

Less hazardous repair and maintenance

Problems created by uncontrolled change often lead to equipment stress and damage, and repair and maintenance of such equipment can be hazardous to personnel. Some examples of these hazards are vessel entry, climbing on and moving heavy machinery, and working on high voltage electrical systems.

Fewer operational incidents

Uncontrolled (unevaluated) change may move operating conditions into an unsafe range, encouraging or often requiring operators to override built-in safety systems. In some cases, uncontrolled change means that personal protective equipment must be discarded or physical safety devices, such as pressure relief valves and fire water systems, must be temporarily overridden.

Economic considerations

Economic considerations are another compelling reason for implementing an MOC program.

Production

Production rates should increase because of fewer direct losses. Production quality and capacity should increase and energy costs decrease because there will be less need to recycle or reprocess off-spec materials.

Assets

Fewer incidents will lead to fewer losses.

Operations

Reduced down time for maintenance and repair and fewer injuries will result in increased profit.

Company reputation

A company that has a reliable HSE record satisfies its

- customers
- shareholders
- employees
- local residents
- government agencies
- banks

The company then can attract investment capital, generate sales of its product, and avoid legal expenses.

Conversely, dissatisfaction amongst customers may lead to lost sales. Anger amongst members of the public and the workforce may result in costly lawsuits or disciplinary actions by government regulatory bodies. If these problems tarnish the company's reputation, it may experience difficulty in attracting investment capital.

THE CHANGE PROCESS

Identify problem or opportunity

The change process begins when a problem or opportunity requiring change is recognized. For continual improvement to take place, it is essential that all personnel involved in an operation are actively encouraged to become part of the MOC process. Management and senior technical people must be willing to listen to the ideas of workers at all levels, including temporary and contract workers. Lack of education and experience do not mean that a person cannot come up with useful insights and suggestions.

Evaluate proposed change

The next step is to decide if the change is practical, and if the desired outcome can be achieved by using existing systems more efficiently. Examples are refresher training for employees and improved document/communication management. If possible, corrective actions should be taken while operations continue. If the desired outcome cannot be achieved merely by increasing the efficiency of existing systems, a more thorough analysis is required.

Analyze root causes

A detailed team evaluation is designed to identify the true, underlying causes of the problem and the areas in which change can be most effective.

Note: Root Cause Analysis will be addressed in greater detail during a later module of the HSE Management Training Program.

Obtain approval

Before a change can be implemented, plant management must formally approve it.

Update information

Prior to implementation of the change, safety information needs to be updated. This may include the creation of new procedures, training workers in the new procedures, and updating drawings.

Notify all involved

Before implementation, all affected parties need to be notified of the proposed change and given an overview of what is being done, the reason it is being done, and what the outcome is expected to be.

Implement change

The change is implemented as designed.

Monitor change

Assessments of the impact of change at any time during the design and operation of a facility or process are critical. Unless the implementation of change is monitored closely, opportunities to maximize the effectiveness of the MOC program can be lost. Monitoring change involves ongoing hazard/risk assessment and follow-up to ensure requirements are being met. Post-change assessment is a valuable method of identifying additional need for improvement. It is only in monitoring and follow-up of implemented change that the system can continue to be evaluated and improved.

WHEN IS MANAGEMENT OF CHANGE REQUIRED?

Many changes occur in the everyday operation of a facility. However, not all of these changes require the scrutiny of an MOC procedure. Only initiated change (conscious decision to change) can be analyzed and evaluated for its potential hazardous consequences and, therefore, managed. Reactive, spontaneous or covert (hidden) change cannot be managed because it cannot be anticipated. These kinds of changes must be managed within other elements of the HSE Management System, for instance, Hazard Identification and Mechanical Integrity.

Consideration of the following criteria should help to determine if the Management of Change procedure needs to be followed in a particular case. However, as a general rule, if the proposed change affects one or more of the other elements in the HSE management system, the MOC procedure will probably need to be followed.

Types Of Change

In-Kind/Not In-Kind change

If it is proposed to replace a piece of equipment with another that is functionally identical and of the same specifications, the change is In-Kind and does not require an MOC process.

CAUTION: Always consider that a replacement In Kind may be Not In-Kind in many respects, i.e., it may made by different people, made with different machinery, made at a different time, stored for different lengths of time in differrent conditions, or installed by different people.

Keeping the above points in mind, equipment replacement is considered In-Kind if it meets the following criteria:

- Material specifications (dimensions, weight, etc.) are the same.

- The service for which the equipment is being used remains unchanged. All process conditions must remain the same as for those of the original item. Inspection and maintenance requirements should not change.
- The replacement is part of routine maintenance. The In-Kind item is being replaced because it has a known life span. Replacing In-Kind equipment that is failing without known cause requires investigation and Management of Change.
- The new item is equivalent to the original one, not an improved model or from a new supplier. Upgrades or new vendors should be assessed using the Management of Change process. Even a seemingly minor change in any of the specifications may impact some aspect of the process in some way.

Critical change

A critical change is one that could create a serious incident if it is mismanaged. Critical changes should receive more thorough scrutiny than those considered non-critical.

CAUTION: The criticality of a proposed change is not always obvious without a detailed evaluation within the MOC process.

When a proposed change is deemed to be critical but also expensive, the proposal should be subjected to a Quantitative Risk Analysis (QRA). The story of the Piper Alpha disaster illustrates such a need. The decision not to install blast walls between the oil separation unit and gas intake lines, because they would have been too expensive, proved to be a fatal mistake. A QRA would have shown that the consequences/probability/risk equation warranted the expense of the blast walls.

Note: QRA has been mentioned in the Process Hazards Analysis (PHA) portion of the training, and will be discussed in more detail in a later session of the training.

Small/large change

Large changes usually involve many modifications to equipment, instrument systems and administrative procedures, and therefore should receive a full MOC review. However, small changes may not be reviewed with the same rigor because they can be implemented

quickly and do not appear to make a significant impact on the way a plant operates. MOC reviews, at least through a checklist, should accompany even small changes.

CAUTION: Plant experience shows that it often is the small changes that ultimately lead to serious incidents. Because they are small, they may not be subjected to the scrutiny they really deserve.

Emergency change

Emergency change is one that has to be made very quickly when someone in authority decides that the dangers of doing nothing are greater than those possibly associated with the proposed change. An emergency change may be justified for reasons such as the following:

- danger to personnel
- potential for major equipment damage
- potential for major operational loss
- serious environmental impact
- serious community complaint
- regulatory violation

Every effort must be made to minimize the number of emergency changes, because they bypass the normal systems for hazard identification. After the fact, every emergency change should be reviewed by the formal MOC procedure to ensure that no unforeseen problems exist and to ensure the change is documented and monitored.

Temporary change

In many instances temporary changes also are emergency changes. They usually are implemented to keep an operation running while a piece of equipment is repaired or replaced. **A temporary change should have an automatic termination date**. A temporary change of even a short duration should go through at least a Safety Review Checklist (see Appendix) by at least two or three people. A new procedure should be written and an emergency response prepared in case the modification does not work properly.

CAUTION: Because of the short duration of some temporary changes, there can be a temptation to by-pass the formal MOC procedure. Some of the most serious incidents have occurred because of temporary changes. We saw in the introductory session video how a temporary change that was not thought through or reviewed was the cause of the catastrophic accident in Flixborough, England in 1974.

Infrequently repeated change

Infrequently repeat changes are those that have occurred at least once before and are repeated at infrequent intervals. If a change has been carried out before, and if it was properly managed, the MOC process generally will not need to be repeated. However, it needs to be stated in the MOC records that this is the case.

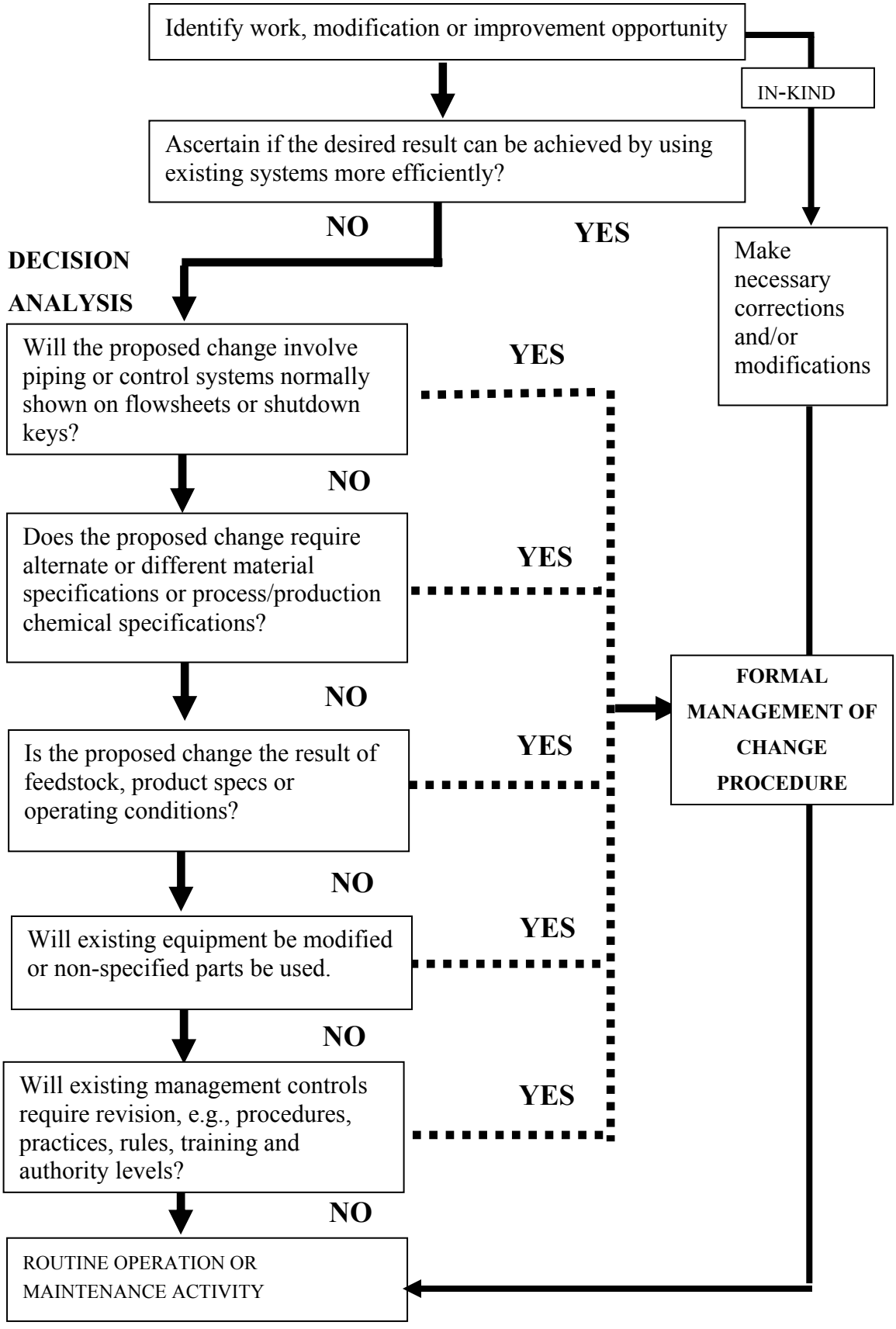
Instrumentation change

Because computerization of instrument systems and the introduction of process simulations has allowed plants to operate closer to their safe operating limits most of the time, there is less latitude for reaction should a process upset occur. Usually, a proposal to change instrumentation systems requires a formal MOC approval.

PHA recommendations for change

One of the most important roles of an MOC program is to manage the recommendations arising from a Process Hazard Analysis such as a HAZOP study. These recommendations could fall into any of the already described types of change and, like any proposed change, each recommendation must be evaluated and managed. Even if a proposed change has resulted from a PHA, an initial review may indicate the need for another PHA or a Root Cause Analysis in order to identify hidden hazards caused by this specific change. Without such an analysis, the quick solution may focus on the symptoms rather than the real cause. Hence, the problem could recur.

MOC Decision Analysis Tree

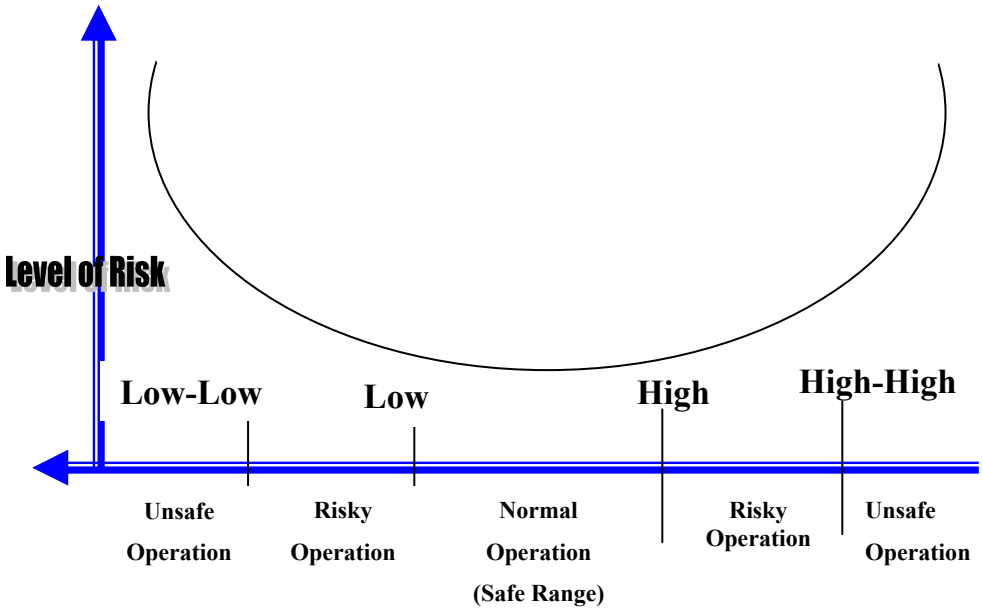


OPERATING LIMITS

A successful MOC program first must establish the safe operating range for all key variables in an operation, such as temperature, pressure and flow. It is necessary to know the upper and lower limits in order to build in necessary safeguards to ensure that no deviation outside these limits can take place. Clearly defined limits provide the necessary reference points against which proposed changes can be measured. If change is to be properly managed, these limits need to be communicated to all involved in evaluating proposed changes.

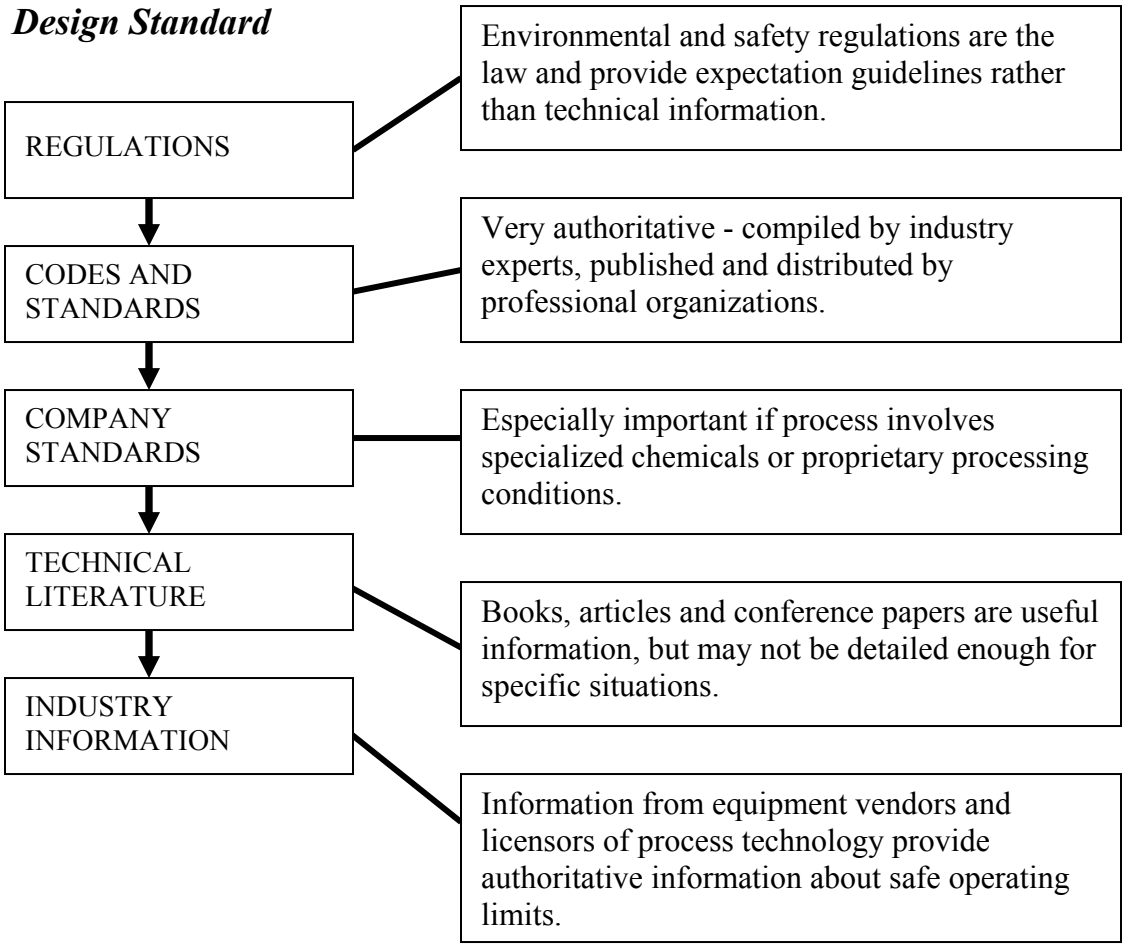
Plant conditions usually do not instantly move from safe to unsafe. This movement more often takes place along the continuum between the safe end of the operating range and the risky end of the operating range. As conditions move further away from design values, the operation becomes more risky.

CAUTION: A plant can move instantly from safe to unsafe in certain conditions, e.g., if the wrong materials are used for construction or if unintended chemical interactions occur.



Defining the Safe Operating Range

Ideally, design engineers specify operating limits. When limit values are not provided, those operating the facility need to find a means for determining safe limits and what needs to be done if those limits are exceeded. The following are the most commonly used resources for ascertaining design standards.



MOC POLICY AND PROCEDURE

Management of MOC

Each company or facility develops its own policy and MOC procedure within the overall HSE Management system. When designing such a policy and procedure it is important that the system reflects the existing culture and the way in which people in a facility actually work and interact with one another. In particular, the system should recognize that informal discussions and conversations are a feature of virtually all aspects of change management, and that these informal communications should be encouraged and, where possible, recorded and attached to the MOC form. It is often in the informal communications that valuable insights can be gained.

Team approach

A team of people should always carry out the Management of Change process. The benefits of fresh ideas and increased commitment to the process make the extra time that this may take worthwhile. More than one person should question the impact of even a small, quick change (along the lines of the Decision Analysis Tree already discussed). Because it is often the small, quick changes that have not been thought through that cause incidents, if the change warrants a formal MOC review, it should be done. This being said, it is important not to make the procedure so cumbersome that workers will be tempted to bypass the process.

Formal structure of MOC

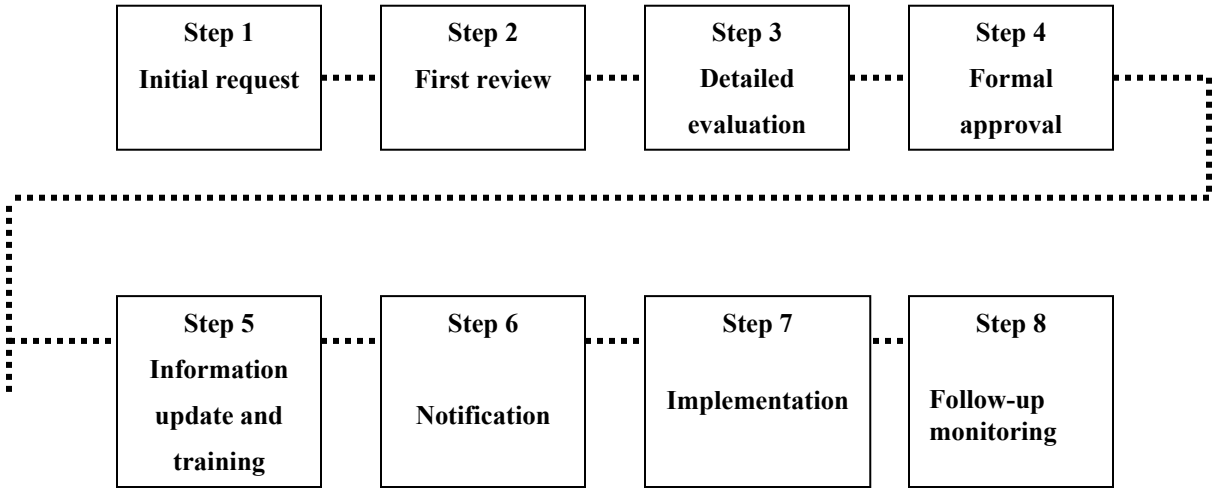
Once a suggested change has been discussed informally and the decision made to commit it to the MOC form, the formal process has begun. It is important that the MOC procedure and form be easy to use while also ensuring that a thorough review takes place before the change is implemented. Designing the procedure and the MOC form is always a challenge when first implementing a Management of Change Program. The following sections provide a basic structure that addresses all the issues that should be covered

when recommending and evaluating change and around which your own policy, procedure and MOC record form can be designed.

MOC Coordinator's responsibilities

The HSE Manager usually is responsible for ensuring that the policy and procedures are followed and that all appropriate documentation and authorizations are in place before the proposed change is implemented. In larger facilities, a separate Management of Change group often carries this responsibility.

The eight steps of the MOC process



1. Initial request

The person who makes the initial request is called the Initiator. Usually the Initiator is a manager, a supervisor or an engineer. However, all employees and contractors should feel free to propose changes they feel will make the facility safer, cleaner or more profitable. Participation of all employees is crucial if continual improvements are to be made.

It should be recognized that, by suggesting the change, the Initiator is demonstrating that he or she cares enough about the plant to want to make it better. So, for an MOC program to encourage other workers to make their own suggestions, it is important that the Initiator be kept involved in the discussions that take place once the proposal for change has been submitted. If the Initiator has proposed a solution, it should be considered along with suggestions solicited by the MOC Coordinator from others in the operation.

2. First review

Before the formal MOC process is initiated, the proposed change needs a quick, commonsense reality check from people the Initiator knows and trusts. If it turns out that the idea is impractical, not much time will have been wasted and the Initiator will not have been made to look foolish in front of his management or colleagues. Regardless of how the Management of Change system is organized, it should be recognized that the first review process will happen anyway, and so it should be incorporated into the Management of Change process. The first review should accomplish two things.

a) Make an initial assessment of the problem and the proposed solution and add relevant information and suggestions based on knowledge and experience.

b) Determine if the change is In-Kind/Not-In-Kind. If the decision is made that the change is In-Kind, the necessary action can be taken without further review or analysis, and the formal Management of Change process is not pursued.

   The "In-Kind/Not-In-Kind" decision is critically important and is the most challenging aspect of managing change. If a supposed In-Kind change turns out to be Not-In-Kind after all, a serious incident may occur.

   Because of the criticality of this decision, supervisors and lead operators need to be thoroughly trained in the criteria for deciding whether a change should be In-Kind or Not-In-Kind, particularly since the choice of In-Kind change offers a tempting way of by -passing the whole Management of Change process.

The MOC Form: Section A – Request for Change

When the request is formulated, it is entered in the first section of the MOC form. This part of the MOC form is completed by the Initiator and the MOC Coordinator. (In a smaller organization or facility, the Safety Manager usually acts as the MOC Coordinator for the duration of the MOC process. In a larger facility or organization,

there usually is a dedicated, permanent MOC Coordinator.) The MOC Coordinator assigns an MOC record number to the suggestion, and tracks the form's progress as it moves through the MOC process. The MOC Coordinator also is usually part of the MOC Committee in the final approval process. The first section of the form should contain the following information:

Administrative information

The first part of the form provides all the administrative information and the basis for the proposed change and should include the following:

- name of the Initiator and the date
- change category (technical, organizational or administrative)
- process system and facility location
- equipment and process identification
- criticality (risk ranking) of the problem
- whether the change is deemed emergency, permanent or temporary and, if temporary, its time frame
- related PHA information if the change is a recommendation arising from a study

Technical basis for the change/description of the problem

The person(s) requesting the change should clearly define the problem to be solved or outline the opportunity for improved performance. This will be the basis for other evaluations of the situation. To the extent that the Initiator is familiar with the historical background of the change scenario, it should be described at this point. In particular, if previous solutions to similar problems were attempted, and failed, a description of what happened should be provided. Here, also, the Initiator should explain why he believes action must be taken. This could be for any combination of the following reasons:

- safety
- environment
- operations
  - ➢ increased production

    - increased productivity/efficiency
    - reduced energy consumption/losses
- maintenance
    - reduced maintenance costs
    - reduced spare parts inventory
- public relations
    - public response
    - other plants in the area
    - other companies using similar technology
- regulatory requirements
- risk vulnerability (refers to those changes that are made to reduce risk, even if an incident has not yet taken place)

See pages 34 and 35 for sample MOC form.

3. Detailed Evaluation

After the first review, if it is decided that the proposed change should be pursued, it will proceed to the next stage of the process, the detailed evaluation. This evaluation is performed by a team representing different disciplines and specialties according to the nature of the change. The detailed evaluation Reviewers have three tasks.

a) Confirm the problem

i) Can the problem be solved by using existing controls more efficiently?
ii) Does the situation under consideration take the work process into an unsafe range?

b) Analyze the problem

i) Thoroughly understand the problem.
ii) Use Checklist, Root Cause Analysis or PHA if necessary.

c) Identify possible solutions

i) Brainstorm.
iii) Think out of the box.

Note: Later in the HSE Management Training Program, the identification and selection of solutions will be covered in more detail.

Evaluation Team

Each change is the responsibility of the MOC Coordinator. Following the same steps as for PHA preparation, his next task is to seek out and select appropriate experienced and technically knowledgeable Reviewers. Someone on the Team also should have an understanding of the organizational issues, such as economics and plant politics/rivalries, related to the proposed change. The Review Team needs to be sensitive to these issues and adjust the proposal accordingly. The following are the minimum selection criteria for the MOC Review Team:

- **Experience:** Members should have knowledge of the process under review and knowledge of similar problems that occurred in the past and actions that were taken to solve them.
- **Knowledge:** Collectively, the Team members should have multidisciplinary technical knowledge in areas such as chemical, mechanical and instrumentation engineering, materials of construction, equipment reliability and Health, Safety and Environment. Someone with knowledge of regulations, codes and engineering standards should review the final recommendations for compliance.
- **Creativity:** Just as for a Process Hazards Analysis, at least some of the Reviewers need to be able to think "out of the box" to generate new ideas.

Establishing time schedule and planning work flow

Having selected the Review Team, the next step for the MOC Coordinator is to plan the work flow and establish a schedule that will make sure the evaluation stays on track while also making sure that people have enough time to think about what is being proposed. Scheduling may require coordination with other departments or functions. For example, if the change requires that the plant be shut down, and a full turnaround is scheduled for the near-term, the change review needs to be completed before that turnaround so that the work required by the change can be incorporated into the overall turnaround program.

Locked list

If it is important that people with expert knowledge in a specific area are part of the Evaluation Team and that they review the information in a predefined sequence, the Reviewer list can be locked. In this way the named Reviewers must have input to the evaluation and analysis of the change in a certain order.

Technical information coordination

The Reviewers usually want access to technical documents in order to conduct their evaluations. The MOC Coordinator, where possible, should make sure he

has ready access to documents that are likely to be requested by the Reviewers. Providing a single source of information increases efficiency, and reduces the time needed for the review. Such documents frequently include the following:

- process and instrumentation diagrams (P&IDs)
- equipment and material data sheets
- environmental and safety regulations
- plot plans
- other pertinent documents

Change Evaluation: Section B of MOC Form (p.34)

Once the Reviewers have completed their analyses, each should sign off as being in agreement or disagreement with the proposed change and attach comments to the MOC form. The Coordinator should collect all of the comments and ideas that have been generated, and summarize and analyze them. Along with the Initiator, he then decides on what action should be proposed. This is written up in a report, which forms the basis for the recommendations that will be presented to management.

4. Formal Approval

Before a change can be implemented, it must be formally approved and accepted by the plant management. The MOC form and approval provide a paper trail in case there is an incident in which the change is implicated as a possible cause.

MOC Committee

Most facilities use a permanent Management of Change Committee to evaluate the proposed change on behalf of the company's management, and, assuming that it agrees with what has been proposed, and if more than one solution is presented, selects the most appropriate of those presnted. The MOC Committee usually has permanent representatives from Operations, Maintenance, Technical, Engineering Construction and Environmental and Process Safety. Other specializations can be added on an as-needed basis. Each of the Committee members should sign off on

the MOC form once they are satisfied that the change is safe and workable. The change should be given an implementation timeframe, and the responsible person from management should sign the formal authorization.

Process Hazards Analysis (PHA)

One of the most important decisions that the MOC Committee has to make is whether or not to require that a Process Hazards Analysis be carried out.
With regard to most proposed changes, the following five guidelines can provide assistance in determining whether or not a PHA is needed.

a) If the change will be large and extensive, a PHA helps to identify systems problems. For example, if the change will modify or adapt the process and/or layout of a facility, as it did in the Piper Alpha example, the effect on the rest of the facility needs to be considered.

b) If the change involves input from many disciplines and departments, then a PHA may help in the identification of accident scenarios that result from potential interdepartmental misunderstandings.

c) If the consequences of the change could lead to a serious incident, a PHA should be carried out.

d) If the proposed change involves adjusting critical operating parameters, such as reactor temperatures, it should be evaluated with a PHA.

e) If new technology or a brand new process arrangement is proposed, a PHA should be carried out in order to help identify currently unforeseen events. (Think of Piper Alpha.)

5. Information Updating

Once the change has been approved, any new Safe Operating Limits must be defined, and engineering and other documentation updated before start-up. Everyone affected

by the new values must be informed and trained in what to do if the new limits are exceeded.

Process Safety Information (PSI), such as operating and maintenance procedures; process and instrumentation diagrams (P&IDs); training and mechanical integrity documentation, must be updated before the change is completed, otherwise there is a good chance that these paperwork issues will be deferred indefinitely.

Information Updating – Section C of the MOC Form (p.35)
The MOC form should provide an information checklist that must be completed by those responsible from each area before start-up.

6. Notification

Before the change is implemented, everyone who could be affected by the consequences of the change should be notified. It is the MOC Coordinator's responsibility to make sure that relevant personnel are told of the proposed change date, along with a brief overview of what will be done, why it will be done, and what the impact on the process is likely to be.

7. Implementation

Before large changes/modifications are implemented, a Pre-Startup Safety Review (PSSR) should be performed. Because there can sometimes be a considerable time lag between the PHA/formal approval and the implementation of the change, there is a danger that uncontrolled changes may occur during the intervening period.

On smaller projects, events usually move quickly, and the Management of Change Committee's formal review of the change usually is adequate. However, management must be satisfied that the change cannot be modified between approval and implementation.

8. Follow-Up

Once the change has been implemented, there should be a follow-up supervised by the MOC Coordinator to make sure that all precautions and preparations were handled properly and that the change has actually achieved the desired results of improved safety or operability. A follow-up should include the following considerations.

a) Was the change management procedure followed?

b) Were all the other elements of process safety properly evaluated to ensure that there were no unexpected side effects?

c) Was the change itself implemented properly, and do the operators have an understanding of the new operating limits and what to do if those limits are exceeded?

SAMPLE MOC FORM

A	**Management of Change Authorization**	**MOC number:**
	Technical MOC ☐ **Organizational MOC** ☐ **Administrative MOC** ☐	**Process system/Area:** **Facility/Location:**
	Process: YES NO OTHER:	**Equip ID/Unit No**

Emergency Permanent Temporary - From:		**To:**	
Change requested by:			**Date Initiated:**
PHA Recommendation	**YES / NO**	**Risk Rank: LOW MED HIGH**	**PHA Report No.**
Technical basis for change/description of problem:			**Recommendation No.**
P&ID numbers:			**Additional sheets attached:** ☐

B ***Section B To Be Completed Before Authorization of Change***

To Be Routed By Person Responsible for MOC

EVALUATION TEAM

Functional Area:	**Person Responsible**	**Agree**	**Disagree**	**N/A**	**By Initials & Date**
Engineering:……		☐	☐	☐	_____
Health & Safety:…….		☐	☐	☐	_____
Operations:……..		☐	☐	☐	_____
Facility Management:…….		☐	☐	☐	_____
Mechanical Maintenance:...		☐	☐	☐	_____
Inst/Elect. Maintenance:….		☐	☐	☐	_____
Environmental:……...		☐	☐	☐	_____
Other:……..		☐	☐	☐	_____

MOC COMMITTEE

Name _____ Signature & Date: _____
Name _____ Signature & Date: _____
Name _____ Signature & Date: _____
Name _____ Signature & Date: _____
Name _____ Signature & Date: _____

Authorization of Change: ACCEPTED REJECTED : By: _____ (Management)

Reason for Rejection **Date:**

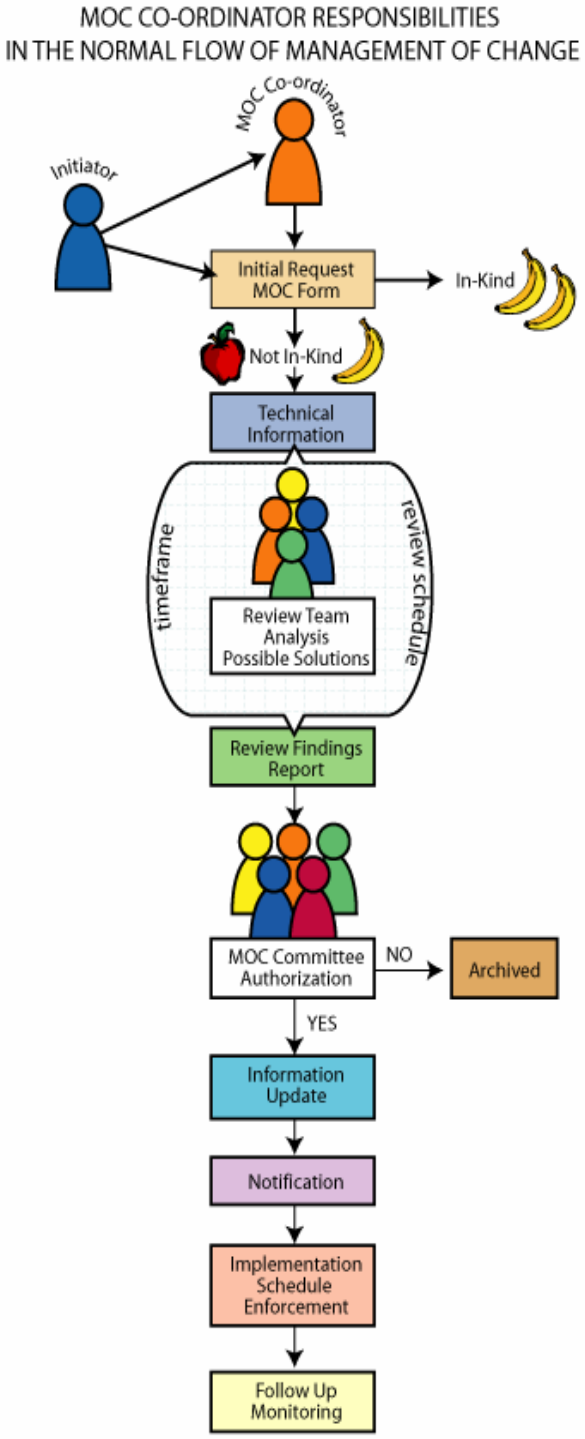
C	***Section C To Be Completed Before Startup***		***By Initials and Date***
Major Modification……..	☐ YES	☐ NO	*If YES, complete a PSSR or PHA*
Construction and Equipment in Accordance with Design Documentation…..……..	☐ YES	☐ N/A	***Date*** _____
PSI Updated……	☐ YES	☐ N/A	***Date*** _____
Operation & Maintenance Procedure Updated……	☐ YES	☐ N/A	***Date*** _____
PHA Safety/Regulatory Items Resolved…….	☐ YES	☐ N/A	***Date*** _____
Training Completed…….	☐ YES	☐ N/A	***Date*** _____
Safe Work Practices in Place……	☐ YES	☐ N/A	***Date*** _____
Emergency Response Plan in Place…….	☐ YES	☐ N/A	***Date*** _____
Impact on Health & Safety Documented…….	☐ YES	☐ N/A	(Attach detailed statement)
Does RMP Need to be Updated……...	☐ YES	☐ N/A	***Date*** _____
Additional Forms or Backup Comments…….	☐ YES	☐ N/A	***Number of Forms***

Startup of Change Authorized By: _____ (Mgmt.) Date:

Date to be Implemented By: Date MOC Implemented:

REVIEW

If MOC Coordination was your responsibility, what would you be required to do at each step? Review and make notes beside the diagram at each step



MANAGING A NEW PROJECT

It is important to have a way of safely managing change during a project. However, a conventional Management of Change program, as described in this course, is not appropriate for a new project environment. As suggested in the previous Process Hazards Analysis session of this training program, project design and construction need to be systematically reviewed using a PHA structure — with increasing levels of detail and complexity as the project grows. A formal Pre-Startup Safety Review should be undertaken after the PHA and before plant commissioning.

MOC AUDIT

Audits are an integral part of any management program, including Management of Change. There is always a gap between what management believes is occurring and what actually is taking place in the field. Hence, audits are needed to identify the gaps and to provide guidance for improvements. With regard to Management of Change, audits can help in the following areas:

- Ensures that a functioning and effective Management of Change system is in place. (The audit must ensure that changes are being properly identified and managed.)
- Identifies those situations in which the proper change analysis procedures were not followed.
- Ensures that all those people who felt that they had a contribution to make were given the opportunity to do so.
- Ensures that the formal change control procedures with respect to regulations and standards were followed.

SEE INFORMAL MOC PROGRAM EVALUATION CHECKLIST IN APPENDIX

APPENDIX

CCPA Checklist for Management of Change

MOC Program Evaluation Checklist

Canadian Chemical Producers Association (CCPA)

Checklist for Management of Change

1. Does the change involve any different chemicals that could react with other chemicals (including diluents, solvents and additives) already in the process?
2. Does the new proposal encourage the production of undesirable byproducts either through primary reactions, side reactions or introduction of impurities with the new chemical?
3. Does the rate of heat generation and/or the reaction pressure increase as a result of the new scheme?
4. Does the proposed change encourage or require the operation of equipment outside the approved operating or design limits of chemical processing equipment?
5. Does the proposal consider the compatibility of the new chemical component and its impurities with the materials of construction?
6. Has the occupational health and environmental impact of the change been considered?
7. Has the design for modifying the process facilities or conditions been reviewed by a qualified individual using effective techniques for analyzing process hazards, particularly when the modifications are being made in rush situations or emergency conditions?
8. Has there been an on-site inspection by qualified personnel to ensure that the new equipment is installed in accordance with specifications and drawings?
9. Have the operating instructions and engineering drawings been revised to take into account the modifications?
10. Have proper communications been made for the training of chemical process operators, maintenance craftsmen and supervisors who may be affected by the modification?
11. Have proper revisions been made to the process control logic, instrumentation set points and alarm points, especially

MOC Program Evaluation Checklist

The following MOC checklist provides an informal way of evaluating a Management of Change program.

Management Systems

- Is there a procedure for ensuring that all regulations and standards that apply to the facility are known about and are being complied with?
- Is there procedure for determining when a change is a "Replacement In-Kind"?
- Are changes coordinated with operations so procedures and training materials can be updated?
- Are changes analyzed with a PHA?
- What criteria are used for determining when a PHA is needed?
- Which PHA methods are used?
- Is there a clear policy as to who signs off each Management Of Change request?

Change Process

- Are there adequate controls on design changes?
- Are field changes by operations or maintenance personnel handled in the same way as engineering changes?
- What administrative control is necessary to ensure replacement of proper materials during construction/modification/maintenance so as to avoid excessive corrosion and to avoid producing hazardous compounds and reactants?
- Is there a system for ensuring that operating procedures are changed in a timely manner, and that operators and maintenance personnel are trained in the new procedures?
- Is there a system for ensuring that the Process Safety Information records are updated in a timely manner?
- Is there evidence that operators and other workers keep private supplies of spare parts so that they can get work done quickly but unofficially?

Personnel

- Is the person who initiated the change involved in all aspects of the review and follow-up process?
- Is Management of Change effectiveness considered in performance reviews?

Process Engineering

Is there a procedure that ensures that the following items are considered in any proposed change evaluation?

- location/siting
- layout
- pressure relief devices
- ignition sources
- flames
- electrical
- static electricity
- engines
- lightning
- chemical

Piping

- fireproofing
- emergency isolation
- fixed breathing air
- firewater/fixed suppression
- vent/flare systems
- drain systems
- sampling systems
- fall protection
- loading/unloading
- human factors (outside)

- heat stress
- safe access

Instrument/Control Systems

- human factors (inside)
- emergency shut down
- workstations
- alarm stations

Structural/Civil

- drainage
- support buildings
- process buildings
- secondary containment
- spill control

Mechanical

- noise
- storage tanks

Electrical

- Area Classification
- Alternate Power
- Lighting

Equipment

- In view of process changes since the last process safety review, how adequate is the size of:
  - Other process equipment?

- Relief and flare systems?
- Vents and drains?

- Are the flare, blowdown, and off-gas systems capable of handling overpressure events (including loss of utilities) for the plant after the changes have been made?
- What safety margins have been narrowed by revisions of design, construction, or operation in efforts to debottleneck operations, reduce cost, increase capacity, or improve quality?

GENERAL REFERENCES

The following are general sources of information on Management of Change and Process Safety Management used in the creation on this course.

AIChE-CCPS. 1992. Guidelines for Hazard Evaluation Procedures, New York: Center for Chemical Process Safety.

AIChE-CCPS. 1994. Guidelines for Preventing Human Error in Process Safety, New York: Center for Chemical Process Safety.

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American Petroleum Institute.1990. API Recommended Best Practice 750, Washington, DC

OSHA 29 CFR Part 1910. 1992. Process Safety Management of Highly Hazardous Chemicals, Explosives and Blasting Agents, Final Rule

Sutton, Ian S. 1998. *Management of Change*, Houston, Texas: Southwestern Books