SAND2011-0550C

Chemical

SAFETY AND SECURITY TRAINING

Management of Change

Bangkok, Thailand

3 March 2011

SAND No.

Sandia National Laboratories

Key Acronyms

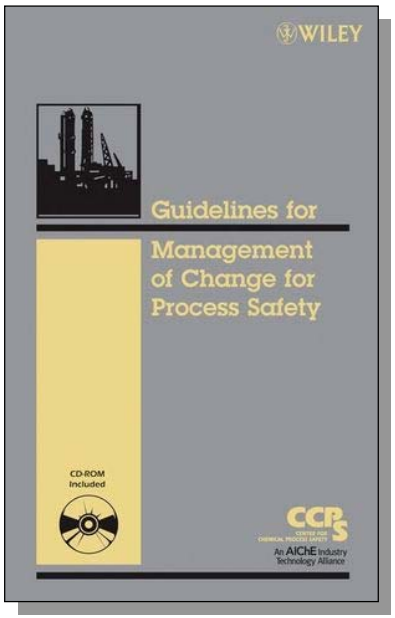
MOC = ***management of change***

RIK = ***replacement in kind***

PSSR = ***pre-startup safety review***

MOC / PSSR Resources

CCPS 2008c. Center for Chemical Process Safety, *Guidelines for Management of Change for Process Safety*, NY: American Institute of Chemical Engineers.



Chapter

1 Introduction
2 Relationship to Risk-Based Safety
3 Designing an MOC System
4 Developing an MOC System
5 Implementing and Operating an MOC System
6 Monitoring and Improving an MOC System
7 The Future of Change Management

CD-ROM (tools; example procedure, forms)

CSP
CHEMICAL SECURITY
ENGAGEMENT PROGRAM

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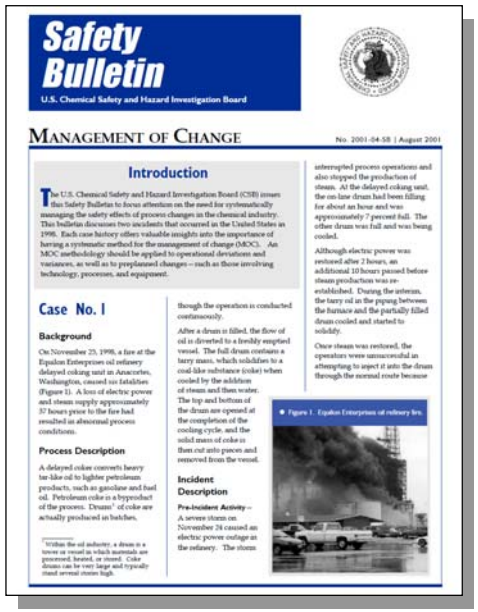
MOC / PSSR Resources

CSB 2001. **Safety Bulletin No. 2001-04-SB, "Management of Change." Washington, DC: U.S. Chemical Safety and Hazard Investigation Board.**


Safety Bulletin
U.S. Chemical Safety and Hazard Investigation Board

MANAGEMENT OF CHANGE

No. 2001-04-SB | August 2001

Introduction

The U.S. Chemical Safety and Hazard Investigation Board (CSB) issues this Safety Bulletin to focus attention on the need for systematically managing the safety effects of process changes in the chemical industry. This bulletin discusses two incidents that occurred in the United States in 1998. Each case history offers valuable insights into the importance of having a systematic method for the management of change (MOC). An MOC methodology should be applied to operational deviations and variances, as well as to preplanned changes – such as those involving technology, processes, and equipment.

Case No. 1

Background

On November 23, 1998, a fire at the Equilon Enterprises oil refinery delayed coking unit in Anacortes, Washington, caused six fatalities (Figure 1). A loss of electric power and steam supply approximately 37 hours prior to the fire had resulted in abnormal process conditions.

Process Description

A delayed coker converts heavy tar-like oil to lighter petroleum products, such as gasoline and fuel oil. Petroleum coke is a byproduct of the process. Drums[1] of coke are actually produced in batches,

[1] Within the oil industry, a drum is a tower or vessel in which materials are processed, heated, or stored. Coke drums can be very large and typically stand several stories high.

through the operation is conducted continuously.

After a drum is filled, the flow of oil is diverted to a freshly emptied vessel. The full drum contains a tarry mass, which solidifies to a coal-like substance (coke) when cooled by the addition of steam and then water. The top and bottom of the drum are opened at the completion of the cooling cycle, and the solid mass of coke is then cut into pieces and removed from the vessel.

Incident Description

Pre-Incident Activity –

A severe storm on November 24 caused an electric power outage at the refinery. The storm interrupted process operations and also stopped the production of steam. At the delayed coking unit, the on-line drum had been filling for about an hour and was approximately 7 percent full. The other drum was full and was being cooled.

Although electric power was restored after 2 hours, an additional 10 hours passed before steam production was re-established. During the interim, the tarry oil in the piping between the furnace and the partially filled drum cooled and started to solidify.

Once steam was restored, the operators were unsuccessful in attempting to inject it into the drum through the normal route because

Figure 1. Equilon Enterprises oil refinery fire.

(on course CD-ROM)

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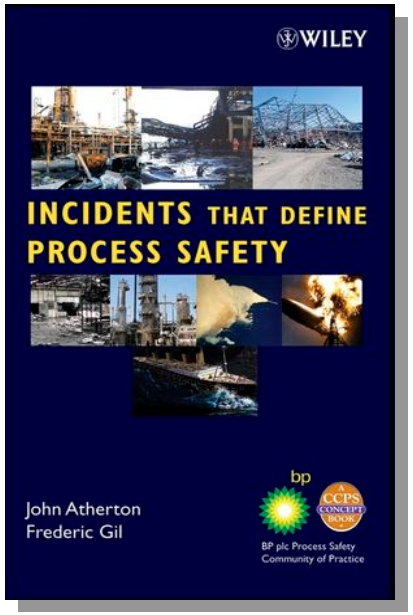
MOC / PSSR Resources

CCPS 2008b. Center for Chemical Process Safety, *Incidents that Define Process Safety*, NY: American Institute of Chemical Engineers.



Chapter 8 Management of Change

- Chernobyl, USSR: How a safety enhancement experiment turned into a world-scale disaster, April 26, 1986
- Dutch State Mines Nypro Plant, Flixborough, UK, June 1, 1974

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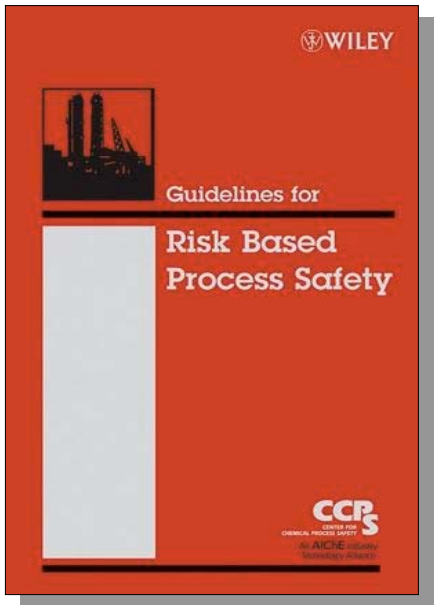

Chapter 15 Management of Change
Chapter 16 Operational Readiness

§ .1 Element Overview
§ .2 Key Principles and Essential Features
§ .3 Possible Work Activities
§ .4 Examples of Ways to Improve Effectiveness
§ .5 Element Metrics
§ .6 Management Review

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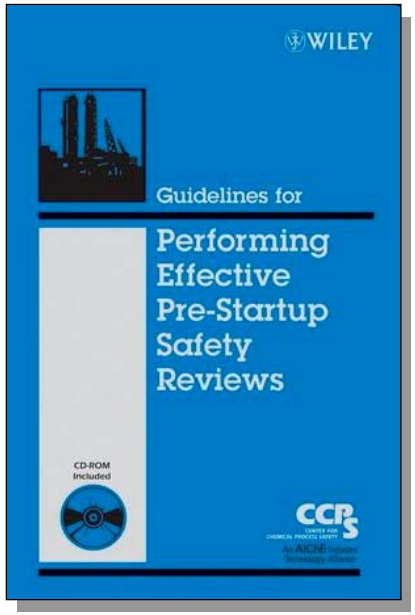
MOC / PSSR Resources

CCPS 2007b. Center for Chemical Process Safety, *Guidelines for Performing Effective Pre-Startup Safety Reviews*, NY: Amer Inst of Chem Engineers.



Chapter

CD-ROM

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Chemical SAFETY AND SECURITY TRAINING

Management of Change

1. Why manage change?
2. What is a "change"?
3. What types of changes need to be managed?
4. What is needed to manage changes?
5. What considerations need to be addressed?
6. What about temporary and emergency changes?
7. What information needs to be updated?
8. What else needs to be done pre-startup?
9. How are changes communicated?

Management of Change

1. Why manage change?

If you want to make enemies, try to change something.

- Woodrow Wilson

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REVIEW

During "**normal operation**," all hazards are contained and controlled, so the plant is operating safely.

Key concept

Changes

either

(1) shift the bounds of “Normal Operation”

or

(2) put the facility into an “Abnormal Situation”

Flixborough, England 1974

Process Safety Beacon
Special Issue
http: //www.aiche.org/ccps/safetybeacon.htm
Messages for Manufacturing Personnel

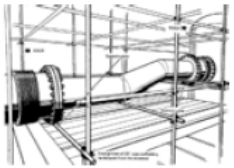
Sponsored by the 5th Global Congress on Process Safety

Flixborough — In June 2009 it will be 35 Years since the tragedy…

Originally published in June 2004, Re-issued April 7, 2009

What Happened?

One of the six reactors in series needed repairs. To minimize downtime, it was decided to bypass that one reactor and repair it off line. A temporary bypass line was installed using a pipe with an expansion bellows on each end and supported by scaffolding. Because of the rush to resume production, the new bypass was not tested prior to start up nor were engineering standards or manufacturer's recommendations considered.



Approximately three months later, the expansion bellows in the bypass line failed and released an estimated 30 tons of flammable cyclohexane. The resultant vapor cloud ignited killing 28 people and injuring 89 more. The entire plant was destroyed and hundreds of homes and stores were damaged.

See the Chemical Safety Board web site: http://www.csb.gov/safety_publications/docs/moc082801.pdf for MOC related accidents.

PSID Sponsors see:
Free Search—Management of Change

Why this Happened

The temporary modification was not adequately reviewed for potential adverse consequences!

- The temporary bypass was made with two bends in it because the nozzles on the two tanks were at different levels. The impact of internal forces and flow stresses were not considered on the expansion bellows.
- Expansion bellows were left in place on each end of the bypass line. The suitability of this design and manufacturer's recommendations were not considered.
- The weight of the temporary bypass was not securely supported—it was simply placed on scaffolding. The amount of movement and the effect of that movement on the bellows were not considered.

What You Can Do

- Always follow your company's Management of Change (MOC) procedure. *Remember, temporary changes demand the same rigorous review as do permanent changes.* If you do not utilize a MOC procedure, discuss the value it could provide to your facility.
- Make changes only after thorough hazard reviews have been conducted and approved by qualified experts.
- Use good engineering practices and manufacturer's recommendations.

Evaluate Every change, even Temporary ones—for Expected and Unexpected Consequences

DISCUSSION

Changes

either

(1) shift the bounds of “Normal Operation”

or

(2) put the facility into an “Abnormal Situation”

Which of these occurred at Flixborough?

Management of Change

1. Why manage change?
2. **What is a "change"?**

What is a “change”?

Definition:

Change. Any addition, process modification, or substitute item (e.g., person or thing) that is not a replacement-in-kind.

- CCPS 2008c Glossary

What is a “replacement-in-kind”?

Definition:

Replacement-in-kind (RIK). An item (equipment, chemicals, procedures, organizational structures, people, etc.) that meets the design specification, if one exists, of the item it is replacing.

- CCPS 2008c Glossary; see Appx. A for change vs RIK examples

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What is a “replacement-in-kind”?

Additional information in RIK definition:

- This can be an identical replacement or any other alternative specifically provided for in the design specification, as long as the alternative does not in any way adversely affect the function or safety of the item or associated items.

What is a “replacement-in-kind”?

Additional information in RIK definition:

- For nonphysical changes (relating to procedures, personnel, organizational structures, etc.), no specification *per se* may exist.
- In these cases, the reviewer should consider the design and functional requirements of the existing item (even if nothing is written down) when deciding whether the proposed modification is an RIK or a change.

DISCUSSION

Is the following a *change* or a *replacement in kind*?

1. Adding a block valve beneath a pressure relief valve so the relief valve can be removed and tested while the system is still in operation.

2. Making minor editorial changes or typographical corrections to an operating procedure.

3. Adding a break room inside the control building.

DISCUSSION

Is the following a *change* or a *replacement in kind*?

4 Ordering the same chemical ingredient from a different supplier.

5 Bringing on board a new production supervisor.

6 Installing a gear pump with the same motor, flow capacity and materials of construction as the piston pump it is replacing.

DISCUSSION

Is the following a *change* or a *replacement in kind*?

7 Sampling a waste stream on Tuesday and Friday of each week instead of Monday and Thursday.

8 Replacing a section of piping with a higher grade of steel.

9 Going from 8 hour shifts to 12 hour shifts.

10 Changing a process setpoint within previously established safe operating limits.

Management of Change

1. Why manage change?
2. What is a "change"?
3. **What types of changes need to be managed?**

What is a “change”?

There are many types of changes, such as:

- **Equipment changes**
- **Procedural changes**
- **Chemical changes**
- **Process changes**
- **Control / limit changes**
- **ITM changes**
- **Personnel changes**
- **Infrastructure changes**

All must be managed !

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DISCUSSION:

Give one example of each type of change.

Equipment change -

- **Procedural change -**
- **Chemical change -**
- **Process change -**

DISCUSSION: *Give one example of each type.*

- **Control / limit change -**
- **ITM change -**
- **Personnel change -**
- **Infrastructure change -**

Reminder

* Changes that are proposed as <u>improvements</u> can have unintended consequences, so must be managed like all other changes! *

Example: Chernobyl disaster (see CCPS 2008b).

"Any change, even a change for the better, is always accompanied by drawbacks and discomforts." - Arnold Bennett

DISCUSSION

Give some reasons why a permanent change might need to be made to a process plant.

> It is not necessary to change.
> Survival is not mandatory.
>
> *- W. E. Deming*

Management of Change

1. Why manage change?
2. What is a "change"?
3. What types of changes need to be managed?
4. **What is needed to manage changes?**

MOC ingredients for success[1]

To manage change successfully and safely, you must have:

- **A robust management-of-change program in place**
- **Clear ownership of the program and its constituent parts**

[1]CCPS 2008b p. 193

MOC program essential elements[2]

Essential elements of a robust MOC program:

1. **Agree on the technical justification for the change**
   - **at the appropriate management level**

2. **Risk-assess the proposed change**
   - **Using a multi-disciplined team of competent people**
   - **Including specialists and vendors when needed**

[2]CCPS 2008b pp. 193-194

MOC program essential elements

Essential elements of a robust MOC program (cont'd):

3 Put in place a rigorous <u>design approval system</u>

- To ensure that the proper engineering standards are applied to the design
- To ensure any deviations from design are approved by an engineering authority of sufficient knowledge and experience

4 Write formal <u>operating procedures</u> for the change

- Train all staff who are directly affected
- Obtain confirmation that training has been effective

MOC program essential elements

Essential elements of a robust MOC program (cont'd):

5 Carry out a pre-startup safety review to:

- Ensure all recommendations from the risk assessment process have been incorporated into the design
- Ensure any deviations from established standards or practices have been approved at the appropriate level
- Confirm that all integrity testing has been successfully completed
- Confirm that operating procedures and training are complete

MOC program essential elements

Essential elements of a robust MOC program (cont'd):

6 **Monitor the period of change closely**

- With people of sufficient knowledge and experience
- Feeding back any lessons learned for the benefit of future projects

Management of Change

1. Why manage change?
2. What is a "change"?
3. What types of changes need to be managed?
4. What is needed to manage changes?
5. **What considerations need to be addressed?**

MOC considerations

All staff must follow a written MOC procedure to assure that all of the following considerations are addressed prior to making any change:

- **Technical basis for the proposed change**
- **Impact of change on safety and health**
- **Modifications to operating procedures**
- **Necessary time period for the change**
- **Authorization requirements**

- U.S. OSHA Process Safety Management Standard, 29 CFR 1910.119(l)(2)

MOC considerations

Aids in developing/implementing an MOC procedure:

- **Workflow diagrams**
  - See Simplified MOC Flowchart on last 2 slides
- **Forms**
  - Example forms given in CCPS 2008c appendices
- **Electronic MOC tracking systems**
  - From simple to sophisticated
  - Can tie into plant's work order system
  - Can inform personnel by email
  - Can route MOCs for approvals

CCPS 20 YEARS
CENTER FOR CHEMICAL PROCESS SAFETY
An AIChE Industry Technology Alliance

Process Safety Beacon

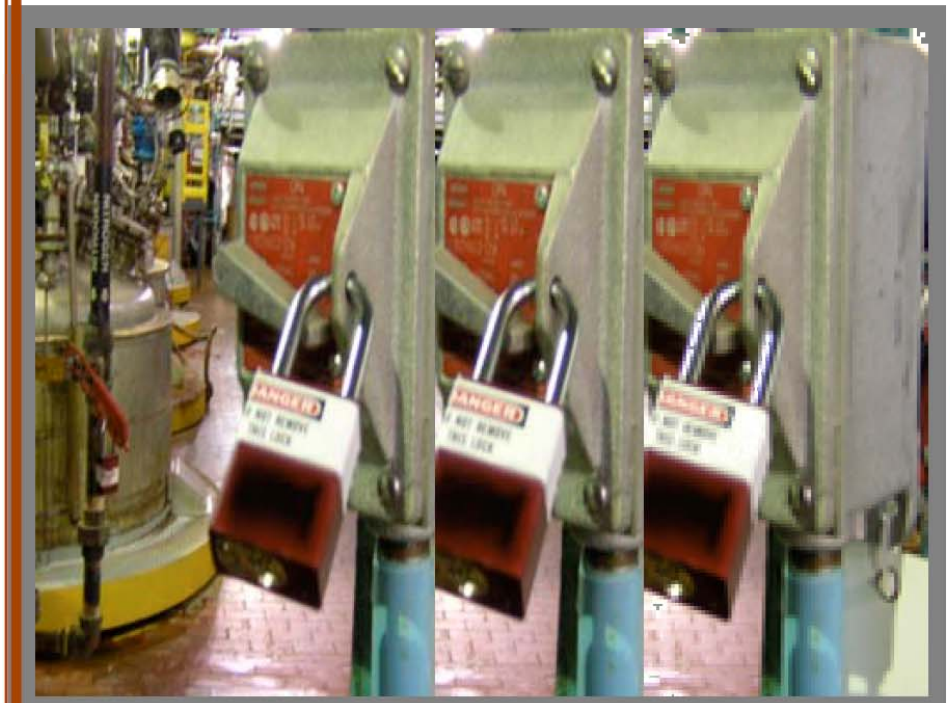
http: //www.aiche.org/ccps/safetybeacon.htm

Messages for Manufacturing Personnel

Sponsored by CCPS Supporters

June 2005

Too Many Start-Stop Switches



PSID Members see: Free Search--Agitator

Here's What Happened

The evening shift was assigned to clean an agitated mixing vessel. The supervisor asked the lead operator to complete the "Lock out." The lead operator tagged and locked out the motor starter in the Motor Control Center, verified the motor would not start by pressing the Start button and put a lock and "Danger—Do Not Operate" tag on the Start-Stop station near the vessel. The supervisor then issued the Confined Space Entry permit and two workers entered the vessel and cleaned it for the rest of the shift.

The oncoming day shift needed to reissue the Confined Space Entry permit. When they tried the Start button on the Start-Stop station, the agitator started! The agitator motor was **NOT** locked out!

http://www.psidnet.com

How Did This Happen ?

Easier than you might imagine. Did the Lock-out undo itself? No, but the wrong motor was locked out. How can that happen when the starter was labeled the same as the agitator? And, why didn't the agitator start when the Start button was tested the first time?

Here's how. Several months before, the agitator motor was changed out to a larger size. The size increase required a larger motor starter and wiring. Because the plant might need the "old" system again some day, it was not removed. Instead, a new Start-Stop station was installed near the vessel, in fact, right next to the old Start-Stop station. The "old" Start-Stop station was on the flange part of a column next to the vessel and the "new" Start-Stop station was in the web of that same column. When the technician locked out and tested the system, he was testing the "old" system which was disconnected. The "new" system was still active!

What You Can Do

- Follow all safety procedures as written. Do not take short cuts or assign your duties to someone else.
- Keep abreast of changes in your unit. Know what has been changed and how that change might affect your job.
- Use your Management of Change procedures to ensure that all out-of-service equipment is labeled so that it cannot be confused with equipment being used.
- Consider disconnecting electrical leads whenever uncertainty exists.
- Check and re-check, especially where safety is concerned. Look around the area. Is anything unusual?
- Remember that your safety depends on others and your own personal actions. Don't bet your life on someone else's word. Verify safety checks yourself.

When you do a safety check, make sure it is on the right equipment !

DISCUSSION

Discuss the lockout near-miss situation.

- **What could have happened?**
- **How could this been avoided?**
- **Where does this fit into Management of Change?**

Management of Change

1. Why manage change?
2. What is a "change"?
3. What types of changes need to be managed?
4. What is needed to manage changes?
5. What considerations need to be addressed?
6. **What about temporary and emergency changes?**

What is a “temporary change”?

Definition:

Temporary change. A change that is implemented for a short, predetermined, finite period.

- CCPS 2008c Glossary

DISCUSSION

Give some reasons why a *temporary* change might need to be made to a process plant.

Temporary changes

"Temporary" changes have led to many severe process safety incidents.

- **Flixborough (1974) is an example of a temporary equipment modification**
- **See CSB 2001** (on CD-ROM) **for two incidents involving *deviations from normal operating procedures due to abnormal situations***

Safety Bulletin

U.S. Chemical Safety and Hazard Investigation Board

MANAGEMENT OF CHANGE

No. 2001-04-SB | August 2001

Introduction

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Case No. 1

Background

On November 23, 1998, a fire at the Equilon Enterprises oil refinery delayed coking unit in Anacortes, Washington, caused six fatalities (Figure 1). A loss of electric power and steam supply approximately 37 hours prior to the fire had resulted in abnormal process conditions.

Process Description

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[1] Within the oil industry, a drum is a tower or vessel in which materials are processed, heated, or stored. Coke drums can be very large and typically stand several stories high.

though the operation is conducted continuously.

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Incident Description

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Although electric power was restored after 2 hours, an additional 10 hours passed before steam production was re-established. During the interim, the tarry oil in the piping between the furnace and the partially filled drum cooled and started to solidify.

Once steam was restored, the operators were unsuccessful in attempting to inject it into the drum through the normal route because

Figure 1. Equilon Enterprises oil refinery fire.

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Temporary changes

A temporary change must go through the same documentation, review and authorization procedure as a permanent change.

IN ADDITION:

- **Change is only authorized for a specific time period**
- **Plant must then be put back to its original state**

What is an “emergency change”?

Definition:

Emergency change. A change needed in a situation where the time required for following the normal MOC procedure could result in an unacceptable safety hazard, a significant environmental or security incident, or an extreme economic loss.

- CCPS 2008c Glossary

DISCUSSION

Give some reasons why an *emergency* change might need to be made to a process plant.

Emergency changes

Typical considerations for emergency changes:

- Have a procedure in place ahead of time to deal with emergency changes, including authorization requirements
- Obtain and document at least verbal approval from line management (often the plant manager or designee)
- Communicate the change to all affected persons
- Follow up through the normal MOC process as soon as possible

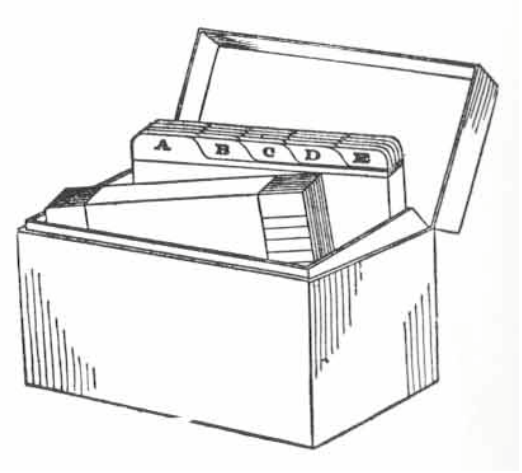
Management of Change

1. Why manage change?
2. What is a "change"?
3. What types of changes need to be managed?
4. What is needed to manage changes?
5. What considerations need to be addressed?
6. What about temporary and emergency changes?
7. **What information needs to be updated?**

Information updates

The MOC procedure needs to assure that <u>all information defining "normal operation"</u> is updated when changes are made; e.g.:

- **Process safety information, including**
  - **Drawings**
  - **Chemical data**
  - **Equipment files**
  - **Process chemistry**
  - **Facilities design data**
  - **Material / energy balances**
  - **Safe upper and lower limits**



Information updates

The MOC procedure needs to assure that <u>all information defining "normal operation"</u> is updated when changes are made; e.g.:

- Process safety information
- **Written procedures**
  - **Operating**
  - **Maintenance**
  - **Emergency**
  - **Safe work practice**

Information updates

The MOC procedure needs to assure that <u>all information defining "normal operation"</u> is updated when changes are made; e.g.:

- **Process safety information**
- **Written procedures**
- **Inspection / testing / maintenance schedules**

Information updates

The MOC procedure needs to assure that <u>all information defining "normal operation"</u> is updated when changes are made; e.g.:

- **Process safety information**
- **Written procedures**
- **Inspection / testing / maintenance schedules**
- **Control system documentation**

DISCUSSION

What are some challenges to getting the process safety documentation updated?

How can they be overcome?

Management of Change

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6. What about temporary and emergency changes?
7. What information needs to be updated?
8. **What else needs to be done pre-startup?**

Pre-startup safety reviews

PSSR = ***pre-startup safety review***

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Pre-startup safety reviews

A PSSR confirms that, before re-starting a process:

- ❑ **Construction and equipment is in accordance with design specifications**
- ❑ **Safety, operating, maintenance, and emergency procedures are in place and are adequate**
- ❑ **Training of each employee involved in operating a process has been completed**
- ❑ **Modified facilities have completed the MOC process**
- ❑ **For new facilities, a process hazard analysis has been completed and recommendations are resolved**

- U.S. OSHA Process Safety Management Standard, 29 CFR 1910.119(i)(2)

Pre-startup safety reviews

Key elements of successful PSSRs:

- Performed by team of knowledgeable persons
- Includes a field inspection of modified facilities
- Uses a checklist to ensure completeness (see CCPS 2007b)
- Generates list of pre-startup follow-up items
- Is integrated with the MOC procedure

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Pre-startup safety reviews

Note:

- **Larger projects may require multiple PSSRs**
- **Non-physical changes, such as modifications to operating procedures, may not require PSSRs**
- **PSSRs are part of the more general idea of "operational readiness" (see CCPS 2007a)**

Management of Change

1. Why manage change?
2. What is a "change"?
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5. What considerations need to be addressed?
6. What about temporary and emergency changes?
7. What information needs to be updated?
8. What else needs to be done pre-startup?
9. **How are changes communicated?**

Communication of changes

Inform of and train in the change:

WHO?

- **Employees involved in operating a process**
- **Maintenance and contract employees whose job tasks will be affected by a change in the process**

WHEN?

- **before starting up the process or affected part of the process.**

- U.S. OSHA Process Safety Management Standard, 29 CFR 1910.119(l)(3)

Communication of changes

Inform of and train in the change:

HOW?

- **Train through plant training program when needed**
  - **Use appropriate techniques**
  - **Verify understanding**
- **Otherwise inform, such as by**
  - **Safety meetings**
  - **Beginning-of-shift communications**
  - **E-mail**
- **Document training / informing**

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Communication of changes

Inform of and train in the change:

WHAT?

- **Physical changes**
- **Personnel or responsibility/accountability updates**
- **Operating / maintenance procedures**
- **Emergency procedures; Emergency Response Plan**
- **Safe work practice procedures**
- **Control limits or practices**

For Discussion

A process manufactures a key chemical intermediate by an exothermic chemical reaction.

The plant chemist has an idea that if a particular new catalyst is used, the yield will be increased by 5%.

- ***This change might lead to what kinds of process safety issues?***
- ***What kind of training or informing might be needed?***

MOC “To Do” List

- **Regularly train all staff to recognize change.**
  - **MOC awareness training**
  - **Changes vs RIKs**
  - **Refresher training**

MOC "To Do" List

- Regularly train all staff to recognize change.
- **Follow a written procedure to manage changes.**
  - **Assign roles, responsibilities and accountabilities**
  - **Include temporary and emergency changes**
  - **Describe the entire process for managing changes**

NOTE: Different procedures can be followed for different types of changes (equipment, personnel, control system, operating procedure changes, etc.)

MOC “To Do” List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ **Review all proposed changes for safety impact.**

MOC “To Do” List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ **Have all changes <u>approved</u> before making them.**

MOC "To Do" List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ Have all changes approved before making them.
- ❑ **Properly reverse all temporary changes.**
  - **– Go back to exactly how it was before, or do a MOC**
  - **– Don't exceed the authorized time limit**
  - **– Go through the MOC process again to make permanent**
  - **– Inform all affected persons of the reversal**
  - **– Document the reversal**

MOC “To Do” List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ Have all changes approved before making them.
- ❑ Properly reverse all temporary changes.
- ❑ **<u>Update</u> all affected process safety information.**

MOC "To Do" List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ Have all changes approved before making them.
- ❑ Properly reverse all temporary changes.
- ❑ Update all affected process safety information.
- ❑ **Communicate changes to all affected persons.**
  - **Including reversal of temporary changes**
  - **Re-training may be required for some changes**

CSP CHEMICAL SECURITY ENGAGEMENT PROGRAM

Chemical SAFETY AND SECURITY TRAINING

MOC “To Do” List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ Have all changes approved before making them.
- ❑ Properly reverse all temporary changes.
- ❑ Update all affected process safety information.
- ❑ Communicate changes to all affected persons.
- ❑ **Field-inspect changes before re-starting.**

CSP
CHEMICAL SECURITY ENGAGEMENT PROGRAM

Chemical
SAFETY AND SECURITY TRAINING

MOC "To Do" List

- ❑ Regularly train all staff to recognize change.
- ❑ Follow a written procedure to manage changes.
- ❑ Review all proposed changes for safety impact.
- ❑ Have all changes approved before making them.
- ❑ Properly reverse all temporary changes.
- ❑ Update all affected process safety information.
- ❑ Communicate changes to all affected persons.
- ❑ Field-inspect changes before re-starting.

Final Suggestions

- **Assign an MOC Coordinator who is**
  - **Knowledgeable**
  - **Conscientious**
  - Persistent
  - **Detail-oriented**
  - **Well-organized**

Final Suggestions

- Assign an MOC Coordinator
- **Keep an MOC Log**
  - **E.g., spreadsheet by MOC number**
  - **Keeps track of status of all MOCs**
  - **Helps ensure temporary MOCs do not exceed authorized closure date**
  - **Helps report key MOC metrics to management**

Final Suggestions

- Assign an MOC Coordinator
- Keep an MOC Log
- **Complete PSSR follow-up items before restarting**
  - **Signage**
  - **Painting**
  - **Insulation**
  - **Clean-up**
  - **Procedure revisions and approvals**
  - **Training and Communications**
  - **Paperwork**
  - **etc.**

Final Suggestions

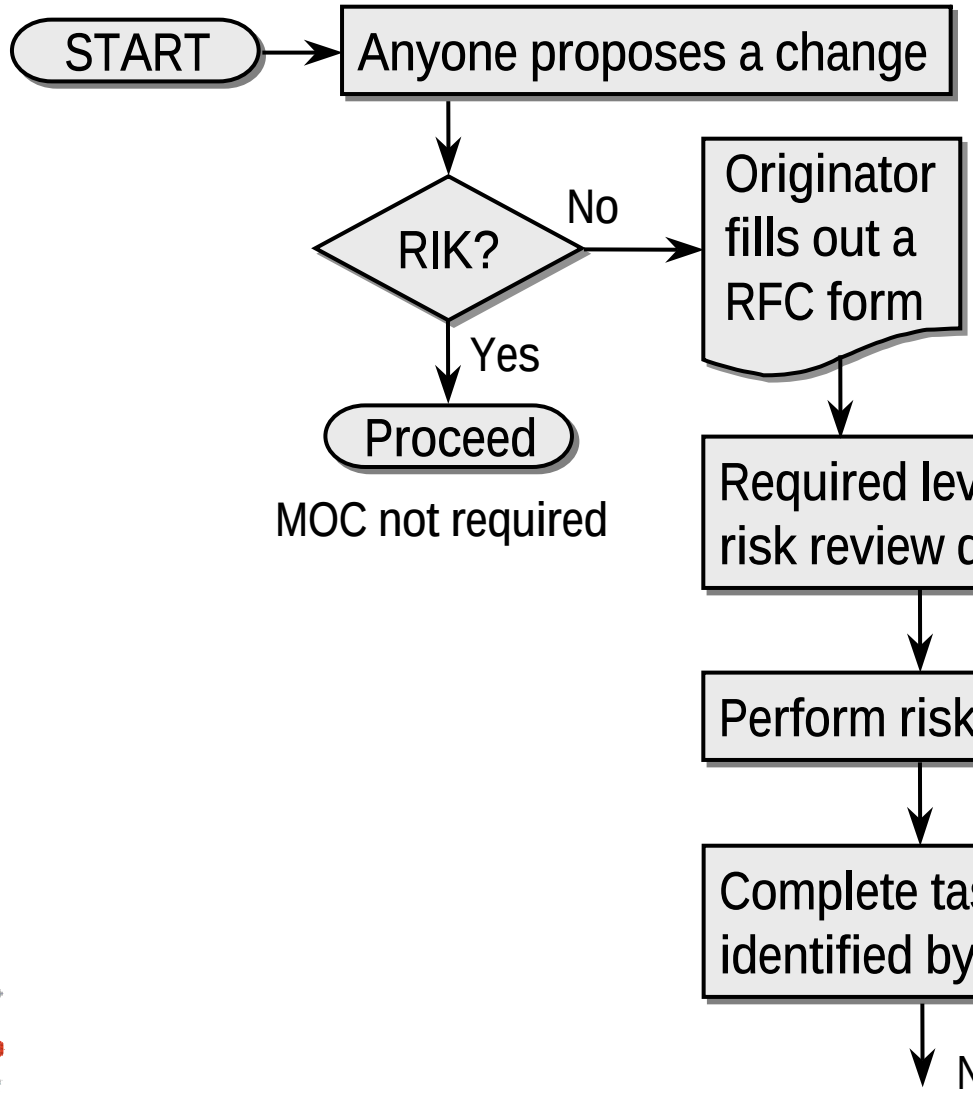
- Assign an MOC Coordinator
- Keep an MOC Log
- **Complete PSSR follow-up items before restarting**
  - **Signage**
  - **Painting**
  - **Insulation**
  - **Clean-up**
  - **Procedure revisions and approvals**
  - **Training and Communications**
  - **Paperwork**
  - **etc.**

Possible exception:
Red-lined P&IDs not re-drafted

Final Suggestions

- Assign an MOC Coordinator
- Keep an MOC Log
- Complete PSSR follow-up items before restarting
- **Don't short-cut the safety & health review!**
  - **(Same as the risk assessment)**

Simplified MOC Flowchart



RFC = "Request for Change"
- Describe what is to be changed
- Identify the type of change
- Document the technical basis
- Specify a time limit if any

- What-If, HAZOP, Safety Review, etc.
- Use required participants per MOC procedure

- Answer questions raised
- Implement risk-control measures

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Simplified MOC Flowchart (continued)