# MANAGEMENT OF CHANGE: AN OVERVIEW

**NJIT Student Section AIChE**

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# WHO AM I?

- Peter Sibilski, P.E., CEM, FAIChE
- Plant Manager, Pharmetic Manufacturing Co., LLC
- B.S., Chemical Engineering - NJIT
- MBA, Technology Management - University of Phoenix
- Work experience includes:
  - Diamond Shamrock – specialty chemicals
  - Occidental Chemical – specialty chemicals
  - Henkel Chemical – specialty chemicals
  - Olin Hunt – microelectronics chemicals
  - EI Associates – A/E consulting
  - BOC Gases – industrial gases
  - Schering-Plough - pharmaceuticals
  - ALZO International, Inc. – specialty chemicals

# ATTRIBUTION

*Information presented on these slides was obtained (with permission) from:*

- **An Engineer's Guide to Management of Change** – R. Wayne Garland, CEP Magazine, March 2012

- *…as well as over 30 years of experience in the chemical process industry!*

# WHY DO WE NEED "MANAGEMENT OF CHANGE"?

- **Seems like a pretty straightforward question with obvious answers:**
  - ***Promotes safe operations***
  - ***Prevents injuries and death***
  - ***Favorably impacts the bottom line***
  - ***…..but maybe it wasn't always so obvious…***

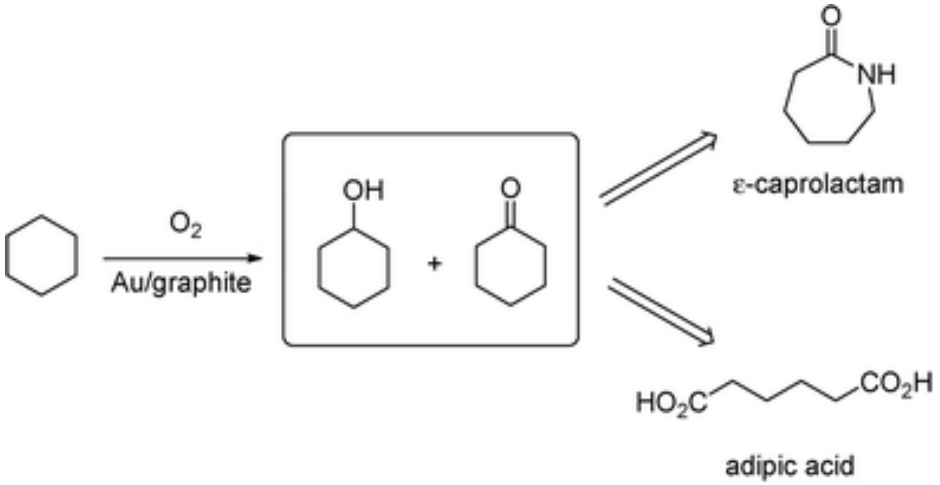
http://www.youtube.com/watch?v=8A1xSCUtB-M

# FLIXBOROUGH, ENGLAND 1974

- On June 1, 1974, an explosion at a chemical plant near the village of Flixborough, England killed 28 people and seriously injured 26

# FLIXBOROUGH, ENGLAND 1974

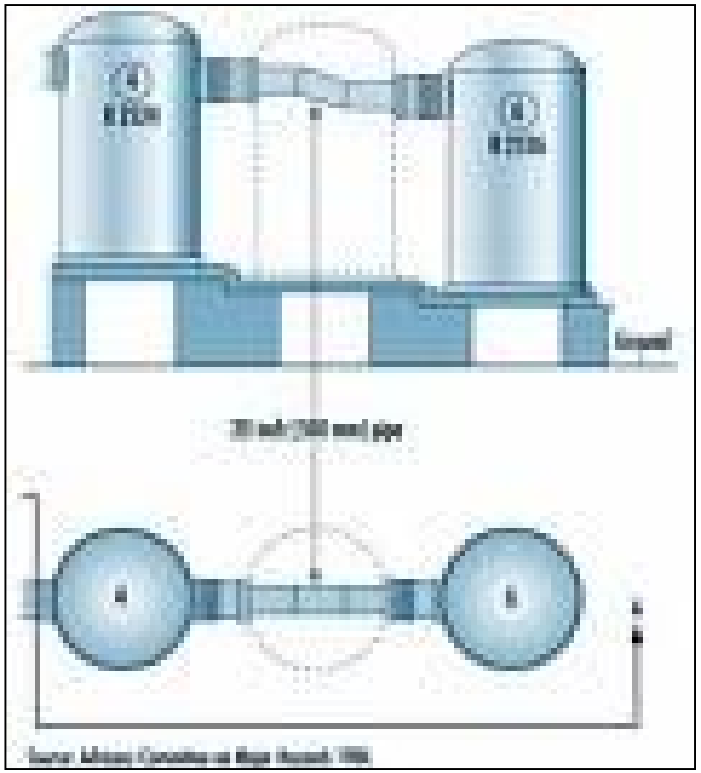
- The chemical plant was owned by Nypro (UK) and had been in operation since 1967, producing Caprolactam, a chemical used in the production of Nylon
- The process involved in the accident was an oxidation of cyclohexane with air in a series of 6 reactors, producing a mixture of cyclohexanol and cyclohexanone:



# FLIXBOROUGH, ENGLAND 1974

- Two months prior to the explosion, a crack was discovered in the # 5 reactor

- A temporary 50 cm (20 inch) diameter pipe was installed to bypass the leaking reactor to allow repairs to be made without interrupting production



# FLIXBOROUGH, ENGLAND 1974

- **At 4:53 pm on Saturday, June 1, 1974, the temporary bypass pipe containing cyclohexane at 150$^{o}$C and 1 MPa (~ 145 psi) ruptured, possibly as a result of a fire on a nearby 8 inch pipe, which had been burning for nearly an hour**
- **Within about 1 minute, approximately 40 tons of cyclohexane leaked from the pipe and formed a vapor cloud an estimated 100-200 meters in diameter**
- **The vapor cloud exploded, completely destroying the plant***
  - ** Ignition source was probably a furnace at a nearby hydrogen plant*

# FLIXBOROUGH, ENGLAND 1974

- The force of the explosion was estimated to be the equivalent of about 15 tons of TNT
- All 18 control room employees were killed, 9 other site workers were killed, and 1 delivery driver died in his truck of a heart-attack
- If the explosion occurred on a weekday, the casualties could've been upwards of 500 people
- Resulting fires raged in the area for 10 days
- The blast was heard up to 25 miles away

# FLIXBOROUGH, ENGLAND 1974

- **It was determined that the bypass pipe had failed due to unanticipated lateral stresses during a pressure surge**
  - ***The bypass pipe had not been designed by engineers experienced in high-pressure piping design***
  - ***No plans or calculations were produced***
  - ***The pipe was not pressure tested before use***
  - ***The pipe was mounted on temporary scaffolding poles that allowed it to twist under pressure***

# NOT THE ONLY INCIDENT

AIChE NORTH NJ WHERE TECHNOLOGY CONNECTS

| Year | Location | Incident | Deaths | Injuries |
|---|---|---|---|---|
| **1976** | Seveso, Italy | bursting disc rupture & chemical release | 0 | ~200 |
| **1984** | Mexico City, Mexico | ruptured LPG pipe leading to a series of explosions | ~ 600 | ~7,000 |
| **1984** | Bhopal, India | MIC release when water introduced to storage tank | ~2,000 | ~100,000 |
| **1985** | Institute, WV | methylene chloride & aldicarb oxide release | 0 | 135 |
| **1988** | Norca, LA | pipe elbow failure leading to cracker explosion | 5 | 23 |
| **1988** | Henderson, NV | welding sparks ingnited chemical, leading to explosions | 2 | 350 |
| **1989** | Richmond, CA | H2 line weld failed, leading to fire and reactor failure | 0 | 9 |
| **1989** | Pasadena, TX | reactor seal blew out resulting in fires & explosions | 24 | 132 |
| **1990** | Channelview, TX | wastewater treatment tank explosion | 17 | 0 |
| **1990** | Cincinnati, OH | flammable cleaning solvent ignited causing fire & explosion | 2 | 41 |
| **1991** | Lake Charles, LA | superheated oil and water resulted in steam explosion | 6 | 8 |
| **1991** | Sterlington, LA | explosion & series of fires at nitroparaffin plant | 8 | 128 |
| **1991** | Charleston, SC | explosion due to ingredient contamination & loss of cooling | 9 | 33 |
| | | | | |

# MANAGEMENT OF CHANGE

- What is the (OSHA) definition of change?
- What are some common types of changes?
- Why do we need a management of change process?
- What is the basic MOC workflow process?
- What are the keys to a successful MOC Program?

# DEFINITION OF CHANGE

- **In the context of OSHA's Process Safety Management world:**

  *…change includes all modifications to equipment, procedures, raw materials, and processing conditions other than "replacement in kind".*

# TYPES OF CHANGES

1. **Facility Changes:**
   - *These include any modifications made to the equipment*
2. **Control System Changes:**
   - *These include changes to the programming or control logic, including who has access to the logic*
3. **Information System Changes:**
   - *These include changes to raw material specifications resulting in the replacement of a chemical*
4. **Procedural Changes:**
   - *These include any changes to previously established safety, quality or operating limits*

# WHY IS MOC PROCESS NEEDED?

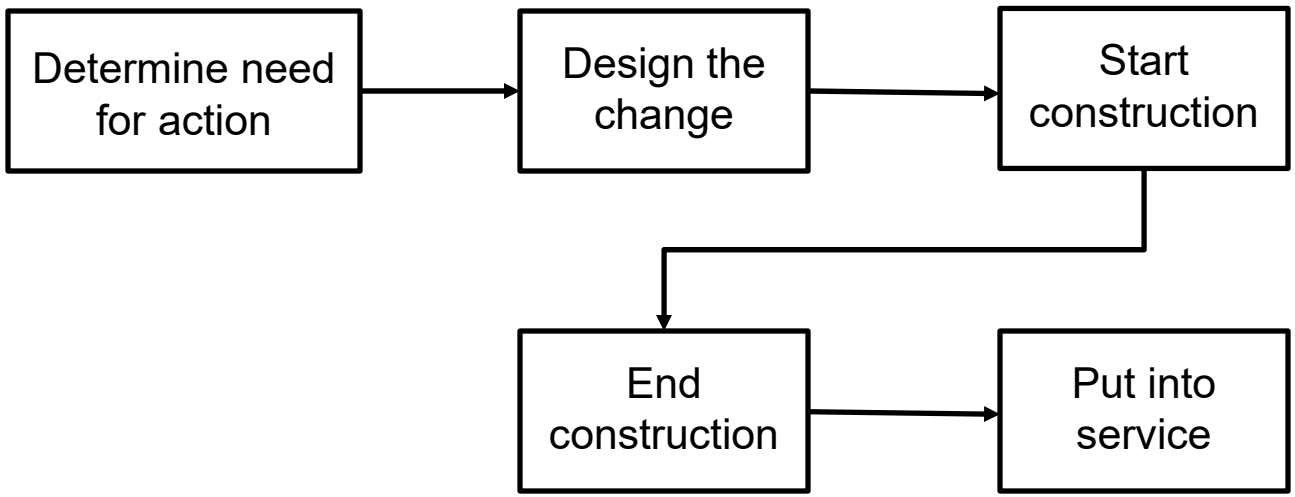
- The story of “Sam Shortcut”

# SAM SHORTCUT'S PROJECT

- **A facility change is needed:**
  - *Alter some piping and a control valve to re-route a conveyor system to an existing storage bin (Bin 99), that is currently not in service*
- Because of the simplicity of the project, (and because he's already over-worked), Sam decides to by-pass the MOC process and gets the alterations done by the area mechanics and electricians

# SAM SHORTCUT'S PROJECT

- **Simple project workflow process:**



# SAM SHORTCUT'S PROJECT

- **Sam is proud of his efficiency until……..**
  - *The material transfer operator cannot get product to go into Bin 99*
  - *The area operations manager has a quality problem because material was transferred to the wrong bin*
  - *An operator returning from vacation uses the old targets for the process variables because he was unaware of the changed targets for the new product*
  - *The area operations manager is upset again because there has been an accidental discharge – the primary level sensor on the bin failed and there was no back-up*

# SAM SHORTCUT'S PROJECT

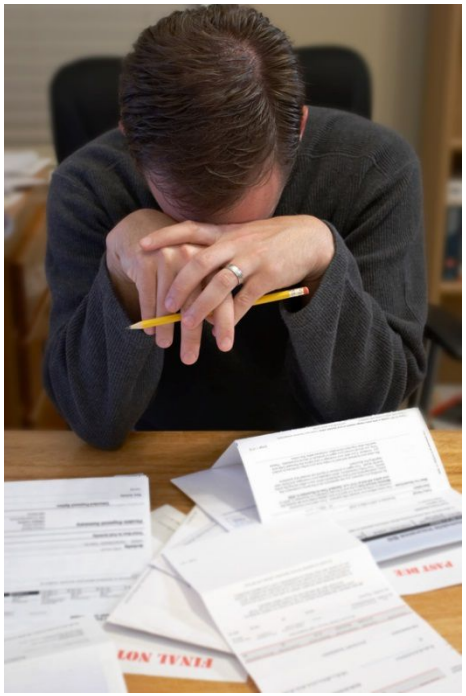
- **Sam is proud of his efficiency until……..**
  - *The shift team manager is concerned about the relief device on Bin 99 cycling frequently and possibly releasing inert gas into the production area*
  - *The pressure vessel inspector becomes aware of the change and believes the state codes for pressure vessels could apply – he asks Sam if the bin is rated for the new operating pressure and if the relief device is set correctly*

# SAM SHORTCUT'S PROJECT

- **Sam is proud of his efficiency until……..**
  - *The environmental coordinator becomes aware of the frequent relief valve cycling and is concerned that it could be a violation of the environmental permit*
  - *Sam returns to work on a Monday morning and gets a call from a control system mechanic that there was a problem in material transfer that shut down production for the weekend. The electricians trouble-shooting the problem could not locate the source because the drawings were not up-to-date and did not reflect the recent changes to Bin 99*

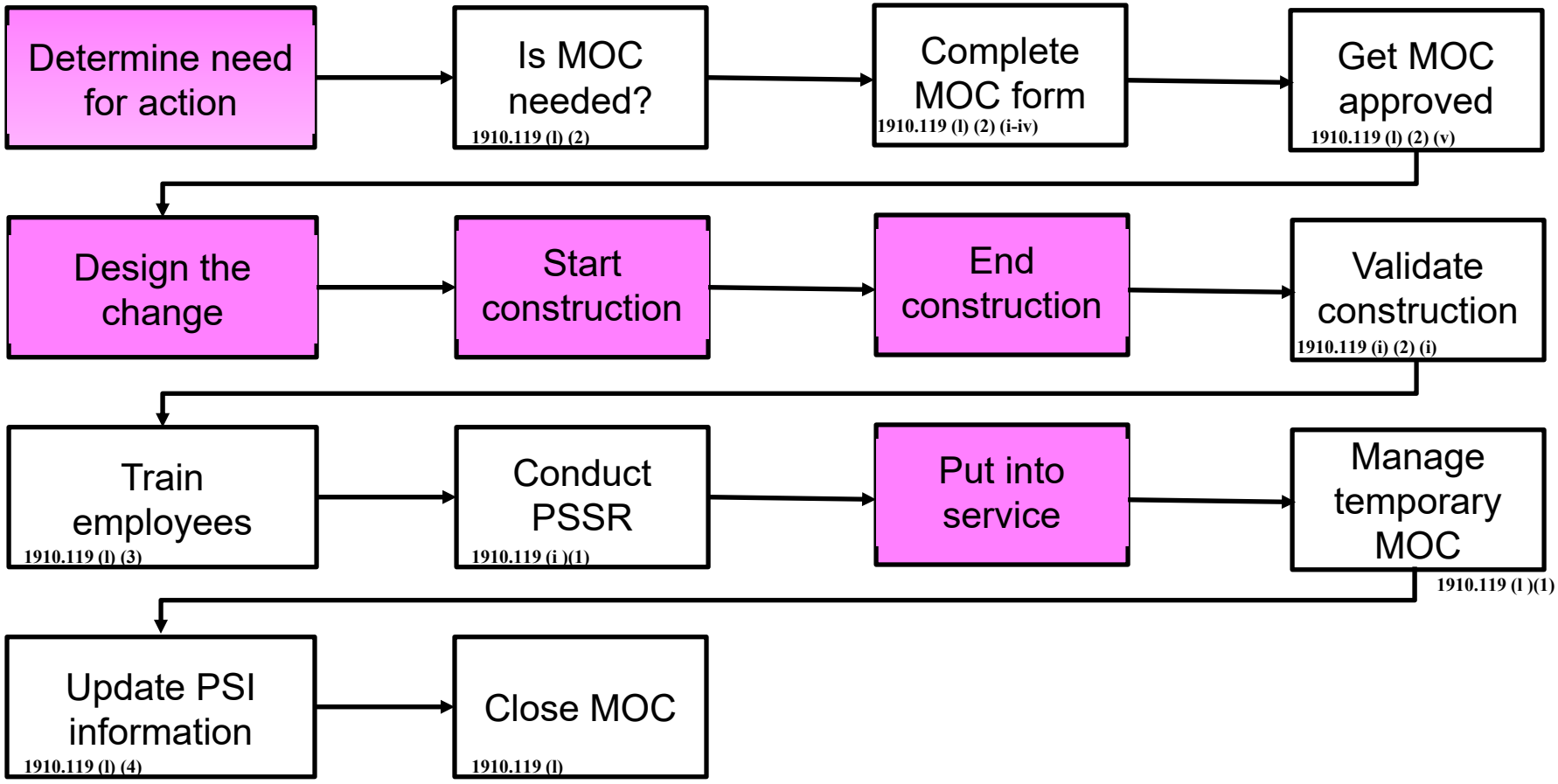
# SAM SHORTCUT'S PROJECT

- **Sam is proud of his efficiency until……..**
  - *He unfortunately acquires the new nickname: "**Bin 99 Engineer**"*



# WHY IS MOC PROCESS NEEDED?

- **Management of Change workflow process:**



# HOW MOC FITS INTO THE OVERALL SAFETY PROGRAM

- **Safety programs of chemical facilities typically consist of process hazard analyses (PHA's), a mechanical integrity program, personnel training, operating procedures, PSSR's, PSI, incident prevention and MOC.**

- **MOC plays a central role because:**
  - *It provides updates to PSI's*
  - *It identifies when a PSSR is needed*
  - *It ensures that employees are trained to carry out the new procedures*
  - *It adds the new equipment to the mechanical integrity test and inspection schedules*
  - *Its documentation is reviewed once every 5 years (req'd by PSM Rule) during the revalidation of PSI's, ensuring process-to-PHA consistency*

# KEYS FOR SUCCESSFUL MOC

- Personnel training
- Change should be managed, not just documented
- Clearly defined role responsibilities for MOC process
- Communication
- Regular audits of the process
- Management expectations that MOC process will be followed all the time

# TEST YOUR KNOWLEDGE

- **What is an example of the (OSHA) definition of change?**
  - A. Adding a new control valve
  - B. Relocating an electrical outlet or light fixture in an office area
  - C. Modifying an operating procedure to correct misspelled words
  - D. An emergency action in response to an accidental discharge, which is discontinued immediately upon termination of the emergency
  - E. Replacing a worn-out valve with a new, essentially identical valve that meets the same specifications

# TEST YOUR KNOWLEDGE

- **What is an example of the (OSHA) definition of change? ANSWER:**
  - A. Adding a new control valve
  - B.
  - C.
  - D.
  - E.

*MOC covers alterations to manufacturing processes that are not replacement-in-kind. Alterations to office areas, editorial changes, or certain emergency actions are not subject to MOC*

# TEST YOUR KNOWLEDGE

- **What is NOT an example of the (OSHA) definition of change?**

  A. Temporarily by-passing an interlock

  B. Using a different schedule of pipe in a pipeline than what is called for in the current piping specification for that service

  C. Adding a new nozzle to a tank

  D. Changing a temperature target or alarm limit within the range defined in a standard operating procedure or control strategy

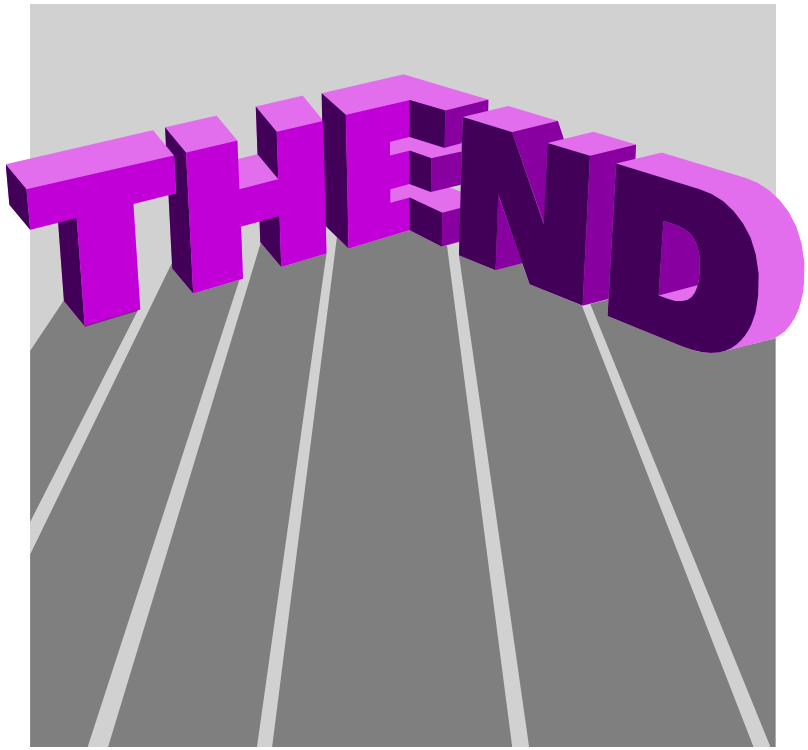
  E. Adding a new step to an operating procedure

# TEST YOUR KNOWLEDGE

- **What is NOT an example of the (OSHA) definition of change? ANSWER:**
  - A.
  - B.
  - C.
  - D. Changing a temperature target or alarm limit within the range defined in a standard operating procedure or control strategy
  - E.

*If safe operating limits are defined in a standard operating procedure, process set-points can be changed within that range without the need for MOC. If the set-point is being changed to a value that is outside of the pre-approved safe operating limits, then MOC should be used.*

# IN CONCLUSION…



*"There is no expedient to which a man will not resort to avoid the real labor of thinking."*

*Sir Joshua Reynolds*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