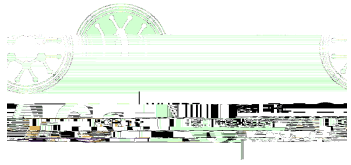
MANAGEMENT OF CHANGE: AN OVERVIEW

NJIT Student Section AIChE

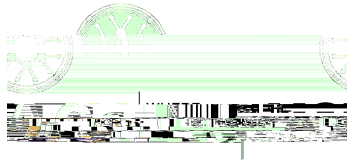
October 11, 2017

WHO AM I?



-

ATTRIBUTION



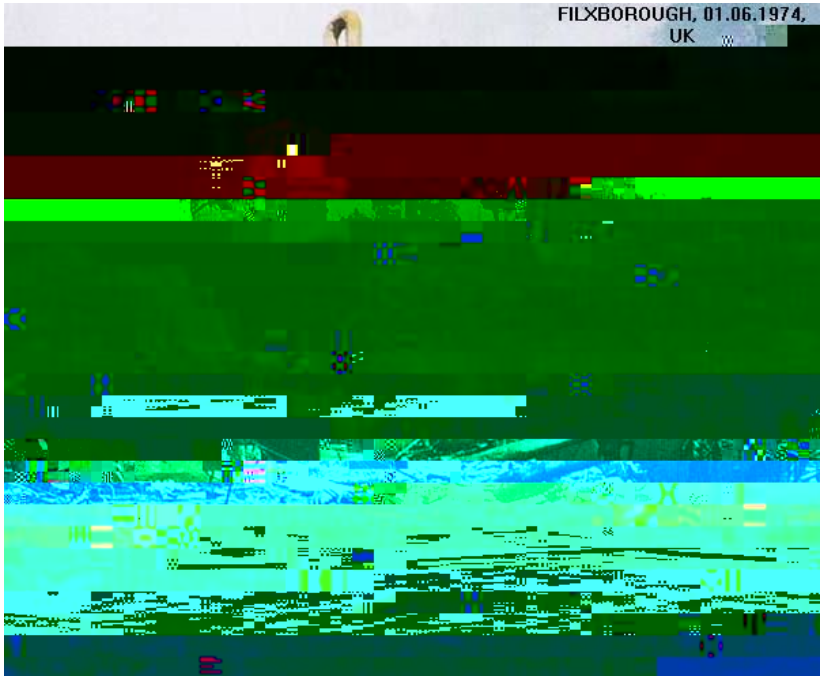
Information presented on these slides was obtained (with permission) from:

- **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!*

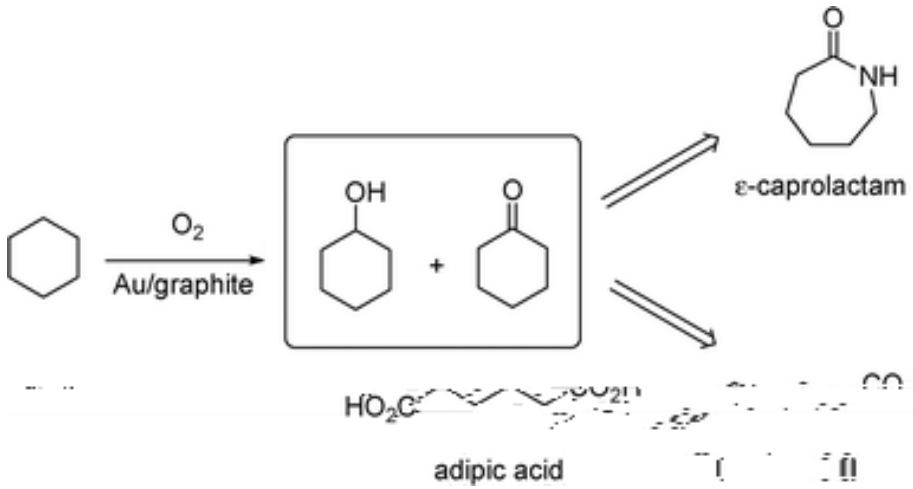
FLIXBOROUGH, ENGLAND 1974

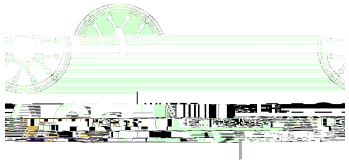
- **On June 1, 1974, an explosion at a chemical plant near the village of Flixborough, England killed 28 people and seriously injured 26**



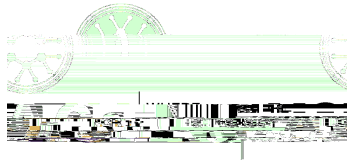
FLIXBOROUGH, ENGLAND 1974

- 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:



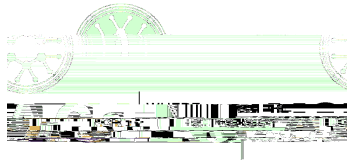


FLIXBOROUGH, ENGLAND 1974



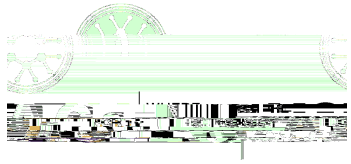
- **At 4:53 pm on Saturday, June 1, 1974, the temporary bypass pipe containing cyclohexane at 150^{o}C and 1 MPa (~ 145 psi) ruptured, possibly as a result of a fire on a nearby 8 inch pipe, which had been burning for nearly an hour**
- **Within about 1 minute, approximately 40 tons of cyclohexane leaked 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



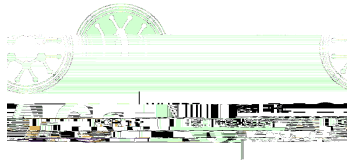
- The force of the explosion was estimated to be the equivalent of about 15 tons of TNT
- All 18 control room employees were killed, 9 other site workers were killed, and 1 delivery driver died in his truck of a heart-attack
- If the explosion occurred on a weekday, the casualties could've been upwards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

FLIXBOROUGH, ENGLAND 1974



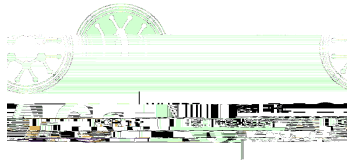
- **It was determined that the bypass pipe had failed due to unanticipated lateral stresses during a pressure surge**
  - ***The bypass pipe had not been designed by engineers experienced in high-pressure piping design***
  - ***No plans or calculations were produced***
  - ***The pipe was not pressure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

NOT THE ONLY INCIDENT



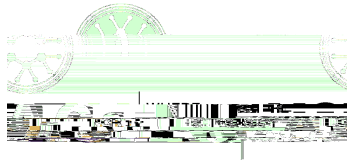
Year	Location	Incident	Deaths	Injuries
1976	Seveso, Italy	bursting disc rupture & chemical release	1	193
1984	Mexico City, Mexico	ruptured LPG pipe leading to a series of explosions	193	7,000
1984	Bhopal, India	MIC release when water introduced to storage tank	3,000	300,000
1985	Institute, WV	methylene chloride & aldicarb oxide release	1	135
1988	Norco, LA	pipe elbow failure leading to cracker explosion	7	42
1988	Henderson, NV	welding sparks ingnited chemical, leading to explosions	2	371
1989	Richmond, CA	2" line weld failed, leading to fire and reactor failure	1	4
1989	Pasadena, TX	reactor seal blew out resulting in fires & explosions	23	314
1990	Channelview, TX	wastewater treatment tank explosion	17	1
1990	Cincinnati, OH	flammable cleaning solvent ignited causing fire & explosion	2	32
1991	Lake Charles, LA	superheated oil and water resulted in steam explosion	5	7
1991	Sterlington, LA	explosion & series of fires at nitroparaffin plant	7	120
1991	Charleston, SC	explosion due to ingredient contamination & loss of cooling	4	400

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?

TYPES OF CHANGES

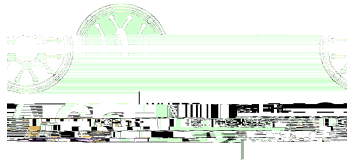


1. **Facility Changes:**
   - *These include any modifications made to the equipment*
2. **Control System Changes:**
   - *These include changes to the programming or control logic, including who has access to the logic*
3. **Information System Changes:**
   - *These include changes to raw material specifications 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”**

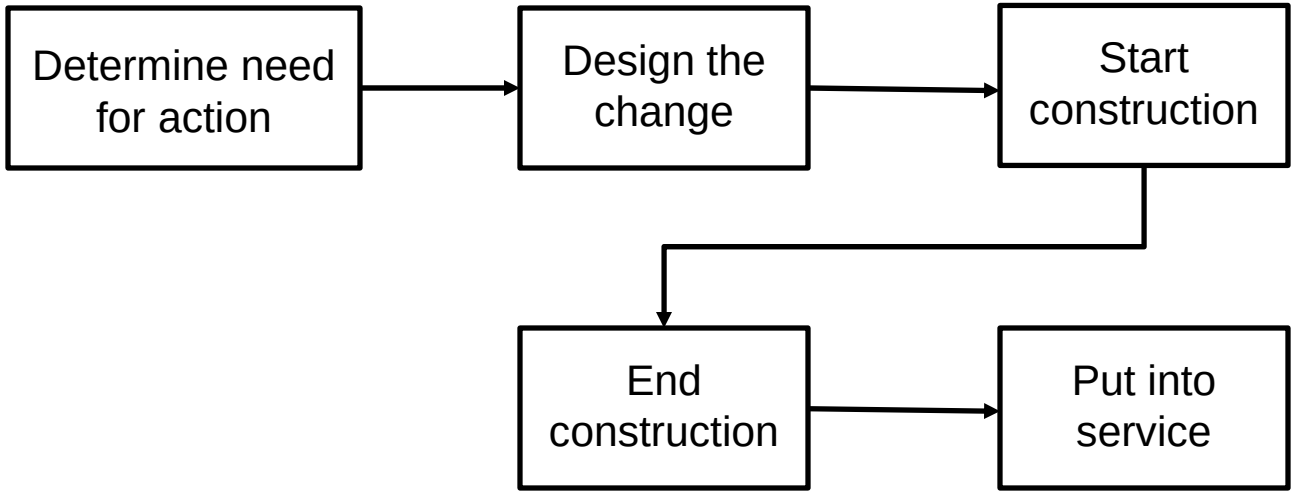
SAM SHORTCUT'S PROJECT



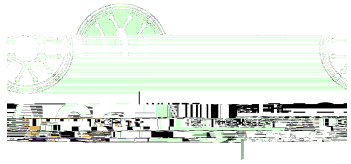
- **A facility change is needed:**
  - *Alter some piping and a control valve to re-route a conveyor system to an existing storage bin (Bin 99), that is currently not in service*
- Because of the simplicity of the project, (and because he's already over-worked), Sam decides to by-pass the MOC process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

SAM SHORTCUT'S PROJECT

- **Simple project workflow process:**

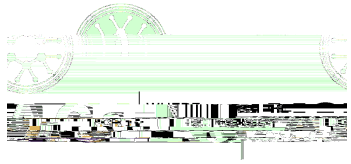


SAM SHORTCUT'S PROJECT



- **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



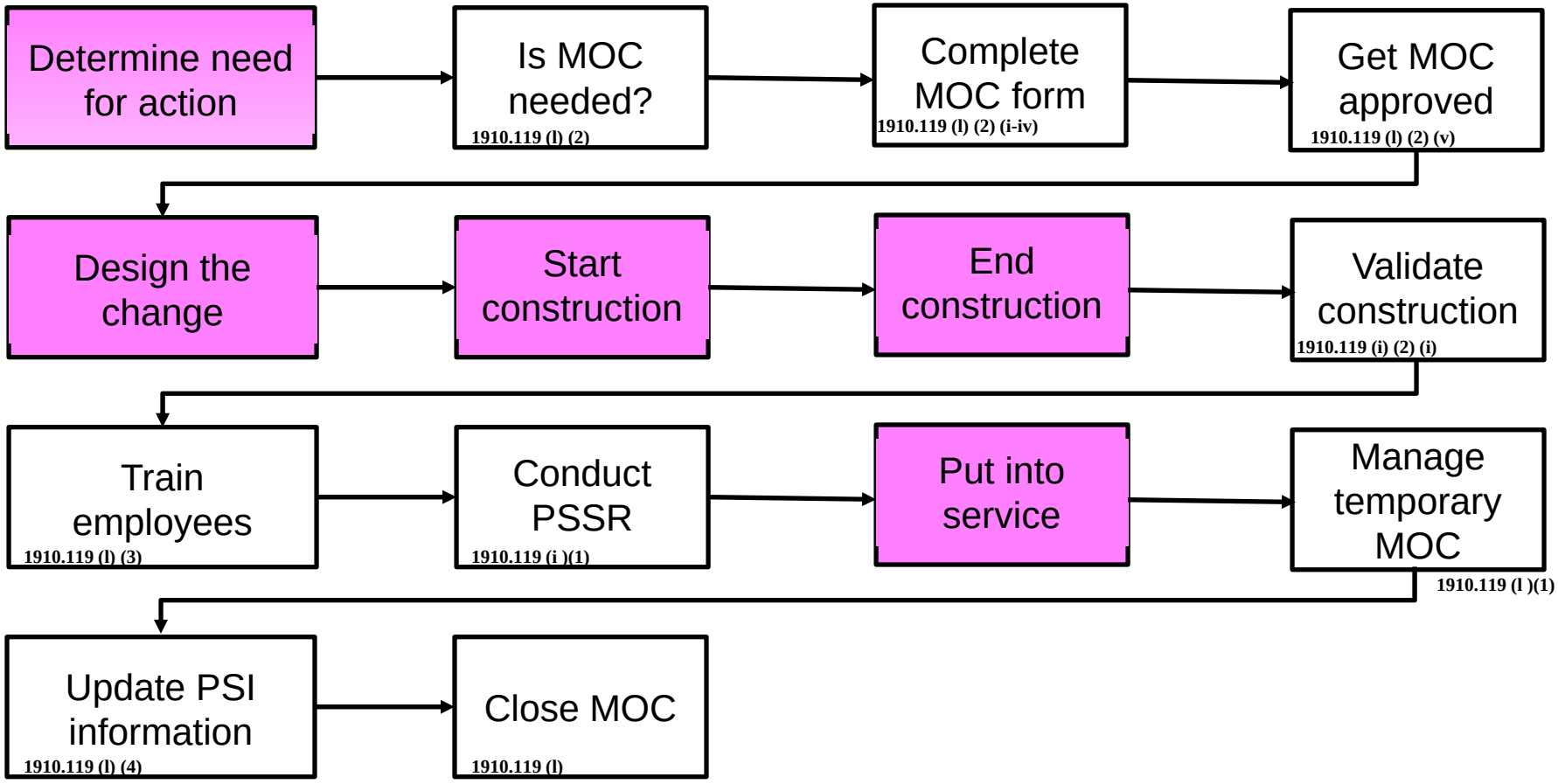
- **Sam is proud of his efficiency until……..**
  - *The shift team manager is concerned about the relief device on Bin 99 cycling frequently and possibly releasing inert gas into the production area*
  - *The pressure vessel inspector becomes aware of the change and believes the state codes for pressure 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

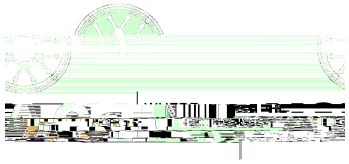
- **Sam is proud of his efficiency until……..**
  - *He unfortunately acquires the new nickname: "**Bin 99 Engineer**"*

WHY IS MOC PROCESS NEEDED?

- **Management of Change workflow process:**



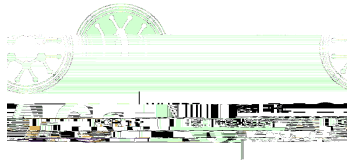
HOW MOC FITS INTO THE OVERALL SAFETY PROGRAM



- **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.**

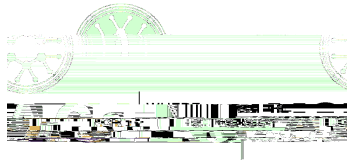
- **MOC plays a central role because:**
  - *It provides updates to PSI's*
  - *It identifies when a PSSR is needed*
  - *It ensures that employees are trained to carry out the new procedures*
  - *It adds the new equipment to the mechanical integrity test and inspection schedules*
  - *Its documentation 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

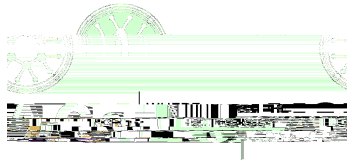
TEST YOUR KNOWLEDGE



- **What is an example of the (OSHA) definition of change? 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

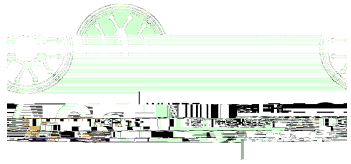


- **What is NOT an example of the (OSHA) definition of change?**

  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 ƒ hrr " i æd ώŭs f i ȳ M

TEST YOUR KNOWLEDGE



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

  A.

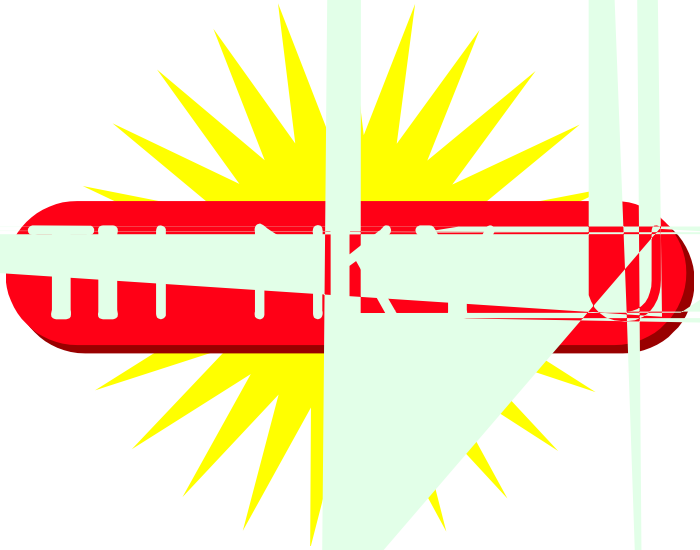
  B.

  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.



North Jersey Section, AIChE