MANAGEMENT OF CHANGE CHALLENGES IN A RESEARCH ENVIRONMENT

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NOVA Chemicals

This is NOVA Chemicals

Introduction

- Challenges of a Research Environment
  - Number and frequency of changes
  - Varied scope of changes
  - Changes from different departments and types of research
  - Temporary changes

Technology Calgary

- Typically review over 200 MOC Forms per year
  - Small changes
    - tubing modifications
  - Medium Changes
    - New experiment construction
  - Large Changes
    - Major facility expansion

Types Of MOC'S

- 3 types of MOC's used
  - Personnel and Organizational Changes
  - Experimentation Changes
  - Facilities and Major Equipment Change

Experimentation Change

- Routine work at our facility is experimentation
- 3 General Categories
  - Routine testing, sample prep or characterization
  - Non-routine testing or sample prep – methods development
  - Synthesis or preparation of new materials (i.e. catalysts, new polymers, new chemicals, etc.)

Experimentation Change

- Reaction Checklists
  - Allows for collection and sharing of info regarding:
    - Chemical Reactions.
    - Hazards of reactants, byproducts and end products.
  - Must be peer reviewed.
  - Both the author and the persons reviewing are responsible for the safety of the reaction.

Experimentation Change

- Reaction Checklists
  - Sign-off Requirements
  - Type 1
    - Reactions $<$ 50mmol in scale
    - Less than 500ml solvent
    - Single peer reviewer required for signoff

Experimentation Change

- Reaction Checklist
  - Type 2
    - Between 50 mmol and 200 mmol in scale
    - Less than 2 liters of solvent
    - Two scientist sign-off
  - Type 3
    - Greater than 200 mmol in scale
    - More than 2 liters in solvent
    - Team Leader or designate sign-off

Experimentation Change

- Reaction Checklist
  - Questions asked around:
    - Possible byproducts and hazards
    - Risk of fire
    - Air/water reactive materials
    - Exothermic
    - Gas evolution
    - Toxicological hazards
    - Waste disposal
    - Reactivity
  - Action plans for undesirable events

Facilities and Equipment Change

- Applies to:
  - Installation of any new equipment
  - Modifications or addition of existing equipment or associated site facilities

  that have the potential to introduce risk to people, property or the environment.
- Not essential for changes to experimental equipment or processes that are within the original design specification of the set-up.

Facilities and Equipment Change

- Applicability
  - Is this a new equipment addition to the site?
  - Does the change involve any replacement not the same as the original?
  - Does the change involve removal or aleration of safety devices, alarms or interlocks?
  - Does the change include equipment designed in-house or built to specification supplied by us?
  - Does the change include any changes in design to equipment?

Facilities and Equipment Change

- Applicability continued…
  - Does the change involve a change in feedstock or chemicals where the chemical composition is outside the range previously defined as acceptable?
  - Does the change involve changing process conditions outside the normal operating range or approaching the defined safe operating limit?
  - Does the change involve life safety systems or equipment?
- If the answer to any questions is yes then the MOC-FE process is applicable.

Facilities and Equipment Change

- Process
  - Idea generation
    - Depending on scope may need decision board approval

Facilities and Equipment Change

- Project Database
  - For all capital projects
  - Updated as project progresses
  - Objectives
    - Ensure that health, safety and environmental learnings from each stage are captured and passed on
    - Document learnings from each development stage
    - Facilitate project planning and execution
      - Identify critical milestones
      - Features such as emissions, waste disposal, safety reviews and project closure

Facilities and Equipment Change

- Project Database cont…
  - Product Steward
    - Administers and communicates shared learnings
  - Project Database Form
    - Stage 1 – Ideas Investigation
      - Project focus, impact, hazardous material handling, waste minimization and emissions management
    - Stage 2 – Results/Testing/Piloting
      - Lessons learned communication, process management and Responsible Care/Product Stewardship
    - Stage 3 – Implementation Stage
      - Scale up concerns, risk assessments, process management, emissions assessment, waste management and overall project impact

Facilities and Equipment Change

- Preliminary Hazard Review
  - All MOC-FE changes must go through the Preliminary Hazard Review
  - Questions on form:
    - Proposed design option
      - Potential hazards over life cycle of the change
    - Rejected design options
    - Recommendations to be considered during the design stage to reduce the risks
  - Must be signed off by the change initiator and their Team Leader

Facilities and Equipment Change

- MOC-FE Form
  - Description, Purpose and Justification
  - Budget Approval Sign-off
  - Project Manager
  - Temporary Change
    - Length of time in service
  - Signatures before review by MOC Sub-Team
    - Change initiator
    - Team Leader
    - Area Landlord
    - Others as needed

Facilities and Equipment Change

- MOC-FE Form
  - Documentation
    - Preliminary Hazard Review
    - As-is drawings
    - To-be drawings
    - Equipment Specifications
    - Material Safety Data Sheets (MSDS)
    - Calculations
    - Proposed maximum intended inventory of chemicals
    - Proposed safe upper and lower operating limits for process conditions
    - Any other information regarding Safety, Operations, Construction, Ergonomics or Environmental Impacts, etc. as necessary.

Facilities and Equipment Change

- Reviewer Expectations
  - Will review the proposed change in a manner consistent with his or her own specific education, knowledge and expertise.
  - Signature indicates the reviewer believes that the proposed change does not introduce an unacceptable risk to people, property or the environment.

Facilities and Equipment Change

- Minor Changes
  - Change that has a limited potential to introduce an unacceptable risk, or will result in minimal impact to people, property or environment.
  - Provision to allow minor changes to proceed prior to review by the MOC Sub-Team.
  - Team Leader or designate must sign-off and accept full accountability for allowing the changes to proceed before a review.

Facilities and Equipment Change

- MOC Sub-Team
  - Fixed membership
    - Responsible Care Specialist
    - Engineering Representative
    - Maintenance/Electrical Consultant
    - Process Consultant
    - Others as needed (I.e. environmental specialist, laser safety, etc.)
  - Two members must have received formal training in risk assessment
  - One must be a Professional Engineer
  - One must be an electrician or electrical engineer
  - One must be a member of the Loss Prevention Standards Committee

Facilities and Equipment Change

- MOC-FE Sub-Team
  - Members must have a general awareness of applicable regulatory requirements.
    - Not expected to be experts but at least one member shall have sufficient knowledge of each of the areas to recognize when further investigation is required.
  - Tools used:
    - Memory joggers checklist
    - MOC Risk Assessment Guide
    - Risk Matrix
    - MIACC list

Facilities and Equipment Change

- MOC-FE can be
  - Approved
    - Sent to initiator for change to commence
  - Returned for More Information (RMI)
    - Sent to initiator for more information before review continues
  - Sent to Detailed Hazard and Risk Assessment (DHRA)

- Any recommendations are captured in our electronic Audit Information System

Facilities and Equipment Change

- DHRA
  - Determining need
    - Does the change introduce new hazards to the lab or facility?
    - Do these changes have the potential to impact adjacent labs / process units / experiments, or global systems?
    - Will the experimental equipment operate unattended or outside regular business hours?
    - Does the experiment use flammable gases or liquids in a quantity or concentration capable or producing a risk of explosion?

Facilities and Equipment Change

- DHRA
  - Determining need continued…
    - Does the experiment require connection to the Unified Alarm System, Building management System or Uninterruptible Power Supply?
    - Have more than five MOC-FE Reviews been done on this set-up / process / unit since the last DHRA?
  - If the answer to any of these is yes, the MOC Sub-Team may request a review by the DHRA Sub-Team

Facilities and Equipment Change

- DHRA Sub-Team
  - Engineering Team Representative
  - General Lab Safety Consultant
  - Chemical Safety Consultant
  - Mechanical Safety Consultant
  - Electrical Safety Consultant
  - Responsible Care Specialist
  - Maintenance Representative
  - Others as required

Facilities and Equipment Change

- DHRA Sub-team
  - Detailed review of the design and proposed operating procedure
    - Identify elements that may present an unacceptable risk and require modifications to mitigate identified hazards
  - Recommendations are captured in the Audit Information System
  - Returned to MOC Sub-Team for approval

Facilities and Equipment Change

- Construction
  - Pre-job Awareness
    - Used when:
      - The task is new or unfamiliar or the individuals involved
      - The task may pose unusual risks
      - Critical tasks and involved (i.e. hot work)
    - Includes
      - Checklist
      - Ergonomic considerations
      - Task list
      - Hazards associated with the tasks
      - Hazard mitigation
      - Sign-off for all involved parties

Facilities and Equipment Change

- Commissioning
  - Must include
    - All safety and fire protection systems must be tested and fully functional prior to start-up
    - Proper orientation of all rotating equipment must be defined and proven prior to start-up
    - Proper operation of all instrumentation and software must be defined and proven prior to start-up
    - All lines must be verified free of contamination which could cause operating or safety problems
    - Equipment must be proven safe to operate prior to introduction of hazardous fluids
  - All commissioning activities must be documented

Facilities and Equipment Change

- Hazard and Operability Review (HOR)
  - Tool used for new, retrofitted or relocated equipment whose operation may have a potential for compromising the safety of employees.
  - HOR Review Team (> 3 members)
    - 2 from Engineering, Maintenance or Responsible Care
    - Where possible one should be someone not closely involved with the project to provide a fresh perspective on the review.

Facilities and Equipment Change

- Hazard and Operability Review Form (HOR)
  - Part 1 – Normal Operation
    - Checklist
      - Ergonomics
      - Pinch Points and Cutters
      - Drives
      - External Hot/Cold Spots
      - Electrical Components
      - Pressure Systems
      - Compressed Gases
      - Hazardous Chemicals/Gases/Radiation
      - Safety Devices

Facilities and Equipment Change

- Hazard and Operability Review Form (HOR)
  - Part 2 – Component Failure Analysis
    - Considers risk of failure of components considered in Part 1
      - Low risk
        - » no further action required
      - Medium risk
        - » Should be tested at each start-up
      - High risk
        - » Must be protected by back-up systems or shielded in such a way as to prevent injury.
        - » Preventative maintenance.
  - Recommendations captured in Audit System

Facilities and Equipment Change

- Project Closeout
  - Project Close-out Meeting
    - For significant or complex projects (>$50k or 80 hours to complete)
    - Shared learnings are communicated
  - MOC-FE Form
    - Must be signed off and returned with all required documentation

Facilities and Equipment Change

- MOC Audits
  - Every MOC is audited by the Engineering department
  - Includes
    - Physical inspection of the change
    - Documentation verification
    - Ensure all recommendations were addressed
  - Deficiencies (if any)
    - Re-assigned in Audit Information System
    - Critical Deficiencies
      - Immediately contact Responsible Care Specialist to asses the situation and take appropriate action

Challenges and Opportunities

- Definitely not perfect

- Too complex and time consuming
  - Could be more user friendly
  - Steep learning curve for first time users
- Amount of documentation
  - 40 MOC's in a 3″ binder in 1999
  - 20 MOC's in a 3″ binder in 2004

- Constantly making improvements

Questions??

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Thanks!!