MANAGEMENT OF CHANGE
CHALLENGES IN A RESEARCH ENVIRONMENT

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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 alteration 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 of 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 assess 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!!