Closed-Loop Model to Optimize Management of Change System and Best Practices to Manage the MOC Digital Transition

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Background	MoC Framework	Closed-Loop	Digitalization	Path Forward

Major Incidents

MoC Contribution

2001 Delaware City Refinery
Explosion
(1 killed, 8 injured, environmental impact)

2003 Hayes Lemmerz International
Aluminium Dust Explosion
(1 killed, 6 injured)

2005 Texas City Refinery
Explosion
(15 killed, 180 injured)

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Modern SMS Models

MoC is a Key Element

#	SAFETY MANAGEMENT FRAMEWORK	MOC ELEMENT
1	OSHA Process Safety Management (14 elements)	Element # 13
2	CCPS Risk Based Process Safety Management (20 elements)	Element # 13
3	EI Framework for Process Safety Management (20 elements)	Element # 12

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MoC Framework
Continual Improvement

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Background	MoC Framework	Closed-Loop	Digitalization	Path Forward

Key Features of MoC

MoC Framework

MoC Steps
- Identification
- Assessment
- Design
- Authorization
- Documentation

Interlink with other Elements
- Risk Assessment
- Pre-Startup Safety Reviews
- Process Safety Information
- Asset Integrity

MoC System
- Process
- Accountabilities
- Qualifications
- Performance Review

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Background	MoC Framework	Closed-Loop	Digitalization	Path Forward

MoC Self-Assessment

Proposed Scheme at Facility Level

1st Party Audit

Auditors from the facility being audited
- Time flexibility
- In-depth knowledge

Standardized Scheme
- Thoroughness
- Consistency

Process Review

Personnel Interviews — Self-Assessment — Creeping Changes

MOC Documentation

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MoC to the Next Level

Closed-Loop Model

02

Auditing Function

Measurement of Effectiveness

2nd Party Audit

From another location within the company (a corporate group such as a centralized safety function)

→ Auditing expertise
→ Objectivity and independence
→ Cross-learning among facilities

Auditing Function Independent from Operating Facilities

Technical Authority

Responsive Governance

Checks and Balances

→ Independent oversight of safety programs
→ Authorization to changes/waivers to safety requirements
→ Enhancement of governing requirements
→ Development of supplementary tools
→ Improvement of knowledge

Responsive Governance

Fit-for-Purpose Tools

Skill-based Training

Technical Authority Focus Areas

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Closed-Loop Model

Effective and Prioritized Improvements

New requirements/Focus areas

Technical Authority

❖ Trend Analysis
❖ Enhanced Requirements
❖ Guidelines/Tools
❖ Focused Training/awareness

❖ Gap Analysis
❖ Enhanced Questions
❖ Focused Assessments

Audits

Major findings

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Closed-Loop Model

Application to Common MOC Challenges

Uncontrolled Changes

Failure to trigger the process to manage applicable changes, leading to accumulation of small changes (creeping changes) that could escalate to major incidents.

Control measures

→ Standardized self-assessment scheme
→ Integration with Quarterly Safety Inspections
→ Trending
→ Training and awareness

Improper Process Hazard Analysis

Lack of or less-than-adequate risk assessment for proposed changes.

Control measures

→ Standardized hazard identification tool - (PrHA)
→ Skill-based training

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Closed-Loop Model

Effective and Prioritized Improvements

*CLM: Closed Loop Model

Closed Loop Model (CLM)

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MoC Digital Transformation

Process Safety Opportunity with Emerging Challenges

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Digital Transformation

Definition and Impact

Digital Transformation

Anything from IT modernization (for example, cloud computing), to digital optimization, to the invention of new digital business models.

Digital transformation can play a significant role in reducing human error, simplifying processes and minimizing risk exposure to personnel.

Gartner Glossary ©

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Digital MoC

Opportunity to Thrive

A digital MoC solution will optimize a closed-loop performance.

Risk maturity of companies with automated feedback loops is more than 30% above the average. (McKinsey & Company)

Other Advantages

→ visibility of MoC
→ consistent implementation across facilities
→ real-time analytics
→ thorough audits
→ detection of uncontrolled changes

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MoC Digital Transition

Risks and Opportunities

Topics:

1 Alarm Management
2 Noisy Data
3 Behavioral KPIs
4 Integration
5 Operating Procedures
6 Technical Expertise

Early identification of hazards and opportunities is essential for robust risk management.

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MoC Digital Transition

Challenges and Opportunities

1 Alarm Management

Application of human factors, instrumentation engineering and systems thinking to manage the design of alarm systems.

→ Alarms rationalization
→ Timely fault prompting and diagnosis
→ Defined operator response
→ Human-machine interface
→ Interface with advanced technologies (e.g. hand-held devices, smart helmets)

There is a great deal of evidence relating to the role of poorly design alarm systems in major incidents. (UK HSE)

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MoC Digital Transition

Challenges and Opportunities

2 Noisy Data

Large amount of additional corrupt data, meaningless data, less relevant data, etc.

→ Identify required data points early in design phase
→ Ensure agility of the digital solution to modify data points
→ Involve relevant expertise to interpret new trends

Noisy data can lead to wasted time and effort in understanding irrelevant information and trends leading to misinformed decisions.

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MoC Digital Transition

Challenges and Opportunities

3 Behavioral Key Performance Indicators

To drive the behavioral change and bridge the gap between employees' training/qualifications and the organization's objectives.

🔑 The availability of a wide range of data coupled with the ability to easily develop and monitor behavioral KPIs will provide value added insights.

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MoC Digital Transition

Challenges and Opportunities

3 Behavioral Key Performance Indicators

To drive the behavioral change and bridge the gap between employees' training/qualifications and the organization's objectives.

→ Management of human factors
→ Foundation for machine learning

#	BEHAVIOURAL KPIS	EXPECTED INSIGHTS
1	Percentage of MoCs authorized at the correct level	High percentage indicates adequate level of leadership engagement in the MoC system.
2	Average time to complete MoC activities	Increasing time to complete activities may indicate overloaded personnel and the need for more resources.
3	Frequency of reviewers change	High frequency may indicate a habit of delegating technical review tasks to less experienced employees.
4	Number of escalated tasks	High frequency may indicate limited resources to effectively complete MoCs on time.

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| Background | MoC Framework | Closed-Loop | Digitalization | Path Forward |

MoC Digital Transition
Challenges and Opportunities

4 Integration and Legacy Data

MoC controls a wide range of changes including those in processes, maintenance/inspection, organizational, spare parts, etc.

→ Integration capabilities (e.g., by Robotic Process Automation)

→ Legacy data (e.g., closed MoCs, open MoCs in the existing system)

Multiple provisions of digital MoC solutions can lead to duplication of processes, unnecessary costs, and manual transfer of data to implement other processes.

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MoC Digital Transition
Challenges and Opportunities

5 Operating Procedures (OP)

Automation will eliminate some job functions, while connectivity/mobility will introduce new tasks as part of operators' daily rounds.

Update OP to reflect new mechanisms for:

→ Troubleshooting

→ Alarms (including required response)

→ New tasks (i.e., as a result of connectivity/mobility features)

Deployment of digital provision should be accompanied with an exercise to updating operating procedures.

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MoC Digital Transition
Challenges and Opportunities

6 Technical Expertise

Digitalization will entail modifying job functions (e.g. de-manning, new responsibilities, etc.).

A comprehensive skill assessment should be part of the digitalization project

→ Digitalization and process safety skills

→ Reskilling/upskilling to accommodate automation/de-manning

Process safety expertise is key to drive sustainable advancement of digital solutions while meeting the intent of process safety management.

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Path Forward
Effective MoC Digitalization

Continual Improvement
Formal Business Processes

Closed-Loop Model
Prioritized Improvements

Digitalization Risk Management
Unintended Consequences

Automated Closed-Loop Model
Enhanced Risk Maturity

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