ASSET INTEGRITY & CONTINUOUS IMPROVEMENT

VI Operational Safety & Environment Workshop – ANP

Claudio Costa – Total E&P do Brasil HSE Director
COULD AN HSE MS PREVENT THIS EVENT?

Safety Moment
HOW COULD HSE MS HELP TO PREVENT THIS EVENT?

Improvement plans
HSE performance review
Identification and treatment of non-conformities

No actions implemented from previous incidents

Proper Leadership
HSE Focus

Strict compliance with laws
Risk Identification and Management
Integrity Management Focus
Contractor Selection Qualification

Emergency structure (people and equipment)
CONTINUOUS IMPROVEMENT: FROM WHERE DID IT COME?

Source: Moen & Norman, 2006
EVOLUTION OF PDCA CYCLE

Shewart cycle, 1939

Deming wheel, 1951

Japanese PDCA cycle, 1951

Shewhart cycle: Deming, 1986

PDSA Cycle: Deming, 1993

Model for Improvement, 2009

Source: Moen & Norman, 2006
BENEFITS OF A « MANAGEMENT SYSTEM » APPROACH

- Brings **structure and coherence**
  - Normalized structure allowing integration of different HSE domains
- **Requiring a continual improvement effort**
  - PDCA cycle -> Management review
- **Helps to maintain performance through time**
  - Performance is linked to the process and not to specific individuals
  - Offers an “assurance” of performance
- **Structured process**
- **Requiring verification of the efficiency of actions implemented**
  - Indicators, audits

Ensures **people** and **processes** are aligned to meet organizational objectives

Composed of **procedures** and **practices** with clear performance standards

“How we do things”
UNDERSTANDING MANAGEMENT SYSTEMS (2)

Management System Maturity

- Fatalist/Metier
- Bureaucratic
- Intégrated/Sustainable

Developing

- Basic management processes and controls are established to track progress. The necessary discipline is in place to repeat earlier successes.

Initiating

- Few activities are explicitly defined and success depends on individual effort and heroics.

Standardizing

- Rules and processes are documented, standardized and integrated in an organization-wide methodology.

Optimizing

- Continual improvement is enabled by quantitative feedback of the processes and from piloting new ideas and technologies.

Innovating

- Detailed measures of the effectiveness and quality of the rules and processes are collected. The rules, processes and services are intuitively understood and controlled.

Applied Knowledge

- As the business becomes more mature, they begin to conceptualize processes and seek to organize, repeat success, and measure results.

Dynamic Knowledge

- Most organizations are between “Developing” and “standardizing”. While processes are documented and standardized, manager’s targets are only loosely linked to process outputs.

Leveraged Knowledge

- Few businesses have an understanding of how processes relate and have their corporate strategies aligned to the processes.

Ad-hoc Knowledge

- Entrepreneurial businesses and new teams that do things anyway to get the job done.

At this level, all staff work together to improve processes. They understand their process well enough to conduct experiments to determine if changes will be useful or not.
**TOTAL INTEGRATED HSE MS**

**ONE MAESTRO (Management And Expectations Standards Towards Robust Operations)** is the HSE Management System within the TOTAL Group and defines the HSE principles and expectations that are to be implemented. These principles and expectations are further defined within the HSE rules and guides.

- Management Leadership And Commitment
- Compliance with Laws, Regulations & Group Requirements
- Operational Accountability
- Contractors & Suppliers
- Competence & Training
- Emergency Preparedness
- Learning From Events
- Audits, Inspection, Verification
- Processes, Training, Prevention
- Policy, Objectives, Targets
- Risk Management
- Performance Improvement
- Monitoring, Audit & Inspection
- Continual improvement, Preventives actions, Corrective actions

**ANP SOMA - October 10th - 2018**
03 Risk Management

04 Operational Accountability
Context

Key question:
“How do we keep people from being injured”

Key question:
“How do we keep the product* in the pipe”

* And by extension any form of energy (thermal, pressure, chemical, mechanical)
Many major process accidents in the oil & gas industry could have been avoided if the occurrence of these events were properly identified and assessed and if their associated prevention, mitigation and protection barriers were properly designed, adequately inspected and kept in a good state.

Therefore, technological risk management, including risk assessment and integrity management of assets (equipment and barriers), is of vital importance for the prevention and control of major accidents.
Core Activities of Technological Risk Management

- **Identify** process hazards (using appropriate techniques)
- **Analyze** the risks (in terms of severity of consequences and likelihood)
  - Evaluate the process risks
- **Assess** the risks against risk acceptance criteria
- **Develop** risk reduction strategies
- **Implement** action plans
- **Control** efficiency of implementation of action plans
- **Assure** integrity of equipment, barriers and structures during their operational life
- **Take** corrective action if necessary
Scope of Technological Risk Management

Primary Containment

- Fixed Equipment
- Piping
- Rotating Equipment

Barriers

- Emergency Systems
- Gas & Fire Detection
- Emergency Relief Devices
- Fire Fighting Systems
- Safety Instrumented Systems

Structures

- Structures
Technological Risk Assessment (TRA) & Asset Integrity

Asset integrity is the capability to operate an asset so that it safeguards life and environment whilst meeting production objectives during the operational phase of its lifecycle.
Asset Integrity Challenges

Results of the analysis of **79 important LOPC events (HIPO)** in RC (2012 to 2015). The causes for these events are:

- **Operating Integrity (55%)**
  - Non controlled opening of equipment
  - Drain/vent left open
  - Error in execution of maintenance procedure
  - Error in execution of operating procedure
  - Management of Change issue
  - Operation out of safe operating window
  - Error in execution of startup procedure
  - Bypassing of safety barrier

- **Technical Integrity (38%)**
  - Mechanical degradation (line, small bore, equipment, gaskets,...)
  - Lack of competence
  - Overpressure scenario

- **Design & Construction Integrity (7%)**
Technological Risk Assessment (TRA)

Data Collection (system description) → Hazard Identification (accident case development)

- Frequency Analysis
- Consequence Analysis

Risk Calculation → Risk Assessment

Risk Criteria

- Major Risk Register
- Listing of Safety & Environment Critical Measures*

Risk Mitigation

Risk Acceptable? → Yes

Major Accident Potential?

Design Integrity

- Compliance with approved standards
- Meeting project requirements
- Incorporating recommendations from Technological Risk Assessment in the design

Different acronyms are used to denote the same: ICE (Integrity Critical Equipment), SCM (Safety Critical Barriers), PSECM (Process Safety & Environment Critical Barriers), SCE (Safety Critical Elements), SECE (Safety & Environment Critical Elements),...
Focus of Technological Risk Assessment (TRA)

- **Remote**
  - **Likely**: Very unlikely
  - **Unlikely**: Very unlikely
  - **Very unlikely**: Extremely unlikely
  - **Extremely unlikely**: Remote

- **Moderate**
- **Serious**
- **Very Serious**
  - **Very Serious**
    - People: 1 fatality
    - Assets: 2 - 10 M€
  - **Catastrophic**
    - People: 2 - 5 fatalities
    - Assets: 10 - 100 M€
  - **Disastrous**
    - People: > 5 fatalities
    - Assets: > 100 M€

**Major Accident**
Focus of Technological Risk Management
Management of Design & Construction Integrity

- Based on a review of important Loss of Containment events*, the following organizational processes play a critical role in the assurance of design and construction of integrity critical equipment:
  - Management of Change
  - Use of design standards
  - Use of construction specifications

- For Integrity Critical Equipment, these processes need to be formally verified
Management of Technical Integrity

- For process equipment, general Inspection, Testing and Preventive maintenance procedures (ITPM) are developed.

- For integrity critical equipment, **specific** Inspection Testing and Preventive maintenance (ITPM) & Performance Standards (PS) need to be established.
Management of **Operating Integrity**

Based on an analysis of important Loss of Containment events*, the following activities can be identified and considered as fundamental rules for the preservation of operating integrity of Integrity Critical Equipment:

- Always use 2 barriers for hydrocarbon and chemical **vents & drains**
- Do not leave an **open drain** unattended
- Take interim **mitigating measures** in case of failure of Safety Critical Equipment
- Follow the **startup and shutdown procedures** and sign off after every step
- **Walk-the-line**: verify and validate any line up change
- Verify for completeness of **tightness after maintenance work**
- Always check that **equipment is pressure free** and provide safe isolation before starting maintenance
- Always operate within the **safe operating window** of the equipment

*Analysis of 79 important LOPC events at TOTAL Refining & Chemicals in the period 2012-2015.
Management of Asset Integrity: other suggestions

- **Management & Leadership**
  - Verify knowledge of ICE in the field during safety tours

- **Operational safety**
  - Include special warning upon drafting or updating of operating procedures involving ICE
  - Apply tags in the field for identification of ICE

- **Risk assessment**
  - Include quality assurance of risk studies involving ICE (HAZOP, LOPA, ERA, QRA, ...)
  - Include quality assurance of Critical Task Analysis involving ICE

- **Contractor safety**
  - Use of ICE list during preparation of works
  - Apply special warning on work permits involving works involving ICE

- **Audits**
  - Assure that the ICE list is subjected to a periodic management review
  - Give special focus on equipment in ICE list during audits (technical audits, management system audits)

- **Communication**
  - Use ICE in review and update of safety promotion campaigns

- **Training**
  - Use ICE list in review and update of site training programs
  - Include chapter on ICE in Process Safety Training

- **Performance indicators**
  - Develop a few representative performance indicators to assess the health of the ICE management
Thank you!