ASSET INTEGRITY & CONTINUOUS IMPROVEMENT

VI Operational Safety & Environment Workshop – ANP

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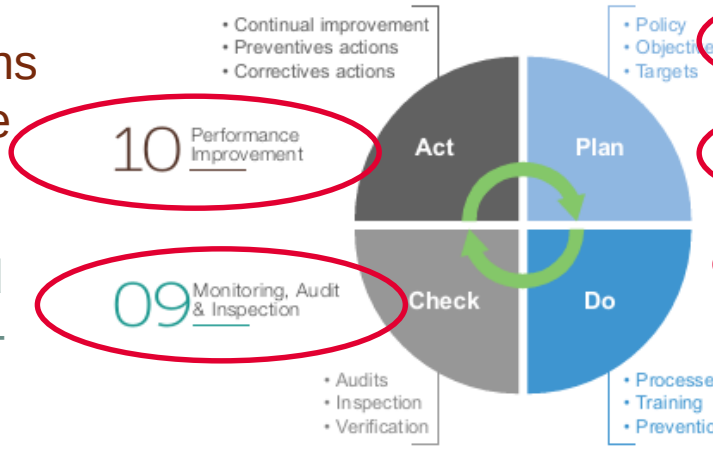
October 10th – 2018

COULD AN HSE MS PREVENT THIS EVENT?

Safety Moment

HOW COULD HSE MS HELP TO PREVENT THIS EVENT ?



Improvement plans HSE performance review

10 Performance Improvement

Identification and treatment of non-conformities

09 Monitoring, Audit & Inspection

01 Management Leadership and Commitment

Proper Leadership HSE Focus

02 Compliance with Laws, Regulations & Group Requirements

Strict compliance with laws

03 Risk Management

Risk Identification and Management

04 Operational Accountability

Integrity Management Focus

05 Contractors & Suppliers

Contractor Selection

06 Competencies & Training

Qualification

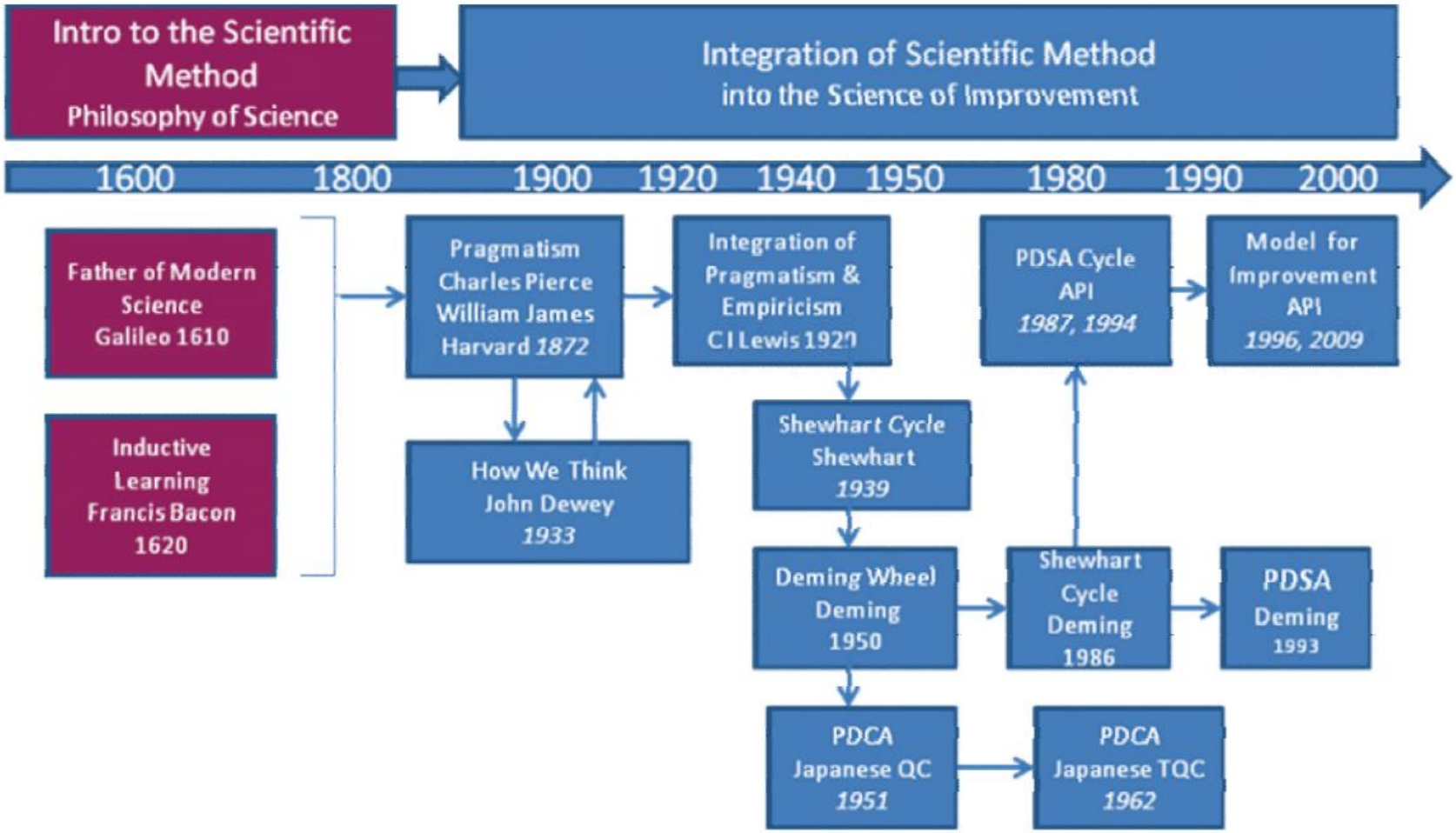
No actions implemented from previous incidents

08 Learning from Events

07 Emergency Preparedness

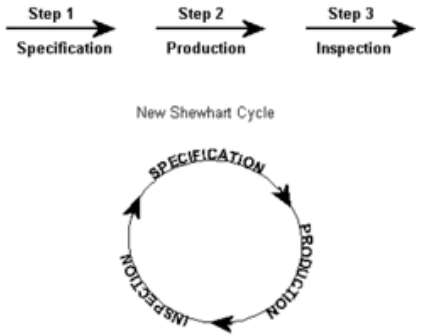
Emergency structure (people and equipment)

CONTINUOUS IMPROVEMENT: FROM WHERE DID IT COME?

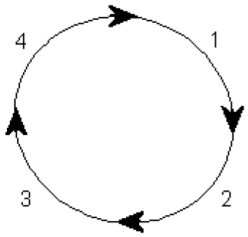


Source: Moen & Norman, 2006

EVOLUTION OF PDCA CYCLE

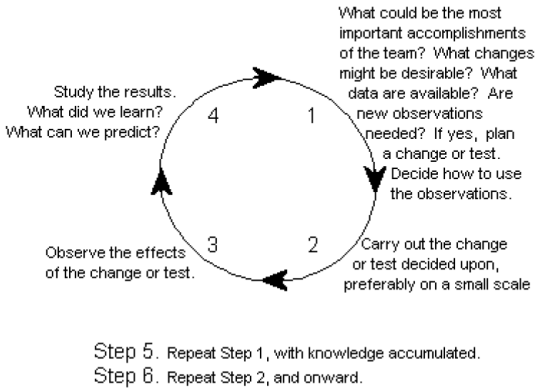


Shewart cycle, 1939

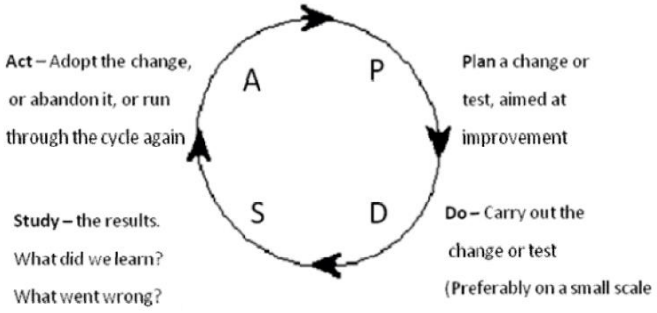


Deming wheel, 1951

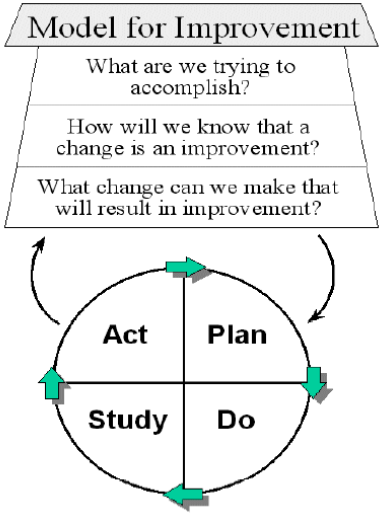
Japanese PDCA cycle, 1951



Shewhart cycle: Deming, 1986



PDSA Cycle: Deming, 1993



Model for Improvement, 2009

Source: Moen & Norman, 2006

BENEFITS OF A « MANAGEMENT SYSTEM » APPROACH

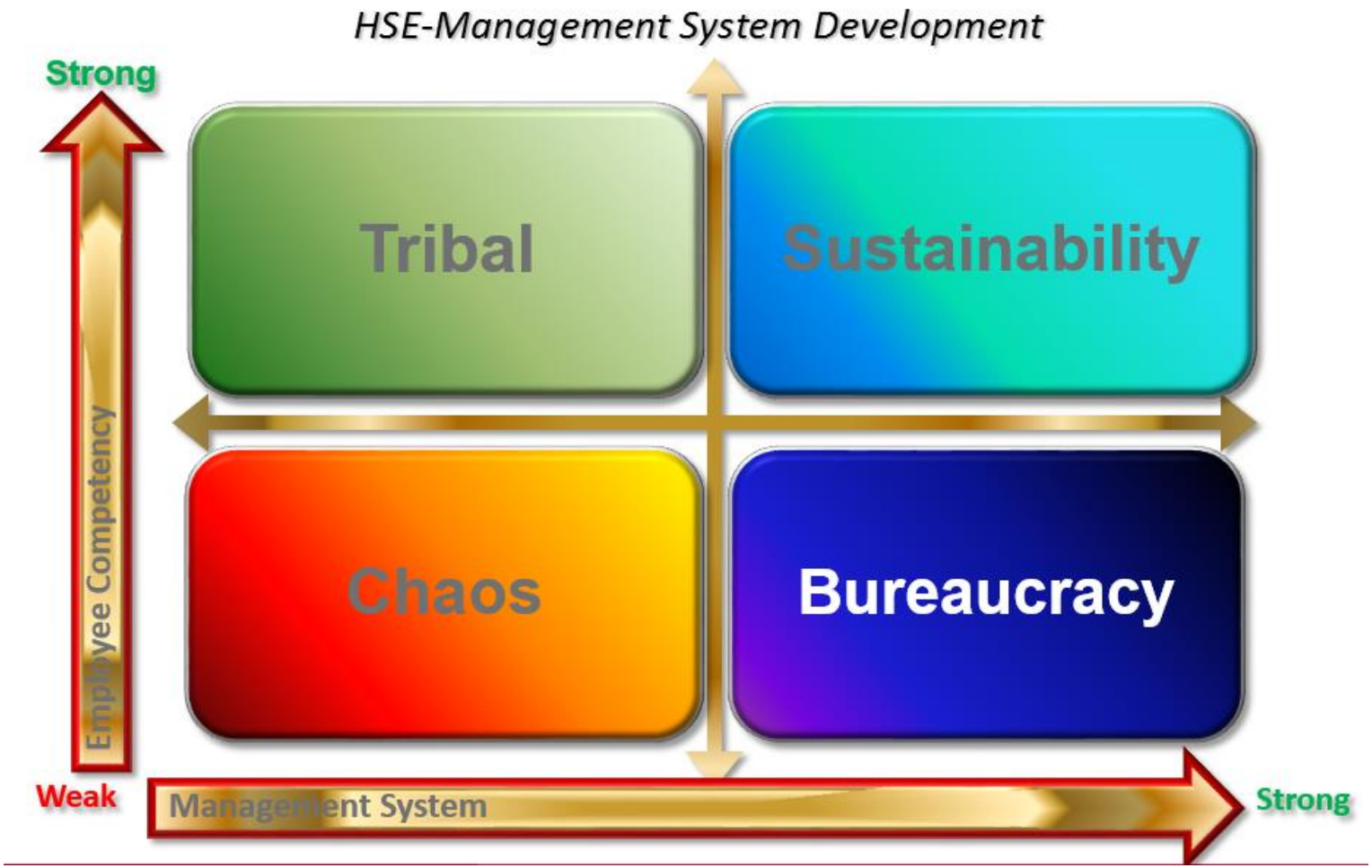
- **Brings <u>structure and coherence</u>**
  - Normalized structure allowing integration of different HSE domains
- **Requiring a continual improvement effort**
  - PDCA cycle -> Management review
- **Helps to maintain performance through time**
  - Performance is linked to the process and not to specific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

Ensures **<u>people</u>** and **<u>processes</u>** are aligned to meet organizational objectives

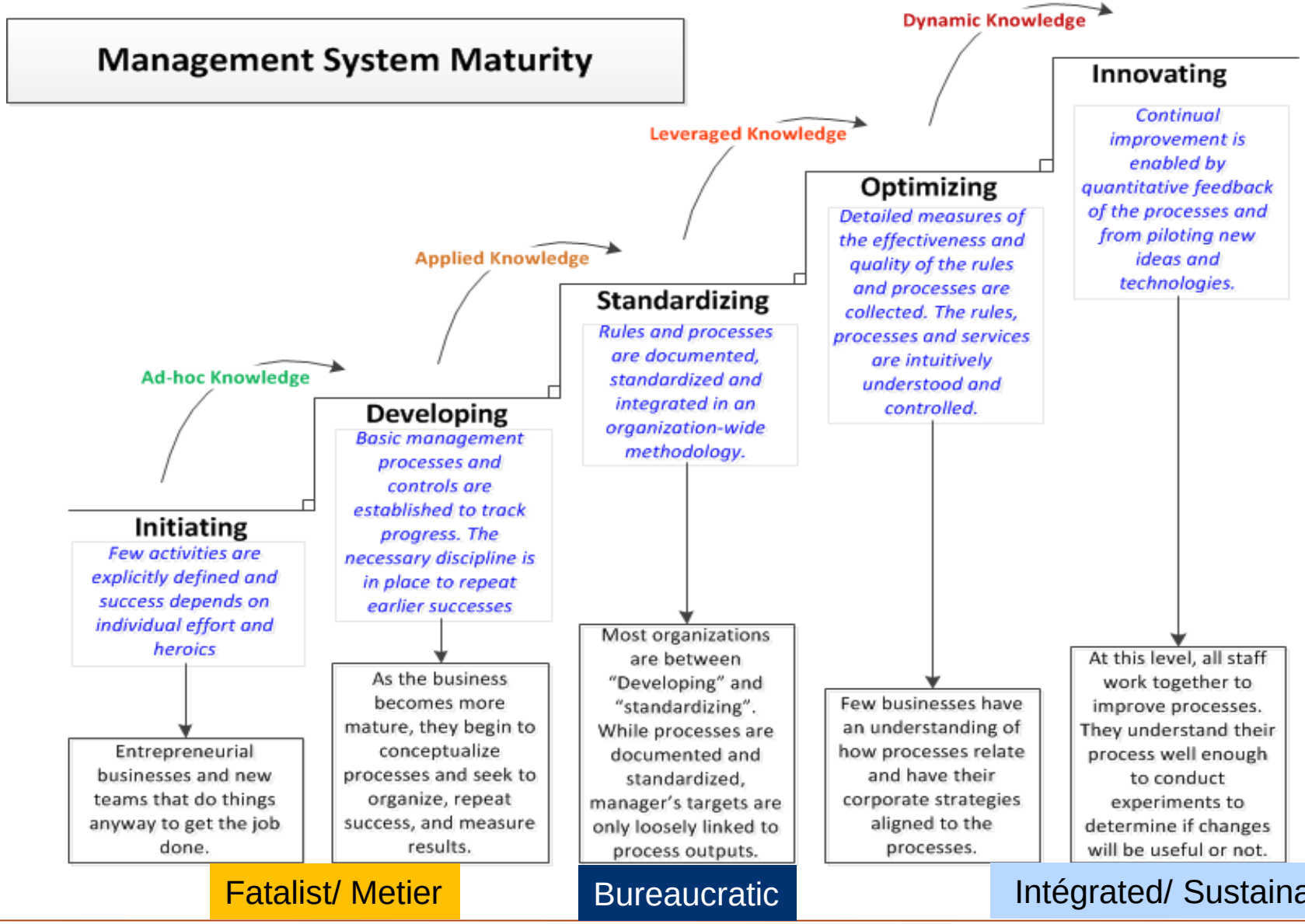
Composed of **<u>procedures</u>** and **<u>practices</u>** with clear performance standards

“How we do things”

UNDERSTANDING MANAGEMENT SYSTEMS (1)

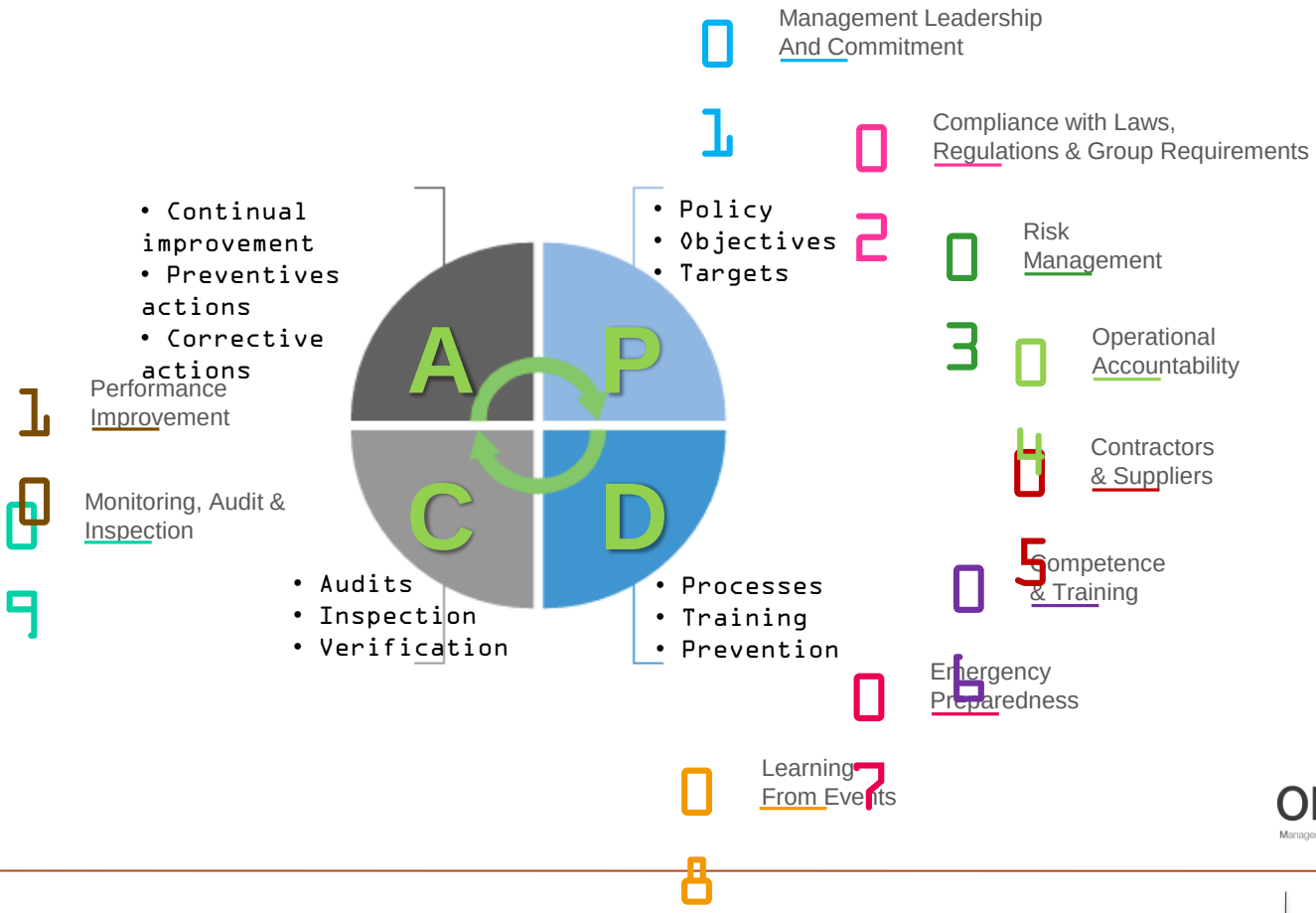


UNDERSTANDING MANAGEMENT SYSTEMS (2)

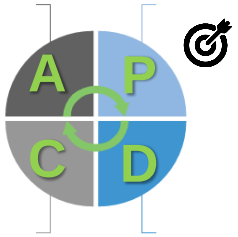


TOTAL INTEGRATED HSE MS

ONE MAESTRO (**M**anagement **A**nd **E**xpectations **S**tandards **T**owards **R**obust **O**perations) 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.



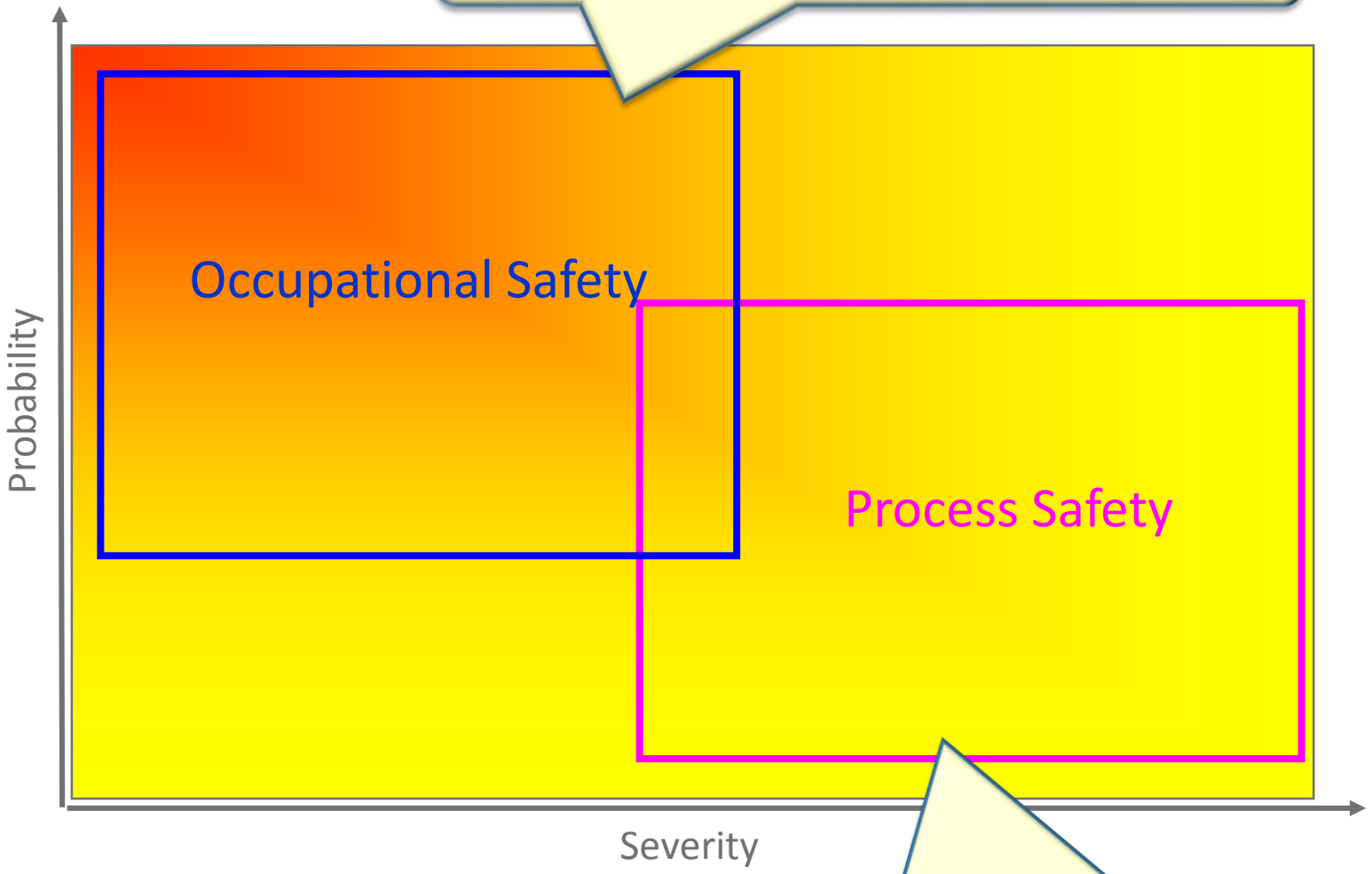
ONE MAESTRO
Management And Expectations Standards Towards Robust Operations



03 Risk Management

04 Operational Accountability

Context



* And by extension any form of energy (thermal, pressure, chemical, mechanical)

Context

- 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.

Texas City, US (2005)
Major VCE, 15 fatalities

Buncefield, UK (2005)
Destruction of storage area

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

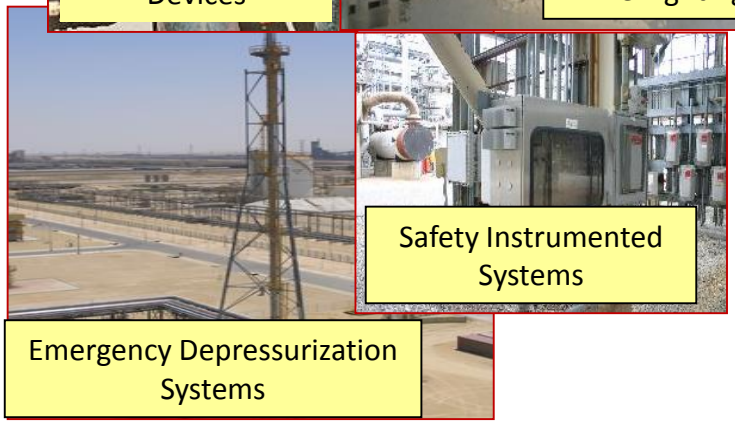
Barriers

Emergency Systems

Gas & Fire Detection

Emergency Relief Devices

Fire Fighting Systems



Safety Instrumented Systems

Emergency Depressurization Systems

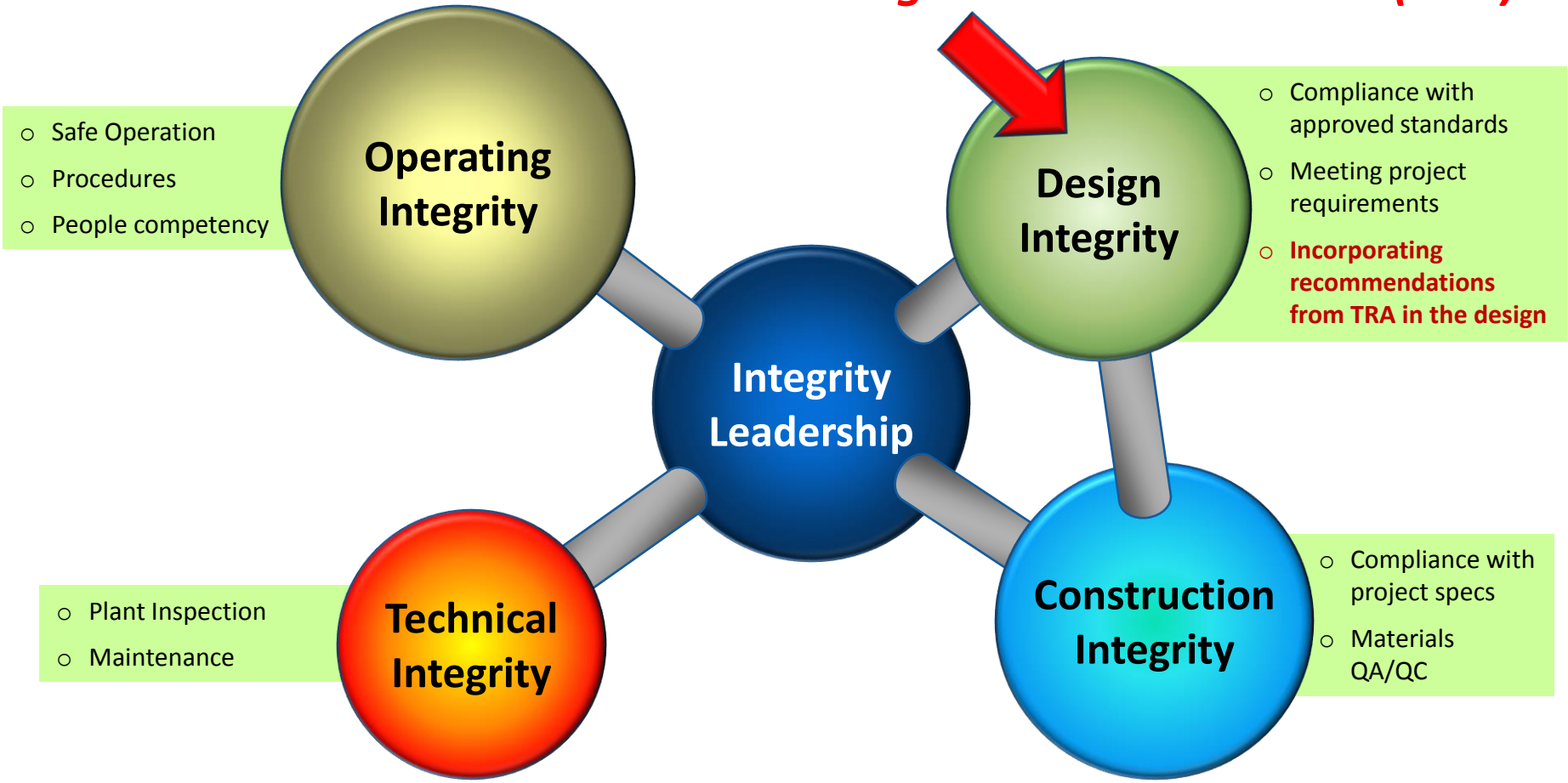
Structures

Structures

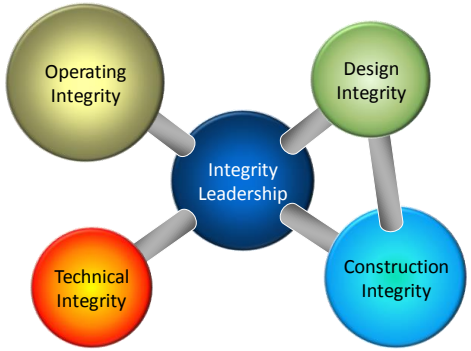
Technological Risk Assessment (TRA) & Asset Integrity

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

Technological Risk Assessment (TRA)

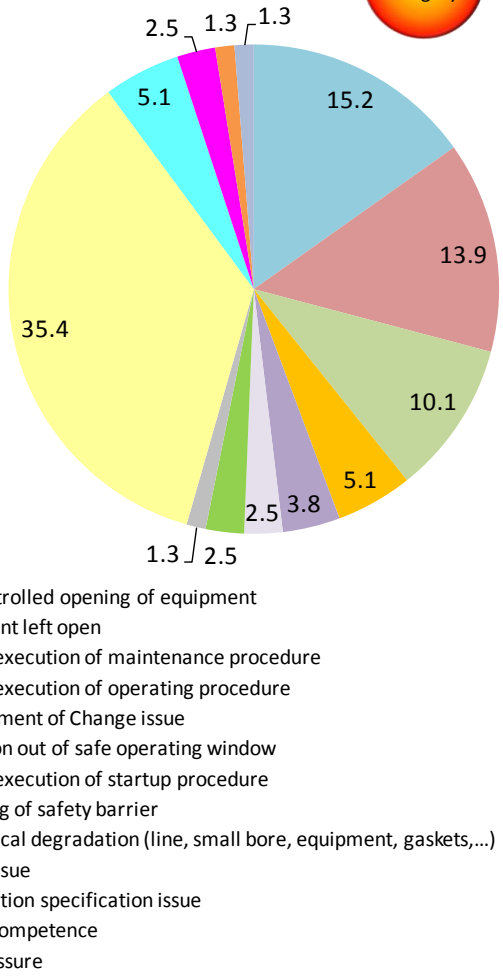


Asset Integrity Challenges



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

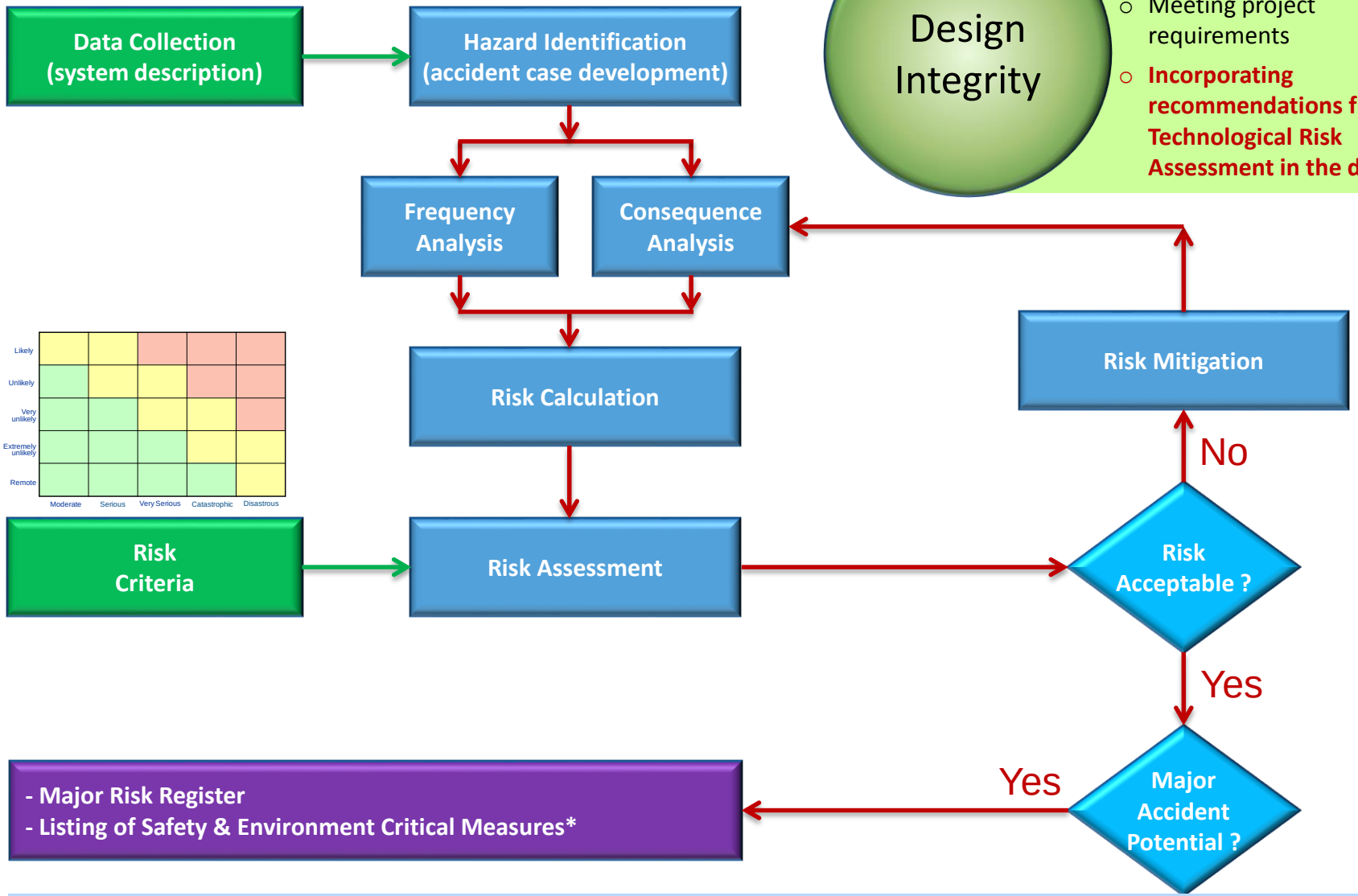
- Operating Integrity (55%)
  - Non controlled opening of equipment
  - Drain/vent left open
  - Error in execution of maintenance procedure
  - Error in execution of operating procedure
  - Management of Change issue
  - Operation out of safe operating window
  - Error in execution of startup procedure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

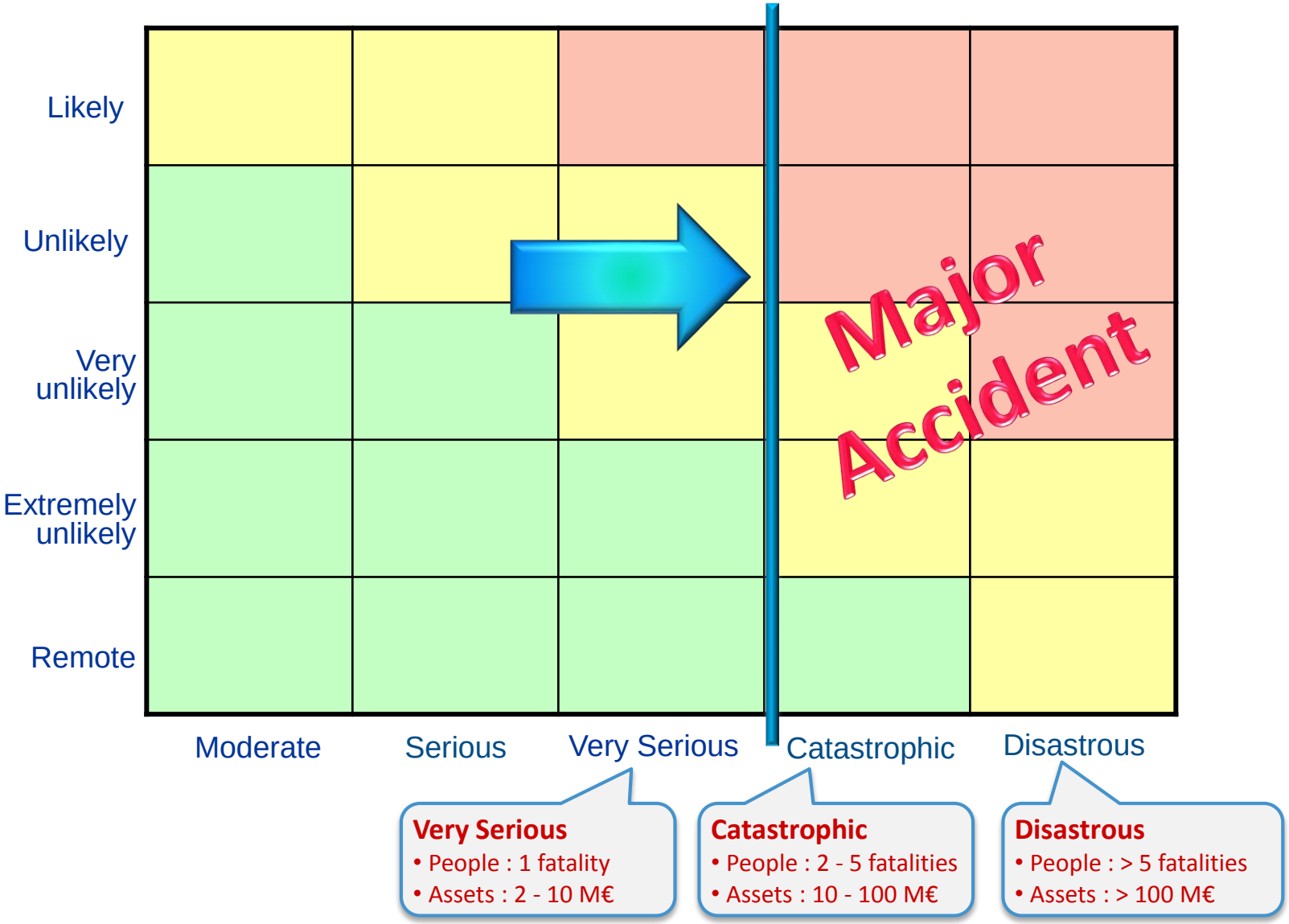
Design Integrity

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

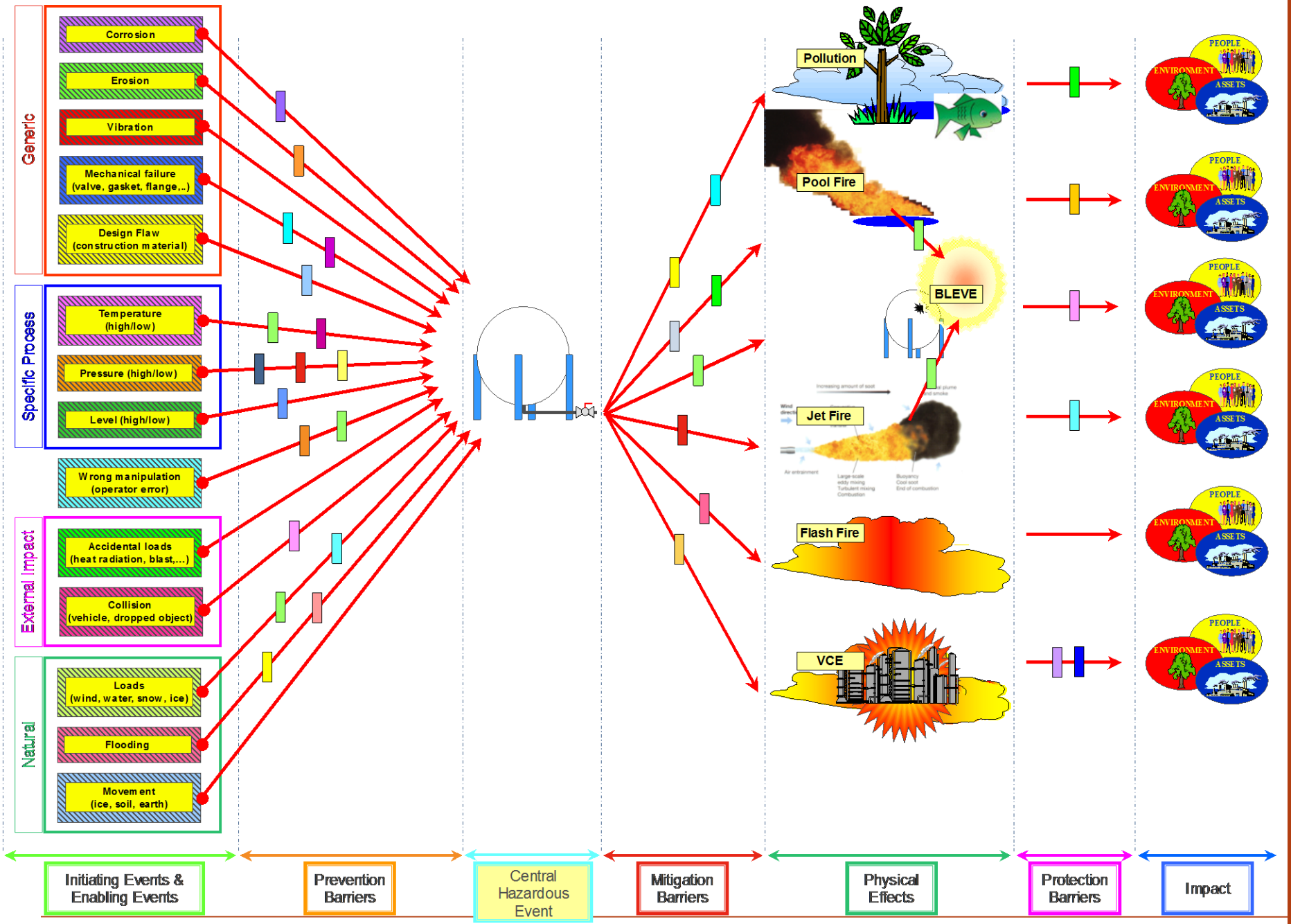


Different acronyms are use to denominate the same : ICE (Integrity Critical Equipment), SCM (Safety Critical Barriers), PSECM (Process Safety & Environment Critical Barriers), SCE (Safety Critical Elements), SECE (Safety & Environment Critical Elements),….

Focus of Technological Risk Assessment (TRA)

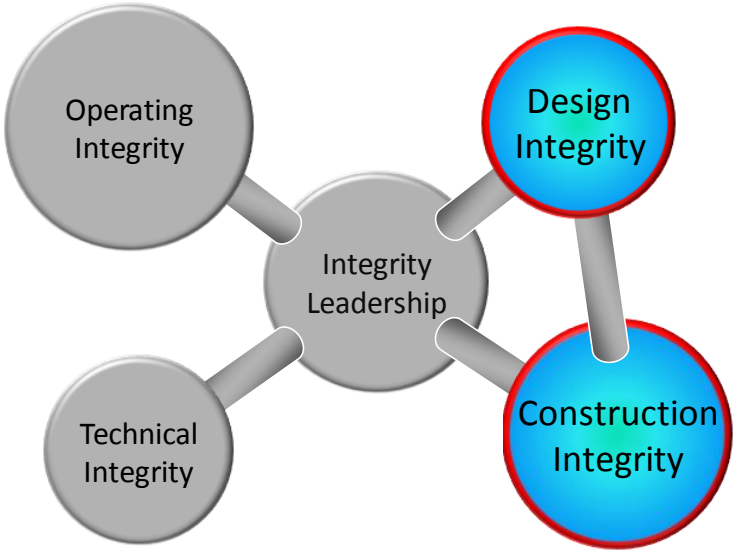


Focus of Technological Risk Management


Generic
Corrosion
Erosion
Vibration
Mechanical failure (valve, gasket, flange,..)
Design Flaw (construction material)
Specific Process
Temperature (high/low)
Pressure (high/low)
Level (high/low)
Wrong manipulation (operator error)
External Impact
Accidental loads (heat radiation, blast,...)
Collision (vehicle, dropped object)
Natural
Loads (wind, water, snow, ice)
Flooding
Movement (ice, soil, earth)
Pollution
Pool Fire
BLEVE
Jet Fire
Flash Fire
VCE
PEOPLE
ENVIRONMENT
ASSETS
Initiating Events & Enabling Events
Prevention Barriers
Central Hazardous Event
Mitigation Barriers
Physical Effects
Protection Barriers
Impact

Management of Design & Construction Integrity

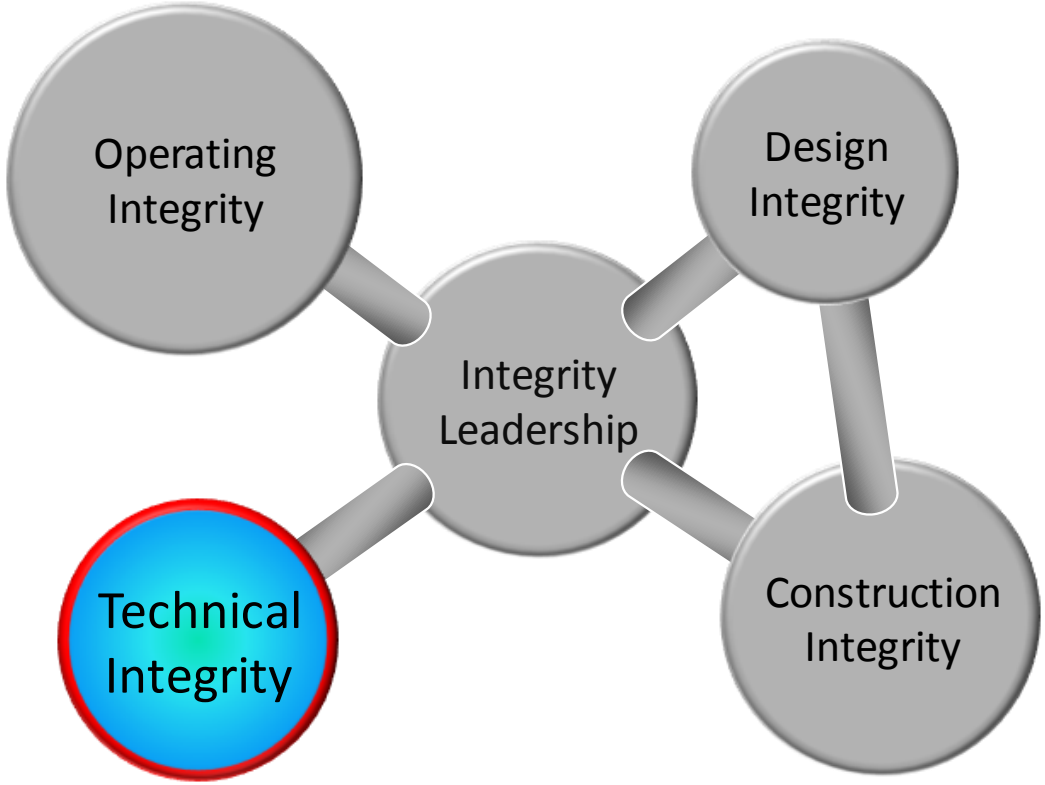
- Based on a review of important Loss of Containment events*, the following organizational processes play a critical role in the assurance of design and construction of integrity critical equipment:
  - Management of Change
  - Use of design standards
  - Use of construction specifications
- For Integrity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

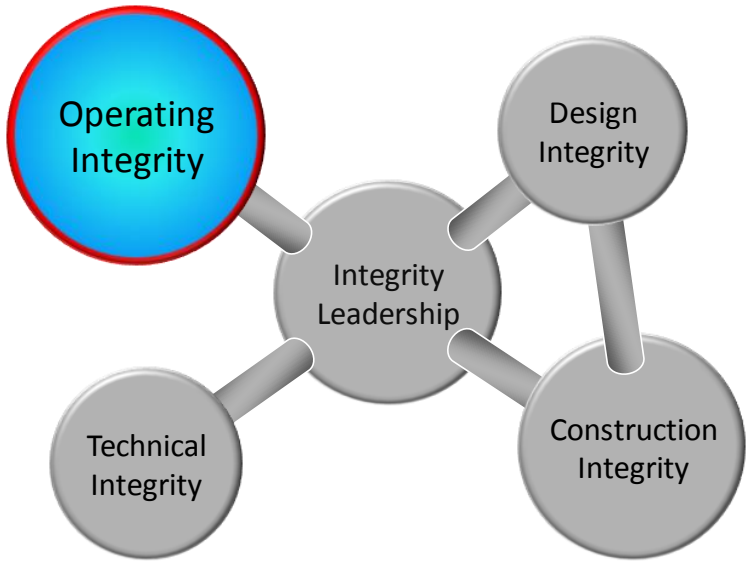


Management of Operating Integrity

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:

* Analysis of 79 important LOPC events at TOTAL Refining & Chemicals in the period 2012-2015.

- 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



Management of Asset Integrity : other suggestions

- Management & Leadership
  - ✓ Verify knowledge of ICE in the filed 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!