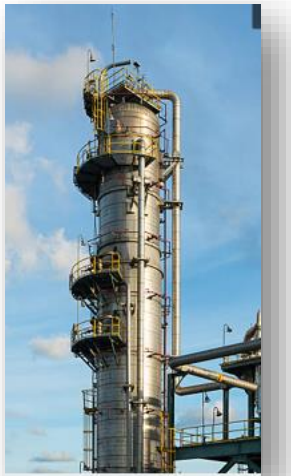
Process Safety Fundamentals for Pharmaceutical Operations



Contents

- Introduction to the Pharma Group
- Background to the Project
- Introduction / Objectives
- Original EPSC Fundamentals
- Why something specific for Pharma?
- Development of the Process Safety Fundamentals for Pharmaceuticals
- How do they fit along Life Saving Rules?
- Closeout / Questions

Introduction to the EPSC Pharma Group

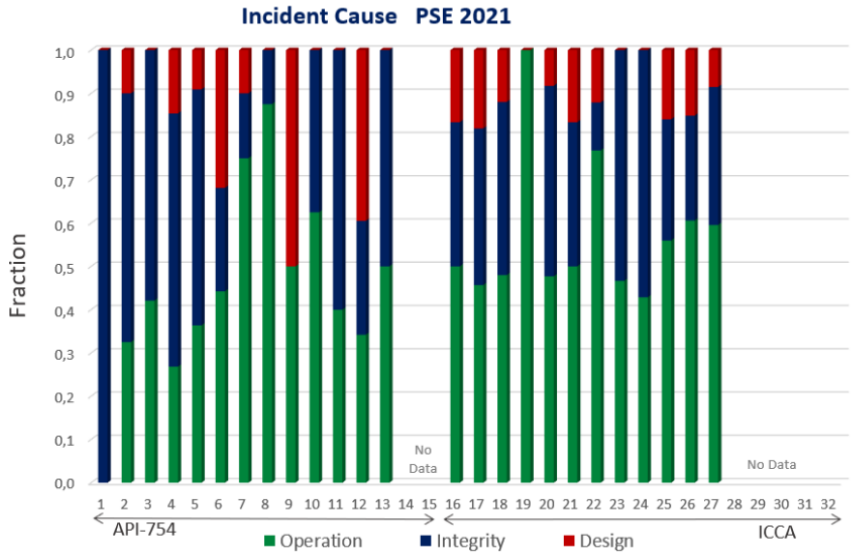
Working group comprising safety engineers and leaders from 14 Pharma companies specifically interested in sharing learnings from incidents, best practices and collaborating on projects relevant to our industry.

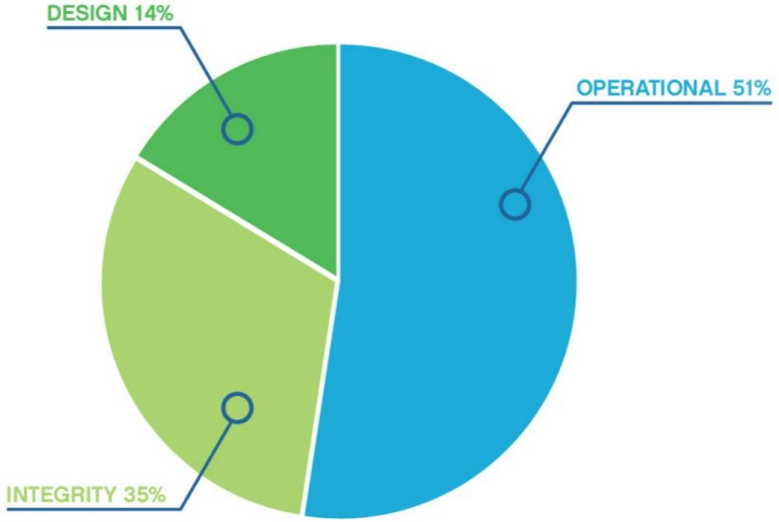
Previous projects:-

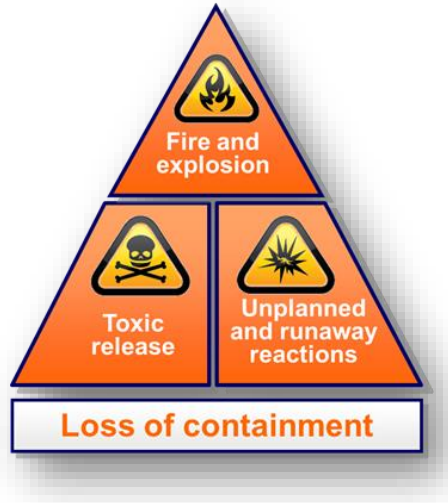
- Process Safety Hazards associated with Pharma Unit Operations
- Fluid Bed Drying Hazards
- Best Practice Guide on Electrostatics

Background: EPSC Fundamentals

- EPSC Project group developed the “Process Safety Fundamentals” in 2020 based on a concept introduced in Shell.
- The objective was to produce a set of key concepts which could be discussed with front-line staff who are directly engaged in activities which could lead to (or prevent) Major Accident Hazards.





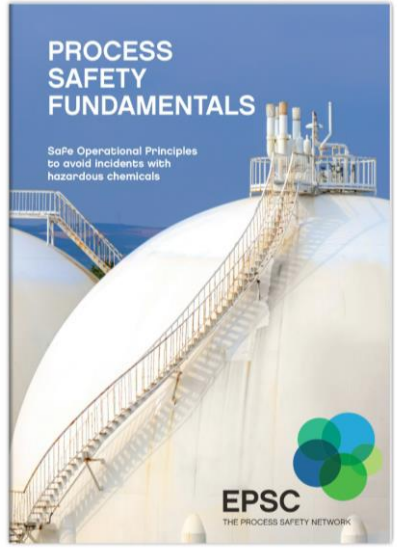


Background: EPSC Fundamentals

Purpose:

- Highlight hazardous conditions and when they are typically presented
- Emphasising good practices with a specific focus on operation and maintenance aspects.
- Intended to be used on site, to support coaching and development of frontline staff.
- Based on established practices, not something new!

- Key Themes:
  - Plant integrity,
  - Process control,
  - Ignition risk management and
  - Reporting/escalation processes



Process Safety Hazards in the Pharmaceutical Industry

EPSC

API Manufacture

- Making the “Active”
- Traditionally batch operations.
- 50kg to 1000kg scales
- Highly potent chemicals
- Reaction, Distillation, Evaporation, Crystallisation
- Filtration (Centrifugation) and Drying
- Solvent based chemistry in multiple stages.
- Recovery of solvents by distillation/drying

Drug Product Formulation

- Formulation and filling technologies depend on the dose form – oral, topical, inhaled, pastes.
- Handling the pure API and excipients.
- Combustible dusts are the major hazard.
- Equipment might include mixing vessels, granulators, fluid bed dryers, filling machines
- Some solvent based processes.

Evolving the Fundamentals for the Pharma Environment

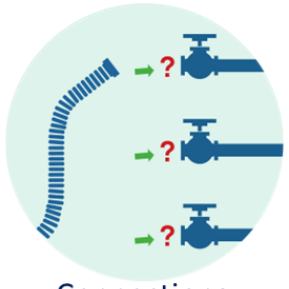
- Incorporated double isolation, open drain, plugs/blockages and first line break into "Safe isolation and draining"
- Added ventilation in hazardous areas since most facilities are indoors and ventilation is critical to hazardous area, toxic gas and asphyxiant management
- Added combustible dust housekeeping as significant hazard specially in secondary/formulation plants
- Added electrostatics since these are a prevalent and often transient risk of ignition in our facilities.
- General refocus on guidance towards batch manufacturing / high frequency turnarounds / multipurpose plant

Process Safety Fundamentals for Pharma Industry

EPSC

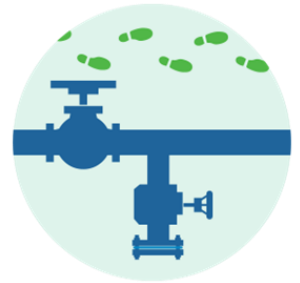
Safe Isolation and Draining

Leak Tigntness and Testing



Connections and Unloading

Use of Flexible Hoses



Configuration and Line Walks

Operating Limits

Overrides

Report Issues with Critical Equipment

Report Process Safety Incidents

Line of Fire

Ventilation in Hazardous Areas

Dust Housekeeping

Electrostatics

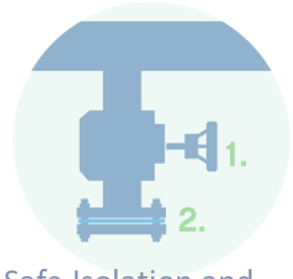
Splash Filling

Run Away Reaction

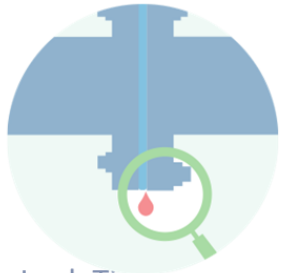
Process Safety Fundamentals for Pharma Industry

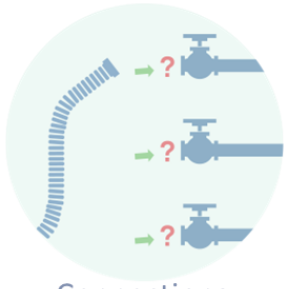
EPSC

Plant Integrity

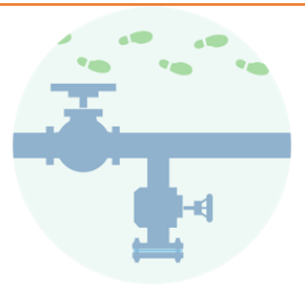


Safe Isolation and Draining


Leak Tigntness and Testing


Connections and Unloading


Use of Flexible Hoses


Configuration and Line Walks

Operating Discipline


Operating Limits

Overrides


Report Issues with Critical Equipment


Report Process Safety Incidents


Line of Fire

Fire/Explosion Hazards


Ventilation in Hazardous Areas


Dust Housekeeping


Electrostatics


Splash Filling


Run Away Reaction

1. Safe Draining and Isolation

EPSC

Hazards:

Hazardous fluids such as steam, solvents, and pressurised gases present a significant risk of injury, fire or explosion. Follow good isolation and draining practices

When important:

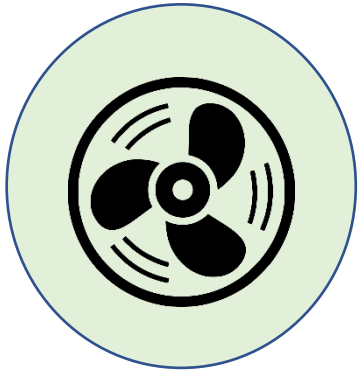
During draining, sampling and other non-routine activities such as line-breaks

Challenges in the field:

- Two levels of isolation should be used.
- In older plants this standard may be difficult to apply and aseptic plant design reduces number of isolation points.
- Blind flanges not put back after maintenance work or flanges not fully tightened.
- Drain valves left open.
- Valve handles that can be opened accidentally

Options to get it right:

- Clearly define/label plant where hazardous fluids are present
- Where possible drain and flush hazardous fluids from plant before working on it.
- Apply two points of isolation for highly hazardous or pressurised services.
- “Prove” the isolation, by checking valves hold through a drain point before disconnecting pipework.
- Ensure all points of isolation are locked-out &tagged.
- Fit routine points of isolation with spectacle blinds, valve locking kits etc.
- Point of isolation as close as possible to where you are working (visible).
- Do not accept missing blind flanges or missing bolts on blind flanges.
- Ensure there is an emergency plan if an isolation leaks.



11. Ventilation in Hazardous Areas

EPSC

Hazards:

Accumulation of flammable concentrations of vapours or dusts leading to an explosion
Toxic gases and vapours and Asphyxiants such as nitrogen or carbon dioxide.

When important:

Plants areas where flammable, toxic or asphyxiant materials are handled.

Challenges in the field:

- Technical assessments of ventilation e.g. Hazardous Area Calculations or Asphyxiation calculations may not be available.
- Ventilation systems may not have monitoring instrumentation e.g. to detect failure of fans/motors/belts
- Systems are often designed to recirculate air to reduce energy demands therefore hazardous materials can accumulate.
- Some powders can be difficult to remove/collect through basic ventilation
- Changes to HVAC settings can compromise the safety function if the MoC process is not robust.

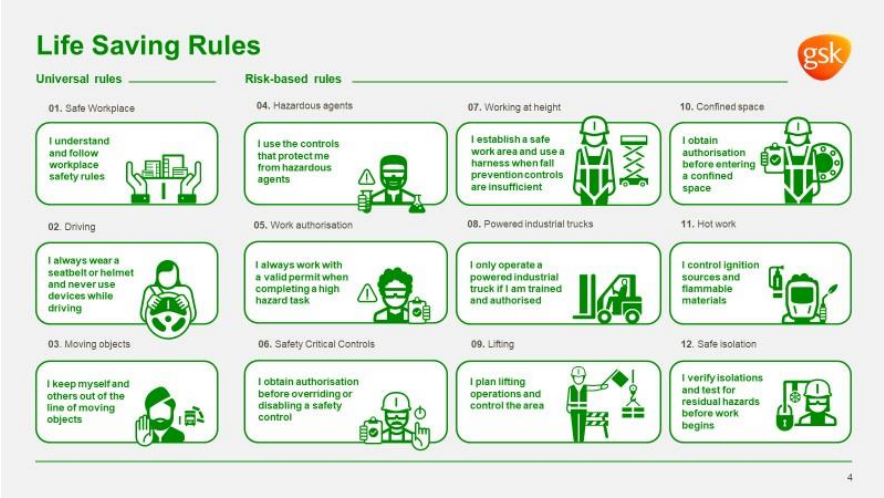
Options to get it right:

- Minimise sources of release – keep materials in the plant or operate outside!
- Provide good local ventilation near release points (sample points, charge ports, manholes etc)
- Conduct Hazardous Area Assessments and specify suitable equipment in these zones.
- Robust change control for HVAC equipment, changes to air flows, Hazardous Area Reviews.
- Install low flow alarms/trips on critical ventilation systems.
- Use of gas detection systems e.g. oxygen depletion, flammable gas detection.
- Where spillages could occur, minimise the floor/spill area to reduce evaporation.
- Ventilation systems should be considered safety (and quality) critical devices with planned preventative maintenance programmes.
- Provide a basis of safety for asphyxiation, flammable gas/dust and toxics to enable design of right ventilation system and train plant operators and engineers.

Process Safety Fundamentals and Life Saving Rules

Life Saving Rules

- Apply for all company personnel and typically contractors
- All in all settings; occupational safety and areas of high severity risk.
- Rules - considered “non negotiable”



Process Safety Fundamentals

- Designed for front-line staff managing or working with Major Accident Hazards
- Emphasise key hazards, risk factors and good practices
- Primarily for coaching/developing/training of operators, supervisors, technicians

Next Steps

Final copy editing & update pictograms

Integrate with Pharma Unit Ops Guidance (tbc)

Brochure/pdf format

Publish to EPSC website

Thank You!