Process Safety Congress Dordrecht May 2024

Impact of key management on process safety

Speaker introduction

sofis

Product Manager

Alphen aan den Rijn, Netherlands
Manual valve operations company
Captive key systems
Portable valve actuators
Valve position indicators

Halma

Graduate Trainee, Halma Future Leaders Program

FTSE 100
Group of companies in the Safety, Environment and
Analysis and Medical sectors

Indian Institute of Technology, Kharagpur

BTech (Hons.), Chemical Engineering
MTech (Hons.), Chemical Engineering

Raj Narayanan

I have discussed key management with:
- Operations Supervisors and HSE Managers
- Working with 14 major end-users / contractors / operators
- In 12 countries across regions

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Safe and sustainable manual valve operations protecting people, property and the planet

No accidents. No injuries. No downtime. No spills. No loss.

Oil & Gas

Chemical

New Energies: Wind, Hydrogen

Pharma

Food

FPSO

LNG

Tank storage

Marine, naval

Water-/wastewater

Agenda

- Captive key system / Valve Interlocks and Layer of Safety

- Sample captive key system – Double PSVs

- Focus : Keys

- Missing keys – impact on safety layer

- Common solutions and practices

- How to mitigate risks? Maintain the safety layer

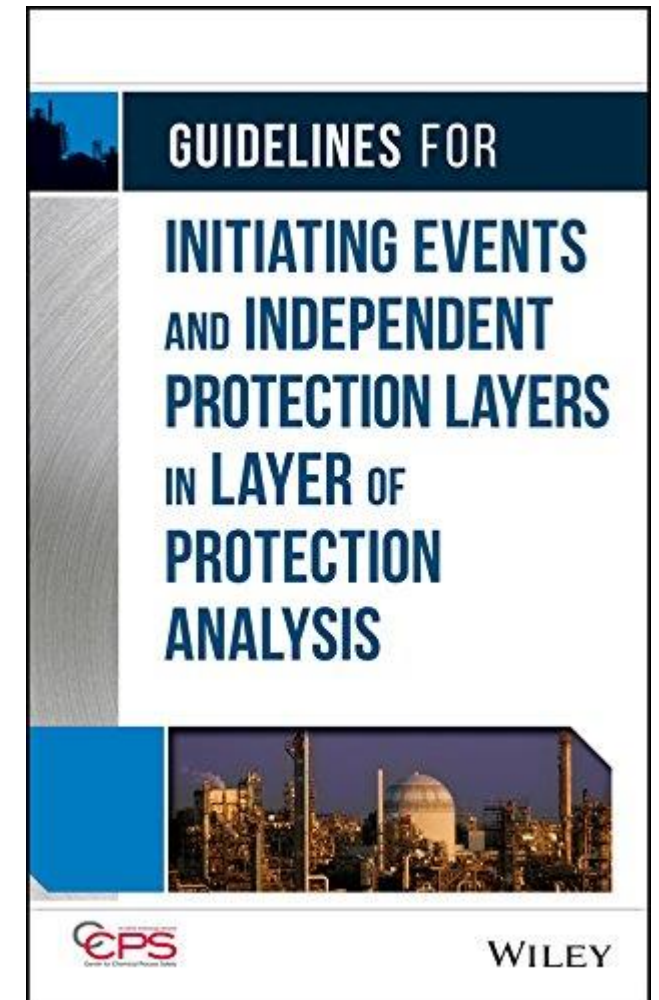# Who is involved in LOPA / HAZOP?

Author: Raj Narayanan

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The Captive Key System is described as follows:

A captive key/lock system employs mechanical linkages that are released by unique keys to prevent movement of a device (such as door handle or valve). This prevent humans from operating the valves in the wrong sequence.

The captive key lock capability is an integral part of the hardware design and is not able to be removed or defeated by tools readily available to the worker.
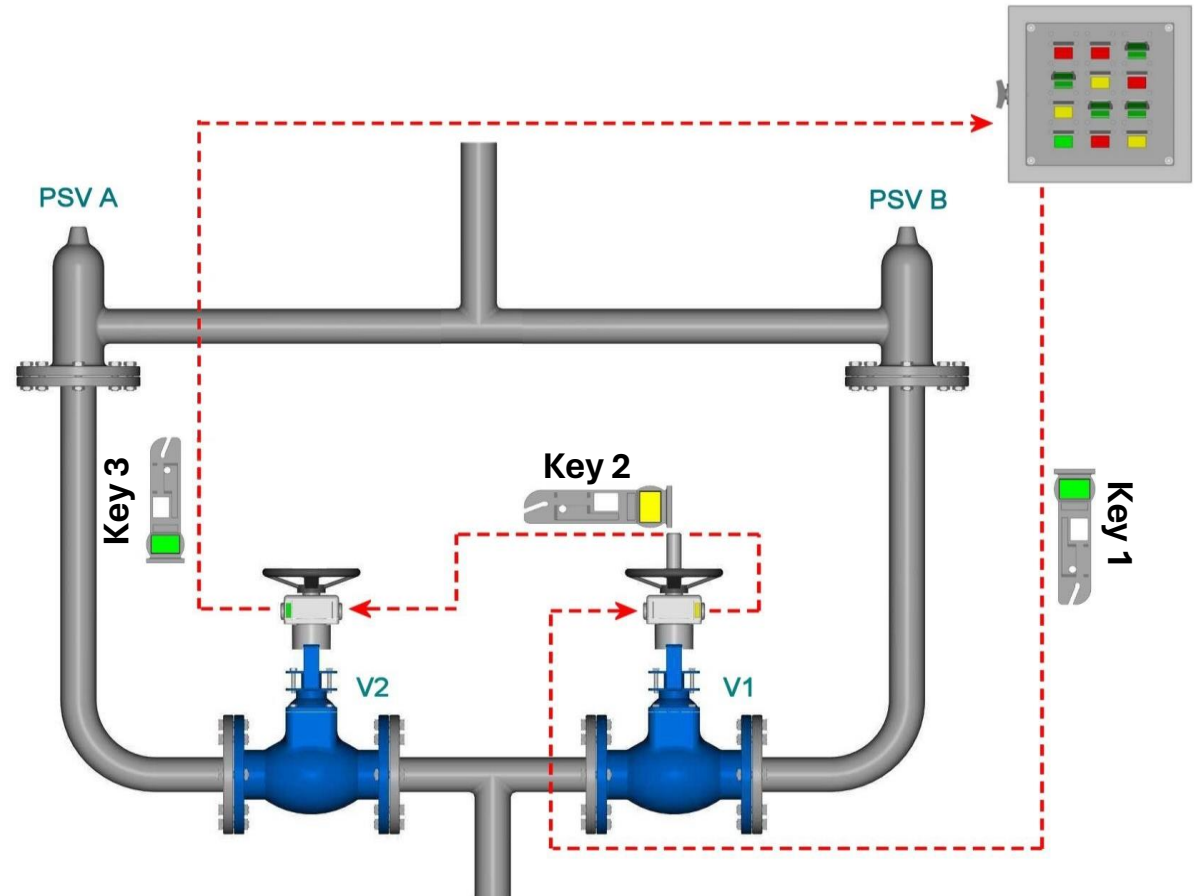
Generic PFD **suggested** for use in LOPA: **0,01 (2 credits)**

GUIDELINES FOR INITIATING EVENTS AND INDEPENDENT PROTECTION LAYERS IN LAYER OF PROTECTION ANALYSIS

CCPS

WILEY

Example of valve interlocks used for isolation of a PSV scheduled for maintenance

Trapped key interlocks are used for systems with critical manual valves (VCF 1, VCF 2)

Focus : Keys - Types

Personnel Keys

Crucial for operator safety.

Used under a LOTO program.

Safety guidelines suggest that a process should be followed

Operating Keys

- Used most frequently and ideally the only keys a site should require to operate all critical systems

- Keys are accessed by internal teams (operations, maintenance) and external vendors / partners

Spare Keys

Clients order them due to:

- Efficiency in maintenance operations

- Losing operating keys

Based on site:

- Good: Stored in a locked cabinet separate from operating keys

- Bad: Stored with operating keys

Master Keys

For time-critical maintenance requirements

Ideally, locked in a separate key cabinet, accessible only to supervisors

- Danger when used in regular operations replacing operating keys

- Most sites have extra sets of master keys

A lock is only as good as your key management!

Missing Keys – Impact on safety layer

Where is the key now?

- Has it left the facility with an operator or a contractor who forgot to return it?
  You do not get the key when you need it – efficiency loss and frustration
- Is it in a lock on a critical valve – may indicate incomplete maintenance on a critical system, or a valve left in an unsafe position
- With unauthorised personnel – critical operations may be possible without proper permitting, authorization, or out of phase with other processes

What is missing?

- Is it an operation key? The system can be operated at the wrong time (during operation or without the right permits)
- Is it a spare key or a group key? One captive key sequence can be bypassed
- Is it a master key?
- LOTO key: Is it safe to start-up? Is the operator safe?

When is it missing?

- Before a start-up? What impact does it have on your Pre-Startup Safety Audit (PSSA)? Do you have to do a walk-the-line inspection again?

Which keys are missing? Is the system highly critical?

How many missing? How does that affect the risk levels / safety layer?

How did this happen? Do you have the logs / means to investigate? Do existing processes work? How does that affect the safety layer?
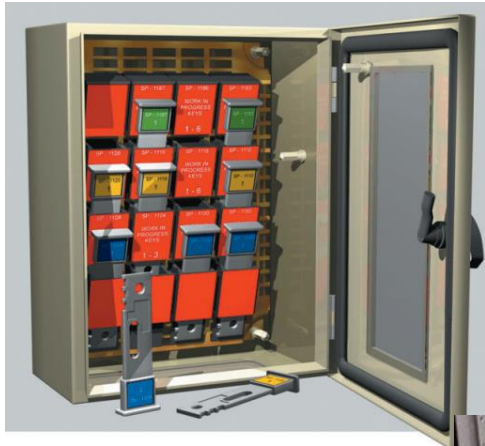
Methods of managing keys

Storage options – unmanaged / poorly managed – common in the industry!!

Methods of managing keys

Holster

- Uncoded key slots
- Tagged to guide the operator to insert the key in the correct slot

Coded cabinets

- Coded key slots
- Tagged to guide the operator to insert the key in the correct slot
- Back tags to provide visibility on missing keys
- Key (when present) tags to reflect system status

Electrical cabinets

- Coded key slots
- Solenoid locked keys -released via a permissive from the DCS
- Key presence detection – could be used to indicate system / valve status

Digital cabinets

Digital full scope key management

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Common Practices – Example 1

- 2 coded cabinets – keys segregated based on criticality

- Higher criticality -> key + logbook with supervisor -> permission
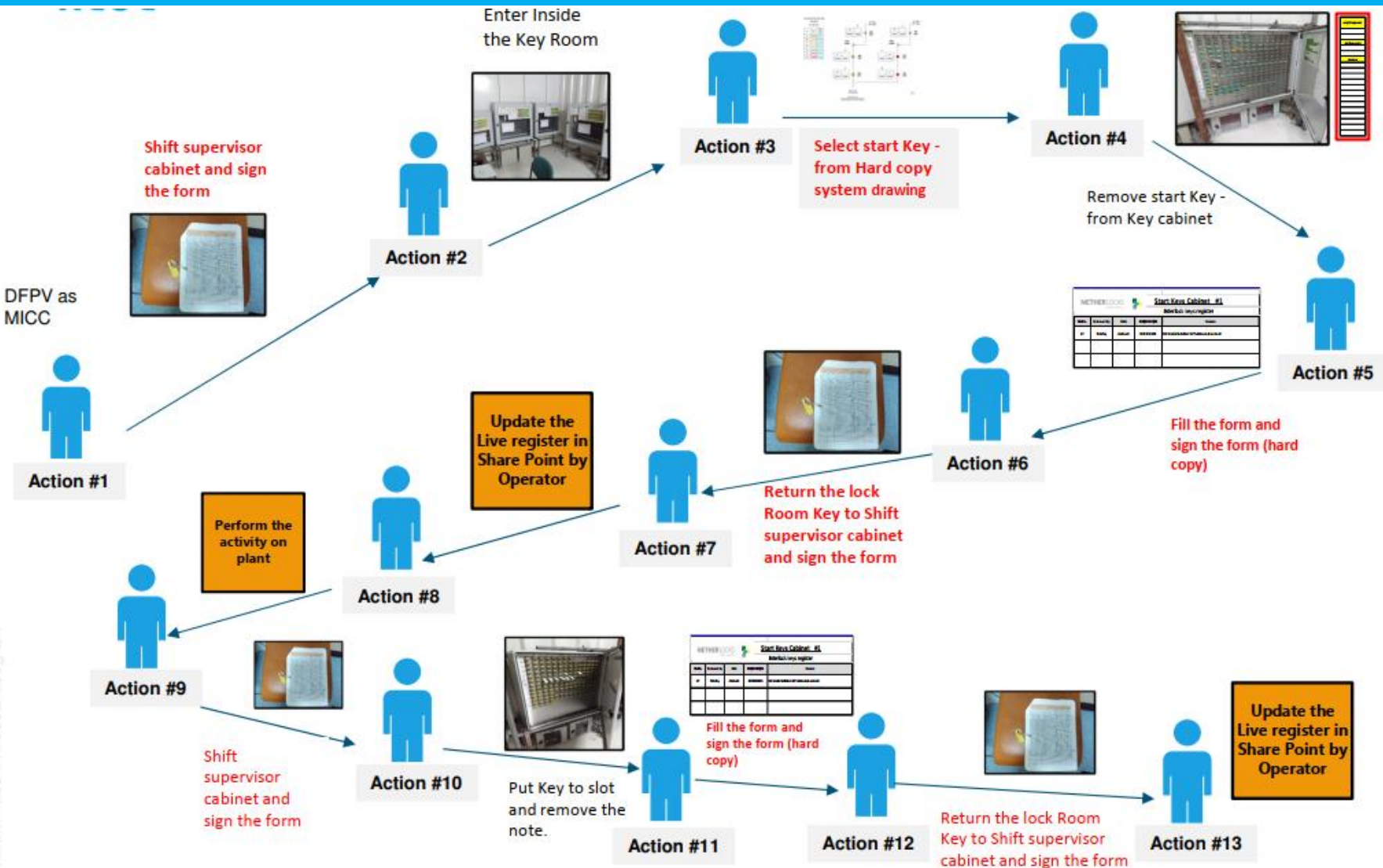- Lower criticality -> key + logbook available to operations staff

Process reliant on non-written procedures, and on operators to follow said process.

What is the impact on the PFD? Is it still 0.01?
What is the impact on the safety layer?

- What are they tracking?
- What is the impact on efficiency?
- Are practices effective when you have a high number of systems?

- What is the impact on the PFD? Is it still 0.01?
- What is the impact on the safety layer?
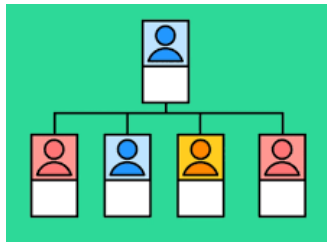
How to mitigate the risk?

What should good key management do?
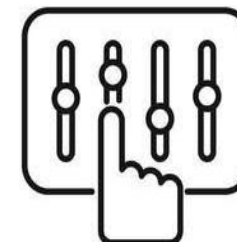
Identify **Authorise** **Guide** **Visibility** **Audit** **Control** **Alarm** **Ease**

- Operators must be recognised and recorded before a key transaction.
- Only the authorised / trained personnel should have access to keys. They must have the correct work permits to operate on the system.
- Personnel with access to keys must have the information to perform the operation.
- All key transactions must be tracked down to the operator, date and time. Accurate valve and system status information must be always available.
- Key management practices must be audited regularly to identify gaps. Crucial before shift changes, startups, etc.
- Correct practices must be enforced for each transaction.
- An alert should be raised immediately if a deviation from process is observed.
- Should be easy to implement, and intuitive and efficient for the operator.

Audience poll:

What are your thoughts on the impact of key management processes on the safety layer?

General questions?

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Thank you!

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