Organizational learning

MEC-E3004 Safety management in complex sociotechnical systems

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1. 2.3. Introduction and the basic concepts of safety management
2. 9.3 Basic concepts: Human Factors and Safety Management (Douglas Owen)
3. 16.3 Accident models
4. 23.3 Accident case (BP Texas City refinery explosion in 2005)
   - Mid-term assignment
5. **30.3 Organizational learning**

6.4 NO LECTURE

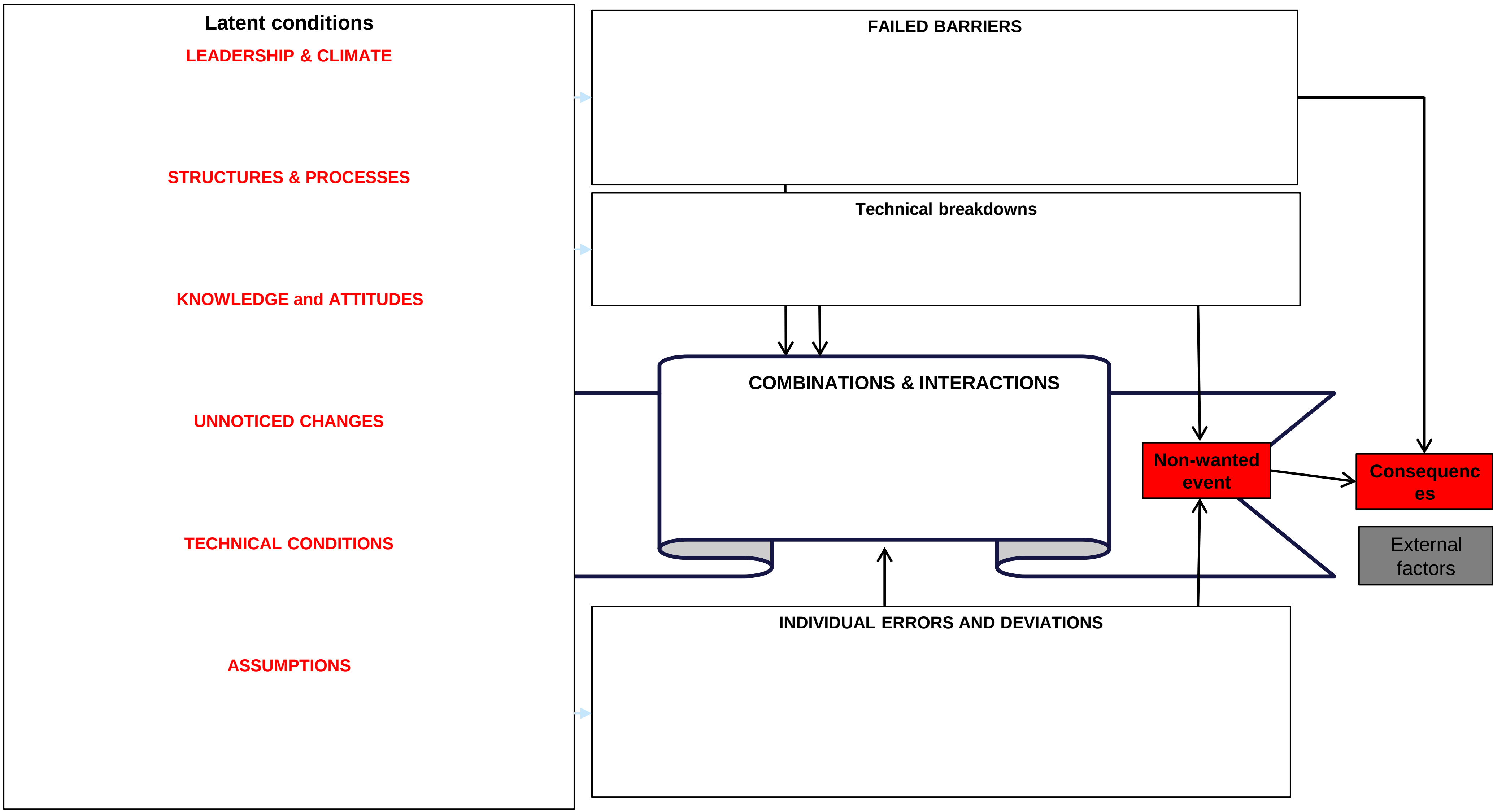
13.4 Returning the mid-term assignment

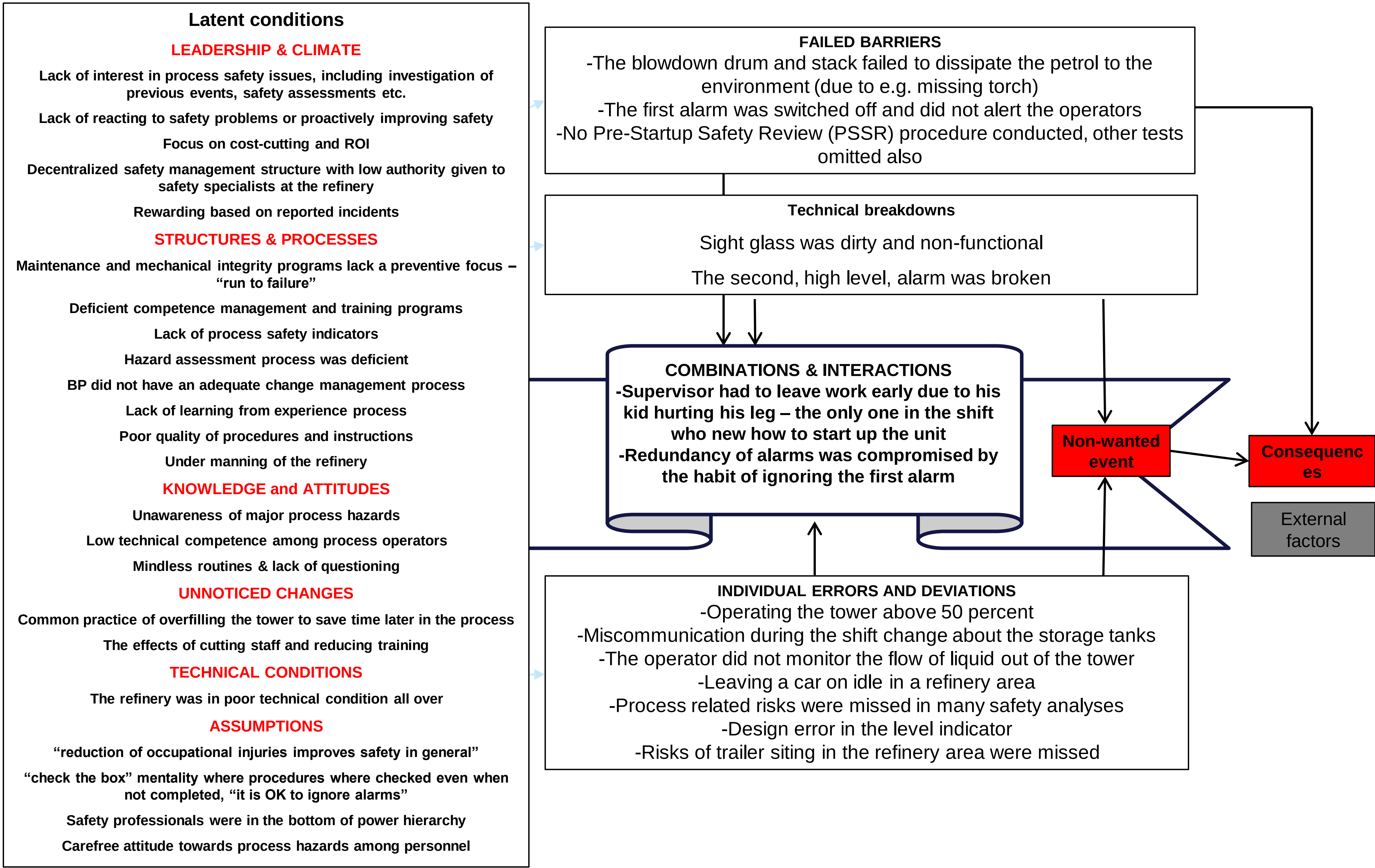
6. 13.4. Safety culture
7. 20.4. Safety leadership
8. 27.4. The basic principles of safety management
9. 4.5 Safety management systems
10. 11.5. Tools of safety management
11. 17.5 Future challenges and new directions of safety management (TIME!)
12. 25.5 Recap and Q&A
    - Deadline for returning the paper 31.5.2023

The Texas City refinery explosion in 2005

- **What kind of latent conditions did you identify?**
- **What technical breakdowns were caused by the latent conditions?**
- **What individual activities contributed to the event?**
- **What circumstances coincided?**
- **How did the safety barriers affect the event?**

- How could better safety management have prevented the accident?
- How could better safety culture have prevented the accident?


Latent conditions
LEADERSHIP & CLIMATE
STRUCTURES & PROCESSES
KNOWLEDGE and ATTITUDES
UNNOTICED CHANGES
TECHNICAL CONDITIONS
ASSUMPTIONS
FAILED BARRIERS
Technical breakdowns
COMBINATIONS & INTERACTIONS
Non-wanted event
Consequenc es
External factors
INDIVIDUAL ERRORS AND DEVIATIONS


Latent conditions
LEADERSHIP & CLIMATE
Lack of interest in process safety issues, including investigation of previous events, safety assessments etc.
Lack of reacting to safety problems or proactively improving safety
Focus on cost-cutting and ROI
Decentralized safety management structure with low authority given to safety specialists at the refinery
Rewarding based on reported incidents
STRUCTURES & PROCESSES
Maintenance and mechanical integrity programs lack a preventive focus – “run to failure”
Deficient competence management and training programs
Lack of process safety indicators
Hazard assessment process was deficient
BP did not have an adequate change management process
Lack of learning from experience process
Poor quality of procedures and instructions
Under manning of the refinery
KNOWLEDGE and ATTITUDES
Unawareness of major process hazards
Low technical competence among process operators
Mindless routines & lack of questioning
UNNOTICED CHANGES
Common practice of overfilling the tower to save time later in the process
The effects of cutting staff and reducing training
TECHNICAL CONDITIONS
The refinery was in poor technical condition all over
ASSUMPTIONS
“reduction of occupational injuries improves safety in general”
“check the box” mentality where procedures where checked even when not completed, “it is OK to ignore alarms”
Safety professionals were in the bottom of power hierarchy
Carefree attitude towards process hazards among personnel
FAILED BARRIERS
-The blowdown drum and stack failed to dissipate the petrol to the environment (due to e.g. missing torch)
-The first alarm was switched off and did not alert the operators
-No Pre-Startup Safety Review (PSSR) procedure conducted, other tests omitted also
Technical breakdowns
Sight glass was dirty and non-functional
The second, high level, alarm was broken
COMBINATIONS & INTERACTIONS
-Supervisor had to leave work early due to his kid hurting his leg – the only one in the shift who new how to start up the unit
-Redundancy of alarms was compromised by the habit of ignoring the first alarm
Non-wanted event
Consequenc es
External factors
INDIVIDUAL ERRORS AND DEVIATIONS
-Operating the tower above 50 percent
-Miscommunication during the shift change about the storage tanks
-The operator did not monitor the flow of liquid out of the tower
-Leaving a car on idle in a refinery area
-Process related risks were missed in many safety analyses
-Design error in the level indicator
-Risks of trailer siting in the refinery area were missed

WHAT DOES THIS MODEL MISS?

Latent conditions

LEADERSHIP & CLIMATE

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Lack of reacting to safety problems or proactively improving safety

Focus on cost-cutting and ROI

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STRUCTURES & PROCESSES

Maintenance and mechanical integrity programs lack a preventive focus – “run to failure”

Deficient competence management and training programs

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Under manning of the refinery

KNOWLEDGE and ATTITUDES

Unawareness of major process hazards

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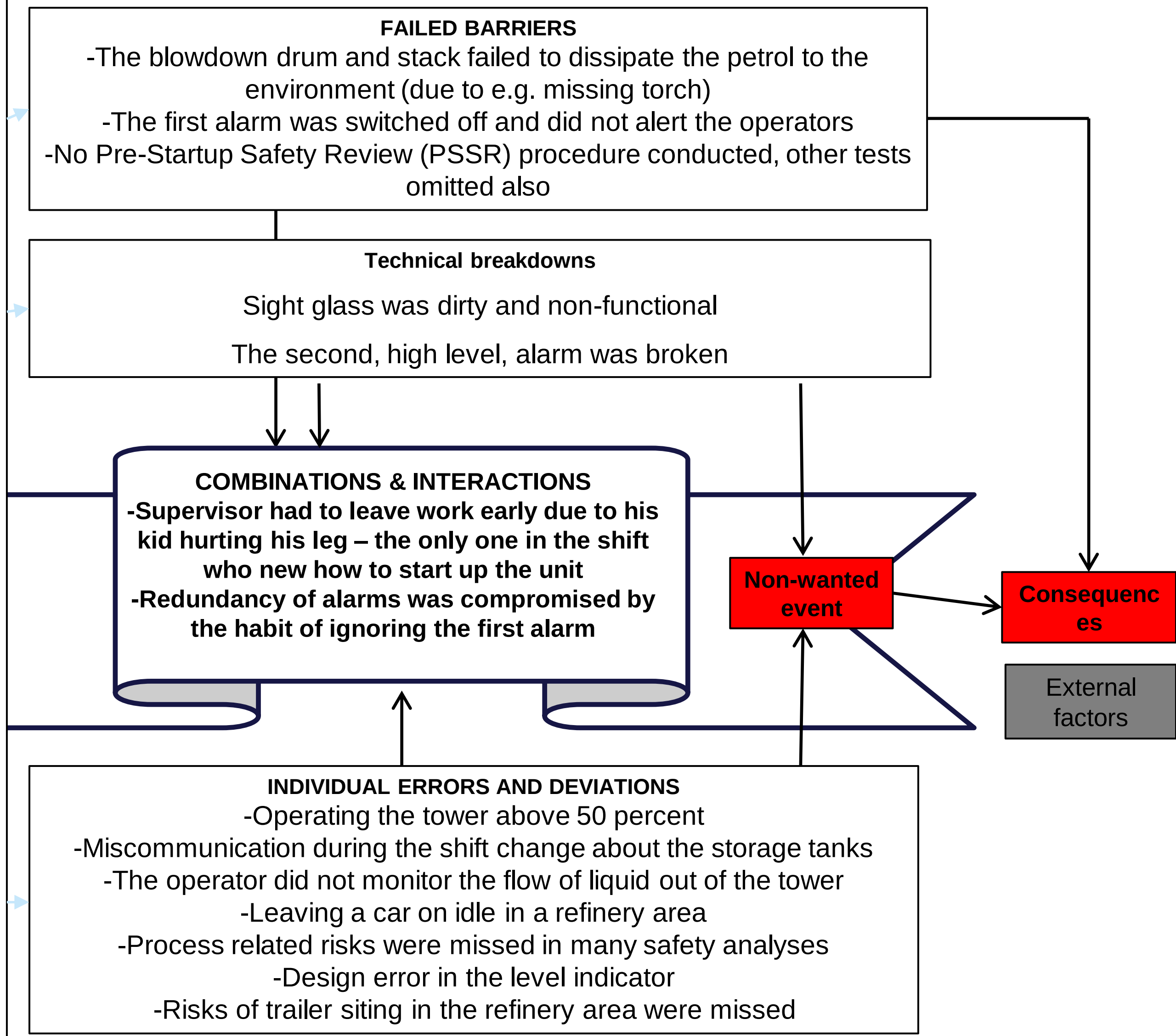


BP's response to the Texas City refinery accident (Hopkins 2012)

- Main learning was to minimize the number of people working close to potential explosion sources and providing blast-proof walls to protect those work areas that could not be moved further away
- All open vents with a possibility to release hydrocarbons to air were replaced with flares that would ignite escaping material safely at the point of the release
- BP created an independent Safety and Operations function at the corporate level
  - However, this function did not report directly to the CEO until 2011, when it was reorganized into Safety & Operational Risk function
- BP did NOT
  - Change the rewarding structure that emphasized production and rewarded non-reporting
  - Increase centralized control of safety and lessons learned issues, or give more power to safety personnel
  - Revise its approach to measuring safety based on Lost Time Incidents
  - Train process safety issues to personnel
- In October 2012, BP sold Texas City refinery to Marathon Petroleum Corporation

Challenges of learning from accidents – BP 2005 - 2010

The April 2010 blowout in the Gulf of Mexico occurred during operations to “temporarily abandon” the Macondo oil well, located in approximately 5,000' of water some 50 miles off the coast of Louisiana. Mineral rights to the area were leased to oil major **BP**, which contracted with **Transocean** and other companies to drill the exploratory Macondo well under BP’s oversight, using Transocean’s football-field-size *Deepwater Horizon* drilling rig. The oil spill is regarded as one of the largest environmental disasters in American history. In September 2014, a U.S. District Court judge ruled that BP was primarily responsible for the oil spill because of its gross negligence and reckless conduct.

The Chemical Safety and Hazard Investigation Board (CSB) found ”eerie resemblance” between the 2005 explosion at the BP Texas City refinery and the explosion aboard the Deepwater Horizon

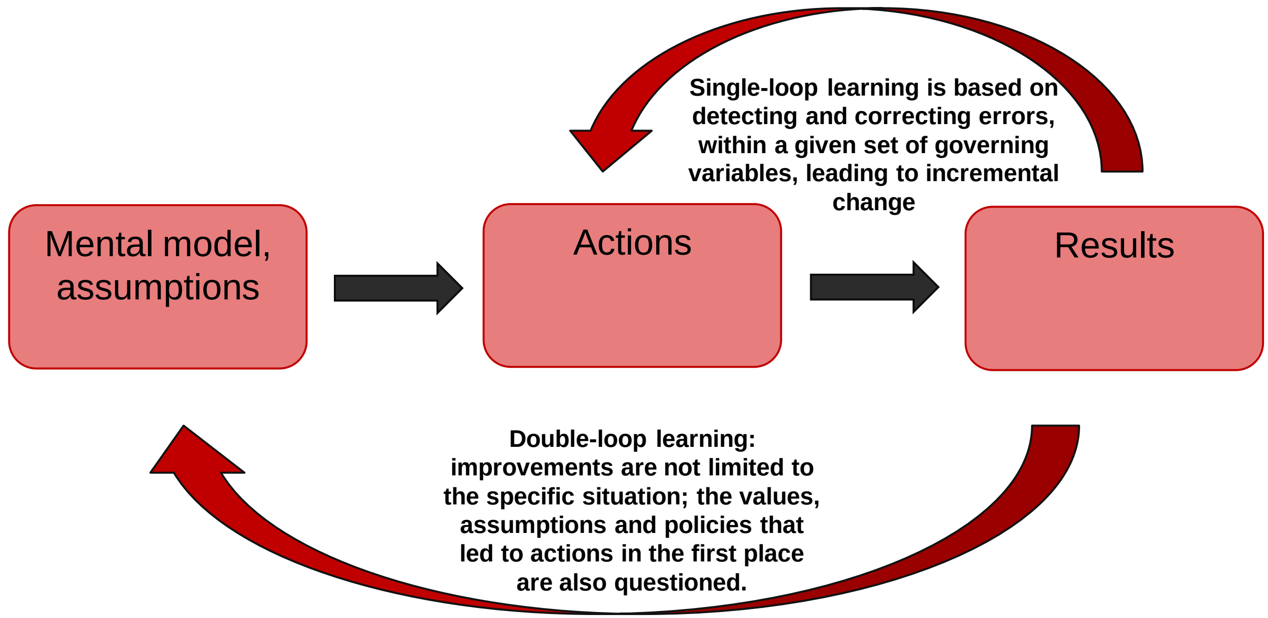
“A number of past CSB investigations have found companies focusing on personal injury rates while virtually overlooking looming process safety issues – like the effectiveness of barriers against hazardous releases, automatic shutoff system failures, activation of pressure relief devices and loss of containment of liquids and gases. Furthermore, we have found failures by companies to implement their own recommendations from previous accidents involving, for example, leaks of flammable materials.” (CSB Chairman Dr. Rafael Moure-Eraso)

“How safety is measured and managed is at the very core of accident prevention. If companies are not measuring safety performance effectively and using those data to continuously improve, they will likely be left in the dark about their safety risks.” (CSB Investigator Cheryl MacKenzie)

At Texas City a major program was ongoing at the time of the accident to improve safety (occupational) and the Deep Water Horizon has just won the company safety price for its low occupational accident levels – both celebrated low Lost-Time Incident (LTI) numbers before the accident

Types of learning: single loop versus double loop learning (originally by Chris Argyris)

Single-loop learning is often about the “quick fix”. The problem of quick fixes is that we tend to forget the double-loop learning. This leads to a loop of fighting fires instead of changing the actions that cause the fires



Two types of learning

- In single-loop learning the aim is typically to complete the given task or job
  - Learning is local, corrects errors or removes visible problems
  - Often gives a feeling of gratification, of “getting things done”
  - Easily become rules-of-thumb, that work *most of the time*, and *for a while*
- Double-loop learning questions the premises of the work
  - Learning is wider, aiming at so called root causes
  - Requires time to reflect
  - Typically requires interaction with others, which in turn enhances learning on an organizational level

What makes a group stick to single-loop learning

- Lack of systems view and consideration of the whole
  - Front-line workers (or managers, designers, etc) may not perceive the wider implications of the issues they encounter
- Lack of resources & time to reflect
  - Double-loop learning takes time and requires more consideration
- Lack of feedback on wider improvement suggestions & visible improvement
  - Leads to feeling of “we are on our own” and “management does not care”

- Also, these issues are made worse if
  - Management expects workers to solve problems on their own (wrong kind of empowerment)
  - Workers expect that management will not listen to their problems
  - There are pressures to be efficient and show progress
  - There is a lack of trust and lack of psychological safety => leads to underreporting
  - Systems for reporting are poorly functioning
  - Analysis and corrective actions are not done thoroughly in the organizations
  - Issues are not followed-up

Importance of psychological safety to learning (Edmondson 2009)

- Psychological Safety is ***when you feel safe interacting with others*** without fear that you will be embarrassed, humiliated or punished in some way. You feel safe for ***speaking up*** with ideas, questions, concerns, mistakes, or for asking for help and highlighting errors.
- Psychological safety fosters the confidence to report, discuss, manage and learn from any issues encountered by the group
- Psychological safety is a group-level (interpersonal) phenomenon, heavily dependent upon leadership in the given group
  - Also the behaviour of peers has a large influence
  - Relationships in groups with high psychological safety are characterized by trust and respect
- High power distance makes creating psychological safety more difficult – efforts to decrease power distance typically improve psychological safety as well
  - E.g. humble inquiry, dialogue, leader presence, employee involvement / participation

➢ Psychological safety is a necessary, but not a sufficient state for learning to occur

➢ Psychological safety is an aspect of safety culture

Success trap

(Baumard & Starbuck 2005, Snook 2000, Dekker 2011, Leveson 2011)

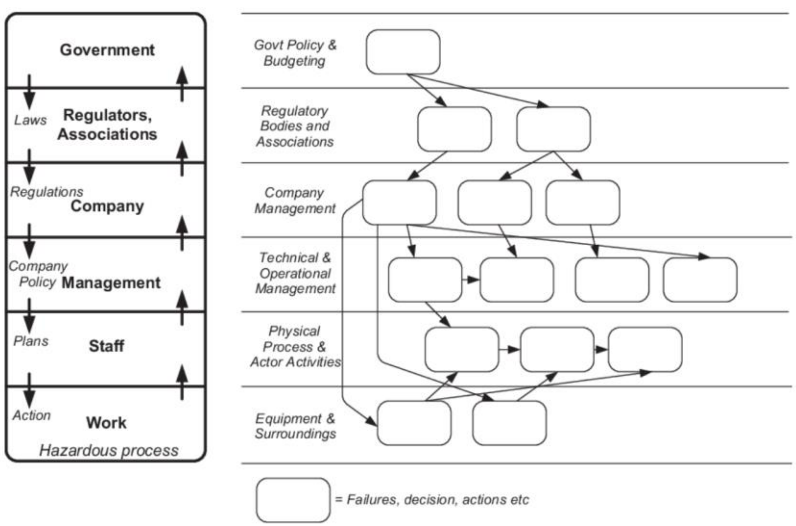
- Through long periods of continuous successes, organizations learn to eliminate activities that appear extraneous to optimize themselves – this makes them rigid and susceptible to disturbances
    - Organizations become simpler, less aware of events outside their immediate domains and less capable of diverse actions
- Having competence in some action leads to this action being successful and improves the competence through experience
    - Organization is more likely to use the same action strategy in future
    - This can also lead to the "solutions looking for problems" strategy, or extreme specialization
- Success breeds self-confidence, which often becomes generalized to other areas as well ("we were able to do this so we can do that as well")
    - The more successful the organization, the narrower its attention typically becomes. More assumptions, more things that are ignored.
- Challenge for safety – safer the system, less opportunities to learn from failures.

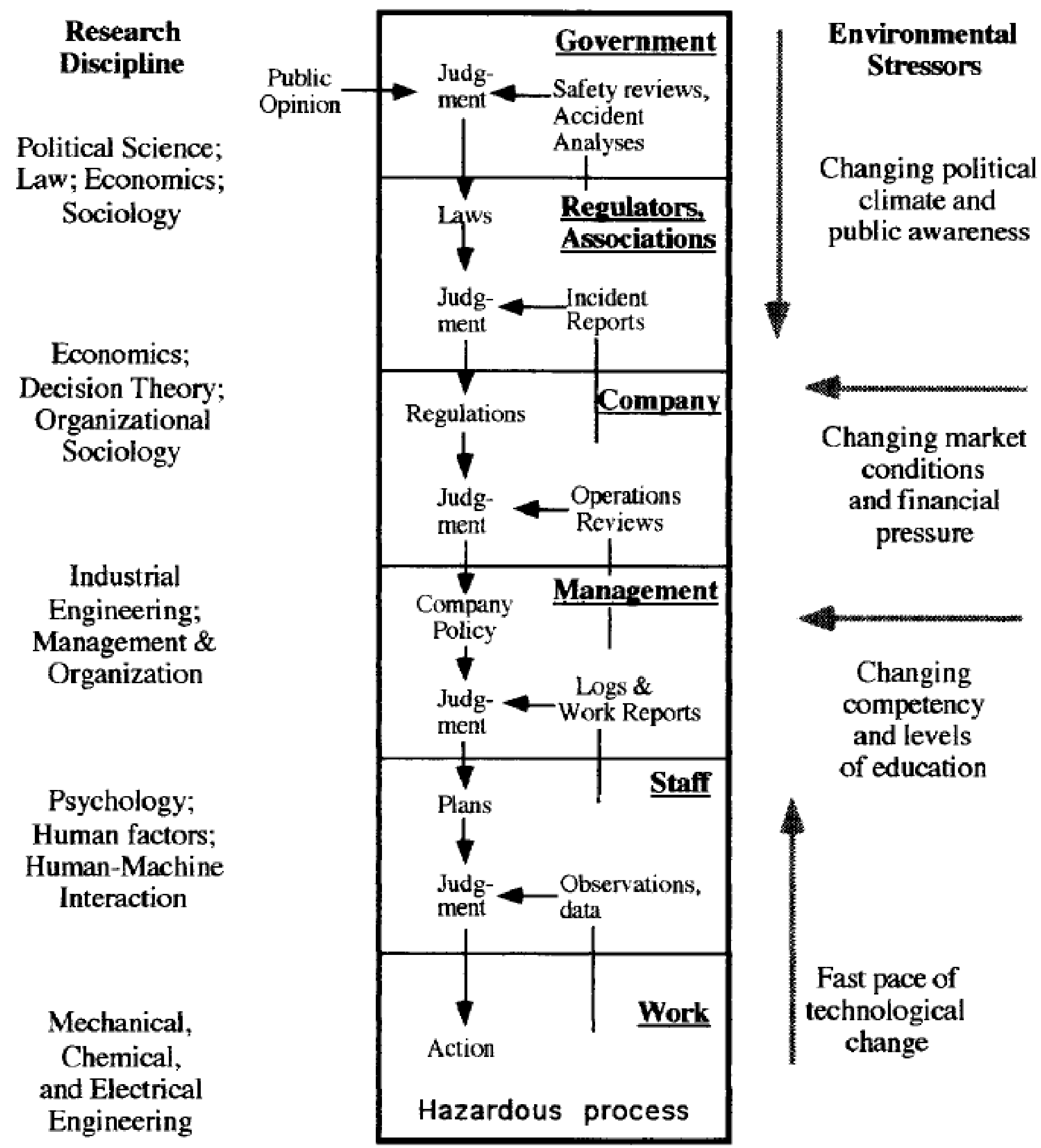
Rasmussen's (1997) model of levels of the sociotechnical system – learning on which level?

Each level has been typically inspected from the perspective of the particular discipline, independent of the other levels.

Incidents should be looked across the levels.

Accimap is one attempt to explain the influences of different levels on each other. We will return to Accimap on later lectures.





Operational experience program (IAEA 2018)

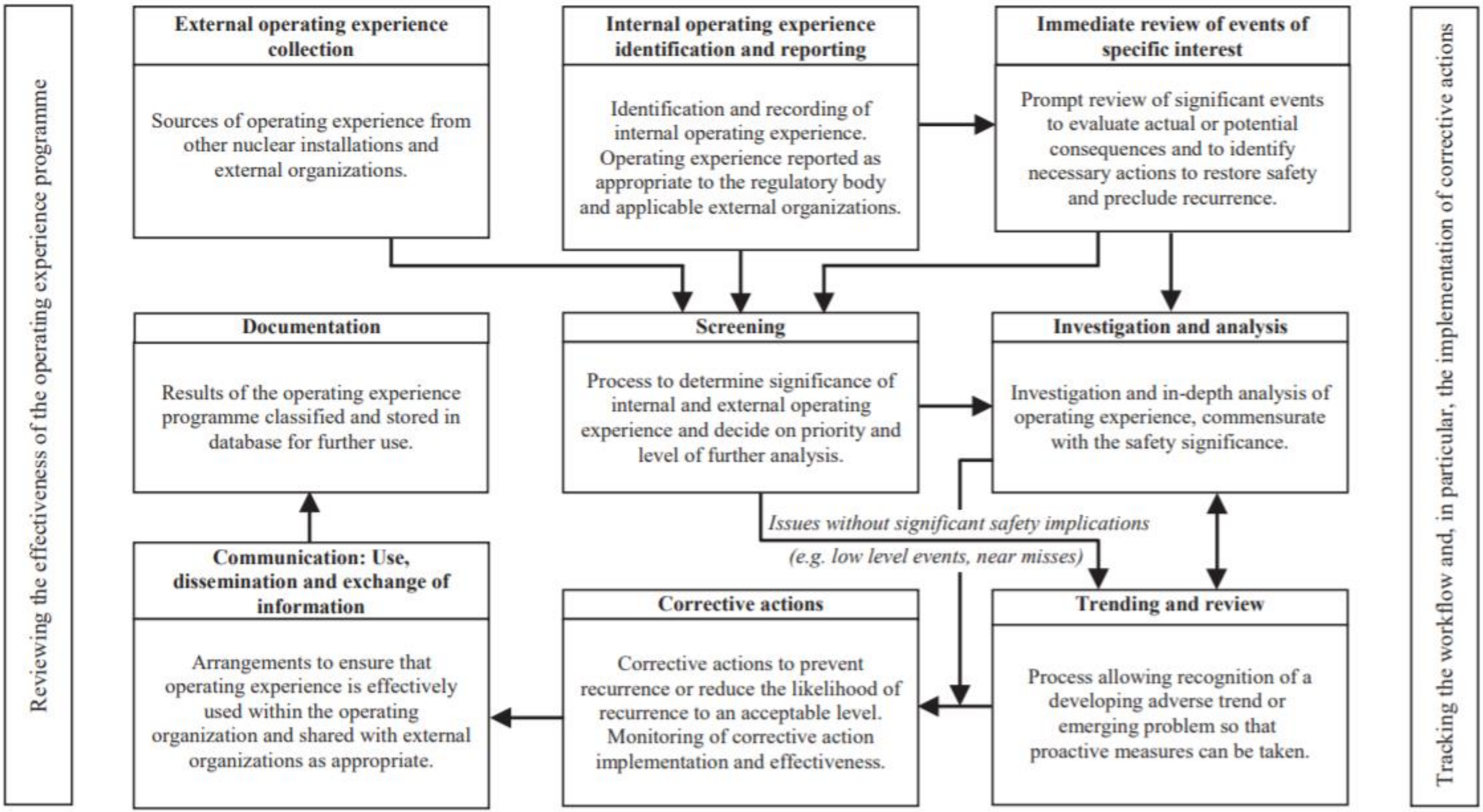


FIG. 1. Typical operating experience programme.

Summary: Why is learning from events important

- Complexity of modern systems makes it difficult to perceive all hazards: near-misses and incident can reveal new hazards and degraded or missing organizational processes / barriers
- Social processes in organizations such as drift, normalizing of deviance change the system in ways that are hard to predict
- The environment changes and creates new demands
- Although optimally organizations would be able to anticipate everything and never suffer from incidents, this is not realistically possible
- The consequences of events are defined partly by chance, thus learning from small incidents can help in reducing the risk of large accidents, if the analysis of the incident focuses on organizational causes and not only on technical &human faults
- However, it is important to remember that this kind of reactive learning from the negative is never enough to guarantee safety
  - Further, a model of safety and accidents is always needed in order to understand what the different events are trying to teach us
- Learning from incidents can be one way of improving the organization’s ability to succeed under varying conditions, but it cannot be the only way
- A learning culture needs to be created and nurtured (including so called reporting culture and just culture)

Mid-term assignment

- Read the paper “Space Shuttle Challenger Explosion” in MyCourses

- Answer the following questions (2-6 pages total):

1) In your opinion, what were the most significant reasons and contributing factors of the explosion of Space Shuttle Challenger?
2) In your opinion, what was the major missed opportunity to prevent the disastrous chain of events? Why was it missed?
3) What information you felt was missing from the paper that would have helped you to better understand the causes of the accident? On what topic you would have wanted more information as an accident investigator?
4) What is the relevance of the accident of the 80s for the present day safety management?

Deliver the paper before 13.4. in MyCourses

The paper is not graded but its quality affects the overall course grading

The paper can be written in English or Finnish

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