The Process Safety Memory Crisis

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Introduction Eline Beulens

- **AcuTech Consulting** ~ 6 months
  - Group Leader, Europe
- **Cargill** ~ 11 yrs
  - Global Sr. Director Process Safety – all businesses & technologies
  - Leadership Development and training
  - Mentor with European LEAD network
- **DuPont** ~17 yrs
  - Process engineering, Operations and Technology management, Operational Excellence
- **European Process Safety Centre Leadership** ~ 5 yrs
  - EPSC Board member
  - Chair of the EPSC Board
- **AIChE / CCPS® Leadership**
  - Planning Committee Member CCPS®/EPSC Process Safety & Big Data Conference
- **Process Safety Leadership & Culture** — Recent Presentations:
  - *Leadership that Drives Process Safety Excellence - AcuTech Consulting Group* – EPSC Conference Aachen 2025
  - *Process Safety Maturity* - EPSC Technical Meeting Presentation April 2022
- **Training & Leadership Development**
  - Development and implementation of Cargill's New Leader PS Program and Exam committee member
  - Taught process safety training, including PS Management Systems and Leadership training
  - Delivered training globally: United States, Brazil, Europe, Türkiye, China, Indonesia
- **Credentials**
  - CCPS® Process Safety Professional Certification
  - MsC, Chemical Engineering, University of Technology Eindhoven, NL

LEAD Network

EPSC

2026 GLOBAL CONFERENCE ON PROCESS SAFETY & BIG DATA

CCPS PROCESS SAFETY PROFESSIONAL CERTIFICATION

AcuTech PROCESS RISK MANAGEMENT

About AcuTech – Operating since 1994

- End-to-end process risk management solutions, integrating consulting, training, and software across the full lifecycle of high-hazard operations.
- Technical risk analysis and management systems, including PSM frameworks, corporate security risk, and emergency management programs.
- Experience across all high-hazard industries.
- Application of risk tools and methodologies, supporting needs from regulatory compliance to advanced risk-based decision-making and operational excellence.
- Global delivery model with technical consistency, supporting sites across the US, Europe, India, Asia-Pacific, and the Middle East.

Why We Keep Repeating the Same Incidents:
The Process Safety Memory Crisis

Remember?

Source: www.CSB.gov

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Highlighting some Training and Knowledge aspects

Formosa Plastics PVC (2004)
- Staffing changes (i.e. elimination of experienced area group leader role)
- Lack of emergency response training for operator crew

BP Texas City (2005)
- No effective reporting and learning cultures where previous incidents and near-misses could serve as learning opportunities to avoid catastrophic incidents
- Risk awareness deficiencies across corporation

Imperial Sugar (2008)
- Hazard of dust accumulation was not included in the training material. Emergency evacuation training and drills missing
- Minimal retention of safety training topics

Deepwater Horizon (2010)
- Gap between Work-As-Imagined and Work-As-Done (response time under pressure, decision making basis)
- Non-technical skills

Didion Milling Combustible Dust Explosion (2017)
- Insufficient process hazard recognition (properties materials, deflagration propagation hazards, design engineering standards, learning from incidents)
- Lack of knowledge transfer
- Fire training program – emergency response

Optima Belle Explosion (2020)
Lack of & inconsistent chemical reactivity & decomp information and understanding led to runaway reaction.

Source: www.CSB.gov

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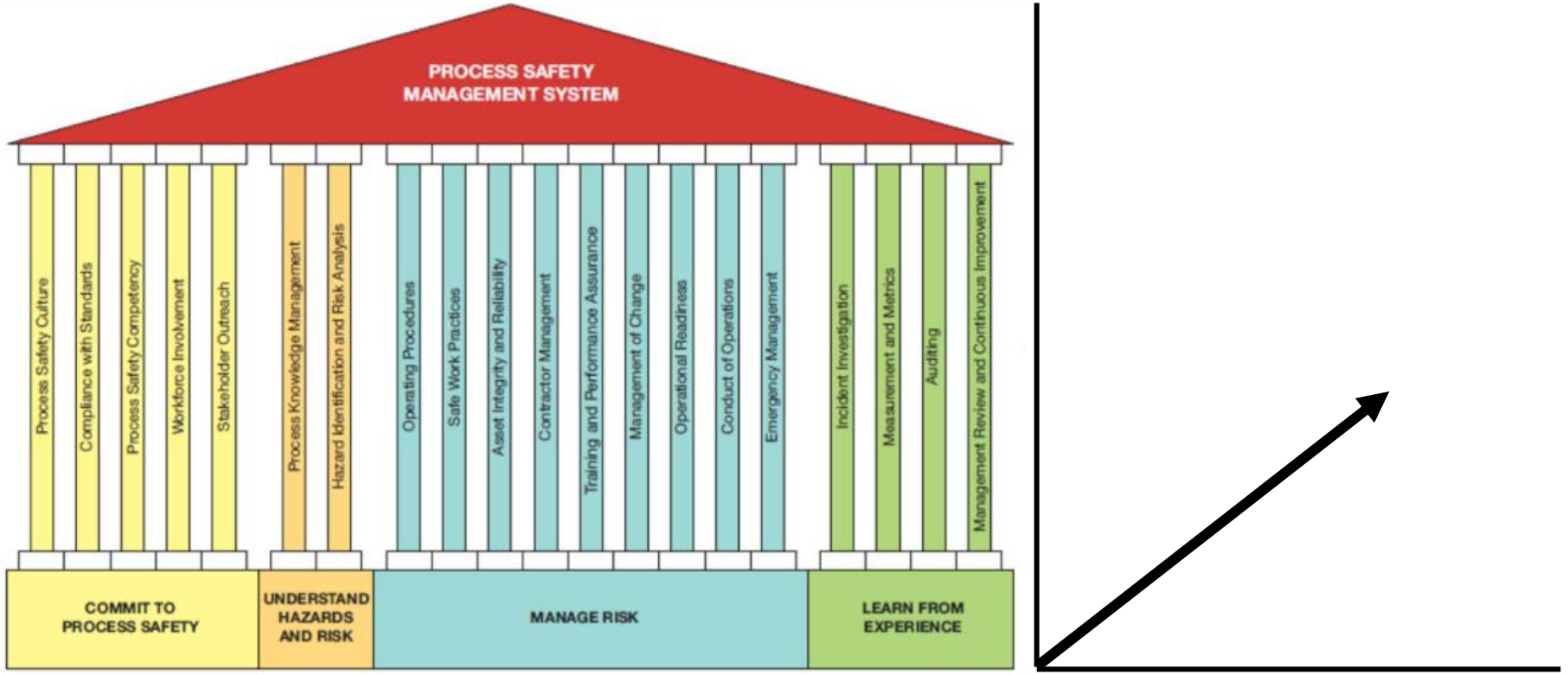
Quality of execution



Why Knowledge Loss Is Accelerating and Incidents Repeat

Process Safety Memory Crisis

Institutional Knowledge Gaps Increase due to…

1. Changing Workforce Dynamics
2. External Factors (Resource Constraints, Industry Transitions)
3. Weak Learning Systems

Organizational Memory Loss

“Organizations have no memory“ - Trevor Klez

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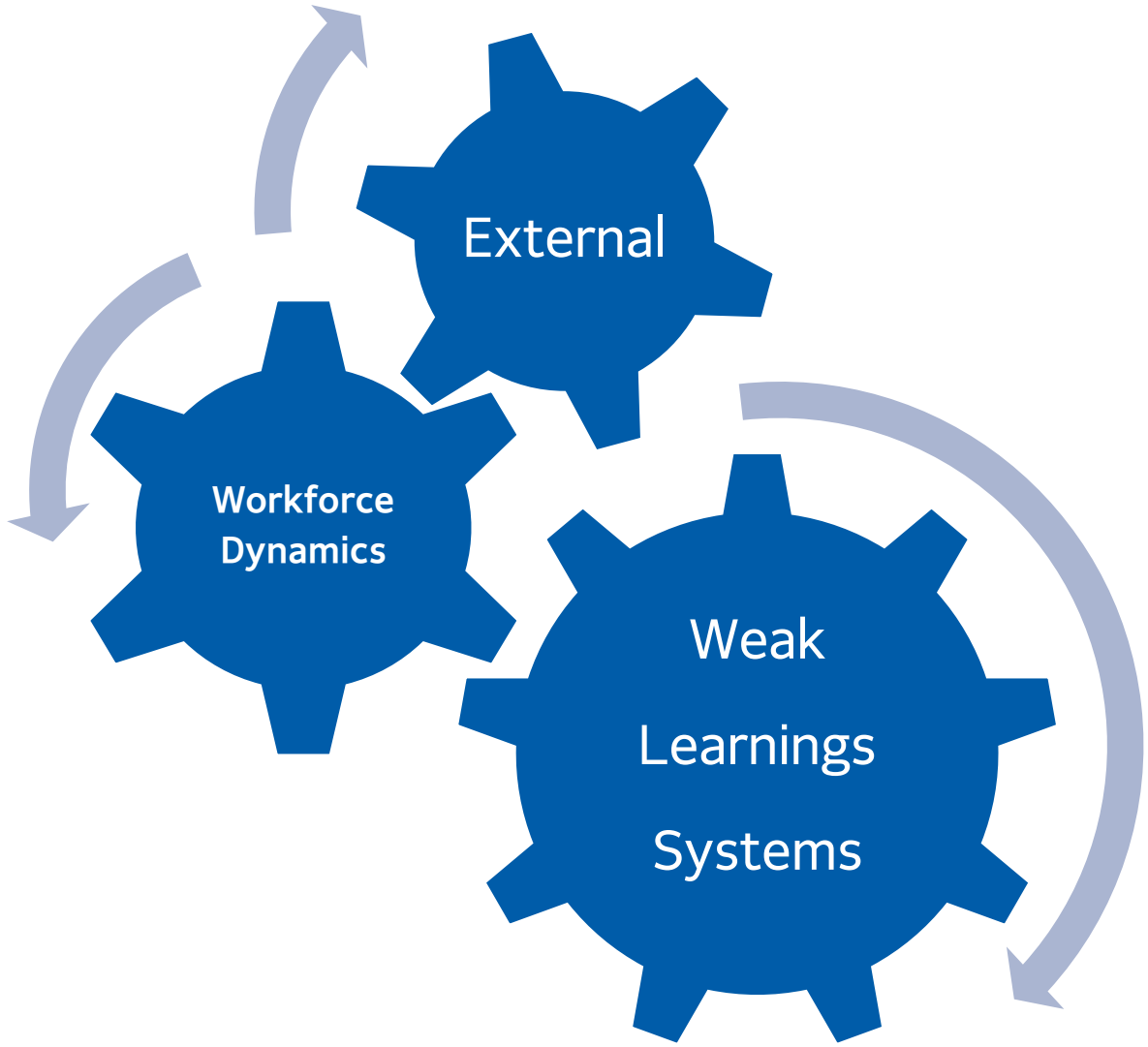
Knowledge Loss Is Accelerating and Incidents Repeat

WORK FORCE DYNAMICS

Staff Turnover without sufficient mitigation strategies

- Tacit knowledge is lost:
  - Intuitive pattern recognition decreases
  - Undocumented operational workarounds and insights lost
  - Rationale behind practices forgotten
- Team dynamics disrupted
- Less ability to detect early warnings and respond effectively to risks



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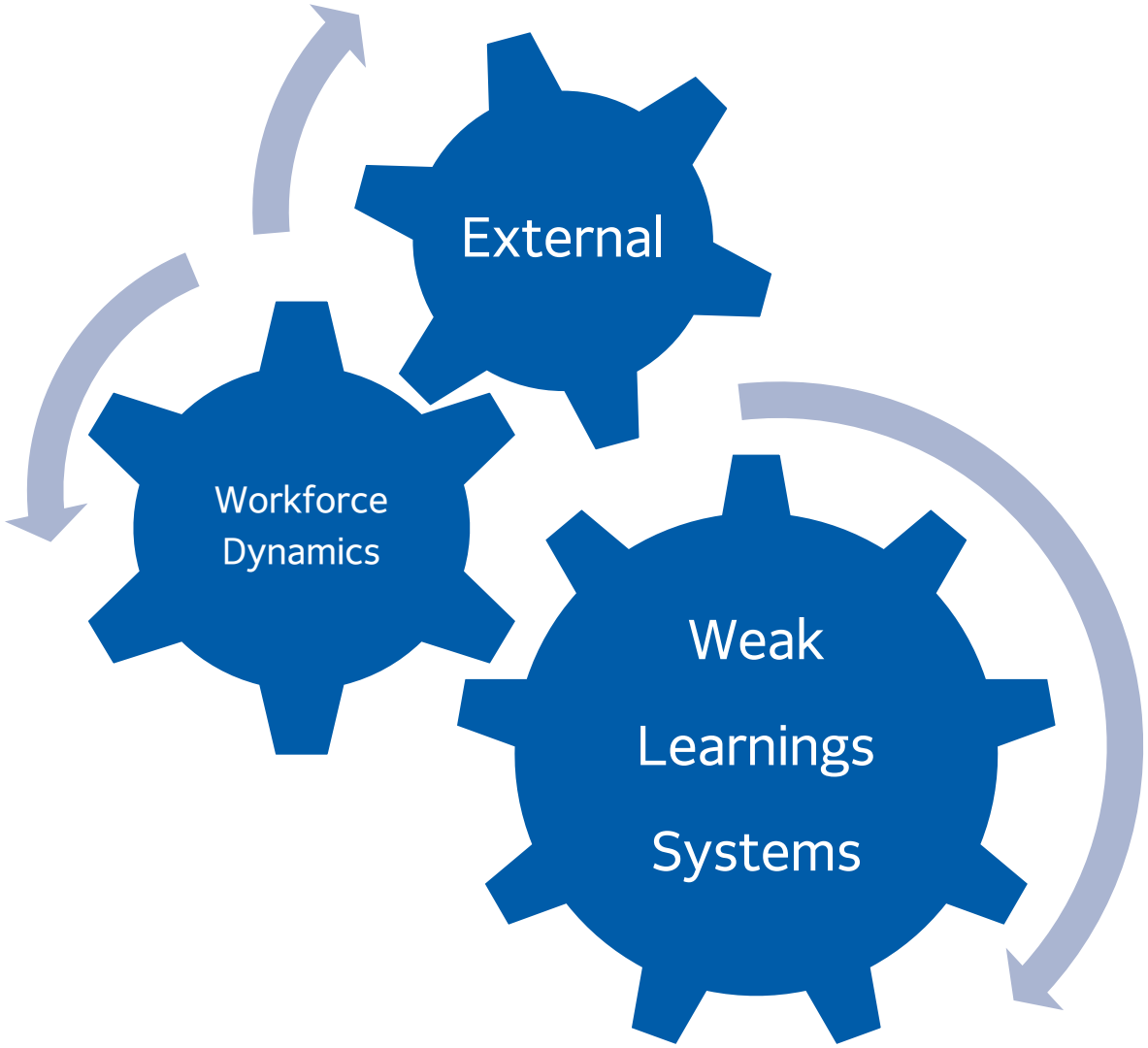
Knowledge Loss Is Accelerating and Incidents Repeat



EXTERNAL FACTORS

- Financial strain
  - Deferred maintenance and unsafe modifications, weaken safety defenses.
  - Cost-cutting removes experienced personnel, eroding safety-critical knowledge and operational continuity
  - Limited training investments increase reliance on inexperienced workers, raising incident risks.
- New Industries lack decades of experience and culture
- Rapid growth and heavy dependence on digital systems increase vulnerability to process safety incidents.

Knowledge Loss Is Accelerating and Incidents Repeat

WEAK LEARNING SYSTEMS:

- **CONTENT**
- **DELIVERY**
- **INTENT**
- **IMPACT**

- **Tacit Knowledge** - Traditional documentation does not capture experiential wisdom or tacit knowledge
- **Siloed Knowledge -** Incident lessons often remain trapped in reports or separate departments, limiting cross-organizational learning.
- **Lack of Integration into Training -** Without integrating lessons into training and procedures, knowledge fails to influence future operations.
- **Ineffective Technology Use -** Data capture technologies do not adequately share insights with frontline workers, impeding awareness.

- **Training vs. Real-World Decisions** - Serious incidents occur despite training due to complex, time-pressured decision-making environments.
- **Limitations of Traditional Training** - Traditional training focuses on information transfer without preparing learners for ambiguous operational conditions.

- **Learning Design for Safety** - Reframing failures, and redesign training to reflect real operational challenges.
- **Need for Proactive Systems -** Organizations must adopt systems that distribute and institutionalize lessons across all levels to prevent recurrence.

- **Continuous Mentoring** - Without strong mentorship, critical safety lessons are lost, increasing risk of incident recurrence.
- **Complacency** grows due to long incident-free periods and/or lack of awareness of past crises, reducing vigilance and increasing risk exposure.
- **New asset owners in Industry** must adopt lessons from traditional industries through deliberate cross-industry knowledge sharing.

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The Path Forward

Consider Three Pillars for Impact

Capture from

- Experts
- Industry
- Incidents

Include Tacit Experience

Transfer

Adult Learning Principles

- Relevant
- Flexible
- Pragmatic/Experience
- Operational Realities

Institutionalize

- Organizational Learning Culture
- Systemic Approach to Knowledge Retention
- Integrated – How We Work

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Understanding the Gap between Training & Safe Performance

Training vs. Real-World Decisions

Serious incidents occur despite training due to complex, time-pressured decision-making environments.

Limitations of Traditional Training

Traditional training focuses on information transfer without preparing learners for ambiguous operational conditions.

Operational Realities and Pressures

Influence decision behavior under pressure.

Learning Design for Safety

Reframing failures as learning design problems supports redesigning training to reflect real operational challenges.

Adult Learning Principles [1]

Knowles: How Adults Prefer to Learn

Autonomy – self-directed

Relevance &
Real operational problems and needs

Respect previously accumulated work experience

Driven by internal factors professional pride , responsibility towards colleagues

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Adult Learning Principles [2]

Mezirow's Transformative Learning: How Adults Change Deeply Held Beliefs & Assumptions

- Many unsafe behaviors are not the result of ignorance, but of mental models shaped by past success or failure, norms or rules, and gradual drift.
- **Transformative Learning Theory**:
  - Changing deep beliefs, internal rules and assumptions
  - Use triggers and dialogue to expose new perspectives, open the door for learning and reflect on decision making processes
- Example: Transformative learning shifts safety focus from rule violations to understanding how normal work drifts into unsafe situations.

Integration with Adult Learning principles enhances training and development impacting how adults think under pressure

Scenario: Loss of Cooling During Plant Startup

Knowles' Theory Application

Engages learners by encouraging sharing of experience and identifying decision points during safety events. Include theoretical and tactic background.

Realistic Safety Scenario

Scenario depicts loss of cooling during plant startup, highlighting common precursors to major accidents.

Mezirow's Critical Reflection

Facilitates critical reflection on assumptions and decision-making. Reveal hidden risks, assumptions, knowledge gaps.

Facilitated Safe Dialogue

Structured prompts guide discussions without blame, promoting psychological safety and learning.

Another Example: Leadership Training

Knowles' Theory Application

- ❑ Include relevant hazards for the leader's area of accountability, right level of technical theory and leadership behaviors
- ❑ Engage leaders by encouraging sharing of experience
- ❑ Respectful of time and pace
- ❑ Celebrate success

Mezirow's Critical Reflection: Facilitated Safe Dialogue

- ❑ Facilitate critical reflection on assumptions and decision-making.
- ❑ Reveal hidden risks, assumptions, missed signals and knowledge gaps.
- ❑ Structured prompts guide discussions without blame, promoting psychological safety and learning.

Leadership that Drives Process Safety Excellence - AcuTech Consulting Group

Practical integration & Key Takeaways

Effective Training Design

Improving process safety requires better training design focused on interactivity and real operational challenges.

Facilitating Reflective Learning

Leaders should facilitate learning that challenges assumptions through incident reviews and reflective questioning.

Leadership Role in Safety

Leaders model reflective practice and encourage questioning, strengthening safety learning at all levels.

Transforming Training Impact

Engaging adults through relevant design and critical thinking turns training into a tool for accident prevention.

Active Problem-Centered Learning

Shift training from passive sessions to active, problem-centered experiences that mimic real operational decisions.

Use of Real Incidents and Examples

Incorporate real incidents, near misses, and plant-specific examples to connect new knowledge with prior experience.

Timing and Context Relevance

Deliver training aligned with current operational risks and relevant timing like startup campaigns or abnormal events.

Focus on Decision Points

Emphasize decision-making under uncertainty to highlight critical moments influencing safety outcomes.

Managing Organizational Competency with intent is a Strategic Investment

- **Importance of Knowledge Retention and preserving Institutional Memory**

- **Building Learning System and intentionally embed learning capture and effective transfer**

Strengthening organizational memory helps prevent future losses and fosters safer, more resilient and sustainable operations.

Process Safety done right, drives operational excellence

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Q&A and reflection?
Meet us at our booth

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