



المؤتمر الافتراضي الاول لسلامة العمليات الكيميائية الأردني الدولي
First Jordanian International Chemical Process Safety Virtual Conference

الصحة، السلامة، البيئة، المجتمع والامن الكيميائي
Health, Safety, Environment, Social and Chemical Security

30 - 31 /3/2021

Virtual Conference

Process Safety Cards™

*"Accidents are not caused by a lack of knowledge,
but by a **failure to use the knowledge that is available.**"*

Trevor Kletz

Challenge

- Process Safety Incidents continue to occur, despite...
 - **Better Technology**
 - **Bigger Data**
- Are we focussing on the wrong ...
 - **Protection**
 - **People**
- Process Safety initiatives are now common...
 - **May exclude external resources**
 - Outsourced Operations & Maintenance
 - **Wisdom is lost with the ageing workforce**
 - Assets getting older but those responsible are getting younger



On Tuesday December 8, 2020, at approximately 10 pm EST an explosion occurred at Optima Chemical LLC in Belle, WV.

The incident lead to one fatality and two injuries as well as a shelter-in-place for community members within a 2-mile radius of the facility.

US Chemical Safety Board

Workforce Engagement



*" People learn nothing when they're asleep
and very little when they're bored "*

John Cleese

- **Gamification**

- Employing game design elements to improve user engagement, learning & knowledge retention.

- **However ...**

- Personnel are time (attention) limited.
- Board games can become bored games if they are rigid or protracted.
- E-learning can be expensive to develop & deploy in the workplace.

- **Microlearning**

- Relatively small learning units and short-term learning activities.

Put Knowledge into the Right Hands

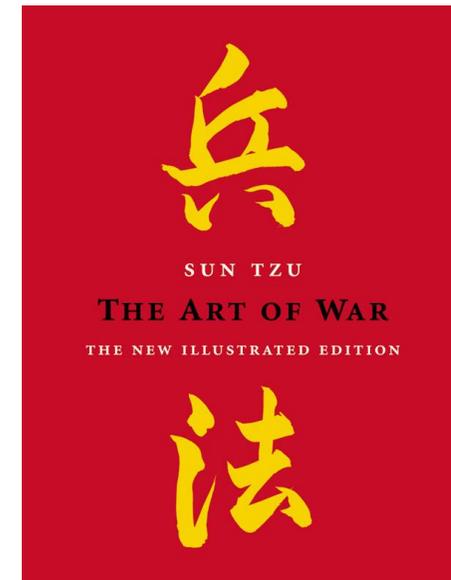
- Players encouraged & helped to learn & apply simple principles:
 - **REMEMBER** Events
 - **RECOGNISE** Cause (Threats)
 - **RESPECT** Controls (Barriers)
 - **REPORT** Concerns
- Thereafter, there is an obligation on the duty-holder or owner/operator to:
 - **RESPOND** to Feedback
 - **RECOVER** Protection



Playing Cards Improve Awareness

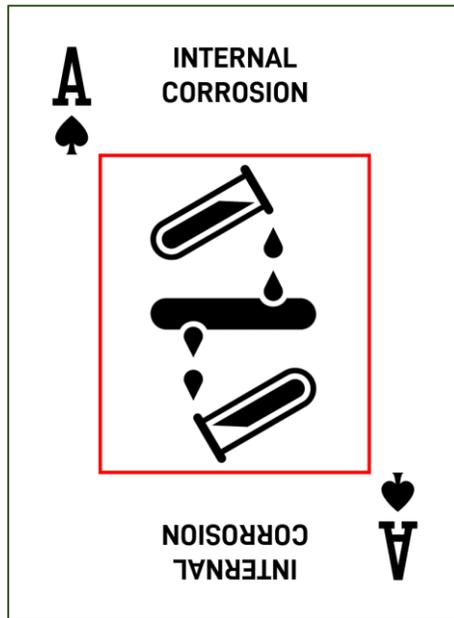
- Visualization to get and **keep** the workforce onboard with the **Process Safety** (Asset Integrity) mission:
 - Use familiar playing cards with 52 separate LoC events.
 - Cards offer an organic approach that can develop with community [feedback](#)

- **“KNOW YOUR ENEMY”**
 - Hazards are **NOT** your enemy !
 - Loss of Containment is everyone’s Opponent



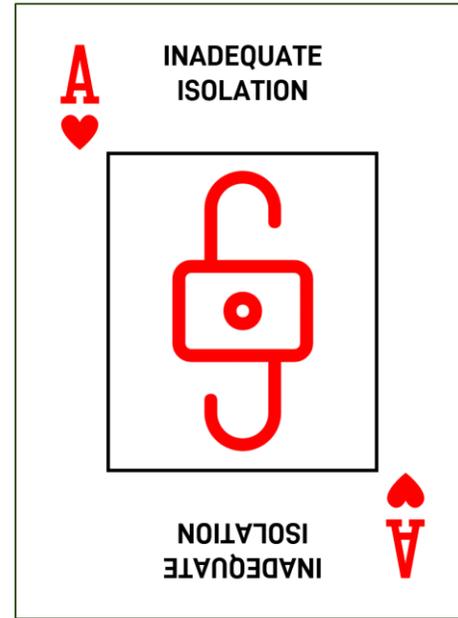
Cards Create Curiosity & Catalyse Conversations

DEGRADATION



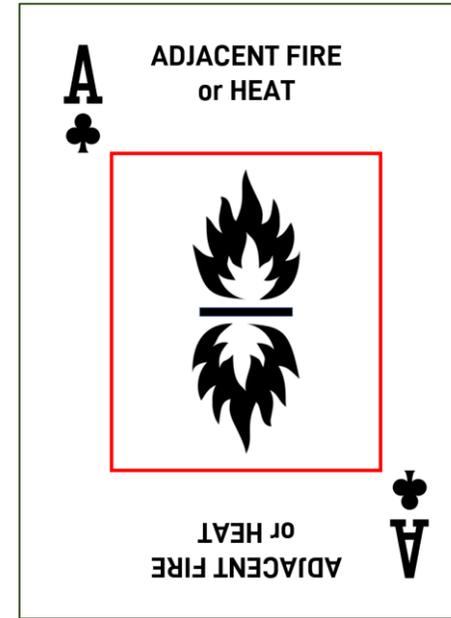
Failure within
design conditions
(under-strength)

DISCHARGE



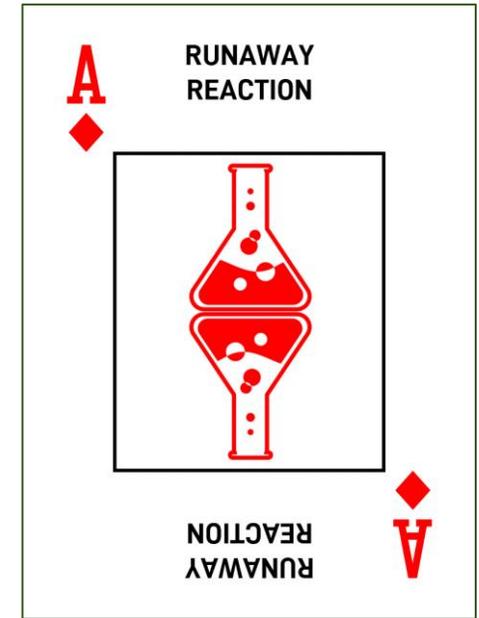
Open route to
atmosphere

DAMAGE



External impact

DEVIATION



Failure beyond
design conditions
(over-stress)

Operational Opportunities

- Passive learning (osmosis) via informal [games](#).
- Toolbox Talks e.g. explain your experience of the card you've been dealt.
- 'Pop' Quiz e.g. name the event on the card (no title).
- Hazard Reminder e.g. attach relevant cards to Work Permits.
- Hazard Spotting/Surveys e.g. cards used to label vulnerable locations during walk round.
- Inductions e.g. Visitors or Outage/Turnaround personnel.
- Online games can be played.



**PERMIT TO WORK SYSTEM
WORK CLEARANCE FORM**

00000

Tick the applicable Life Saving Rules for this activity

Date:
Person undertaking work:
Job / Work Order No.:
Company:
Site Address:
Minimum level of PPE to be worn / used at all times. Tick for confirmation

Work to be done:

HIGH RISK ACTIVITY (PERMIT+ Job Hazard Analysis) MEDIUM RISK ACTIVITY (Job Hazard Analysis) OTHER

Permit No.: JHA Reference No.: JHA Review No.:

Hazards and Controls

Tools / equipment to be used (e.g. hand tools, mechanical tools, plant etc):

Hazards (e.g. moving vehicles, electrocution etc.) and Controls (e.g. guardrails, barricading, lockout/tag out, etc). *Notes: For Medium or High Risk activity refer to the JHA for further details. The Pre-determined JHA must be reviewed for the work that will occur EACH DAY that the permit is open. The Permit*

Personal Protective Equipment (PPE) appropriate to the task:

Fire extinguisher(s) located at:

Remember to carry out the **Last Minute Risk Assessment** before and during any task

ACKNOWLEDGEMENT OF WORK - CONTRACTOR
The contractor acknowledges that the job will be performed in line with the precautions listed above, that all proposed work has been discussed with the Site Representative, and that the Site Representative will be informed of any incidents.
Contractor Site supervisor certifies that the work crew have a valid Safety Passport and can perform work at location

NAME: SIGNATURE: TIME: DATE:

ACKNOWLEDGEMENT OF WORK CREW - The work crew acknowledges that they understand and will comply with the precautions listed above (not required for medium and high risk activities)

SIGNATURES

ACKNOWLEDGEMENT OF WORK - SITE REPRESENTATIVE
The Site Representative witnesses the Contractor's signature and agrees to inform the Contractor of any change in site conditions such as tanker delivery or delivery of food goods

NAME: SIGNATURE: TIME: DATE:

WORK CLEARANCE CLOSE OUT - CONTRACTOR
The contractor acknowledges that the job has been completed / suspended and the site has been left in a safe and satisfactory condition.

NAME: SIGNATURE: TIME: DATE:

WORK CLEARANCE CLOSE OUT - SITE REPRESENTATIVE
The Site Representative acknowledges that the job has been completed / suspended

NAME: SIGNATURE: TIME: DATE:



Engineering/Management Opportunities

- Safety Moments e.g. discuss your role related to the card you've been dealt.
- HAZOP/PHA Validation e.g. ensure all deviations (cards) have been discussed.
- Dashboard e.g. incidents categorised by LoC type.
- Relate cards to Client/Industry incidents.
- Hazard Potential e.g. sum values of each card ... A = 11, K/Q/J = 10 & others numbered.
- Campaigns e.g. each week showcase specific event/card/topic.
- Online exchanges can be hosted.



DEGRADATION		CSB
-	CHEMICAL ATTACK	
-	THERMAL SHOCK	
-	MANUFACTURING DEFECT	
-	CREEP	
-	EROSION or THINNING	
-	AGEING	
-	INSTALLATION ERROR	
-	POOR DESIGN or MODIFICATION	
-	EXTERNAL CORROSION	
-	WEAR & TEAR	
-	VIBRATION & FATIGUE	
-	MAINTENANCE DEFICIENCY	
-	INTERNAL CORROSION	

Scenarios (Bowties) Enhance Understanding

1. Do you **UNDERSTAND** what can go wrong?
2. Do you **KNOW** what your systems are to prevent this from happening?
3. Do you have information to **ASSURE** they are working effectively?



INTERNAL CORROSION

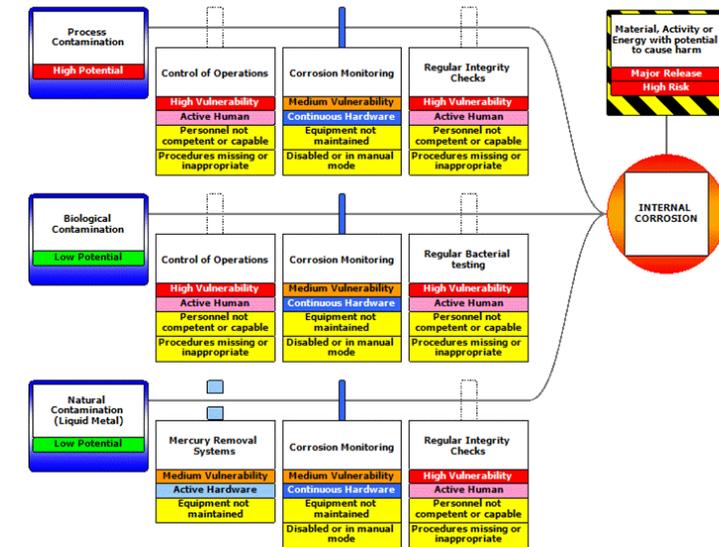


Typical CAUSES (Threats)

- ◇ Contamination
 - Process e.g. carbon dioxide, water, acids & other chemicals.
 - Microbiologically Influenced Corrosion (MIC)
- ◇ Stress corrosion cracking
 - Chlorides, sulphides, alkali & nitrates
- ◇ Chemical embrittlement
 - Hydrogen assisted/induced or Liquid metal (mercury)

Typical CONTROLS (Barriers) & VULNERABILITIES (Degradation Factors)

- Separate pages with one LoC Event per sheet & typical:
 - Causes (Threats)
 - Controls (Barriers)
 - Effectiveness/Vulnerabilities (by Type)
 - Degradation Factors
- Physical posting
 - e.g. Control Rooms, Canteens, Workshops or Meeting Rooms
- Online posting
 - e.g. Intranet, SharePoint, Newsletters

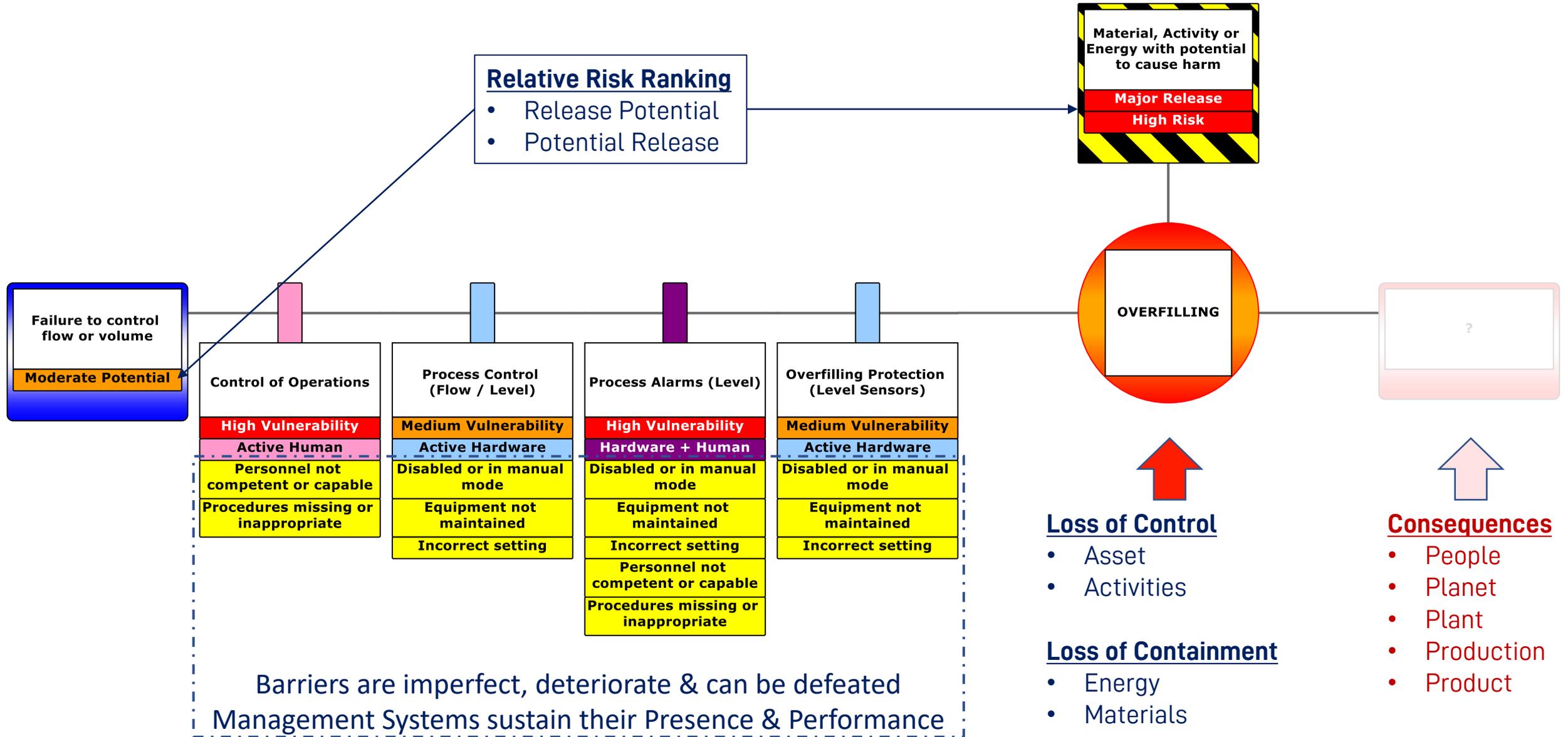


Version 2.1 Process Safety Cards © Process Safety Integrity 2020 www.ProcessSafetyCards.com

BowTie software NOT required !!

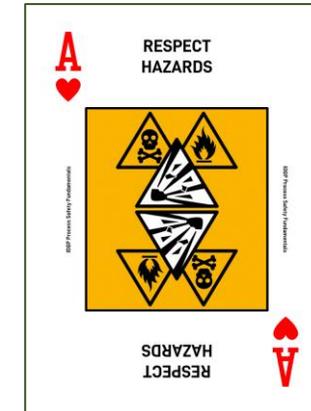
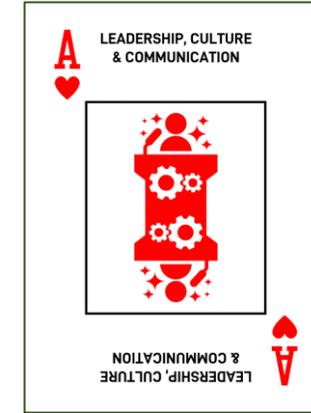
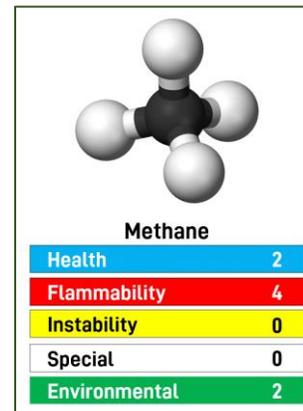
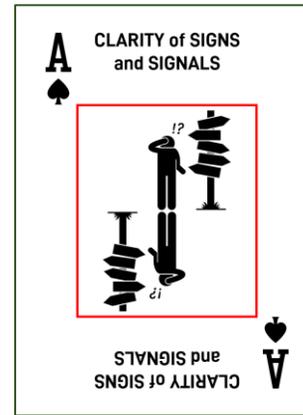
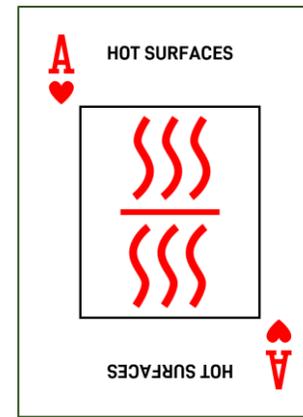


Barrier Focus & Scenario Development



Other Initiatives

- Specific Threat types e.g.
 - Ignition Sources
- Specific Topics e.g.
 - Process Safety Management
 - Process Safety Fundamentals
 - Human & Organisational Factors
- Safety Data Sheets (SDS)
 - Top Trump Cards
- Other Events e.g.
 - Occupational Safety



Conclusions

- **Not a Game !**
 - Knowledge exchange toolkit (Management ↔ Operations)
- **Share the Learning**
 - Universal Images & Local Languages
- **Not a New Strategy !**
 - Help deliver YOUR Process Safety (Asset Integrity) Initiative.
- **Protect the Protection**
 - Look after the systems (Hardware & Humans) that look after you
- **Adaptable to various Assets & Activities**
 - Loss of Control or Containment of Energy or Materials

AWARENESS ⇒ UNDERSTANDING ⇒ VIGILANCE ⇒ INTEGRITY

Thank You – Any Questions?



*“Accidents do **not** occur because we are wicked (most of us are good) or because we are stupid (most of us are quite intelligent), but because ***we have got used to everything we see.***”*

Trevor Kletz

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