




Maintaining process safety controls and knowledge

Elio Stocco
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R4Risk
L14, 222 Kings Way
(PO Box 5023)
SOUTH MELBOURNE VIC 3205

P: (03) 9268 9700
E: solutions@r4risk.com.au
www.r4risk.com.au

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Overview

- Maintaining process safety controls and knowledge
 - Incident case study – Failure of controls
 - Control management
 - How should it be done
 - Incident case studies - Corporate knowledge and learning
 - Maintain corporate knowledge
 - Define the content
 - Retain the knowledge
 - Learn
 - Good process safety outcomes

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R4 RISK

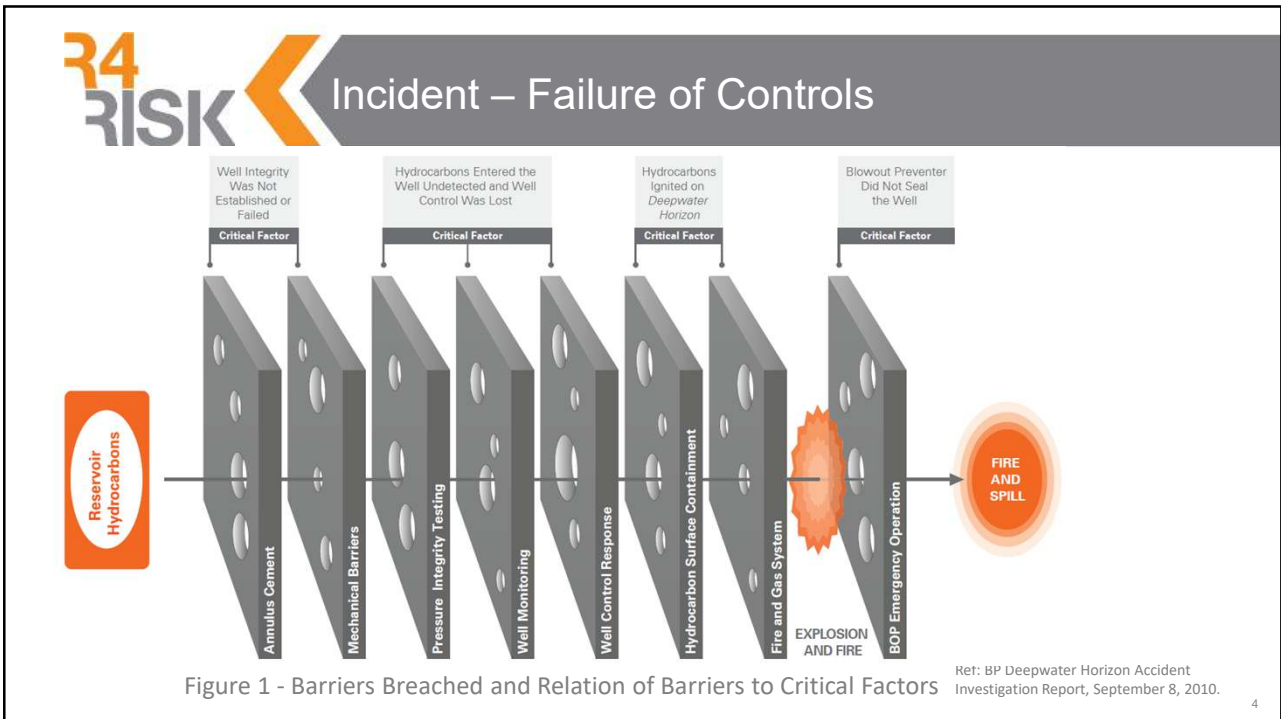
Incident – Failure of Controls



- BP Deepwater Horizon – Explosion and Fire
 - 20 April 2010
 - 11 crew member died and 17 critically injured
 - Approximately 5 million barrels of oil spilled into the Gulf of Mexico
 - US Chemical Safety and Hazard Board found that there were no effective barriers in place to prevent or mitigate the blowout
 - System in place to ensure controls were functional, available and reliable was inadequate

Ref: U.S. US Chemical Safety and Hazard Board, Investigation Report Volumes 1, 2, 3 & 4, Explosion and Fire at the Macondo Well, April 2010

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34 RISK Identify the Major Risk

- Robust hazard identification and risk assessment
 - Hazards identified
 - Control identified and linked to specific causes / outcomes
 - Risk is reduced SFARP

- Establish the required performance for controls

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34 RISK Control Management Process



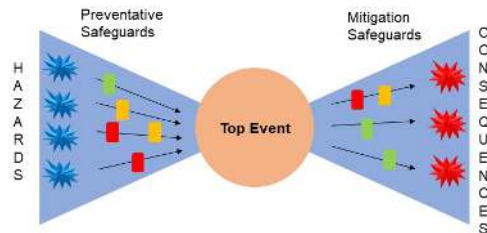
Reproduced and modified from ICMM Critical Control Management

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R4 RISK Step 1 – Identify the Controls

- Bowtie / Bowtie Analysis
 - Cause-consequence analysis
 - Identifies potential causes
 - Identifies potential consequences
 - Identifies applicable controls



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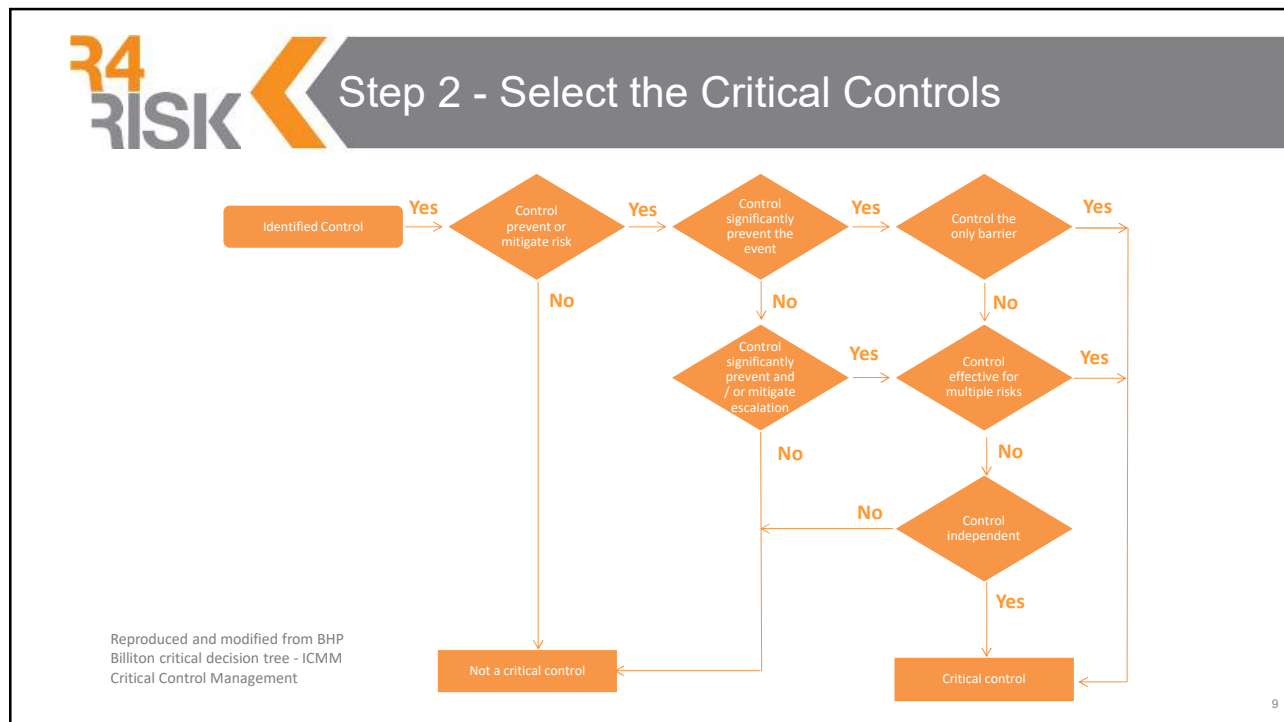
R4 RISK Step 1 – Identify the Controls (Cont'd)

- To assess control measure effectiveness, the following characteristics should be considered:
 - Implemented
 - Functional
 - Integrity
 - Reliable
 - Performance monitored
 - Audited



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R4 RISK Step 3 - Define Performance

- Define Performance
 - **Performance Indicator:** Any quantitative or qualitative information used to measure the performance of any functional aspect of a control.
 - **Performance Standard:** A benchmark, target or reference level of performance set for a control, as measured by the performance indicator, against which the performance of a control may be tracked.

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R4 RISK Step 3 – Define Performance - Example

- Control - High level trip system that alarms, stops and isolates feed into a tank
- Define the system expectation
- What will be the task or activities
- Measurable
- Performance Target (for the measurable)
- Intervention



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R4 RISK Steps 4 & 5 – Assign Accountability and Implementation Plan

- Assign ownership of the control
- Accountability of the control performance
- Implement the Plan



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R4 RISK Step 6 - Verification and Reporting

- Implement control verification activities
 - Define resources for completing control verifications
 - Report control verification data
- Assign a Program Administrator to conduct QA of all activities and data reporting
- Regularly meet to analyse and share information
- Management leadership to drive the program



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R4 RISK Step 7 - Inadequate Control Performance

- Review the results and act when the control performance does not meet the required standard
- Investigate the causes of the inadequate performance
 - Is the risk tolerable?
- Review with the appropriate levels of management depending on the inadequate level of performance



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R4 RISK Performance and Reporting Template - Example

Control:	Gasoline tank high level alarm and trip			
Control Type:	Engineering / Procedural			
Places Used:	R-0001 – LOC during flammable liquid			
System Expectation / Performance	Performance Measure			
	Task/Activities	Measurable	Performance Target (Range)	Intervention
Prevent the overfilling of tanks	Function test of alarm and trip every 6 months	High level switch functions properly, alarm, isolate inlet valve and stops pump	< 5 % fail to danger	Raise a maintenance request, near miss notification and review at management meetings
		Function test completed to schedule	< 30 days overdue	Performance measurable exceptions reviewed at management meetings
Operators are competent in alarm response	Operators complete "Operating Tanks" competency training Operators complete "Operating Tanks" refresher training every 2 years or if absent from the process for more than 6 months	Completing competency assessment	95 % correct	Performance measurable reviewed at Operations meeting
		Complete assessment to schedule	< 90 days overdue	Performance measurable reviewed at Operations meeting
Owner:	Maintenance Manager and Production Manager			

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R4 RISK Supporting the Controls Management

- Management of Change
- Security access
- Auditing
- Manage as part of the safety management system

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R4 RISK Preventing Corporate Amnesia

- Draw on and use knowledge
- Learn from incidents
- Provide that to your decision makers
- If you don't - Increased vulnerability to a process safety incident



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R4 RISK Incident - Corporate knowledge

- Explosion and fire occurred at the Husky Superior Refinery, Wisconsin in April 2018
- Specific safeguards were either not implemented or not effective
- Inadequate process and industry knowledge
- Licensor's service agreement included visits, reviews, and consultations
- Operating procedures had not been reviewed for at least 25 years before the incident.



Ref: U.S. Chemical Safety and Hazard Investigation Board, Investigation Report, FCC Unit Explosion and Asphalt Fire at Husky Superior Refinery, 23 December 2022

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R4 RISK Incident - Failure to Learn

- Explosion and fire at the Caribbean Petroleum Tank Terminal, Bayamon, Puerto Rico, October 2009
- A gasoline storage tank overfilled during the offloading from a ship
- Operators used inadequate formal tank-filling procedures
- Operator failed to learn from two previous overfill incidents
- Authorities also failed to learn from incidents



Ref: U.S. Chemical Safety and Hazard Investigation Board, Final Investigation Report, Caribbean Petroleum Tank Terminal Explosion and Multiple Tanks Fires, October 23, 2009.

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R4 RISK Define the Content

- Process Safety Information
 - Technology information
 - Equipment Information
 - Critical Operating Parameters (COPs)
 - Define safe operating envelope
 - Upper and lower design limits for process equipment
 - Material and chemical information
 - Hazards and risk information



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R4 RISK Key Elements for Retaining Knowledge

- Capture, preserve and transfer knowledge
 - Operating procedures
 - Safe systems of work
 - Data management systems
- Using information management systems
 - Knowledge management system (searchable)
 - Industry incidents
 - Regularly updated
- Promote a learning culture
- Collaborate and communicate
 - Cross-functionally within the organisation
 - Implications of WFH



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R4 RISK Key Elements for Retaining Knowledge (Cont'd)

- Train operators, technicians and engineers
- Subject matter experts
- Succession planning and recruitment
- Robust system to manage staff turn-over



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34 RISK Key Elements to Learn

- Industry standards
 - Stay up to date with standards and codes etc
 - Contribute and attend industry conferences
- Lesson learning
 - Incident and investigation
 - Past industry incidents
 - Other industries
- Learning from industry
 - Knowledge sharing, internal and externally



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34 RISK Other Elements

- Define an engineering standpoint
 - Maintain the engineering basis
- System based assessments
 - Know their limitations
- Outsourcing Services
 - Define in-house knowledge required
 - Maintain new knowledge

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R4 RISK Conclusion

- To achieve good process safety outcomes
 - Establish a process to identify and manage the effectiveness of controls
 - Verify that effectiveness by real time performance
 - Act when the desired performance is not achieved
 - Define the content within corporate knowledge
 - Capture, preserve and transfer the knowledge
 - Use industry standards and learn from industry
 - Train your team and continue to learn from your past mistakes and those made by others



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R4 RISK References and further reading

- U.S. Chemical Safety and Hazard Investigation Board, Investigation Report Volumes 1, 2, 3 and 4, Explosion and Fire at the Macondo Well, April 2010.
- BP Deepwater Horizon Accident Investigation Report, September 8, 2010.
- The International Council on Mining and Metals, Critical Control Management, Implementation Guide.
- HSE UK, Developing process safety indicators, 2006.
- WorkSafe Victoria, Guidance Note, Performance standards and indicators, October 2011.
- U.S. Chemical Safety and Hazard Investigation Board, Investigation Report, FCC Unit Explosion and Asphalt Fire at Husky Superior Refinery, 23 December 2022.
- U.S. Chemical Safety and Hazard Investigation Board, Final Investigation Report, Caribbean Petroleum Tank Terminal Explosion and Multiple Tanks Fires, October 23, 2009.
- Trevor Kletz Series – What went wrong, Still going wrong, Learning from accident.

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R4 RISK Questions

