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BPS1353 Hazard Recognition & Risk Management

Hazard Identification (HAZID) – part II

by
Dr. Hanida Abdul Aziz
Faculty of Engineering Technology
hanidaaziz@ump.edu.my

Chapter Description

- Aims
  - Explain the methods of identifying potential hazards at workplace
  - Demonstrate hazard identification process

- Expected Outcomes
  - Able to describe on how to identify hazard at workplace
  - Able to conduct hazard identification at workplace

- References
  - Crow and Louvar, 1990, Chemical process safety: fundamentals with applications. Pearson Education, London

Content

- Hazard Analysis Techniques

Hazard Analysis Technique

Brainstorming	• Whatever anyone can think of
Checklists	• Questions to assist in hazard identification
Job safety analysis	• Procedures
'What If' Analysis	• Possible outcomes of change
HAZOP	• Identifies process plant type incidents
FTA	• Combination of failures
ETA	• Possible outcomes of incident from initiating event

BRAINSTORMING

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Advantages	Disadvantages
• Good starting point for many HAZID techniques to focus a group's ideas	• Less rigorous and less systematic
• Allows employees experience to surface	• High risk of missing hazards unless combined with other techniques
• Enable 'thinking outside the box'	• Relies on experience and competency of facilitator

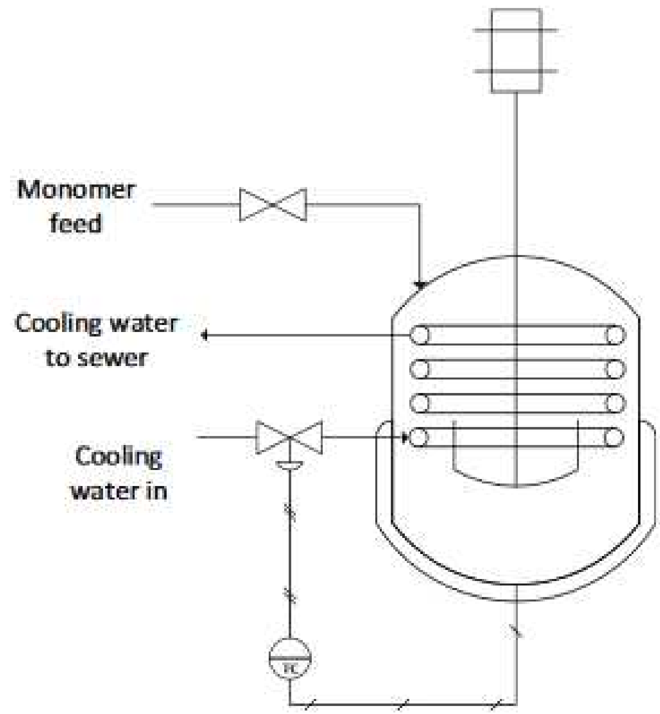
CHECKLIST

Advantages	Disadvantages
• Suitable as a cross check review tool • Safety management system compliance checking tool	• Limit the creative thinking • Potential of limiting to already known hazards • Less ability to satisfy regulatory requirements if used alone

WHAT-IF ANALYSIS: EXAMPLE

PROCESS UNIT	WHAT IF	CAUSES	CONSEQUENCES
Autoclave (toxic chemicals, High pressure, high temperature unit)	Operating error and other human factors (OE&HF)	Mal-operation of valves	Potential overpressure if valves are inadvertently closed.
	Analytical or sampling errors (A/SE)	Sampling of high pressure liquid.	Potential of release of H2S during sampling resulting in exposure to personnel.
		Sampling of high temperature liquid.	Potential injury to personnel due to high temperature of sample.
	Process upsets of unspecified origin (PUUO)	Malfunction of thermocouple.	Potential overpressures of autoclave due to high pressure build up leading to loss of containment (LOC).
	Utility failures (UF)	Power Failure	Potential release of toxic gas within lab area resulting in exposure to personnel.
		Ventilation system fail	Lack of positive pressure in the lab area.
		No water supply for cooling of bearing at rotating equipment.	Potential overheat of magnetic bearing resulting in bearing damage and leak. Loss of containment (LOC).
	Integrity failure or loss of containment (IF/LOC)	Refer to Process upsets of unspecified origin (PUUO)	
		Leakage through to fitting due to wear and tear.	Potential release of flammable / toxic gas within lab area resulting in exposure to personnel.
	Environmental release (ER)	Refer to Integrity failure or loss of containment (IF/LOC) and Equipment/instrumentation malfunction (E/IM)	

HAZOP: EXAMPLE



(source: Crow and Louvar, 1990)

Guideword	Deviation	Possible causes	Consequences	Action
FLOW	LESS	1. Partially plugged cooling line	Diminished cooling	Install back-up control valves, or manual bypass valve
			Possible runaway	Install back-up controller
				Install control valve that fails open
				Install high temperature alarm to alert operator
		2. Partial water source failure		Install filters to prevent debris from entering line
		3. Control valve fails to respond		Install back-up cooling water source
				Install cooling water flow meter and low flow alarm

TYPICAL STEPS IN ETA

Identify an initiating event of interest

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Identify the safety functions designed to deal with the initiating event

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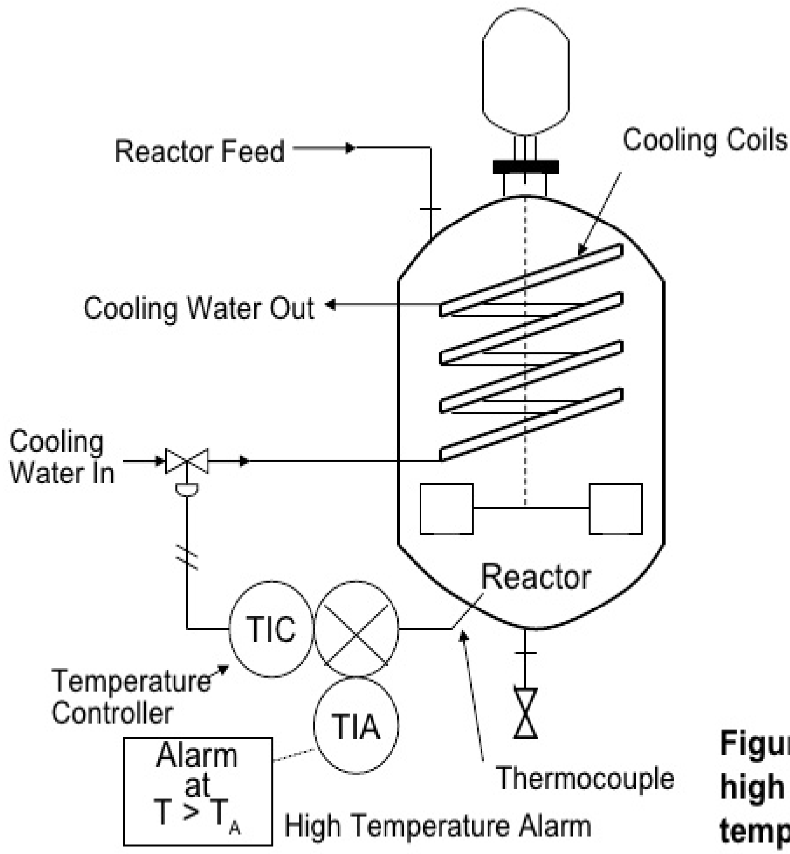
Construct the event tree

↓

Describe the resulting accident event sequences

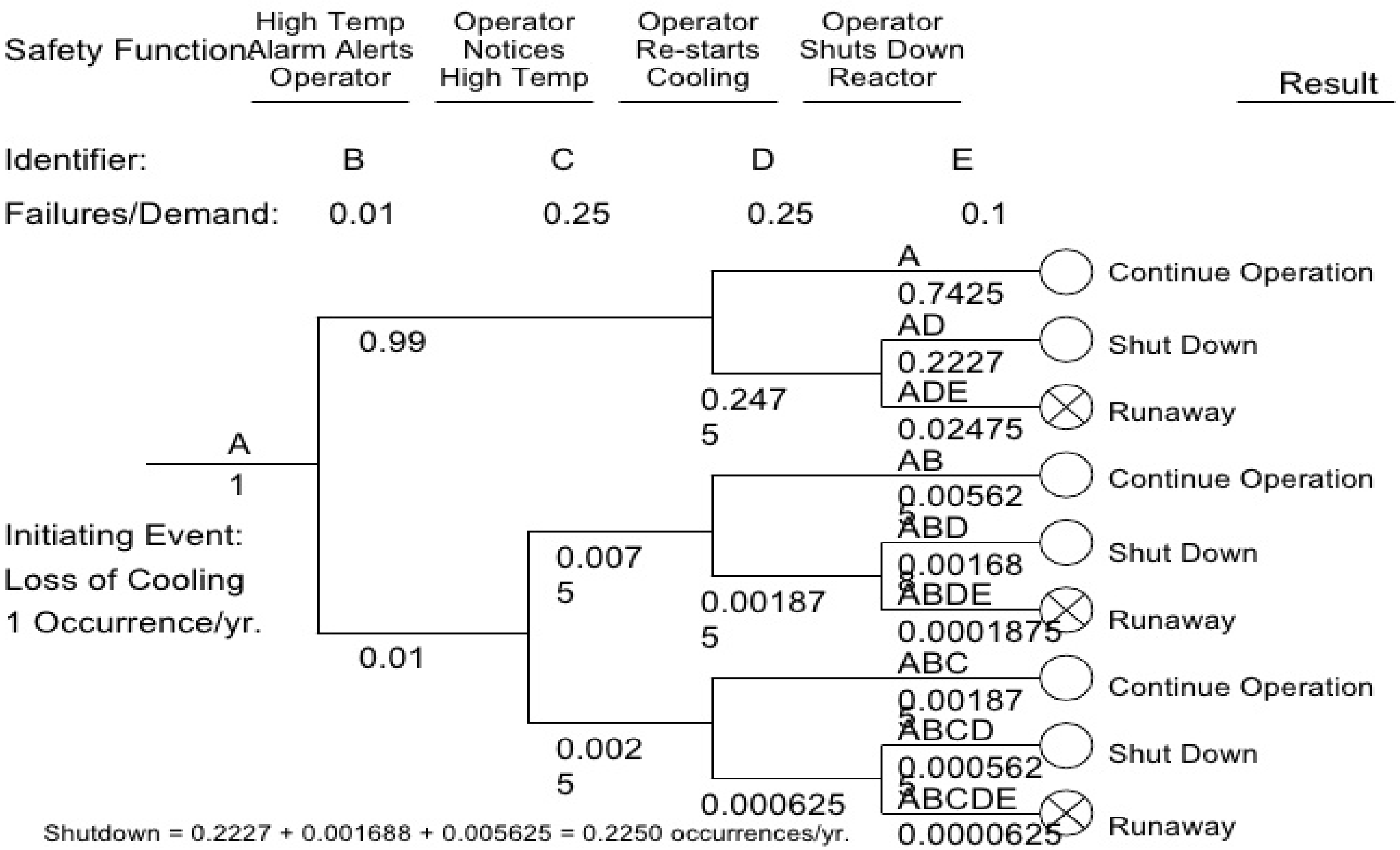
EXAMPLE



(source: Crow and Louvar, 1990)

Figure 11-8 Reactor with high temperature alarm and temperature controller.

EXAMPLE



Shutdown = 0.2227 + 0.001688 + 0.005625 = 0.2250 occurrences/yr.

Runaway = 0.02475 + 0.0001875 + 0.0000625 = 0.02500 occurrences/yr.

Figure 11-9 Event tree for a loss of coolant accident for the reactor of Figure 11-8.

(source: Crow and Louvar, 1990)

EXAMPLE

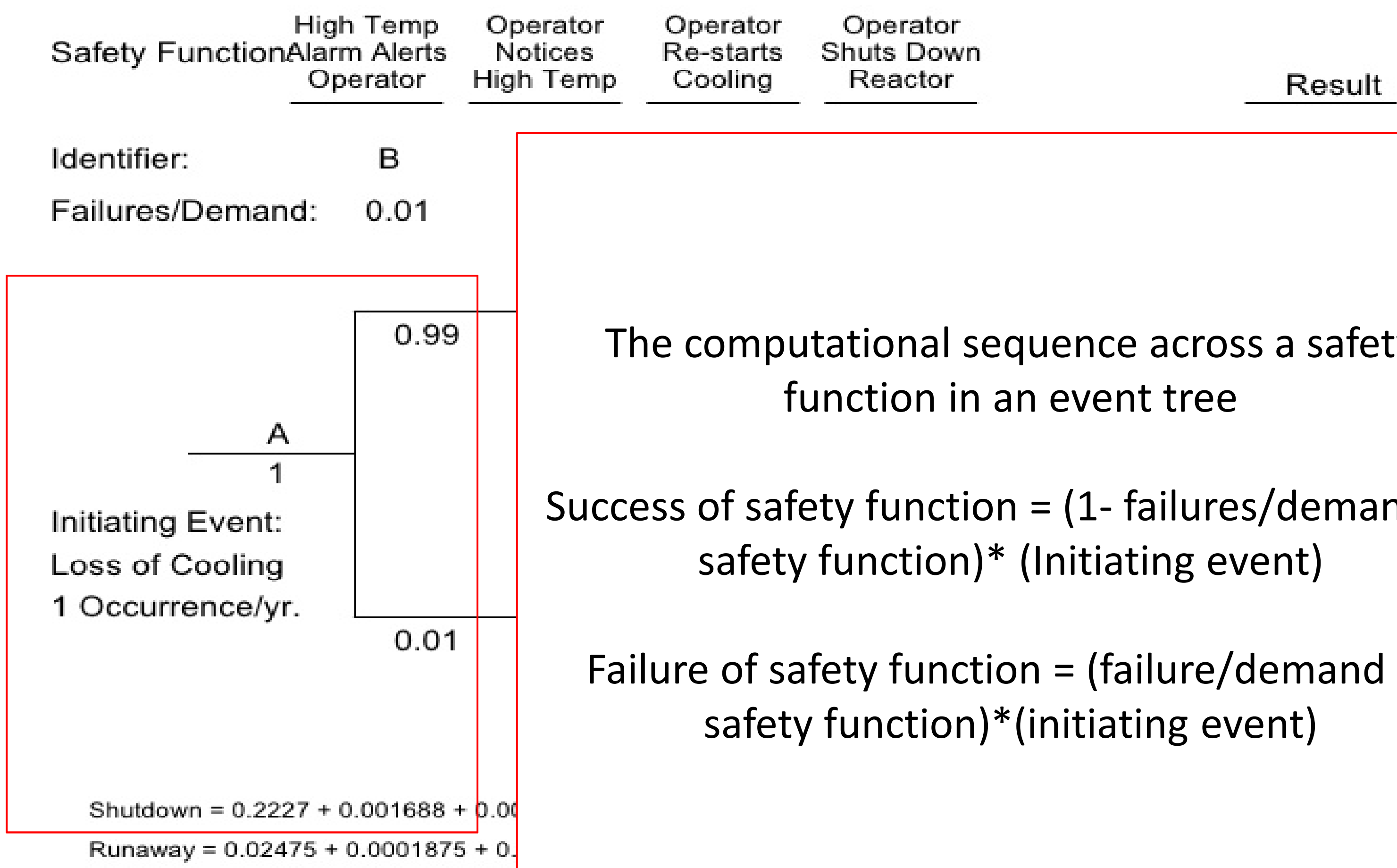


Figure 11-9 Event tree f

The computational sequence across a safety function in an event tree

Success of safety function = (1- failures/demand of safety function)* (Initiating event)

Failure of safety function = (failure/demand of safety function)*(initiating event)

(Sources: Crow and Louvar, 1990)

Conclusion

- Hazard analysis can be conducted via several structured techniques.