JIG Risk Assessment Guidance

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Agenda

- Introduction to Risk Management
- Hazard Identification
- Risk Assessment Process
  - Risk Assessment planning
  - Risk Screening and Hazard Identification
  - Scenario based risk assessment process
  - Generic Risk Assessment scenarios
  - Risk Assessment Matrix and Tools
  - Local Risk Assessment scenarios
- Management Review and Approval
- Report Generation
- Follow up of Recommendations

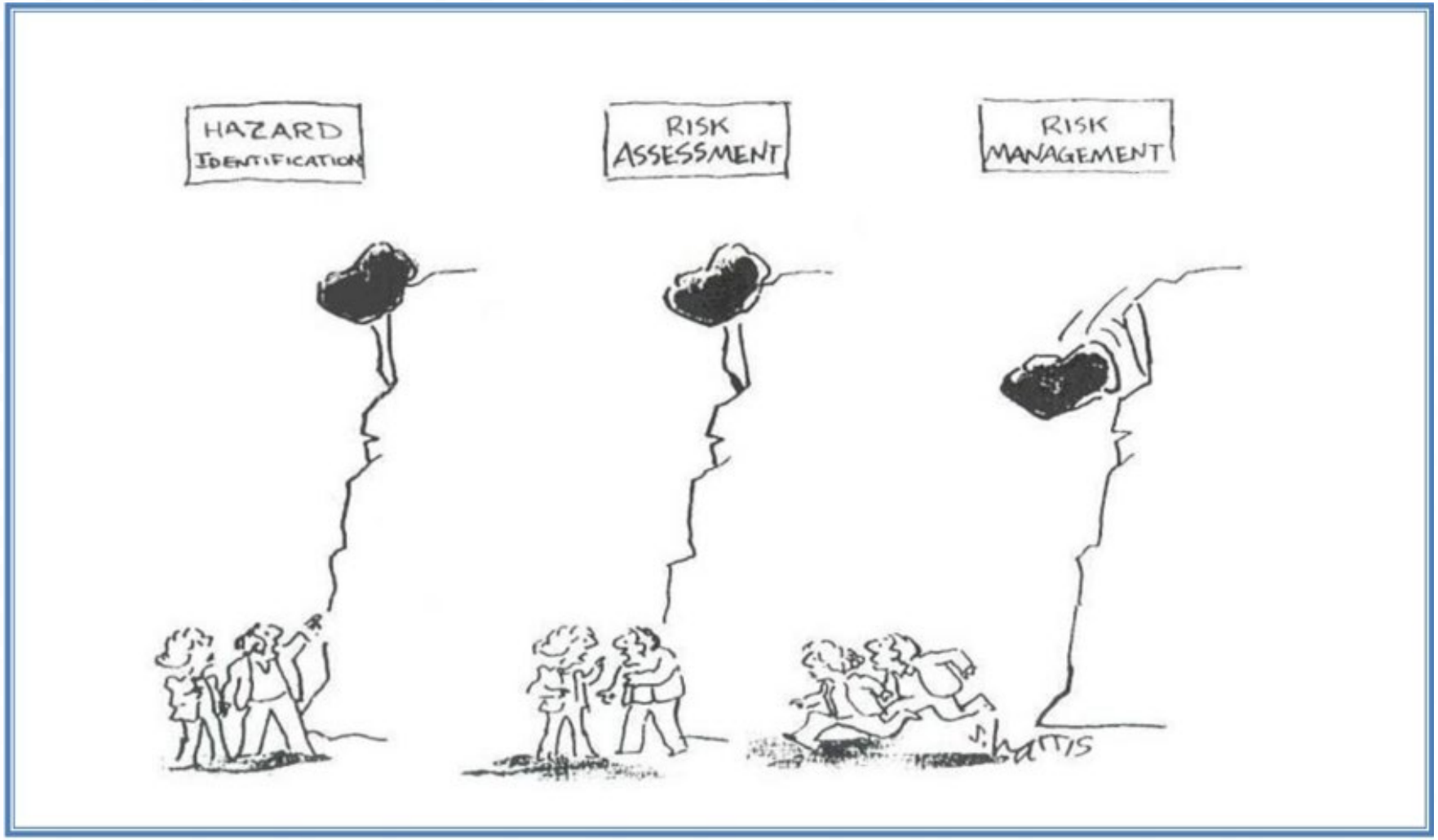
Introduction

Introduction

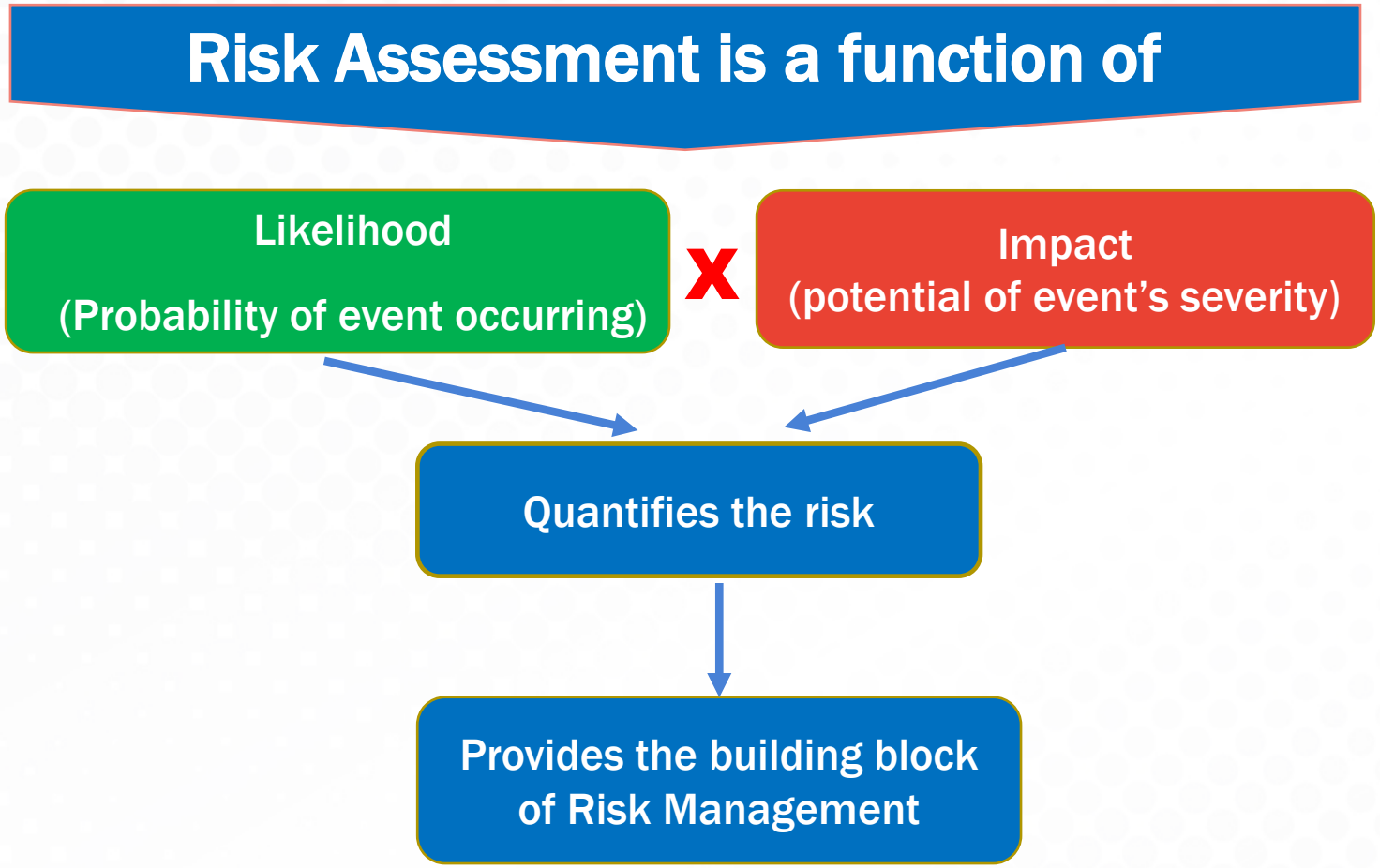
- JIG HSSEMS requires a Risk Management process to be in place for ongoing operations, new projects and products that:
  - Identifies potential hazards
  - Assesses consequences and probabilities which may result from the hazards
  - Evaluates prevention and mitigation measures
  - Ensures risks and measures are reviewed by appropriate levels of management
  - Ensures decisions are satisfactorily implemented
- All relevant employees to be involved in all above stages
- Other elements also require RA processes in place to cover:
  - Management of change
  - Third Party Services
  - Facilities design And construction

Risk Management

To put it another way....



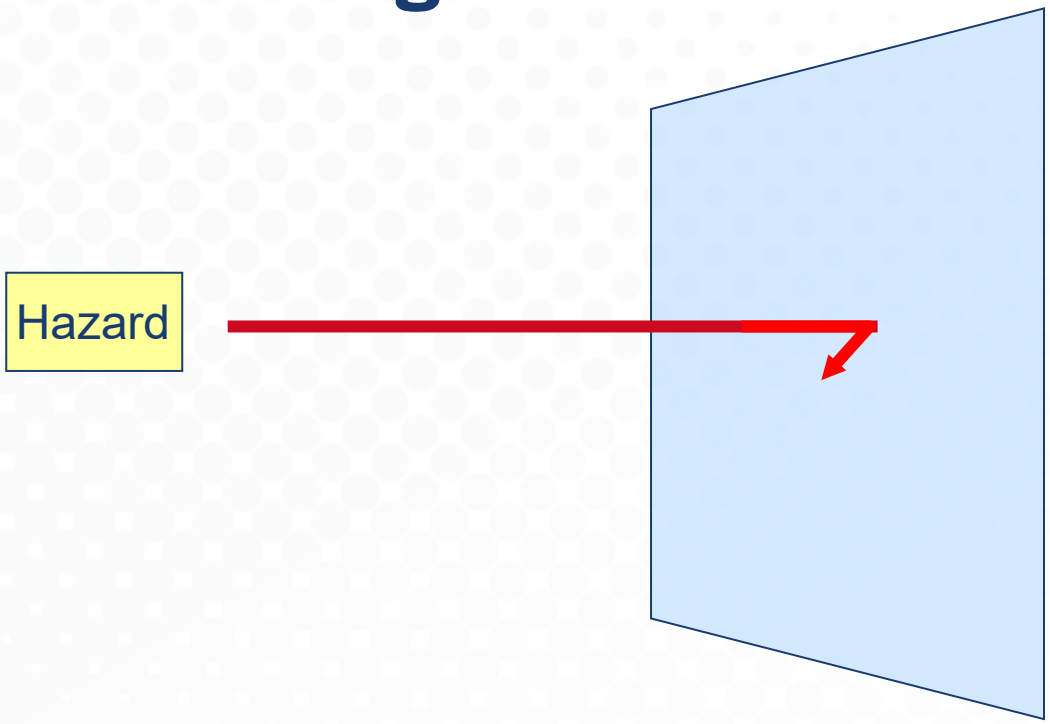
Risk Assessment

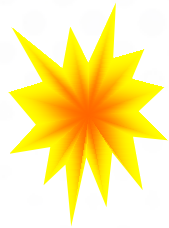


Why do incidents happen

A hazard has the potential to become an incident – why doesn't it always happen?

Barriers - something that prevents the hazard from causing harm





Incident

A “barrier” stops the hazard becoming an incident.
Think about electricity in this room….
Electricity is a hazard – what barriers prevent us all from being electrocuted?

3 Barrier Families

Plant: (Effectiveness High)

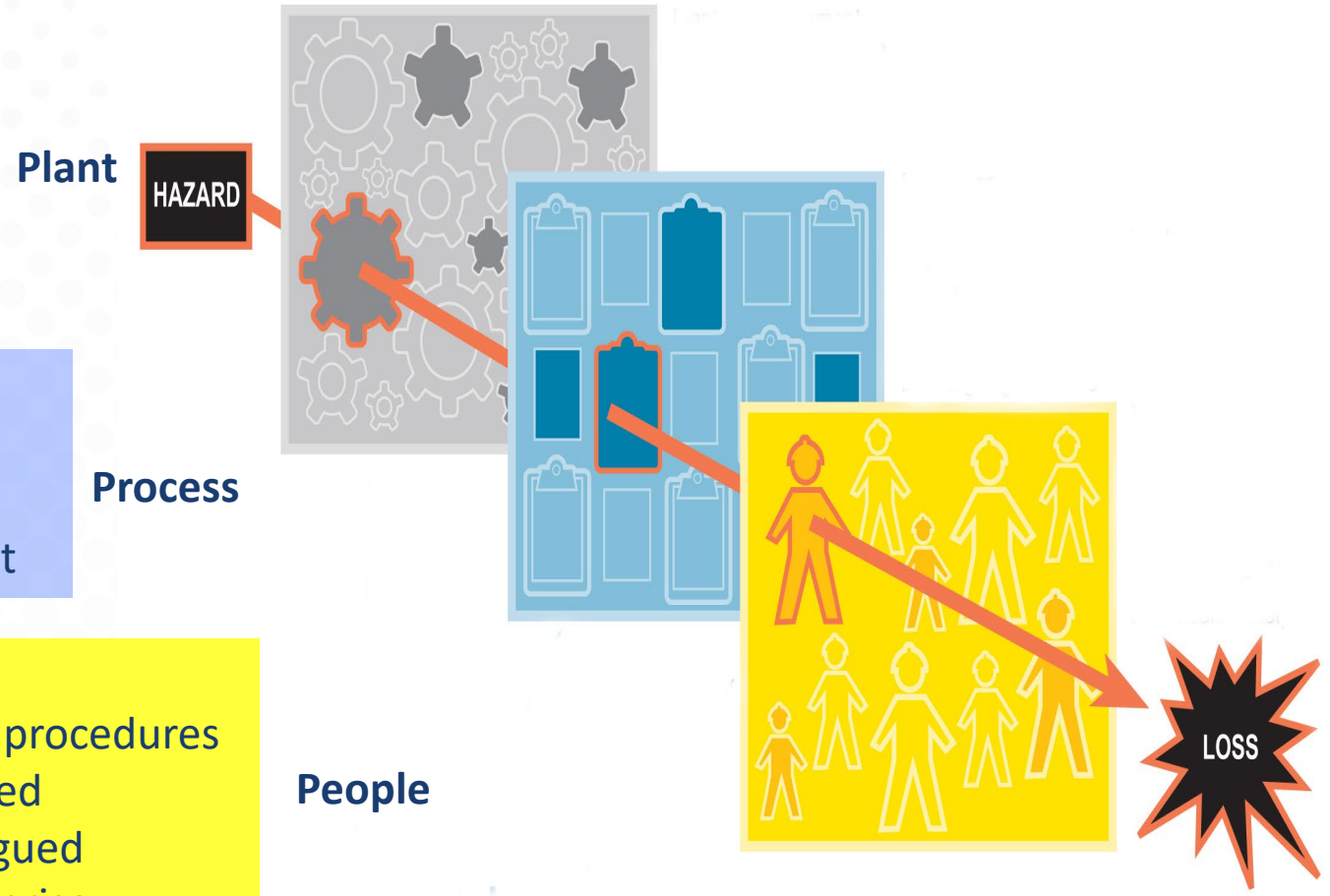
Tanks	Chemical water detectors
Vehicle interlocks	High level cut-off devices
Non-slip surfaces	Brakes
Locked electrical cabinets	

Processes: (Effectiveness Medium)

Task breakdowns	Permits to Work
Defect reports	Emergency procedures
Maintenance	Contractor management

People: (Effectiveness Low)

Receiving training	Not following procedures
Focussing on the job	Being distracted
Alert and attentive	Tired and fatigued
Aware of surroundings	Caught by surprise



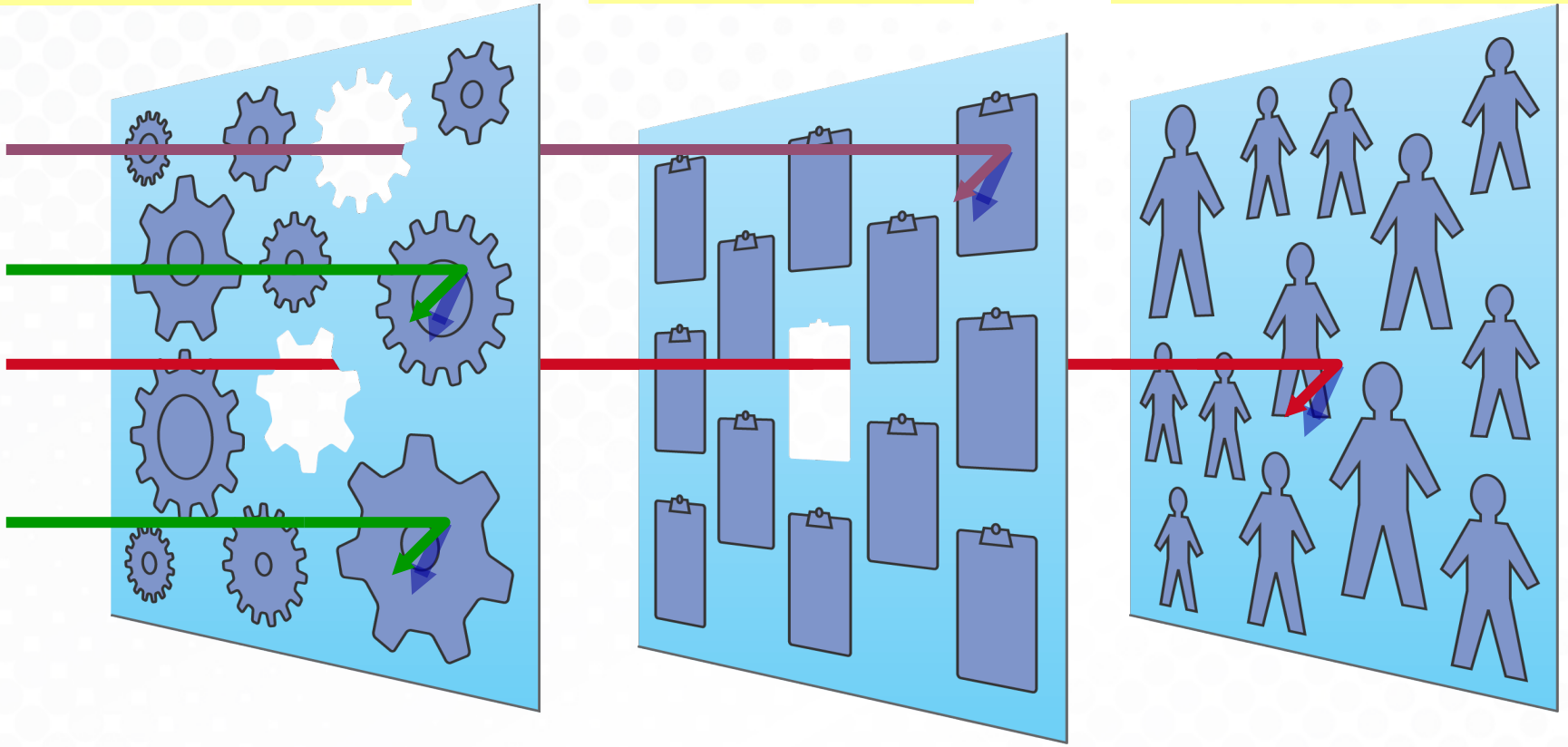
Barriers

The equipment we use, large and small, to deliver safe operations

The procedures we use to do things in the right way

The actions of people that can support or compromise plant and process barriers

Hazard



Incident

Plant

Process

People

Risk Management Process

Step 1: Hazard Identification

Visually see a hazard –
Identifying the hazards that may lead to an incident or unwanted event

Step 2: Risk Assessment

Understand and measure the impact of Hazard -
Developing and evaluating the potential scenarios involving hazards

Step 3: Risk Management

Methodology to eliminate / mitigate the risk
What actions will be taken to reduce or eliminate that risk

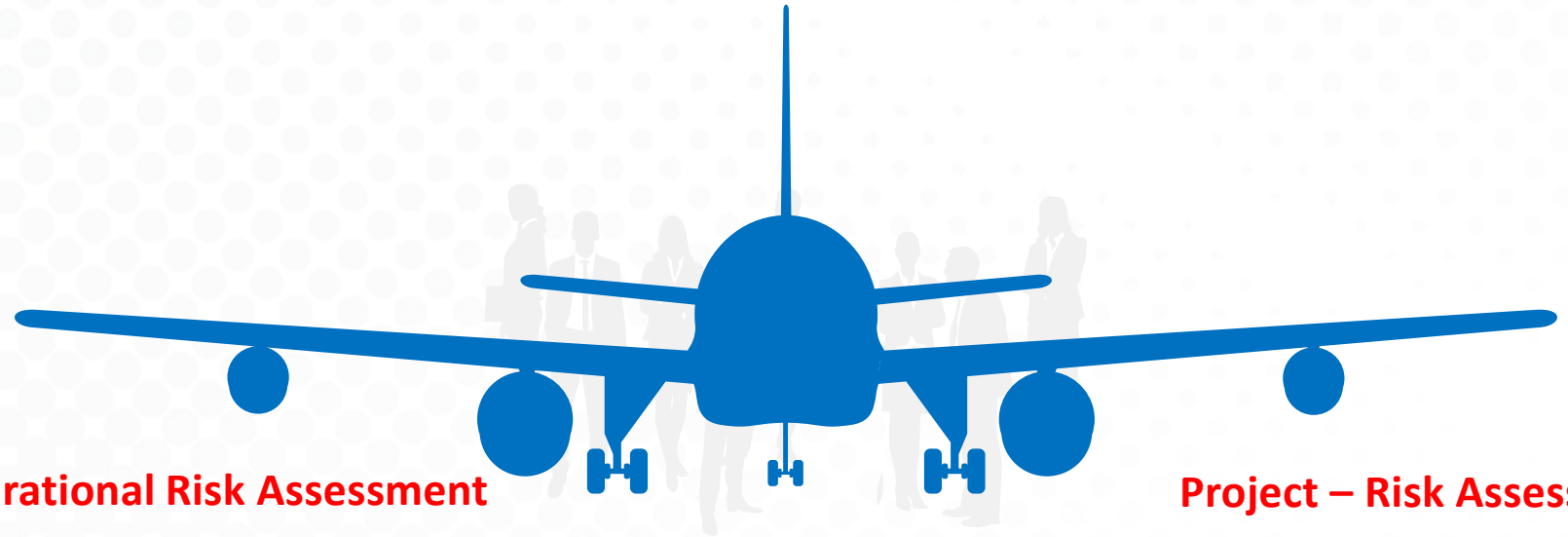
Likelihood

Probability of a scenario taking place - important to consider the frequency of activity

Impact

Severity of potential consequences of a scenario

Categories of Risk Management Process



Operational Risk Assessment

Facilities/operations are subject to a hazard identification and risk assessment on a periodic basis; focus is on significant hazards and day to day activity in the overall facility

Project – Risk Assessment

A hazard identification & risk assessment plan is developed for all projects which includes design, construction, simultaneous operations and start-up phases

How bad can it be ?

Planning – Operational Risk Assessment

Schedule:

Schedule driven by local or international guidelines, based on site specific hazards - typically annually

- **Risk Assessment Team Composition:**

  Need a combination of technical knowledge & practical experience

  - Job knowledge from operations & maintenance personnel (local/external)
  - RA process knowledge from trained personnel
  - Deep technical knowledge as needed.

- **Purpose of Operational Risk Assessment:**
  - Review all the associated risks
  - Verify the effectiveness of existing preventative and mitigative measures and define new ones as needed
  - Assess the risk of operations which may have changed but might not have been adequately assessed during the Management of Change process.

Hazard – Something with the potential to cause harm

What hazards exist ? Examples could be:

- Hazards:
  - Large volumes of flammable material
  - Hydrocarbon movements - receipts / refuelling
  - Pressurised equipment
  - Toxic materials
  - Aircraft movements
  - Temperature extremes
  - Vehicles movements

Risk - The probability of that hazard actually causing harm or loss (an incident)

Hazard:

- Flammable material
- Hydrocarbon movements
- Pressurised equipment
- Toxic materials
- Aircraft movements
- Temperature extremes
- Vehicles movements

Potential loss/incident:

- Fire or explosion
- Spillage – loss to environment
- Personal injury, equipment damage
- Human health and environmental
- Human injury and property damage
- Human health and equipment failure
- Human injury and property damage

Barrier – Can be weak and degrade over time

Examples of weak or degrading barriers:

- Lack of skill / awareness
- Inadequate procedures / procedures not followed
- No provision or use of PPE
- Equipment failure - level gauge, hose
- Inadequate monitoring, e.g. inspections
- A defective bonding cable
- Design flaws - incorrect pump seal material
- Poor emergency preparedness

Which barrier family does each belong to – plant, process, people?

Training and leadership aren't barriers - they strengthen the people barrier.

Assessing risks using a task-based process

Risks are assessed by considering the hazards associated with a task, determining likelihood & impact of those hazards materialising into a loss.

likelihood x impact = risk

When considering the potential likelihood and impact, the effectiveness of the existing barriers need to be considered. **This results in a calculation of residual risk**!

A matrix provides a qualitative assessment result

More quantitative methods can be used but process is still open to subjective assessment.

Risk Matrix

Risk Matrix

Risk = Likelihood x Impact

RISK Rating		LIKELIHOOD				
		5	4	3	2	1
IMPACT	5	H	H	H	M	L
	4	H	H	M	M	L
	3	H	M	M	M	L
	2	M	M	M	L	L
	1	L	L	L	L	L

Score	Risk Level	Acceptability	This risk assessment process shall be applied to each individual risk identified as follows:
>= 15	High (H)	Intolerable	· Risks in the 'Intolerable' region must be reduced to ALARP or lower
> 5 & < 15	Medium (M)	Reduce risk to ALARP	· Risks in the 'ALARP' region shall be mitigated to move them towards the 'Tolerable' area. A risk is considered 'ALARP' provided it has been reduced to the point where the benefit gained by further risk reduction is outweighed by the cost of achieving it and that generally accepted standards have been applied to the control of the risk.
<= 5	Low (L)	Tolerable	· Risks in the 'Tolerable' region may be accepted, but efforts should still be made to reduce or eliminate them if possible

Impact

- **Impact is the potential severity of an event**
- **It is usually the most probable worst-case scenario**

Category	Human injury	Financial cost	Work	Environmental damage
5. Disaster	Multiple fatality	Significant financial loss ($1 to $5m)	Major disruption to operations	Major and unstained pollution external to the site and/or extensive loss of aquatic life .
4. Very serious	Fatality	Significant financial loss ($ 500.000 to $ 1m)	Significant operation disruption	Important pollution with reversible environmental consequences external to the site
3. Serious	Serious injury (permanent disability, amputation)	Substantial financial loss ($ 50.000 to $ 500.000)	Notable operation disruption	Significant pollution external to the site
2. Substantial	Disabling injury (medical treatment)	Notable Financial loss ($ 5.000 to $ 50.000)	Slight operation disruption	Moderate pollution within site limits
1. Minor	First aid treatment - minor cuts bruises or burns	Negligible financial loss (up to $ 5.000)	No effect on work	(Up to) spill or release of pollutant requiring a declaration to authorities , but without environmental consequences

Likelihood

- Likelihood is the chance of an incident occurring

Score	Likelihood	Likelihood Definition	Occurrence/year
5	Likely	Could occur several times during over plant lifetime	> 10-2
4	Unlikely	Could occur once for every 10 to 20 similar plants over 20 to 30 years of plant lifetime	10-2 - 10-3
3	Very unlikely	• One time per year for at least 1000 units. • One time for every 100 to 200 similar plants in the world over 20 to 30 years of plant lifetime. • Has already occurred in the company but corrective action has been taken	10-3 - 10-4
2	Extremely unlikely	Has already occurred in the industry but corrective action has been taken	10-4 - 10-5
1	Remote	Event physically possible but has never or seldom occurred over a period of 20 to 30 years for a large amount of sites (> few thousands, ex: wagons, process drums,...)	< 10-5

Reducing Likelihood

Likelihood of the incident scenario

How often the Hazard associated loss is likely to occur, considering the frequency with which the task is performed

Data points:

- Personal or Site Data
- Company Data
- Industry Data
- History of similar incidents

Factors to consider in estimating the likelihood

- Are the existing safeguards/barriers adequate and perform as intended?
- What's the likelihood of failure?

Notes Impact

Evaluate the magnitude of consequences:

- Use experienced judgement, or quantitative method (e.g. models)
- Consider all consequence categories:

  Health & safety

  Business disruption

  Environmental impact

  Company economics

  - Remember “outrage factor” (public and media attention)

Barriers - Reducing Risk by Prevention

- Inherent safety - remove the hazard
- Improved designs
- Protective devices: alarms, trips, ESD's, interlocks, relief v/v's
- Provide 'redundancy', e.g., in control systems
- Increased equipment inspections
- Establish / enforce operating practices and procedures
- Tighter control of ignition sources
- Increased testing of critical safety equipment
- Observation/Audit/survey programs
- Impose limitations: speed, weight, time, weather, capacity, route
- Enhanced safety awareness, improved employee motivation, better communications
- Physical barriers: guards/rails/cages, PPE
- Training.....to strengthen barriers

Barriers - Reducing Risk by Mitigation

- Improved detection: of leaks, hydrocarbons, fires
- Effective implementation of emergency response plans
  - frequent practice and simulated emergencies
- Increased fire fighting equipment: sprinklers, foam systems, monitors
- Additional fireproofing: fire doors, structural steel protection
- Improved spill containment
  - Additional isolation valves
  - Improved secondary containment
- Additional equipment spacing: process units, segregation of vehicle flows
- Reduce inventory of hazardous material

Risk Matrix

- Risk ranking after preventive / mitigative actions

Risk = Likelihood x Impact

RISK Rating		LIKELIHOOD				
		5	4	3	2	1
IMPACT	5	H	H	H	M	L
	4	H	H	X	M	L
	3	H	M	M	M	L
	2	M	M	M	Y	L
	1	L	L	L	L	L

MATRIX IS DIVIDED INTO 3 LEVELS OF RISK

Higher risk: action to reduce risk required, require endorsement by the Company Mgr at the time of the assessment, and every 12 months thereafter for continued operation

Medium risk: require initial sign off by the Technical Manager or AOM. No further sign off is necessary, providing that there has been no changes to the GRA scenario. Cost-effective improvements should be implemented, cost/benefit analysis may be required to help decide what remedial action is taken or if risk is accepted

Low risk: no action required, but cost-effective improvements may be worthwhile