Qualitative Risk Analysis

Approach to Risk – Qualitative Techniques

Prepared by Ferenc Birloni, PhD

2017

Warm Up

- **Who has any type of insurance?**
- **Had benefit from the insurance?**
- **Have you made a Risk Analysis before entering your insurance?**

Ferenc Birloni, PhD

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Academic Career

- Budapest University of Tech
  MSc in EE & IT
- Tokyo University, Japan
  PhD in Math Eng & IT

MŰEGYETEM 1782

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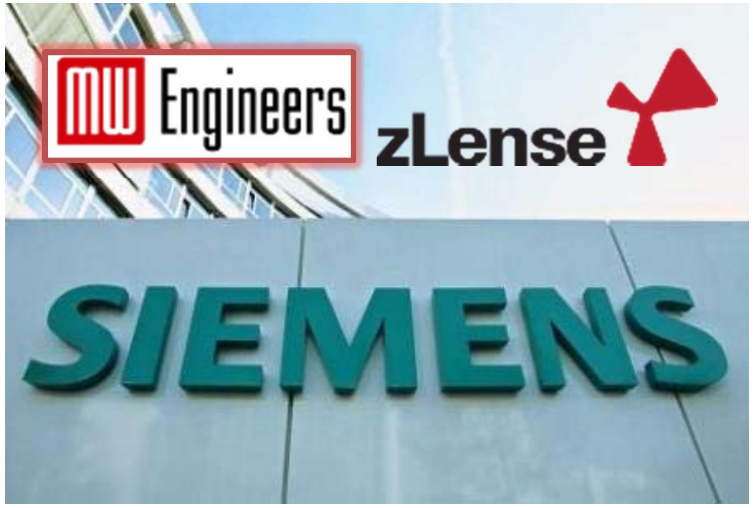
THE UNIVERSITY OF TOKYO



Career

- Siemens PSE, Budapest
- MW Engineers, Melbourne
- Zinemath - zLense

APPROACH TO RISK

Save on Risk Management

Risk Management

Avoiding Future Impacts

SUMMARY FOR TODAY

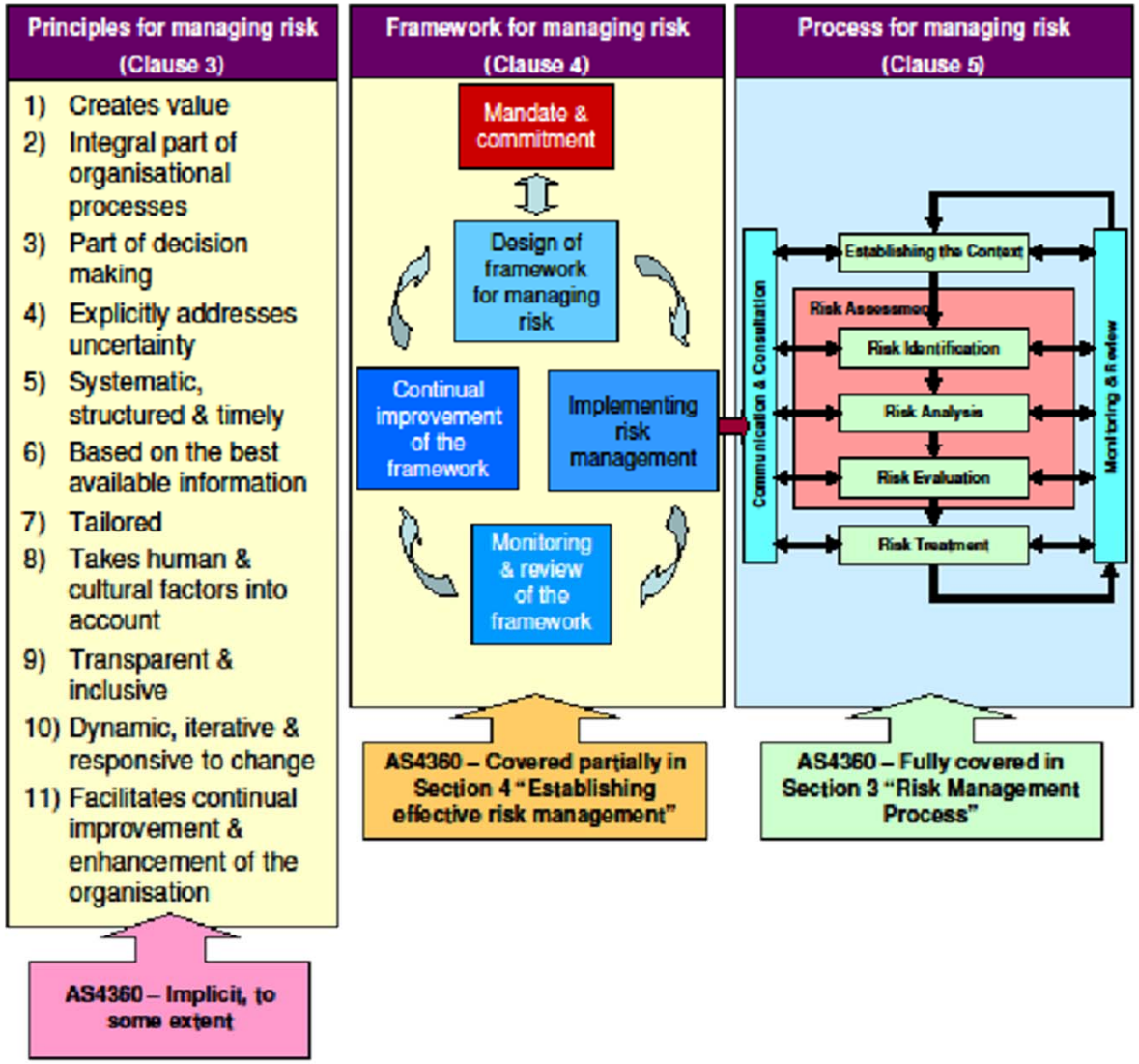
- ✓ Risk Concept – ISO31000
- ✓ Risk Management
- ✓ Risk Analysis – Calculation of Risk Score

Risk Management Basics

- Effect of uncertainty is
  "RISK" to reach objectives.
- "whether having positive or negative consequences"
- *Risk Elimination* (military, law) vs
  Risk Management
- Risk Management - multiple responses

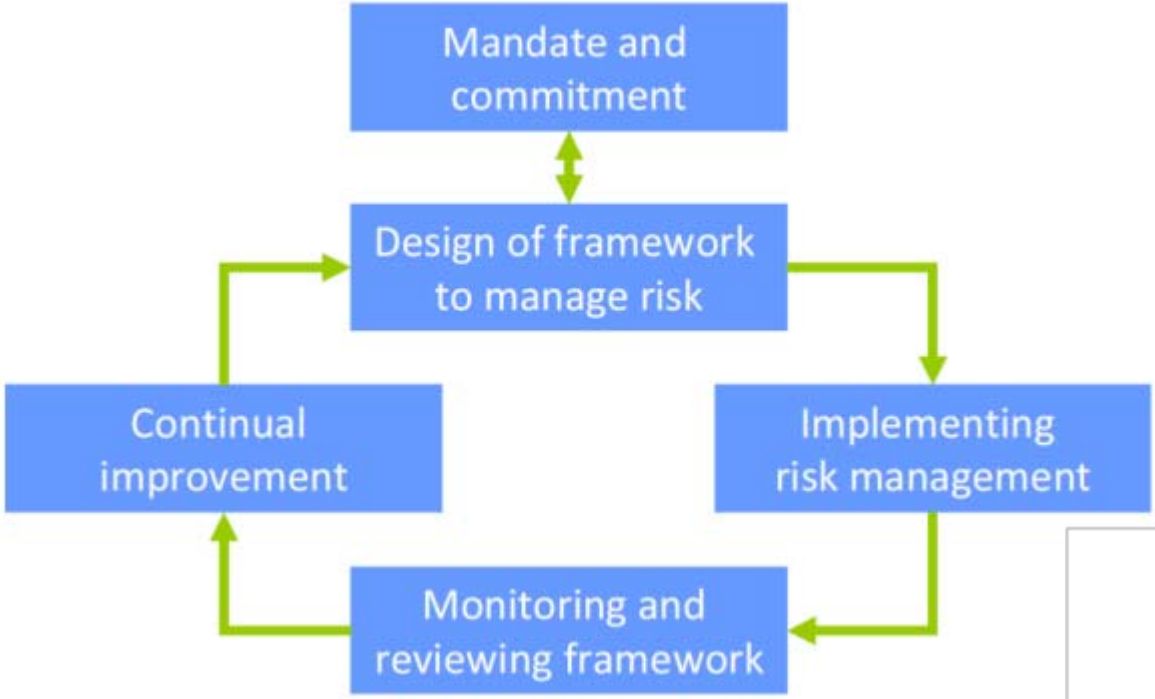
RISK = Negative IMPACT to objectives X
LIKELIHOOD of occurrence.

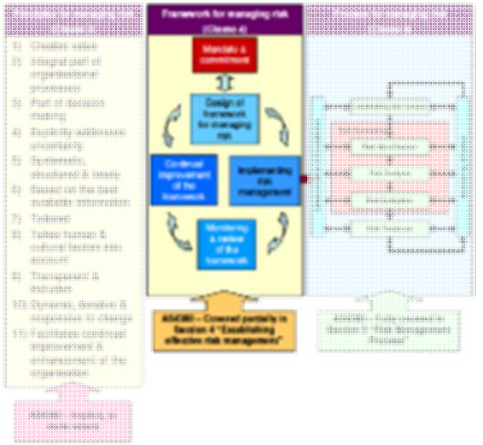
ISO 31000 - Overview

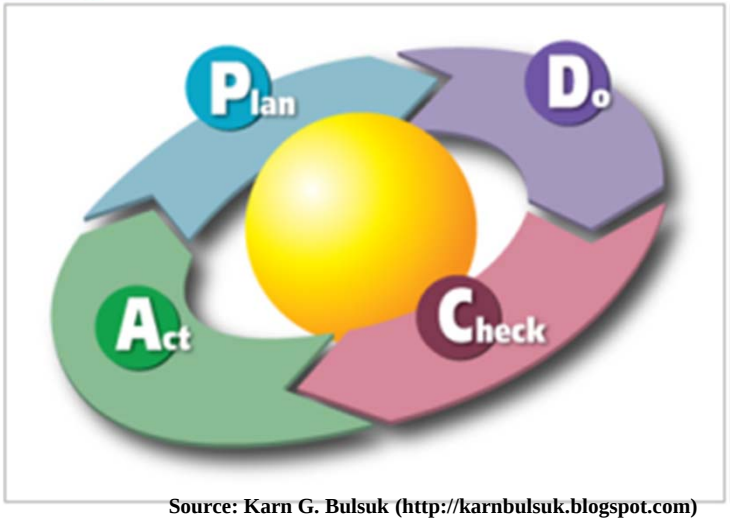


- **Principles**
  - Clause 3
- **Framework**
  - Clause 4
- **Managing Risk**
  - Clause 5

Framework to Work with Risk

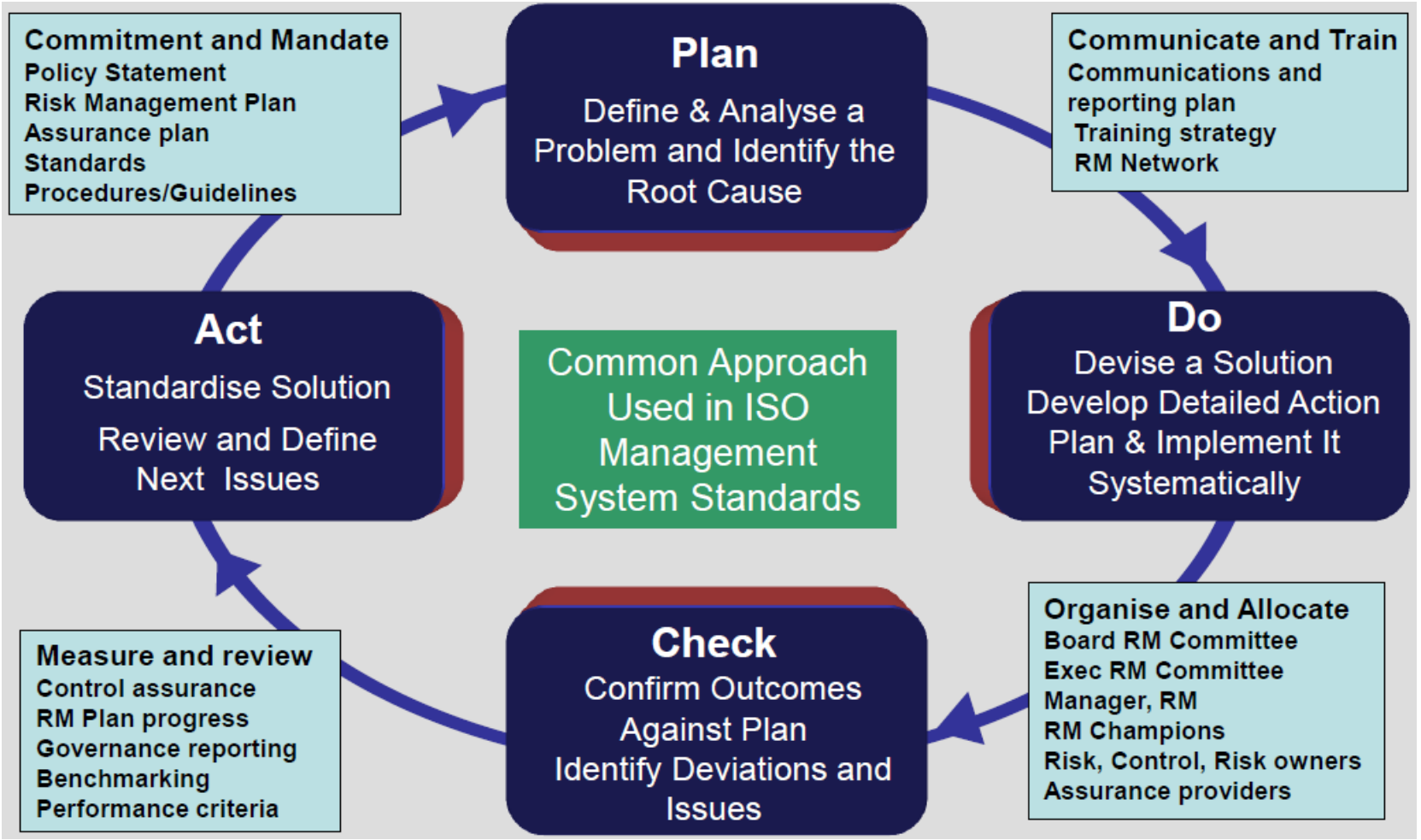






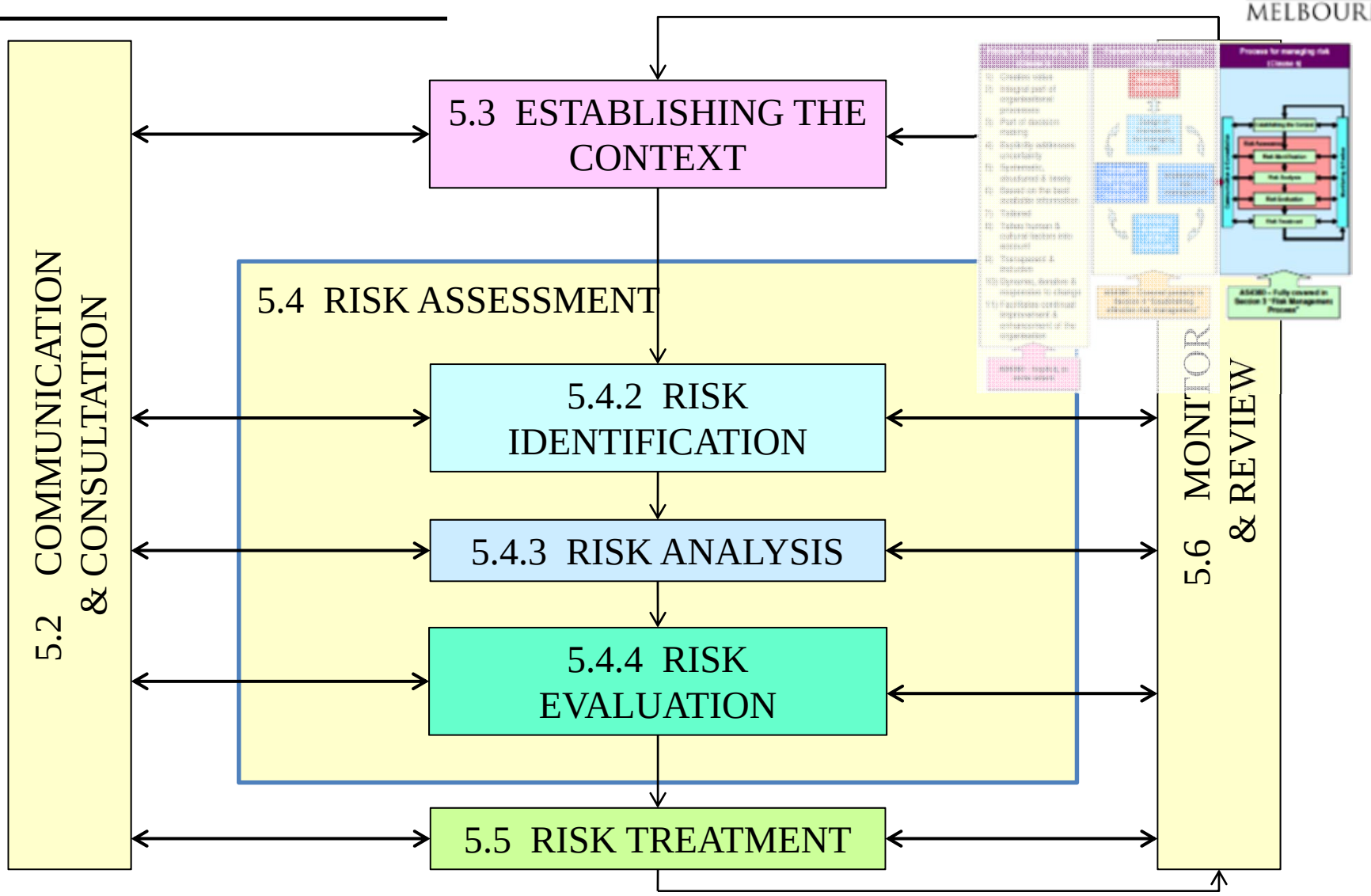
Source: Karn G. Bulsuk (http://karnbulsuk.blogspot.com)

PDCA – Start Point of Mgnt Systems

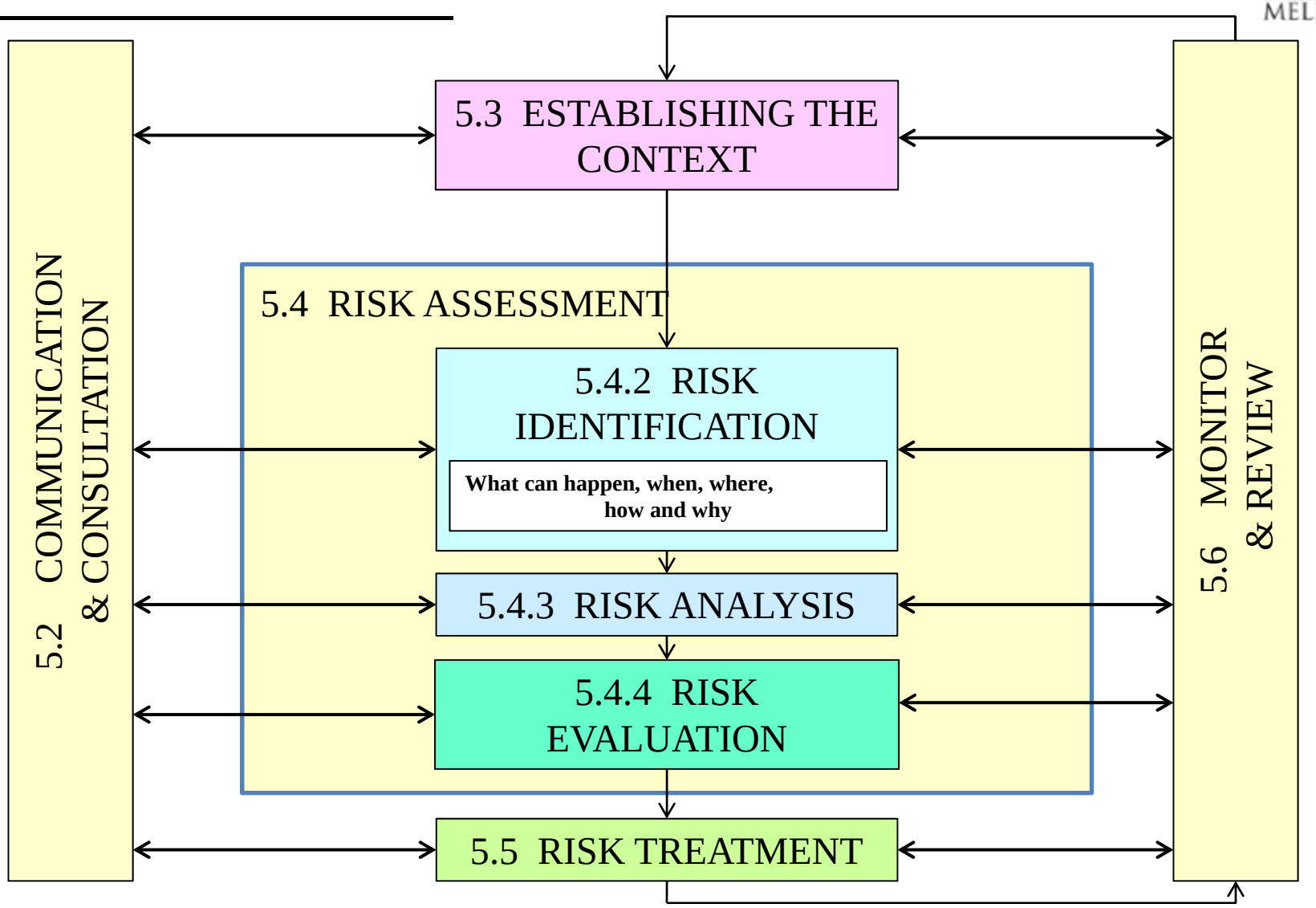


Source: Kevin W Knight – Presentation on Int Conf 2012, Brazil

Risk Management Process



Risk Identification



Risk Identification

- Range of identification techniques include:
  - brainstorming,
  - work breakdown analysis,
  - expert facilitation
- The aim is to generate a list of risks
  - **Risk Register**
- Identification should include risks whether or not their source is under the control of the organisation

Risk Register - Example

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Category	Factor or Event	Id #	Probability	Impact	Score	Mitigation or Countermeasure	Contingency	Owner	Action timing

Example - Warehouse Automation

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- ABC Grocery and Supermarket Outlets desires to automate its warehouse by installing a computer-controlled order-packing system, along with a conveyor system for moving goods from storage to the warehouse shipping area. Four parties are involved in this project:
  - (1) client,
  - (2) project manager,
  - (3) engineer, and
  - (4) contractor.

Example - Warehouse Automation

- The risk events and scenarios associated with this project can be assessed based on the perspectives of the parties

Ex – Warehouse – Client Risk

Risk Category or Scenario	Description
Technological, quality, or performance	
Economic	
Conflict among individuals	
Contractor risks	
Contract & legal	

Ex – Warehouse – Engineer's Risk

Risk Category or Scenario	Description
Technological, quality, or performance	
Contractor risks	
External risks	

Example - Warehouse Automation

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- Risk sources - structured in a multilevel hierarchy.
- Divided into 3 risk levels for managing
  - internal risks,
  - external risks, and
  - technology risks.
- Description of each risk in RBS – Risk Breakdown Structure
- Based on the total vulnerability of the project.
- Provides insights to the parties involved

Risk Breakdown Structure – RBS

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Level 1	Level 2	Level 3
Management	Corporate	History, experience, culture, personnel, organization, com
	Customers & stakeholders	History, experience, culture, personnel Contracts, requirement definition, finance and credits
External	Natural environment	Physical environment, facilities, site, equipment, material Local services, weather, nature, land, etc
Technology	Cultural	Political, legal, regulatory, society and communities
	Economical	Labour market, conditions, competition
	Requirements	Scope and objective, condition of use, users, complexity
	Performance	Technology limitations, new technology, new hazards
	Application	Organizational experience, personnel skill

Ex – Warehouse – RBS

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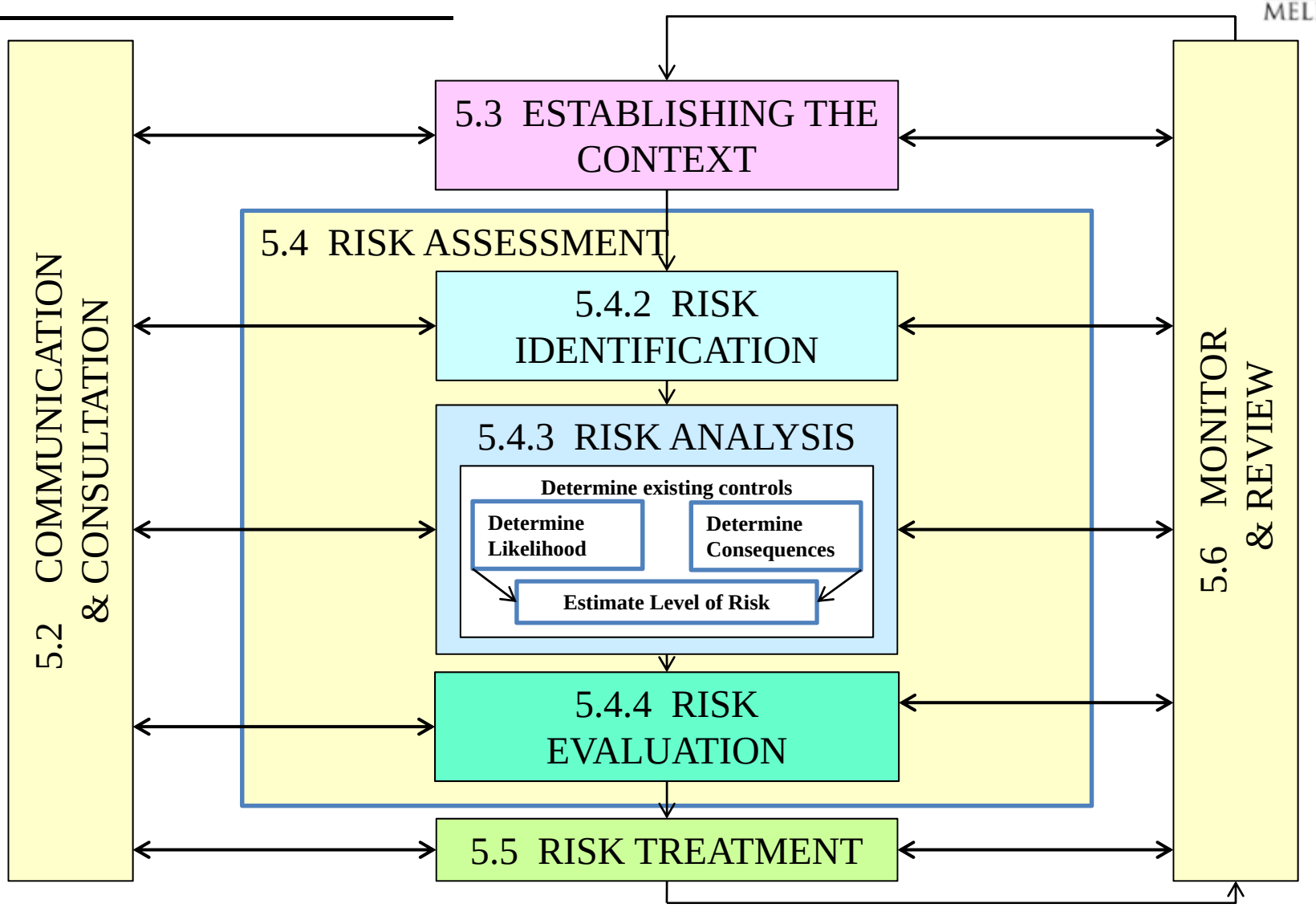
Level 1	Level 2	Level 3
Management	Corporate	
	Customers & stakeholders	
External	Natural environment	
Technology	Cultural	
	Economical	
	Requirements	
	Performance	
	Application	

Risk Assessment Methods

Method	Scope
Safety/ review audit	It identifies equipment conditions or operating procedures that could lead to a casualty or result in property damage or environmental impacts.
Checklist	It ensures that organizations are complying with standard practices.
What-if/ then	It identifies hazards, hazardous situations, or specific accident events that could result in undesirable consequences.
HAZOP	It identifies system deviations and their causes that can lead to undesirable consequences and determine recommended actions to reduce the frequency and/or consequences of the deviations.
FMEA	It identifies the component (equipment) failure modes and impacts on the surrounding components and the system.
FTA	It identifies the combinations of equipment failures and human errors that can result in an accident.
ETA	It identifies various sequences of events, both failures and successes that can lead to an accident.

Risk Analysis



Qualitative Risk Analysis

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- In practice, qualitative analysis is often used first to obtain a general indication of the level of risk. Later it may be necessary to undertake more specific quantitative analysis.
- Qualitative analysis uses word form or descriptive scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.
- These scales can be adapted or adjusted to suit the circumstances, and different descriptions may be used for different risks.

Qualitative Risk Analysis used

1) as an initial screening activity to identify risks which require more detailed analysis;

2) where the level of risk does not justify the time and effort required for a fuller analysis; or

3) where the numerical data are inadequate for a quantitative analysis.

Risk Analysis – Probability

Risk analysis considers possible causes, sources, likelihood and consequences to establish the inherent risk

The Consequence	The Probability
Impact or magnitude of the effect of an identified risk occurring	Frequency or likelihood of an identified risk occurring

Probability of risks occurring		
Rate	**Descriptor**	**Likelihood**
6	Almost Certain	Will most probably occur – more than 75% chance
5	Quite Possible	Will probably occur – risk has 50-74% chance
4	Possible	May occur – 25-49% probability
3	Remotely	Remotely possible coincidence
2	Unlikely	Highly unlikely to occur
1	Practically impossible	Never happened yet

Risk Analysis – Consequences

Assessment need to be made of what might be the result (Consequence of Impact) in the event that the risk occurred

Consequence of risks occurring		
Rate	**Descriptor**	**Equates to**
6	Catastrophic	Numerous fatalities; Outstanding/Catastrophic damage; Business objectives not able to be achieved; Extensive financial loss
5	Disaster	Multiple fatalities; Major (environmental/business) damage
4	Very Serious	Fatality; Significant damage and impact on strategic and business objectives, and financial loss
3	Serious – Moderate	Serious injury; Medium damage, may have impact on strategic and business objectives; Substantial financial loss
2	Substantial	Injury requiring medical treatment; Notable financial loss
1	Minor	Little impact and risks are dealt with during routine operations

Risk Analysis – Risk Ratings

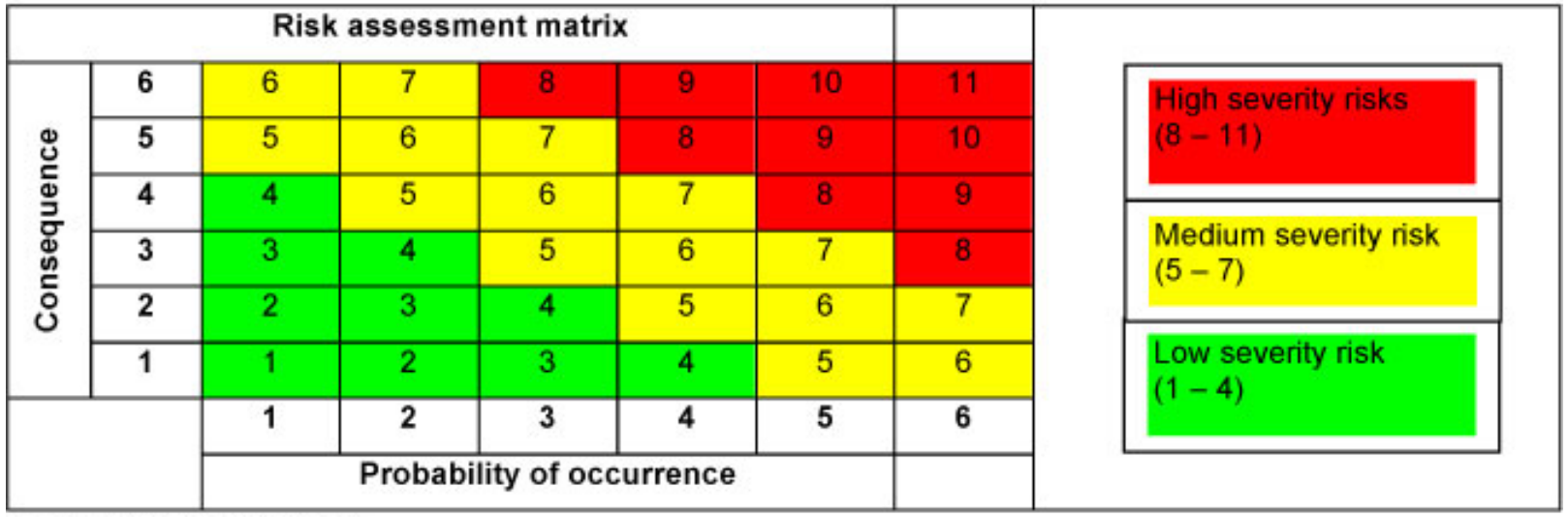
Once assessed

The Consequence	The Probability
Impact or magnitude of the effect of an identified risk occurring	Frequency or likelihood of an identified risk occurring

Combine the two ratings using a Risk Analysis Matrix (PI chart)

- The rating of a risk in relation to Likelihood and Consequence can be plotted on the PI chart
- Once the risks are plotted identify the Risk Rating Score to determine the Action required – Risk Evaluation

Probability Impact (PI) chart



Risk Rating Score	General Evaluation
High	Action plan required, senior management approval needed before commencing
Medium	Specific monitoring or procedure required, management approval needed before commencing
Low	Manage through routine procedures and agreed risk mitigation controls before proceeding

NSCA – Calculate Risk Score

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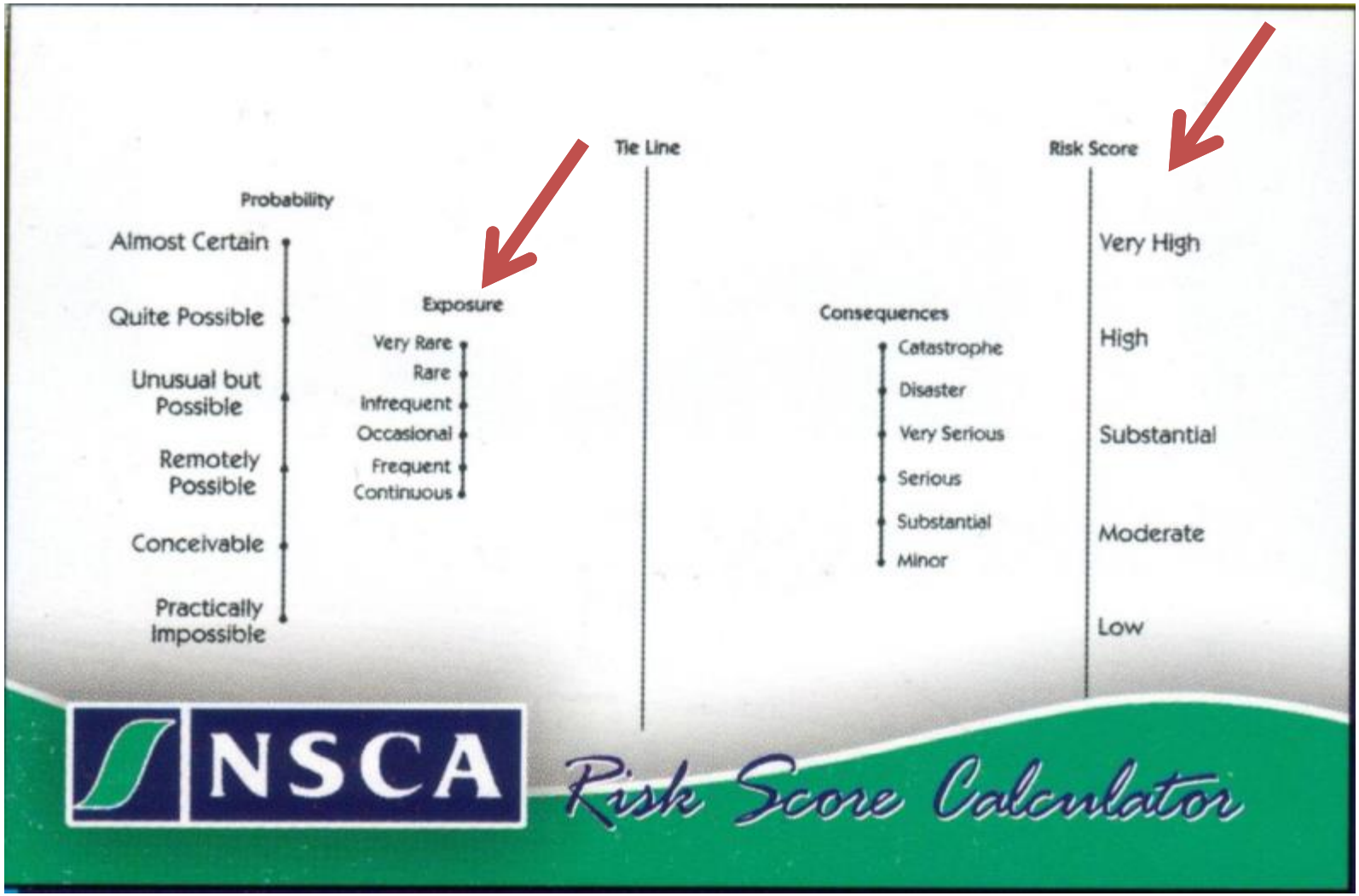
NSCA
National Safety Council of Australia Ltd

NATIONAL SAFETY COUNCIL OF AUSTRALIA

source: http://www.nsca.org.au/

Risk Score Calculator



Risk Analysis – Exposure

How often exposed to the hazard

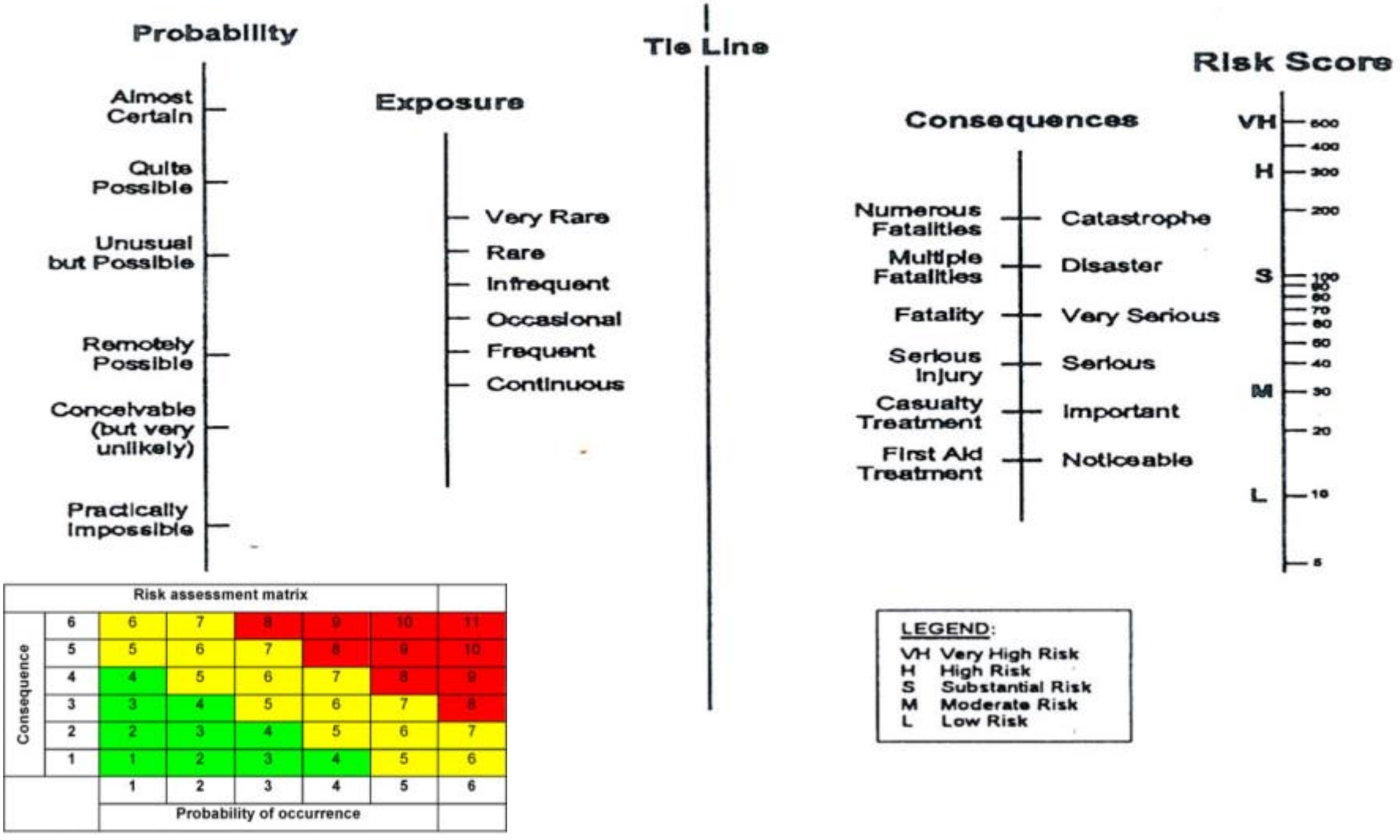
Exposure to the hazard	
Descriptor	**Occurrence level**
Very Rare	Not known to have occurred
Rare	Occurs rarely, but has been known to occur
Infrequent	Occurs between once per month and once per year
Occasional	Occurs between once per week and once per month
Frequent	Occurs approximately one per day
Continuous	Occurs many times daily

Example Risk Score Calculation

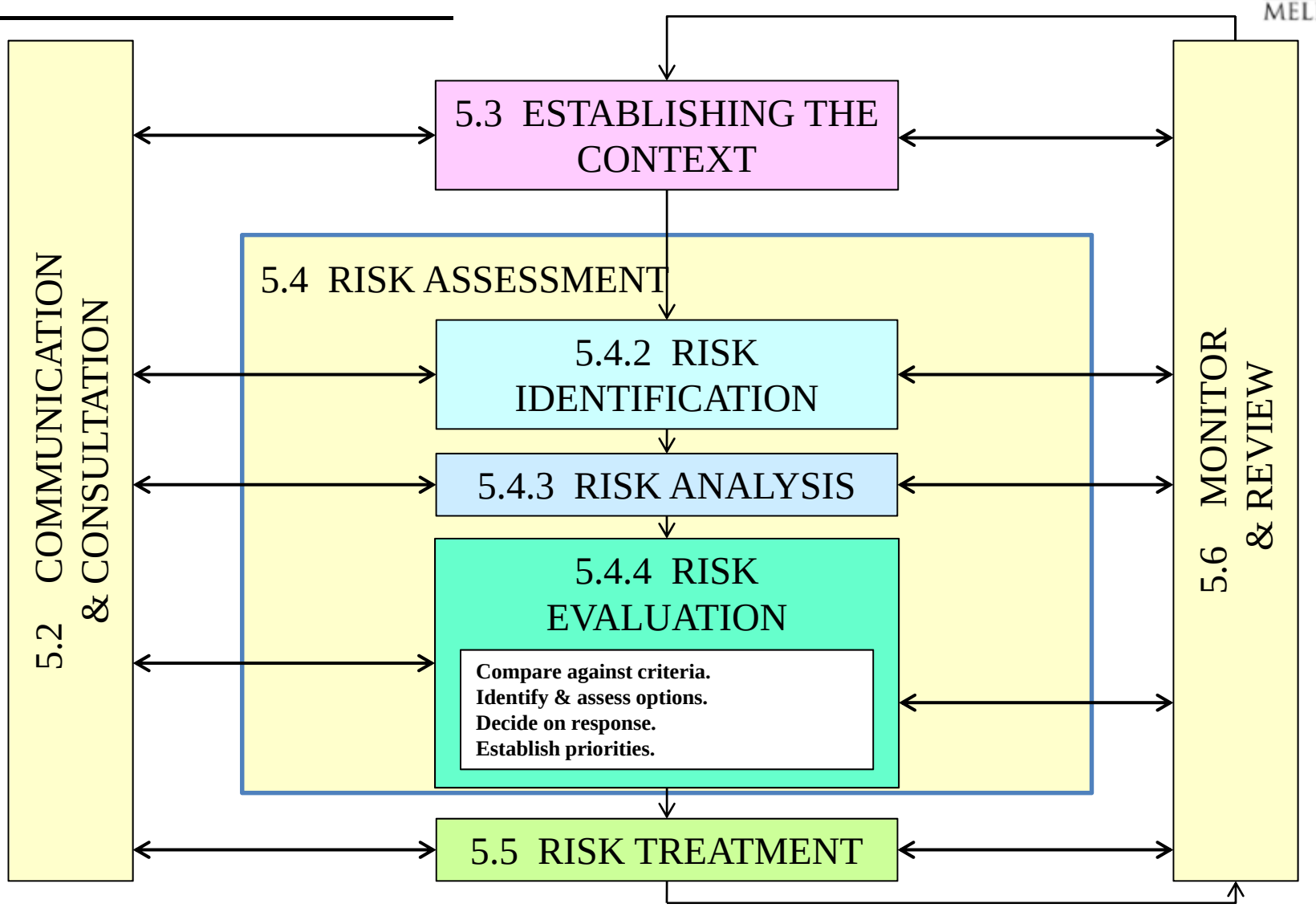
- **Task**: lifting and moving heavy objects
- **Consequence**: SERIOUS – muscular strain/back injury
- **Exposure**: rooms rearranged twice daily – CONTINUOUS
- **Probability:** UNUSUAL BUT POSSIBLE

Draw a line from through the following chart to calculate the Risk Score

Example Risk Score Calculation



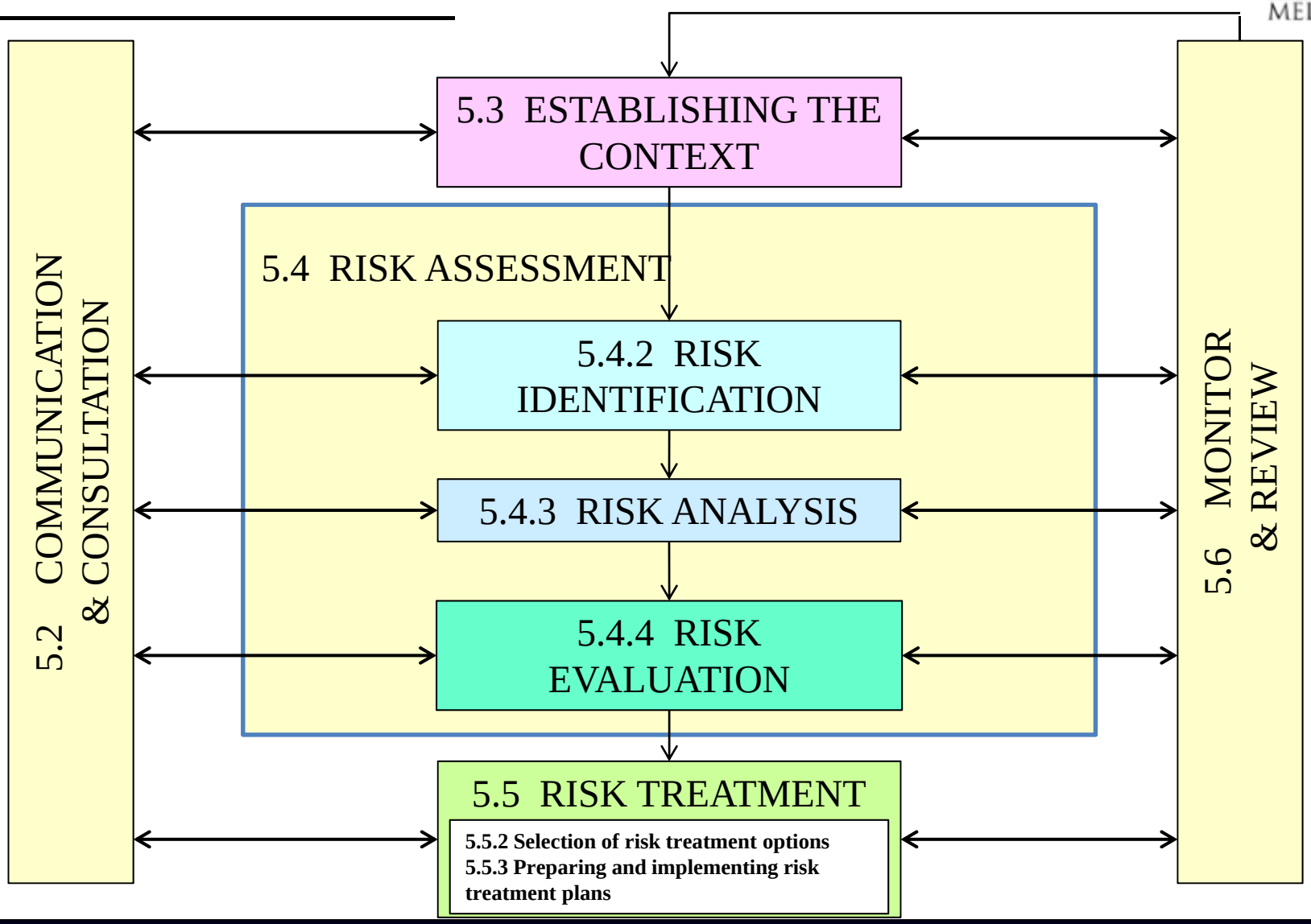
Risk Evaluation



Risk Evaluation

- The purpose is to **assist in** making **decision**, based on the outcomes of Risk Analysis
- **Decision** is to be made if the level of risk is intolerable – risk **treatment** is necessary
- Risk Evaluation involves comparing level of risks with **risk criteria** established at context stage
- Decision should be made **in accordance with** legal, regulatory and other **requirements**
- Risk Evaluation can also lead to **further analysis**

Risk Treatment



Risk Treatment - Responses

1. **MITIGATE** - corrective action to eliminate or reduce IMPACT or LIKELIHOOD
2. **AVOID / REMOVE** - Cease activity/source to eliminate risk
3. **TRANSFER** - Shift IMPACT to another entity
4. **ACCEPT** - No corrective action. Document acceptance decision and monitor

Risk Treatment Options

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- Selecting treatment option involves **balancing** the costs & efforts **against benefits** derived
- **Treatment options** can be considered individually or **in combination**
- Risk treatment itself can **introduce risks**. These **secondary risks** should be incorporated into the same treatment plan.

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RISK TREATMENT – REDUCTION

Example Risk Treatment

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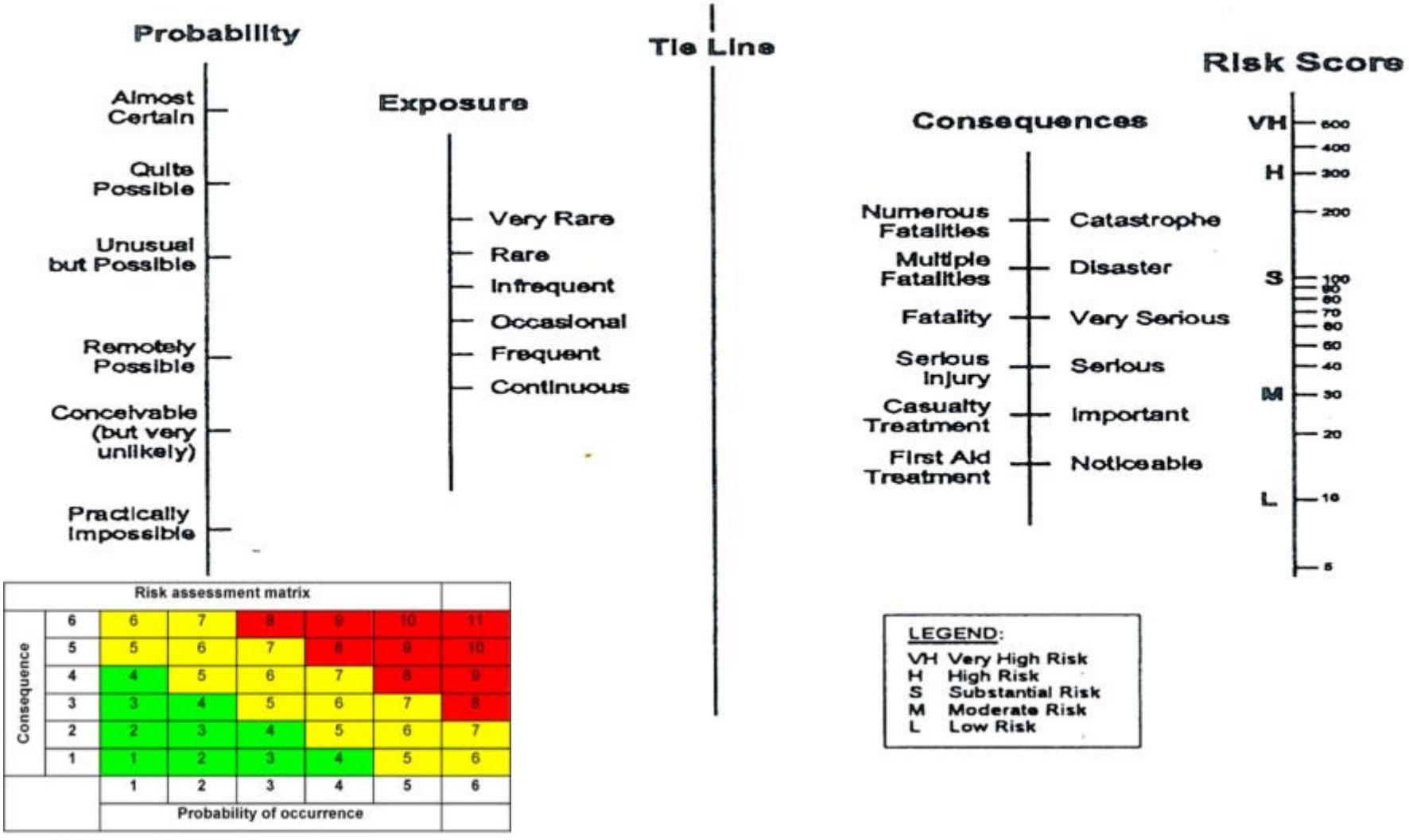
- **Task**: lifting and moving heavy objects
- **Consequence**: SERIOUS – muscular strain/back injury
- **Exposure**: twice daily – CONTINUOUS
- **Probability:** UNUSUAL BUT POSSIBLE

- **Treatment**:
  - use of harness – reduces probability and consequence
  - categorise objects and shift people between categories – reduce exposure

Example Risk Score Calculation

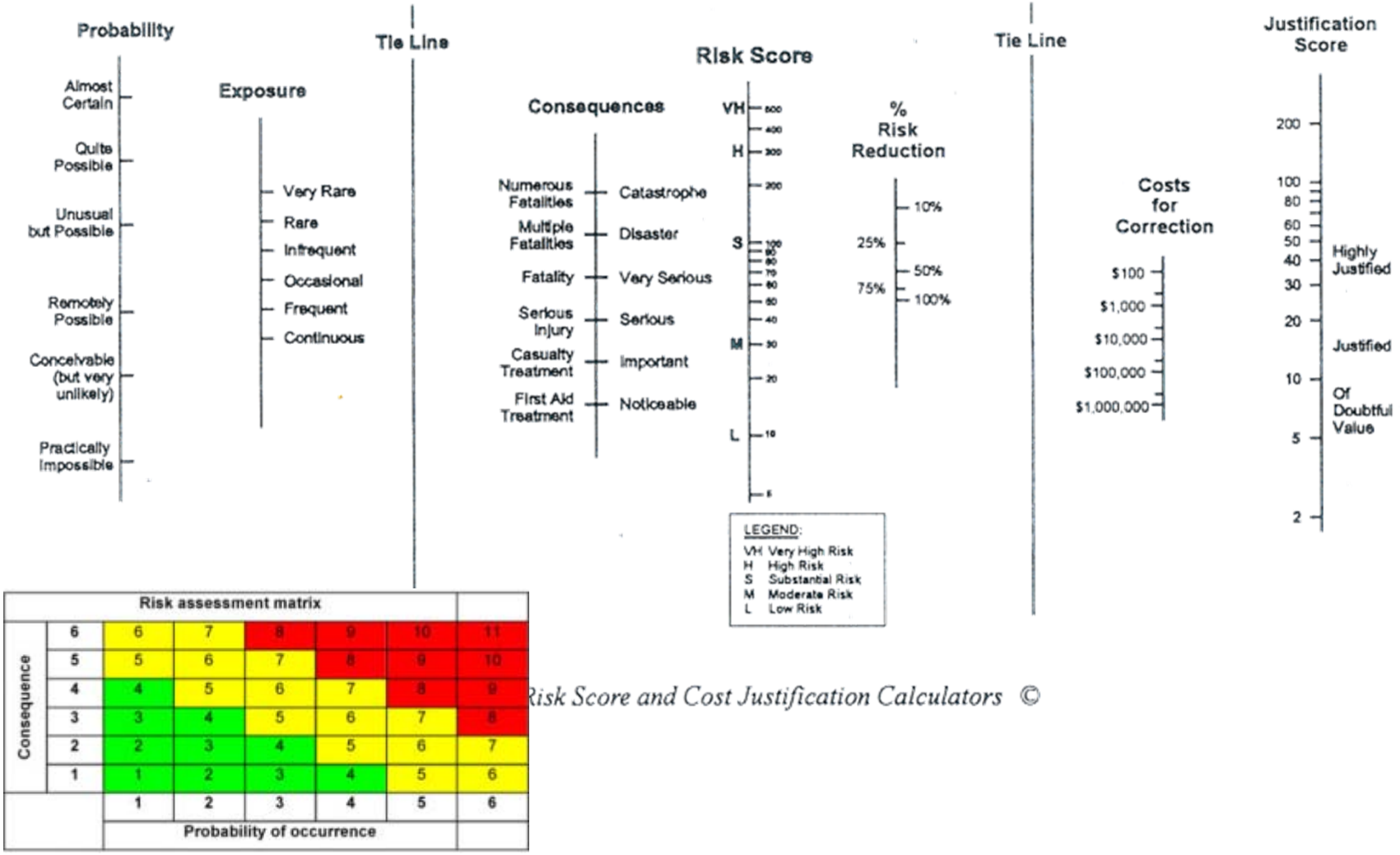


Example Risk Treatment

- **Task**: lifting and moving heavy objects
- **Consequence**: SERIOUS – muscular strain/back injury
- **Exposure**: twice daily – CONTINUOUS
- **Probability:** UNUSUAL BUT POSSIBLE

- **Treatment**: use of harness, work shift
- **Risk Reduction**: 170 =>25; ~85%
- **Cost of Reduction**: less than $1,000

Risk Score Justification

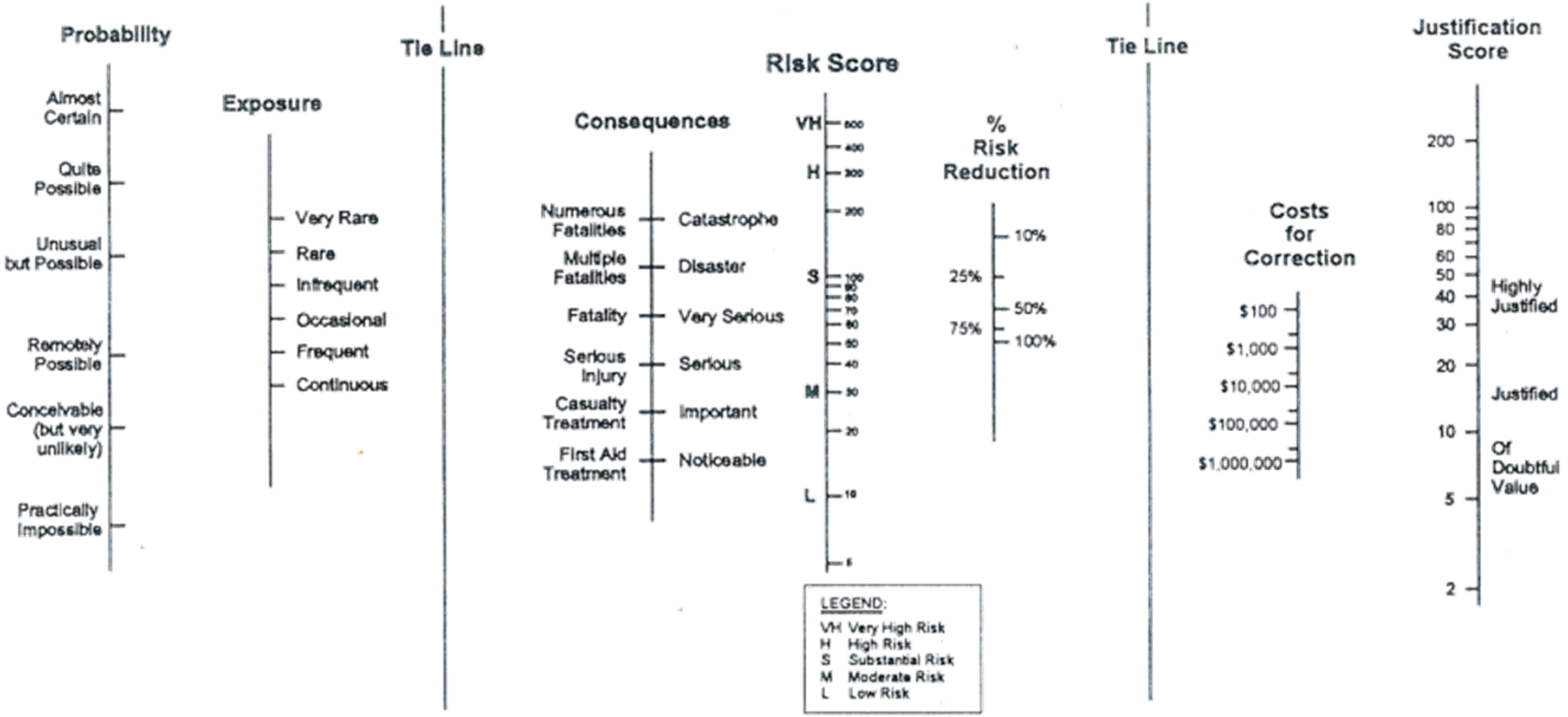


Risk assessment matrix

Consequence		Probability of occurrence					
	6	6	7	8	9	10	11
	5	5	6	7	8	9	10
	4	4	5	6	7	8	9
	3	3	4	5	6	7	8
	2	2	3	4	5	6	7
	1	1	2	3	4	5	6
		1	2	3	4	5	6

Risk Score and Cost Justification Calculators ©

Risk Score Justification



NSCA Combined Risk Score and Cost Justification Calculators ©

End Summary – Approach to Risk

- ✓ Risk Concept – ISO31000
- ✓ Risk Management
- ✓ Risk Analysis – Calculation of Risk Score