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Making the most of the Risk Assessment Matrix  
Webinar  
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## About David McDade



David is a Risk Management Consultant based in Risktec's Glasgow office (having also been previously based in Warrington and Dubai).

He has over 15 years of risk management and technical safety engineering experience in multiple high-hazard industries including oil and gas, clean energy and civil nuclear.

David's key experience includes leading Hazard Identification (HAZID) and bowtie analysis studies, safety/HSE case production, and the development and delivery of training, including at MSc level.

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## The Risk Assessment Matrix

*"The Matrix is everywhere. It is all around us. Even now, in this very room. You can see it when you look out your window or when you turn on your television"*

Morpheus



Severity Rating	Consequence				Increasing probability			
	People	Assets	Environment	Reputation	A	B	C	D
					Has occurred in E&P Industry	Has occurred in operating company	Occurred several times a year in operating company	Occurred several times a year in location
0	Zero injury	Zero damage	Zero effect	Zero impact	Manage for continued improvement			
1	Slight injury	Slight damage	Slight effect	slight impact				
2	Minor injury	Minor damage	Minor effect	Limited impact	Incorporate risk-reducing measures			
3	Major injury	Local damage	Local effect	Considerable impact				
4	Single fatality	Major damage	Major effect	Major national impact	Failed to meet acceptance/criteria			
5	Multiple fatalities	Extensive damage	Maximise effect	Major international impact				

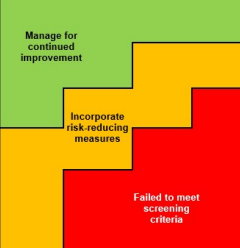


## Agenda

- What is the RAM and what can they look like
- Using the RAM – variables and risk levels
- Unmitigated and mitigated risks
- How many is too many
- Q and A

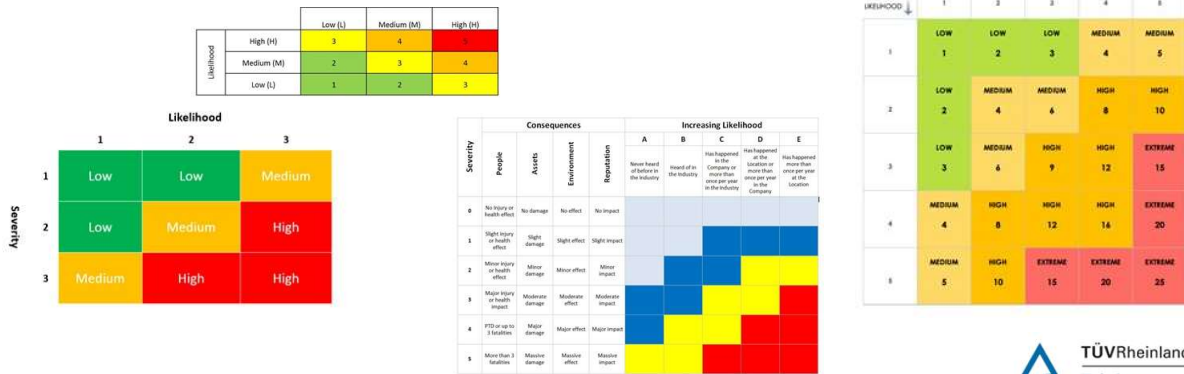
## What is the Risk Assessment Matrix?

- A matrix used during risk assessment to define the level of risk
- Intended to increase visibility of risks and assist decision-making
- The RAM below is derived from ISO 17776 and is a typical example

Severity Rating	Consequence				Increasing likelihood			
	People	Assets	Environment	Reputation	A	B	C	D
0	Zero injury	Zero damage	Zero effect	Zero impact	Has occurred in Industry	Has occurred in operating company	Occurred several times a year in operating company	Occurred several times a year in location
1	Slight injury	Slight damage	Slight effect	Slight impact				
2	Minor injury	Minor damage	Minor effect	Limited impact				
3	Major injury	Local damage	Local effect	Considerable impact				
4	Single fatality	Major damage	Major effect	Major national impact				
5	Multiple fatalities	Extensive damage	Massive effect	Major international impact				

## Risk Assessment Matrices – all shapes and sizes

- RAMs come in many different shapes and sizes, ranging from 3x3 to 10x10
- The most common tend towards the 6x4, 5x5 or 6x6 type.



7 Making the most of the Risk Assessment Matrix Webinar



## Variables: likelihood

- Frequency, Probability, Likelihood
- Qualitative vs Semi-quantitative
- Who is using the RAM

Likelihood of Occurrence			
<b>Very Unlikely</b> Little or no chance of occurrence	<b>Unlikely</b> Could occur less than 50/50 chance	<b>Possible</b> 50/50 chance	<b>Probable</b> More likely to occur than not

Frequency term	Frequency range	Frequency range
Extremely unlikely	<10 <sup>-6</sup> per year	Less than once per 1,000,000 years
Very unlikely	10 <sup>-6</sup> to 10 <sup>-4</sup> per year	Between once per 1,000,000 and once per 10,000 years
Unlikely	10 <sup>-4</sup> to 10 <sup>-2</sup> per year	Between once per 10,000 and once per 100 years
Improbable	10 <sup>-2</sup> to 1 per year	Between once per 100 and once per year
Probable	> 1 per year	Greater than once per year

Occurs 1 or more times a year	<b>Almost Certain (E)</b>
Occurs once every 1-10 years	<b>Likely (D)</b>
Occurs once every 10-100 years	<b>Possible (C)</b>
Occurs once every 100-1000 years	<b>Unlikely (B)</b>
Occurs once every 1000 - 10000 years	<b>Rare (A)</b>

A	B	C	D	E
Never heard of in the industry	Heard of in the industry	Has happened in organisation or more than once/year in industry	Has happened at location or more than once/year in organisation	Has happened more than once per year at the location

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## Variables: consequence

- Defined for assessment purpose, e.g.
  - People (safety, health)
  - Production, environment, reputation, legal
  - Radiological dose
- Qualitative vs Semi-Quantitative

Consequence term	Definition
Catastrophic (Category 5)	<b>Onsite:</b> Many fatalities (5 or more). Numerous serious injuries <b>Offsite:</b> One or more fatalities. Several injuries. <b>Airborne onsite:</b> Major airborne release resulting in the site being shut down. <b>Airborne offsite:</b> Release of large quantities of toxic materials, serious offsite effects. <b>Liquid discharge:</b> Very serious ground or water course contamination. Extensive loss of aquatic life. <b>Media:</b> International TV news. Outcry threatens to close operation.

Consequences				
Insignificant	Minor	Moderate	Major	Severe

- 1 Negligible injury or health implications, no absence from work. Negligible loss of function/production with no damage to equipment or the environment.
- 2 Minor injury requiring first-aid treatment or headache, nausea, dizziness, mild rashes. Damage to equipment requiring minor remedial repair, loss of production or impact to the environment.

## Risk ranking

**Risk = Likelihood x Consequence**

- Consequence is unmitigated 'worst case'
- Likelihood and consequence of each scenario will be different

Severity Rating	Consequence				Increasing likelihood			
	People	Assets	Environment	Reputation	A	B	C	D
0	Zero injury	Zero damage	Zero effect	Zero impact	Has occurred in Industry	Has occurred in operating company	Occurred several times a year in operating company	Occurred several times a year in location
1	Slight injury	Slight damage	Slight effect	Slight impact	Manage for continued improvement			
2	Minor injury	Minor damage	Minor effect	Limited impact				
3	Major injury	Local damage	Local effect	Considerable impact	Incorporate risk-reducing measures			
4	Single fatality	Major damage	Major effect	Major national impact				
5	Multiple fatalities	Extensive damage	Massive effect	Major international impact	Failed to meet screening criteria			

## Risk levels

Many risk matrices typically define 3 or 4 risk levels:

### HIGH

The operation or activity shall not start or continue

### MEDIUM

The operation or activity should start or proceed only when risk-reducing measures are in operation

### LOW

The operation or activity may start or proceed

### VERY LOW

Manage for continuous improvement

**Boundaries recognise risk targets/tolerability framework, e.g. R2P2**

## Boundaries between risk levels – UK example

### ***Boundary between the 'broadly acceptable' and 'tolerable' regions for risk entailing fatalities***

**130** HSE believes that an individual risk of death of one in a million per annum for both workers and the public corresponds to a very low level of risk and should be used as a guideline for the boundary between the broadly acceptable and tolerable regions.

*Reducing Risks, Protecting People*

UK HSE

<https://www.hse.gov.uk/managing/theory/r2p2.pdf>

## Risk levels and scoring

Generally the product of numbers from the consequence and likelihood axes

1	2	3	4	5
2	4	6	8	10
3	6	9	12	15
4	8	12	16	20
5	10	15	20	25

## Keep the purpose in mind

### The key benefits of a RAM are:

- Gives a rapid and consistent risk levels
- Encourages discussion and common understanding of hazardous scenarios

### Using the risk level/score:

- The RAM risk level scores help make an informed decision as to the acceptability of that risk
- The actual cell chosen and the decision-making process cannot be considered as absolutely exact



## Unmitigated and mitigated risk

Residual risk vs inherent risk can show a moving score on the RAM

Severity Rating	Consequence				Frequency (per year)			
	People	Assets	Environment	Reputation	A	B	C	D
					>10 <sup>-3</sup>	10 <sup>-2</sup> to 10 <sup>-3</sup>	10 <sup>-1</sup> to 10 <sup>-2</sup>	>10 <sup>-1</sup> per year
0	Zero injury	Zero damage	Zero effect	Zero impact				
1	Slight injury	Slight damage	Slight effect	Slight impact				
2	Minor injury	Minor damage	Minor effect	Limited impact				
3	Major injury	Local damage	Local effect	Considerable impact				
4	Single fatality	Major damage	Major effect	Major national impact				
5	Multiple fatalities	Extensive damage	Massive effect	Major international impact				

## Unmitigated and mitigated risk – when is it a good idea?

- Easier to justify when using “Frequency”

Frequency (per year)			
A	B	C	D
>10 <sup>-3</sup>	10 <sup>-2</sup> to 10 <sup>-3</sup>	10 <sup>-1</sup> to 10 <sup>-2</sup>	>10 <sup>-1</sup> per year

Likelihood			
A	B	C	D
Very unlikely	Unlikely	Likely	Very likely



## Unmitigated and mitigated risk – when is it a good idea?

*“The magnitude of risk depends on the assumptions made about the presence and effectiveness of relevant controls.*

*Terms such as **inherent** or gross risk (for the situation where those controls which can fail are assumed to do so) and **residual** or net risk for the level of a risk when controls are assumed to operate as intended are often used by practitioners.*

*However, it is difficult to define these terms unambiguously and it is therefore advisable to always state explicitly the assumptions made about controls.”*

### Risk management – Risk assessment techniques (BS IEC 31010:2019)

## One size fits all?

### One RAM for the Company?

- A single RAM allows for a consistent approach
- Can lead to increased RAM size to cover workplace hazards to major events

### A RAM per department?

- Allows for simple, highly targeted assessments
- Managing consistency becomes more difficult



## Summary – Tips for using the RAM

- Ensure users understand its use and limitations
- Make sure to use the correct RAM
- Consequence and Likelihood pairing
- An aid to decision making
- Be careful with mitigated and unmitigated risk



## Q&A

## Thank you for your attention

If you would like to discuss your requirements around this topic or any other risk and safety management issues, then do please contact us at [enquiries@risktec.tuv.com](mailto:enquiries@risktec.tuv.com)

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**Have a safe and secure day!**

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