HKIOEH Annual Technical Conference

Risk management in EOSH – what can we do more?

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Talking points

Assumption: You are seasoned EOSH practitioners and have conducted risk assessments before

- Where have we been
- What we know so far, align terminology

- What has gone right
- What has gone left
- What can we do more
- Do's and don'ts

- Takeaways

You will have more questions after the talk ☺

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Risk management – origin?

The concept of risk assessment and management has a long history. More than 2400 years ago the Athenians offered their capacity of assessing risks before making decisions. From the Pericle's Funeral Oration in Thurcydidas 'History of the Peloponnesian War' (started in 431 BC):

> *We Athenians in our persons, take our decisions on policy and submit them to proper discussion. The worst thing is to rush into action before consequences have been properly debated. And this is another point where we differ from other people. We are capable at the same time of taking risks and assessing them beforehand…*

The Art of War, Sun Tzu's ancient book of strategy has as much to tell us today as when it was first written 2,500 years ago:

> *Understand your weakness to resolve issues, understand your strength to win. Who wishes to fight must first count the cost. Move not unless you see an advantage.*

The Art of War has 11 chapters. Each of these topics can be seen to have a lesson for risk management

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孫子兵法
作戰篇

故不盡知用兵之害者，
則不能盡知用兵之利也。

是故智者之慮，必雜于利害，
雜于利而務可信也，
雜于害而患可解也。

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Risk management – general evolution in safety applications

(my observation)

1950's-60's – Military and defense: fault tree, system safety, RAMS, MIL-STD-882, hazard register, risk matrix
deterministic, more qualitative

1960's-70's – Nuclear and aviation: probabilistic risk assessment (PRA), fault tree/ event tree, Bayesian update, human error, expert opinion, fire, flood
very quantitative, uncertainty analysis

1980's – Petrochem, aerospace, offshore oil, high risk industries: quantitative risk assessment (QRA), HAZOP, IPE, ALARP
less quantitative, deterministic

1990's – Railway/transportation, environmental, project risk, risk matrix, financial risk, ERM, OSHAS 18001
more qualitative, more applications

2000's-now – almost all industries, OSH, ISO31000, ISO 45001, ISO 45003
very qualitative, most industries

Risk analysis is also blossomed in other areas: insurance risk, actuarial science, business strategy risk, financial investment risk, medical diagnosis, etc.

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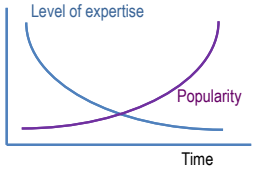
Risk management is confusing ….

- Almost everyone under the sun is conducting risk assessments, from spilling water to Mars landing mission
- There is no ONE approach in conducting risk assessment and risk management
- As risk management is gaining its popularity amongst industries, its application is also getting simpler and less quantitative



Risk has been defined in many ways across industries

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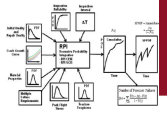
Defining risk

- On the Quantitative Definition of Risk, *Kaplan and Garrick, Risk Analysis, Volume 1, Issue 1,1981*
  - In general, risk is used to answer
    - What can go wrong?
    - What are the damage effects?
    - How likely is it that this will happen?
  - Uncertainties are reflected by the probability of frequency



- ISO 31000:2009 Risk Management- Principles and Guidelines on Implementation; ISO 73-2009: Risk Management – Vocabulary
  - Risk is defined as the "effect of uncertainty on objectives"
  - The "effect" can be positive and/or negative

Even the top experts are not agreeing with each other

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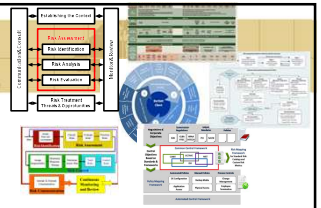
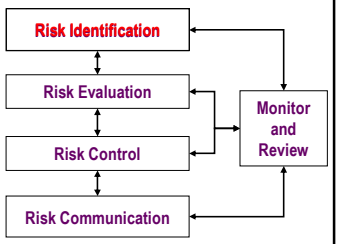
Risk management framework



- Many risk management frameworks around they have similar steps that are often iteratively applied in phases
- Which step is most important? Why?
- Risk management programme is not a one-off activity
- These steps are often iteratively applied in phases, and are applicable to ALL businesses/ disciplines/ industries continually



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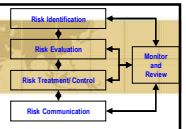
Risk management programme



DO'S&DON'TS

DO

- Keep a simple programme to ease communication
- Involve all staff and relevant parties
- Allow sufficient and adequate resources to implement the programme

DON'T

- Treat risk management programme as an ad hoc one-off process but monitor regularly
- Compartmentalise information but share information between stakeholders
- Underestimate the complexity of risk management but seek external review and look for continuous improvement

Risk management is a life long process and needs to be fit-for-purpose

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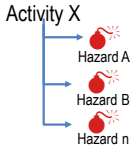
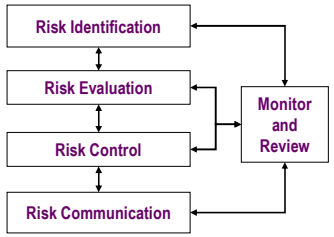
Risk management framework

- In a risk assessment, we want to find out what can go wrong for an activity, X
  - The hazards (sources of potential harm)
  - The severity of the impact
  - The likelihood and exposure





If I give you a hazard, can you me tell me the risk?
e.g., a grenade
A bucket of Chlorine trifluoride?

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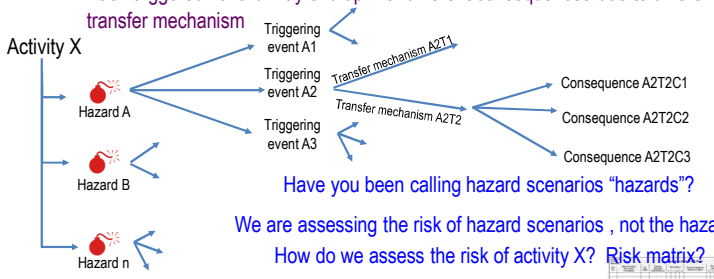
Hazard scenarios

Hazard/ Source of Harm + Triggering Event → Transfer mechanism → Consequence/ Damage effects

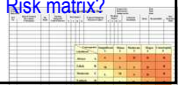
- Almost all activities or events come with multiple hazards
- Each hazard may be activated by different triggering events
- Each triggered hazard may end up with different consequences due to different transfer mechanism



Have you been calling hazard scenarios "hazards"?

We are assessing the risk of hazard scenarios , not the hazards

How do we assess the risk of activity X? Risk matrix?



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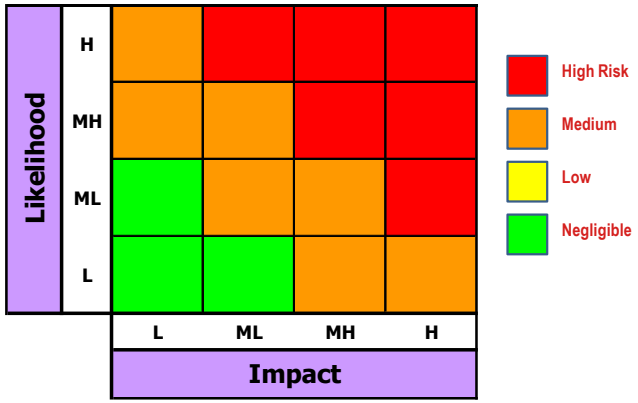
Inside the mechanics of risk matrix



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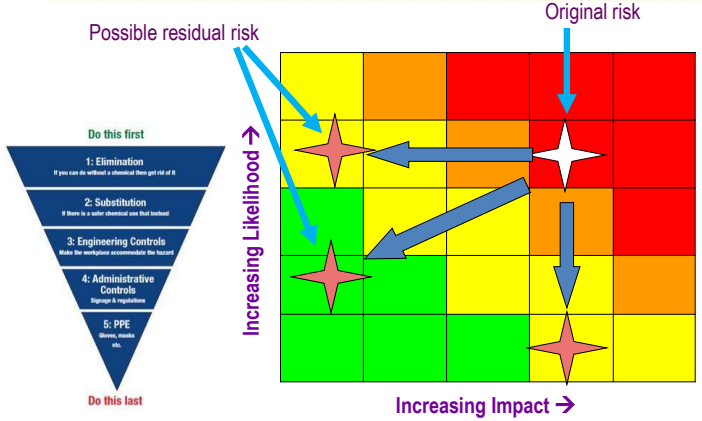
Evaluate the effectiveness of treating risks



We all know this

Who have considered the hierarchy of actions?

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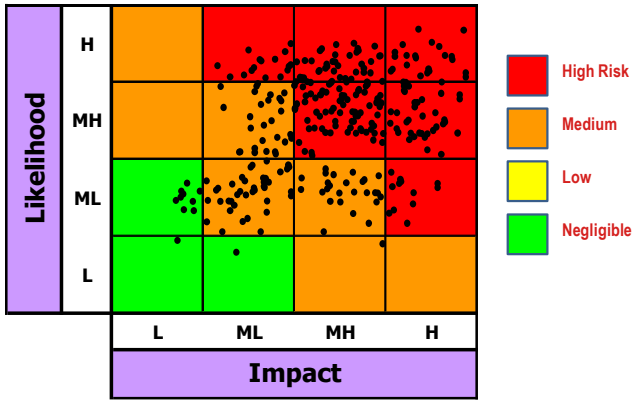
What kind of company is this?

- Hazard scenarios



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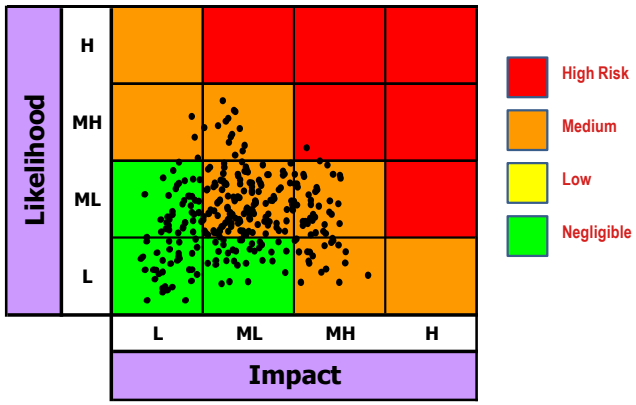
What kind of company is this?

Who have tried to map out your risks?

- Hazard scenarios



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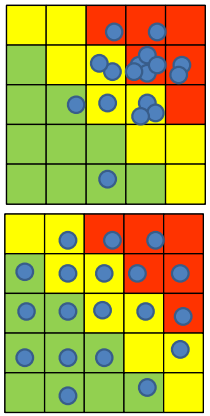
Risk map



- Does your "Risk Map" look more like the top or bottom chart?
  - Clustering or equally-spread risk mapping means that the risk matrix may not suit your operation
- When was the last time you updated your risk matrix?
  - Risk profile changes as risk management program mature, so should your risk matrix

What can we do more?

Understand the applications of our tools

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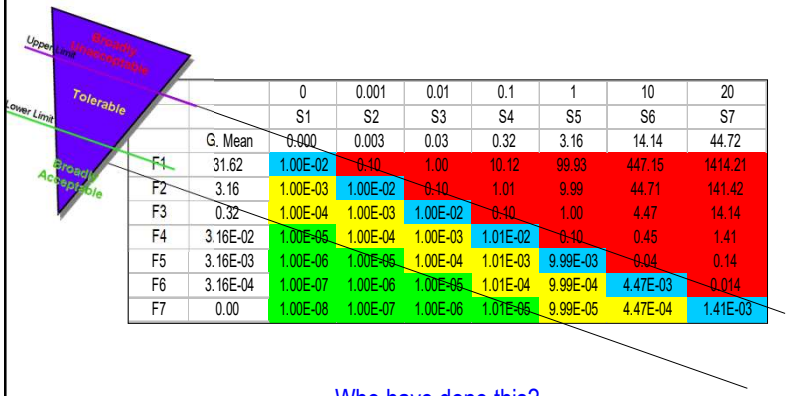
Risk matrix should be designed by quantitative input



		0	0.001	0.01	0.1	1	10	20
		S1	S2	S3	S4	S5	S6	S7
	G. Mean	0.000	0.003	0.03	0.32	3.16	14.14	44.72
F1	31.62	1.00E-02	0.10	1.00	10.12	99.93	447.15	1414.21
F2	3.16	1.00E-03	1.00E-02	0.10	1.01	9.99	44.71	141.42
F3	0.32	1.00E-04	1.00E-03	1.00E-02	0.10	1.00	4.47	14.14
F4	3.16E-02	1.00E-05	1.00E-04	1.00E-03	1.01E-02	0.10	0.45	1.41
F5	3.16E-03	1.00E-06	1.00E-05	1.00E-04	1.01E-03	9.99E-03	0.04	0.14
F6	3.16E-04	1.00E-07	1.00E-06	1.00E-05	1.01E-04	9.99E-04	4.47E-03	0.014
F7	0.00	1.00E-08	1.00E-07	1.00E-06	1.01E-05	9.99E-05	4.47E-04	1.41E-03

Who have done this?

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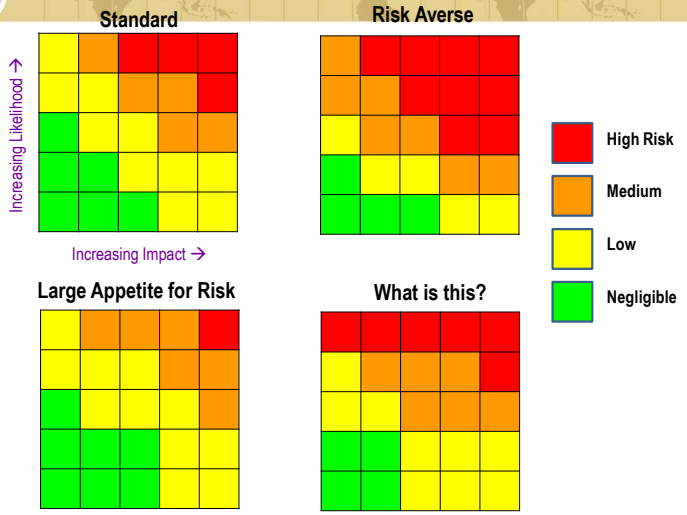
Standard / Risk Averse / Large Appetite for Risk / What is this?



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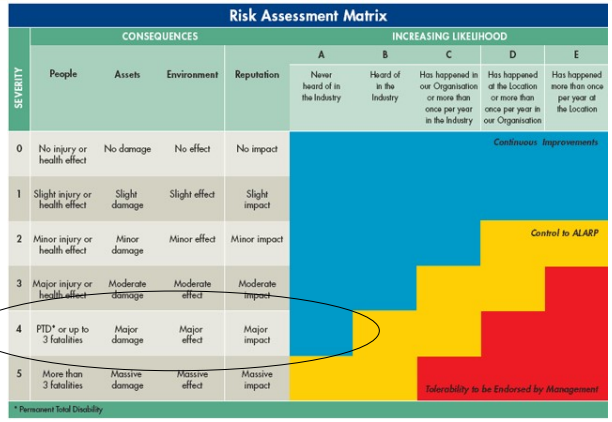
Issues in designing complex risk matrix



Infer economic equivalence of these items

Is your risk matrix like this?
Who is using a 10x10 risk matrix?

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Economic equivalence?

Rating	Likelihood	Consequence
6	Frequency greater than 10 times per year	Multiple deaths (4 or more); loss or harm of more than $100m within a financial year or forced shutdown of railway network (loss of franchise)
5	Frequency of 10 times per year	Deaths (1 to 3); loss or harm of between $10m and $100m within a financial year or extended adverse media campaign or a Judicial or Parliamentary enquiry (loss of franchise)
4	Frequency between once per month to once per year	Single death or multiple serious injuries; loss or harm of between $1m and $10m within a financial year or on-going national media coverage
3	Frequency between once per year and once every 10 years	Serious injuries; loss or harm of between $100k and $1m within a financial year or on-going State-based media coverage
2	Frequency of once per 10 years	Medical treatment; loss or harm of between $10k and $100k within a financial year or on-going local media coverage
1	Frequency less than once every 10 years	Minor injuries or nil treatment; loss or harm of less than $10k within a financial year or minimum media coverage

What can we do more?
Challenge status quo, question the details

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Qualitative vs quantitative

Qualitative risk assessment	Quantitative risk assessment
• Results are based on subjective measures and reflected by risk ratings • Can show relative risk significance with low resolution • Monetary value of assets is usually not important • Requires limited effort to assign likelihood / consequence / risk class • Relatively straightforward, detailed analysis is not required • Can be performed by safety officers and non-expert level staff •	• Results are based on objective measures and reflected by numbers/ distributions • Can show the total risk of an activity or a system with high resolution • Cost/risk-benefit issues are important for effectiveness monitoring • Requires large amount of historical and site specific data • More complex process, mathematical and computer models are required • Mostly performed by expert level staff or risk analysts • ....

Risk assessments for complex engineering systems usually involve both a qualitative phase and a quantitative phases

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Skepticism to using quantitative tools

- "We don't trust the numbers"
- "It can't be done quickly"
- "We don't have all the data"
- "Something is always bothering me and it can't be expressed as numbers"
- "Our senior management does not understand the numbers"
- "Our current tool was developed by a senior manager years ago"
- "Our method is the best tool we have used (because it is the easiest)"

If you don't have the data, how can you assess the risk, even using risk matrix?

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What can go wrong in these steps?

- Check the box "Hazard X present or not" → is it a risk assessment? Check-box safety
- Risk assessment methods vary widely among industries; the most popular methods are usually the least effective
- Strong "placebo effect" in analysis - a completely ineffective method would feel like it worked, particular when it is easy to master
- "Don't make this a Level-A risk, need to tell the boss" Technical risk is difficult to understand, what if you find something we cannot manage

What can we do more?
Understand the limitation of our tools

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Notes

Do's

- ☺ Comprehensively include all reasonably foreseeable scenarios
- ☺ Adhere to evidence
- ☺ Apply logical and technically sound methods
- ☺ Be practical and reasonable
- ☺ Open to evaluation through peer professional review
- ☺ Base on explicit assumptions and premises
- ☺ Specialise to the system being analysed
- ☺ Conducive to learning as a living document
- ☺ Attune to risk communication to stakeholders

Don'ts

- ☹ Focus narrowly with unclear scope
- ☹ Conduct unsystematic and unclear scenario generation
- ☹ Underestimate the complexity of the system and data available
- ☹ Be overly subjective with no supporting evidence
- ☹ Apply only generic data without system-specific input
- ☹ Apply process that is difficult to understand with no open review
- ☹ Apply incorrect tools and techniques
- ☹ Present inconclusive outcome
- ☹ Be too deterministic with no account for uncertainties
- ☹ Be overconfident in applying expert judgment without any calibration

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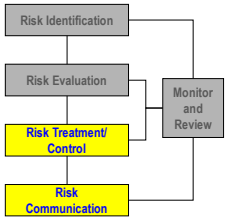
What to do after you have assessed the risk?



- We have the lowest accident rate, why do we do more?
- The residual risk is in the same risk class as the original risk, what is the need to do more?
- The cheapest way to reduce the risk is usually useless, but the expensive way does not mean it is useful
- So many risk control measures, which one should I use?
- Not common to see a cost/risk-benefit analysis being done
- If I have done all these steps, why do I need to tell people?

Need a robust risk control strategy and proper risk communication framework

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Takeaway

We have done a lot and know a lot. We need to understand the applications and limitation of our most used tools

Align the terminology, question the details

Risk matrix – watch out

Communicate

Communicate

Communicate

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Thank you

Without risk,
there is no opportunity.

END

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