Risk Management

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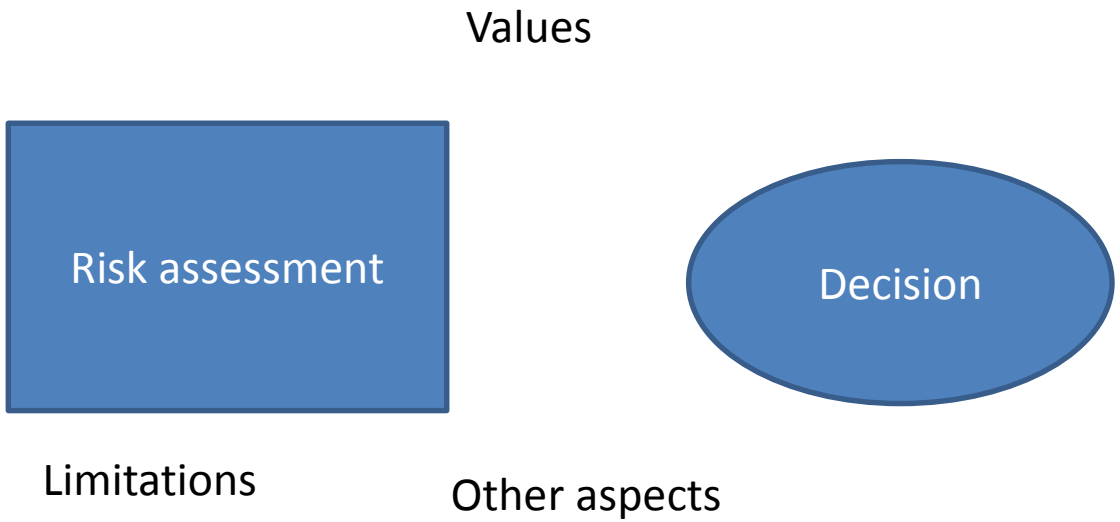
Risk management

Risk analysis informed

Robustness, resilience, cautious policies …

Dialogue


Values
Risk assessment
Decision
Limitations
Other aspects

Balance

Development and protection

Weight given to E
Take risk

Reduce the risks and uncertainties

E[NPV], cost-benefit analyses

ALARP

Cautionary-precautionary

Risk acceptance criteria

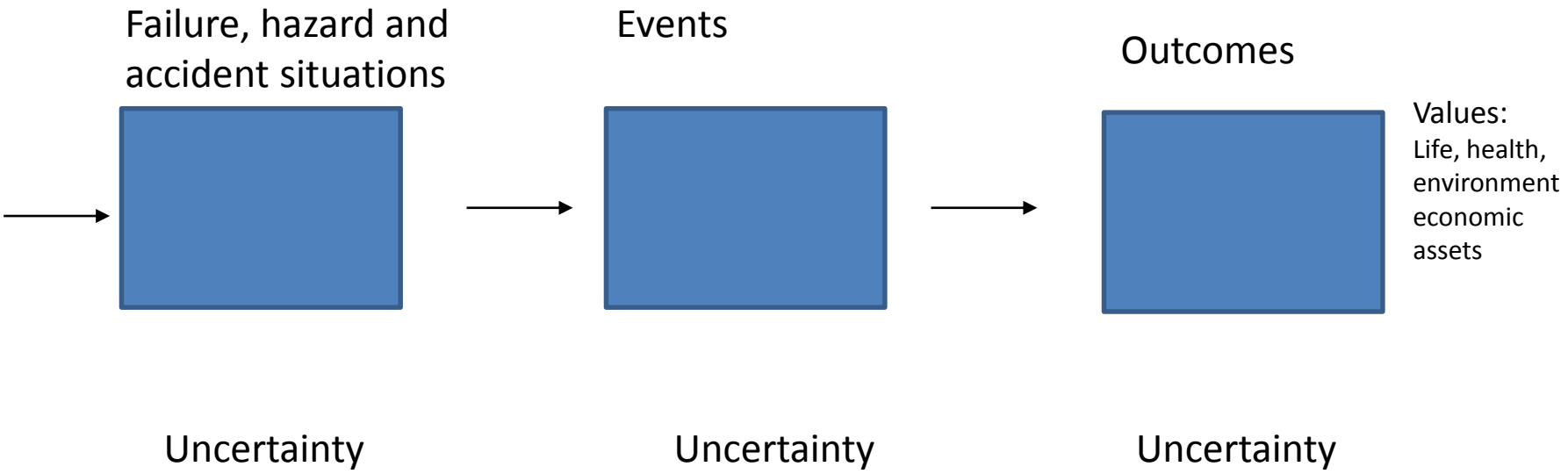
E: Expected value

Risk Management

Management of risk

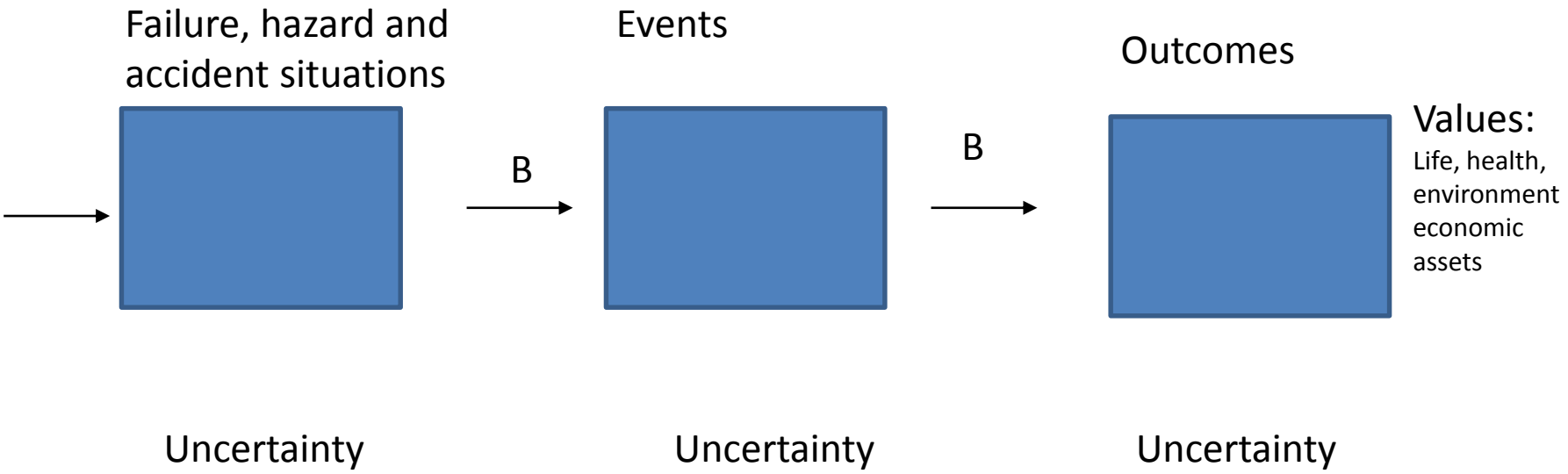
Risk: The consequences of the activity with associated uncertainties (PSA-N)

Risk: The consequences of the activity with associated consequences



Barrier management guidelines
2017 PSA-N

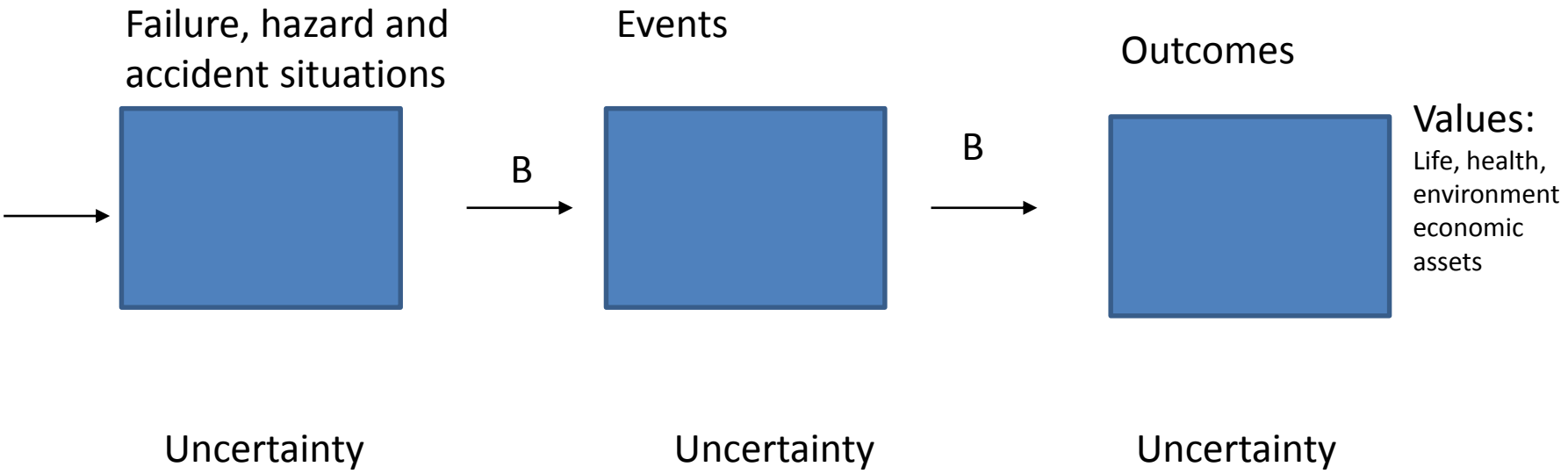
Risk: The consequences of the activity with associated consequences



B: Barriers

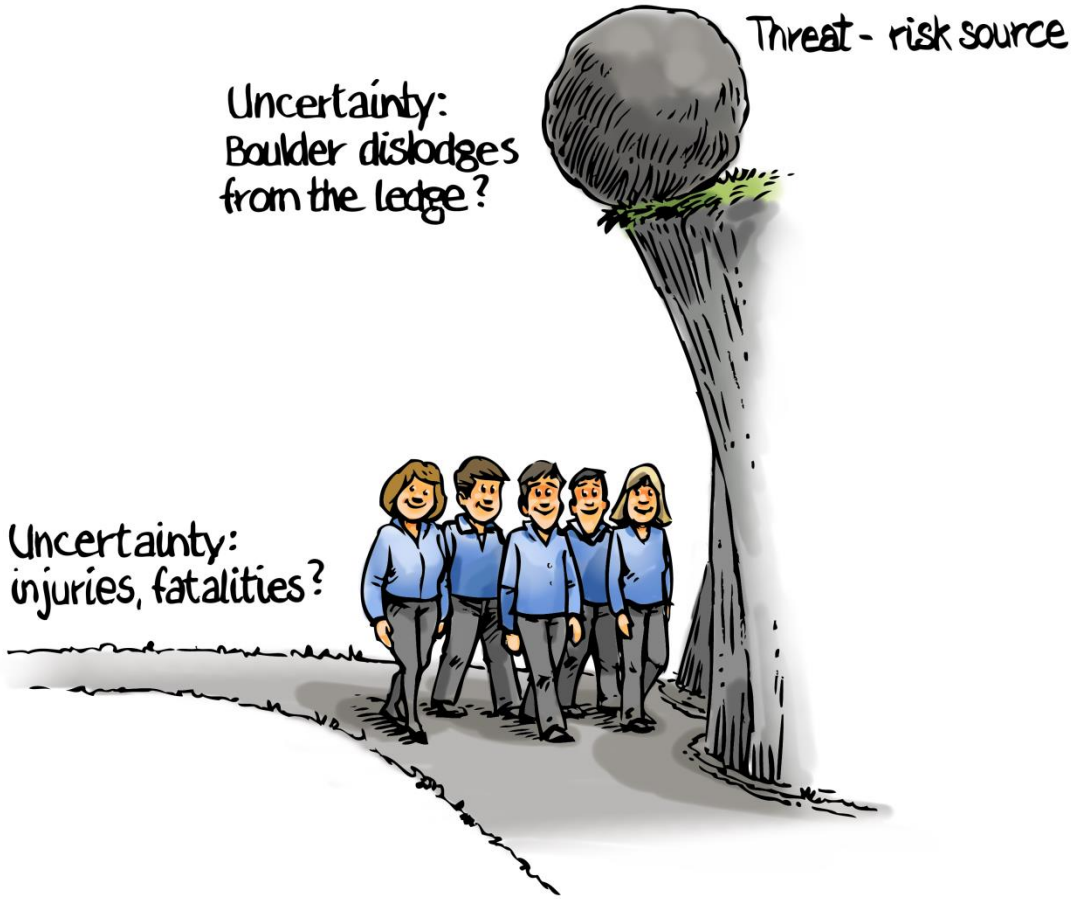
Barrier management guidelines
2017 PSA-N

Risk: The consequences of the activity with associated consequences

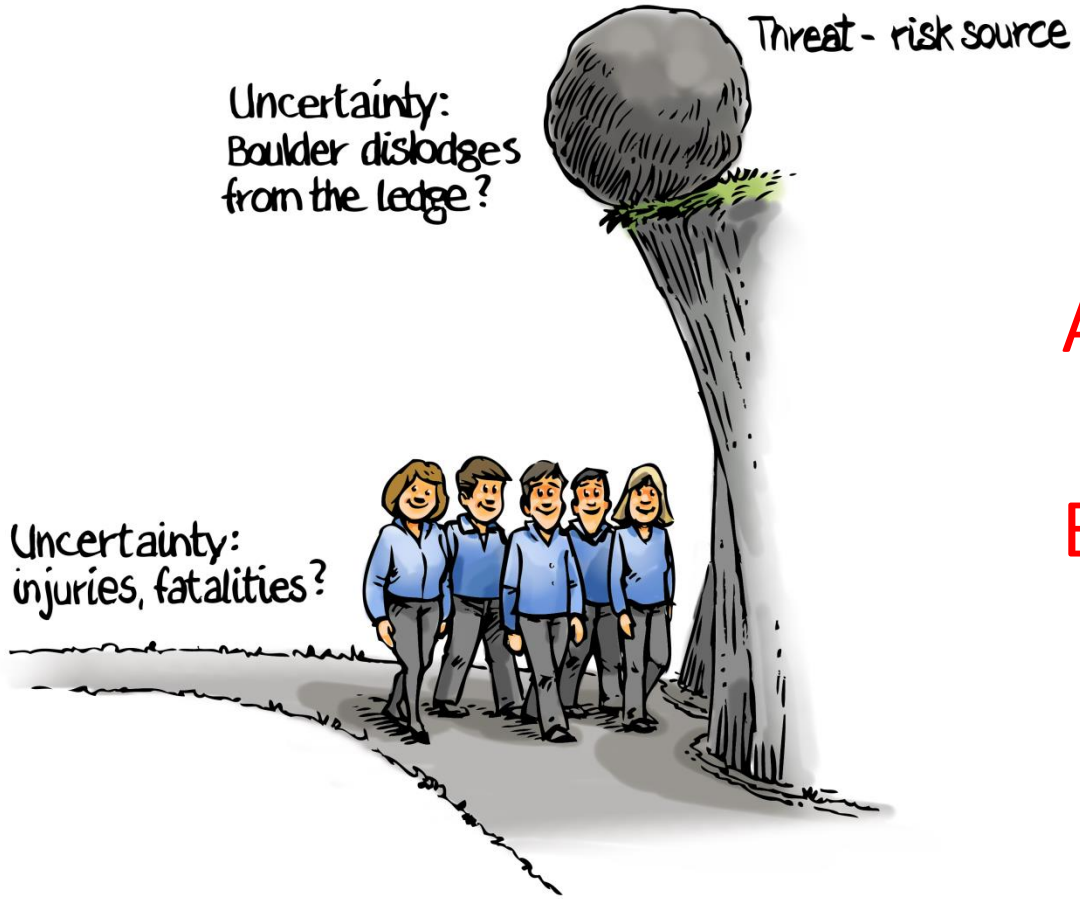


Barrier management is an integrated part of risk management

The Risk Concept



The Risk Concept



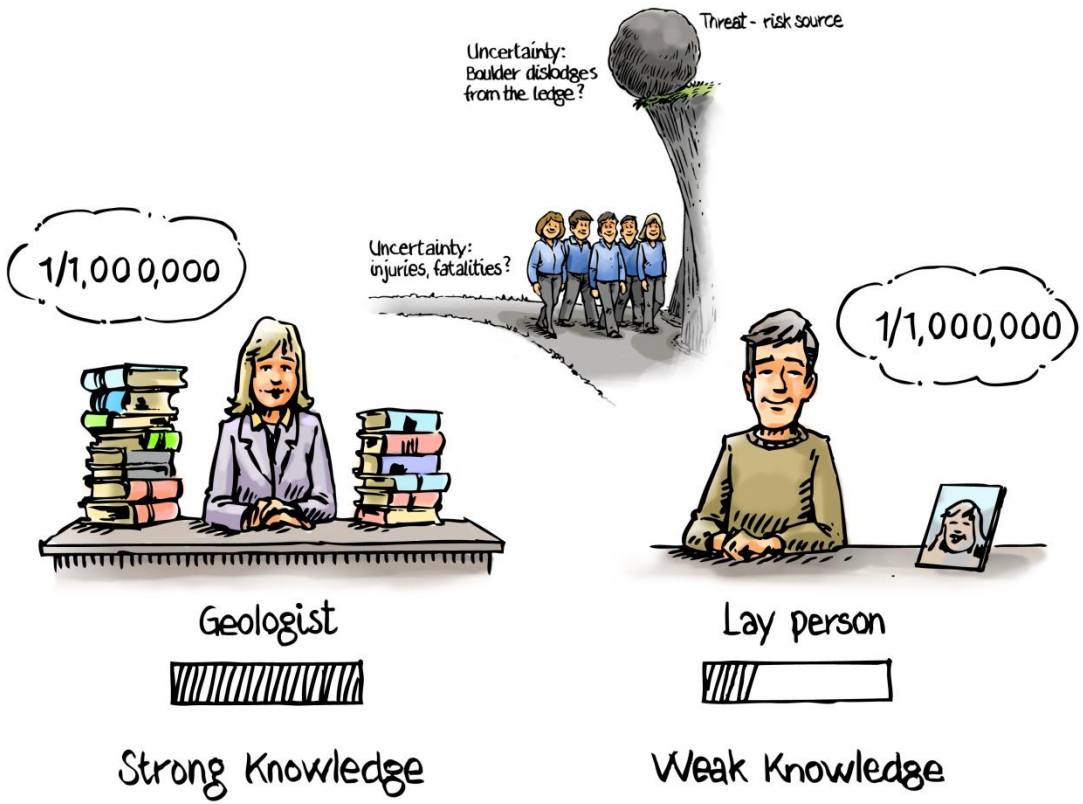
A: Day

B: Night

- Day: small Probability and relative strong K
- Night: small Probability and weaker K

Expressing risk

Consequences + Probability + Knowledge



Expressing Risk

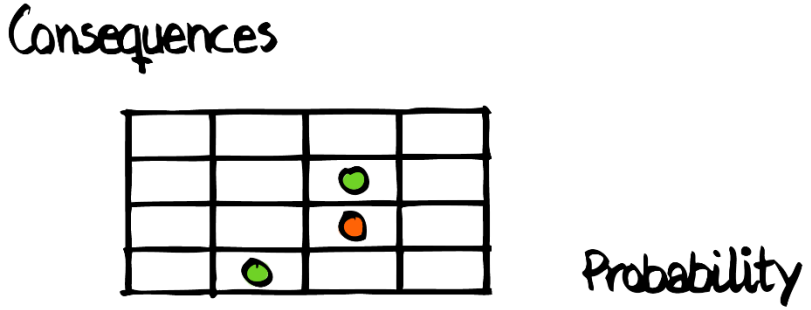
Earlier

1. What can happen (go wrong) ?
2. How likely is it that that will happen?
3. If it does happen, what are the consequences?

Now

1. What can happen (go wrong) ?
2. If it does happen, what are the consequences ?
3. How likely is it that that will happen and give these consequences ?
4. What is the knowledge supporting the likelihood judgments?
5. How strong is this knowledge?

Consequences + Probability + Knowledge



- Poor background knowledge
- Medium strong background knowledge
- Strong background knowledge

The knowledge is considered strong:

- *The assumptions made are seen as very reasonable*
- *Much reliable data are available*
- *There is broad agreement/consensus among experts*
- *The phenomena involved are well understood*
- *The knowledge basis has been thoroughly examined*

Check list risk assessments

- ✓ *Is there an overview of the assumptions made?*
- ✓ *Has a risk assessment of the deviations from assumptions been conducted (an assumption deviation risk assessment)?*
- ✓ *Have attempts been made to reduce the risk contributions from the assumptions that have the highest deviation risk?*

$$P(A \mid \text{assumption}) < 0.0001$$

John offers you a game: throwing a die

- ”1,2,3,4,5”: 6
- ”6”: -24

What is your risk?

Risk

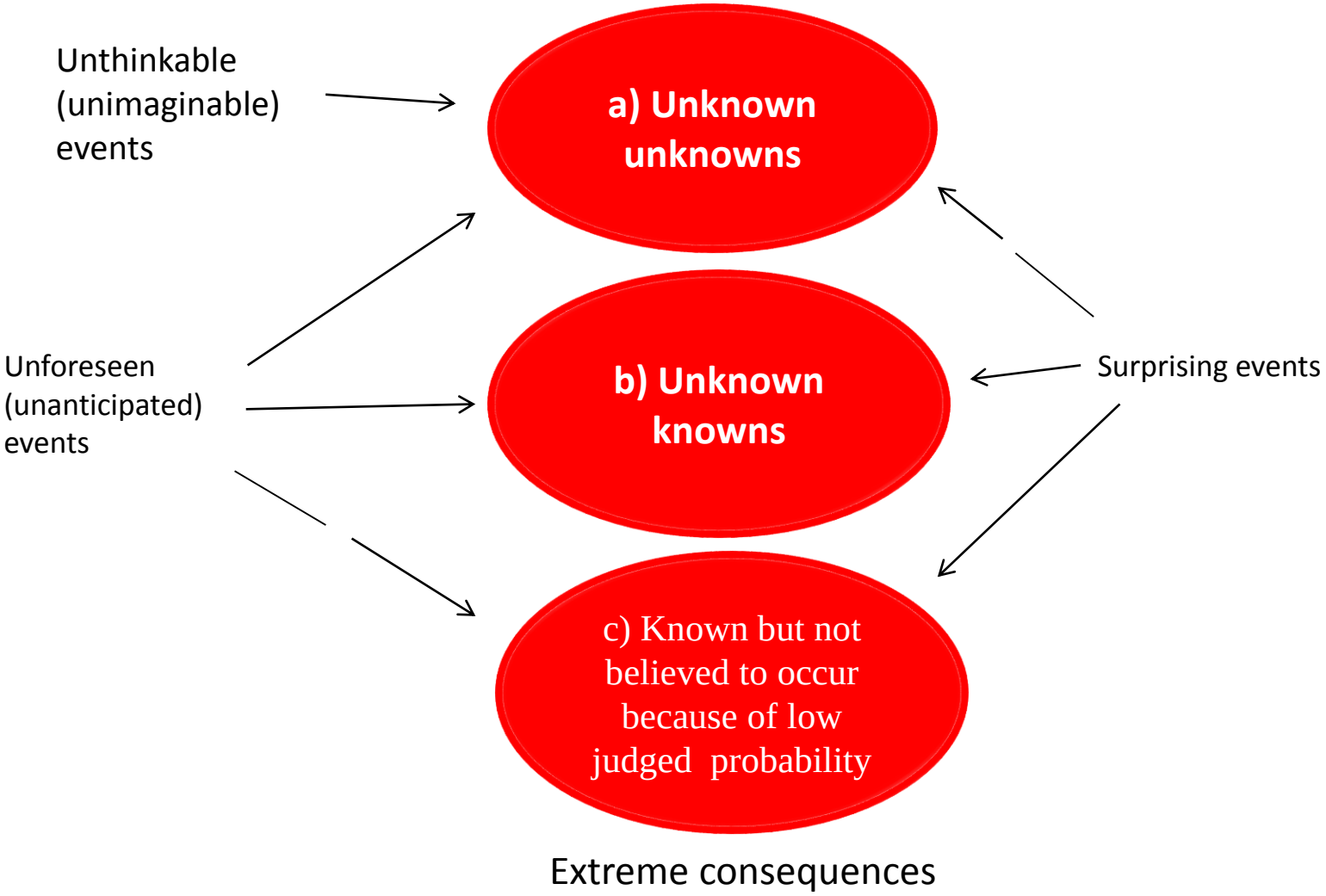
- 6 5/6
- -24 1/6

Is based on an important assumption – the die is fair

Expressing uncertainty

Probability

Knowledge


Unthinkable (unimaginable) events
a) Unknown unknowns
Unforeseen (unanticipated) events
b) Unknown knowns
Surprising events
c) Known but not believed to occur because of low judged probability
Extreme consequences

Black Swan

I. *Outlier as it lies outside the realm of regular expectations, because nothing in the past can convincingly point to its possibility.*
II. *Extreme impact.*
III. *In spite of its outlier status, human nature makes us concoct explanations for its occurrence after the fact, making it explainable and predictable.*

How to confront surprises and the unforeseen?

Risk management approaches

- Signals and warnings
- Sensitivity to operations (principle of collective mindfulness linked to High Reliability Organizations)
- Adaptive risk management
- Robustness
- Resilience thinking
- Understand variation
- …

Cautionary and precautionary principles

Risk (influencing) factors (sources, drivers)

- Identification of such factors
- Crude qualitative analysis to identify the most important ones
  - How sensitive is the risk to changes in the risk factor?
  - And to what extent is the risk factor present (degree of exposure, probability)?
  - The strength of knowledge on which these judgements are based.

What are the elements (systems, components, persons, events, situations, etc.) that generate the potential severe scenarios and consequences?

Manageability of a measure (factor)

- Manageability: how difficult it is to reduce the risk and depends on technical feasibility, time aspects, costs, etc.
- Effect on risk (consequences, robustness/resilience, probability and strength of knowledge)

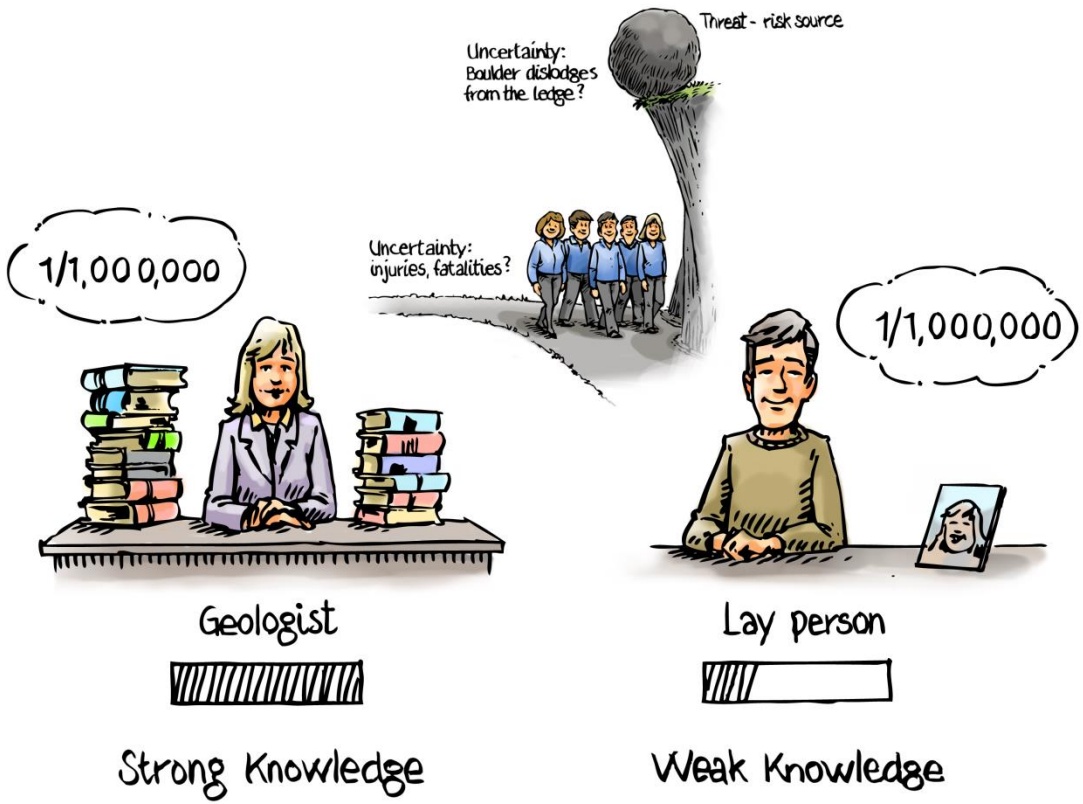
Effect on risk			
	Manageability		

- Glossary Society for Risk Analysis - www.sra.org/resouces - video What is Risk?
- Videos Norsk olje og Gass (Kjerag, sorte svaner, jobbsikkerhetsanalyse)

  https://www.norskoljeoggass.no/no/virksomheten/HMS-og-Drift/Erfaringsoverforing-og-laering/SORTE-SVANER--Et-utvidet-perspektiv-pa-risiko/
- Webinars https://www.youtube.com/playlist?list=PLNFAW9iarHu_kP9n34CSPRoUM8h1hBojp

Expressing risk

Consequences + Probability + Knowledge



Extra

Confidence

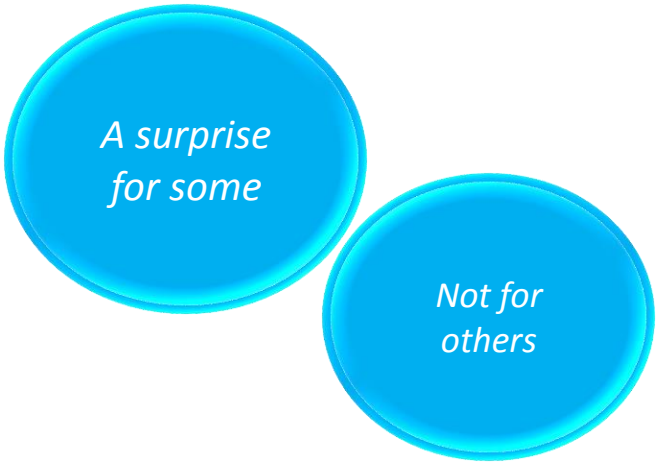
Humbleness

Sjekkliste (Sort svane rapport Norsk olje og gass)

1. Er det gitt en oversikt over de forutsetninger som er gjort? I forhold til system, data, modeller, ekspertvurderinger, m.m.
2. Er det foretatt en risikovurdering av avvik fra forutsetningene? (enkeltvis og ved å se på kombinasjoner av avvik fra flere forutsetninger samtidig)
3. Er det forsøkt å redusere risikobidragene fra de forutsetningene som har høyest avviksrisiko?
4. Er godheten av de modeller som er brukt vurdert?
5. Er modellavvikene (forskjell mellom riktig verdi og modellenes utfall) funnet å være akseptable?
6. Er styrken på kunnskapen som de fastsatte sannsynlighetene er basert på, vurdert?
7. Er denne styrken inkludert i risikobeskrivelsen?
8. Er det forsøkt å styrke kunnskapen der denne ikke er tilfredsstillende?
9. Er det gjort spesielle tiltak for å avdekke ukjente kjente (unknown knowns), altså for å tilegne seg kunnskap om temaområder som den aktuelle analysegruppen ikke har, men som finnes hos andre?
10. Er det gjort spesielle tiltak for å avdekke eventuelle svakheter – hull - i den kunnskapen som analysegruppen har bygd sine analyser på?
11. Er det gjort spesielle tiltak for å vurdere holdbarheten av vurderinger der hendelser i praksis er vurdert å ikke inntreffe pga. neglisjerbar sannsynlighet?
12. Har det vært brukt personer og kompetanse som ikke tilhører analysegruppen for å avdekke slike forhold som omtalt ovenfor?
13. Dersom forventede verdier av en størrelse er angitt, er usikkerheten knyttet til denne størrelsen vurdert (for eksempel uttrykt ved et 90% usikkerhetsintervall for denne størrelsen) ?

Check list

- ✓ *Is the strength of knowledge, on which the assigned probabilities are based, assessed?*
- ✓ *Is this strength included in the risk description?*
- ✓ *Have attempts been made to strengthen the knowledge where it is not considered strong?*



Check list

- ✓ *Have special efforts been made to uncover the black swans of the type unknown knowns?*

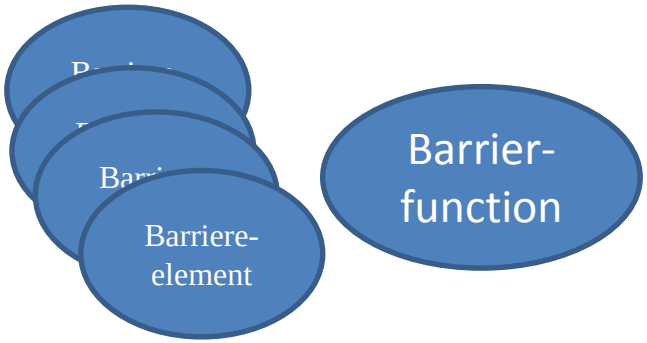
- ✓ *Have special efforts been made to assess the validity of the judgements made where events are considered not to occur due to negligible probability?*

- ✓ *Has a managerial review and judgment been performed which place the analytical results in a broader context reflecting limitations of tools used and uncertainties?*

How to assess the performance of the barriers?

- Effect on risk

- Assessment of the «goodness»/performance of the barriers in relation to their functions



Functionality, integrity, robustness

Risk - Risk perception

Challenge 1

Focus on barrier elements

- *Meeting barrier elements requirements can give the false perception that the risks are low and the barrier functions fulfilled*
- *The connections between barrier element performance, risk and satisfying barrier functions are often unclear*
- *The key concepts are barrier function performance and risk, not the performance numbers for barrier elements*
- *Holistic thinking is important, particularly for responding to black swans as well as for ensuring robustness and resilience*

Challenge 2

Management by objectives and compliance focus

- *Much emphasis on formulating, assigning and satisfying performance requirements*
- *Can easily lead to an inappropriate focus – on meeting requirements rather than identifying the overall best solutions and measures*
- *Does not promote improvement processes strongly enough*