RISK AND RESILIENCE BOOTCAMP

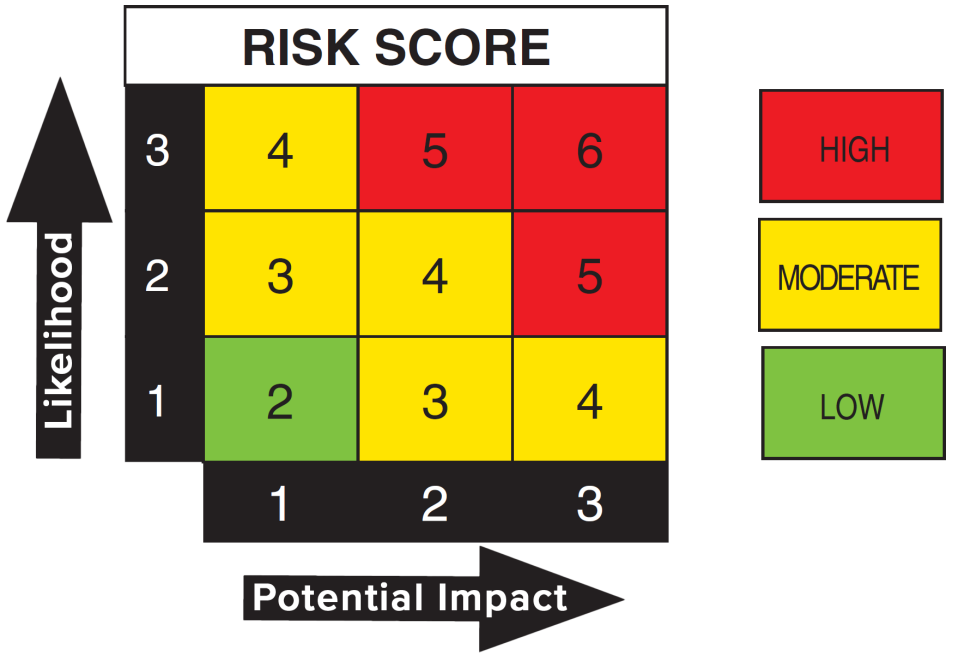
TEKsystems Global Services

WORKFORCE DEVELOPMENT

RISK SCORING

This module introduces

- Risk matrix review
- Risk scoring
- Risk formulas
- Inherent vs residual risk



RATING RISK

- Risk events are evaluated along two dimensions
  - Events have a *probability* of occurring
    - *"The chance of a hurricane making landfall in Boston MA this year is very unlikely"*
    - *"There is a good chance a hurricane will make landfall in Florida this year"*
  - Events have *outcomes* that tell us how negative the impacts of the events could be
- Both dimensions can be quantitative or qualitative
  - *"There is a 45% chance of a hurricane hitting Miami that would cause between $400 million and $800 million in property damage"*
  - *"There is a moderate chance of a hurricane hitting Miami that would cause high levels of property damage"*
  - Qualitative measures are often good enough for informal risk evaluation
  - A primary goal of risk evaluation is to rank the severity of risks in order to prioritize which ones we should address first

RANKING RISK

- To prioritize risks
  - We have to “pick our targets”
    - We can’t do everything, so we will have to ignore some risks
    - The ones we ignore should be either very unlikely to occur or have a very minor impact
  - A typical assessment for risk occurrence is a set of ranked categories
    - *Certain:* it definitely will happen
    - *Likely:* the chance the event occurring is greater than it not occurring
    - *Possible:* even odds of it occurring
    - *Unlikely:* the chance the event occurring is less than it not occurring
    - *Rare:* the chance of it happening is very low
    - *Eliminated:* the event cannot occur

RANKING RISK

- An assessment for outcomes is also a set of ranked categories
  - *Catastrophic:* death or permanent total disability, significant irreversible environmental impact, total loss of equipment
  - *Critical:* accident level injury resulting in hospitalization, permanent partial disability, significant reversible environmental impact, damage to equipment
  - *Marginal:* injury causing lost workdays, reversible moderate environmental impact, minor accident damage level
  - *Minor:* injury not causing lost workdays, minimal environmental impact, damage less than a minor accident level
- If there is no negative outcome when the event occurs
  - Then there is no risk because the event has no impact
- Once there are rankings of the likelihood and outcome
  - We can classify the overall risk of the event
  - Usually taken as the informal product of the two rankings
- Often represented by a risk matrix

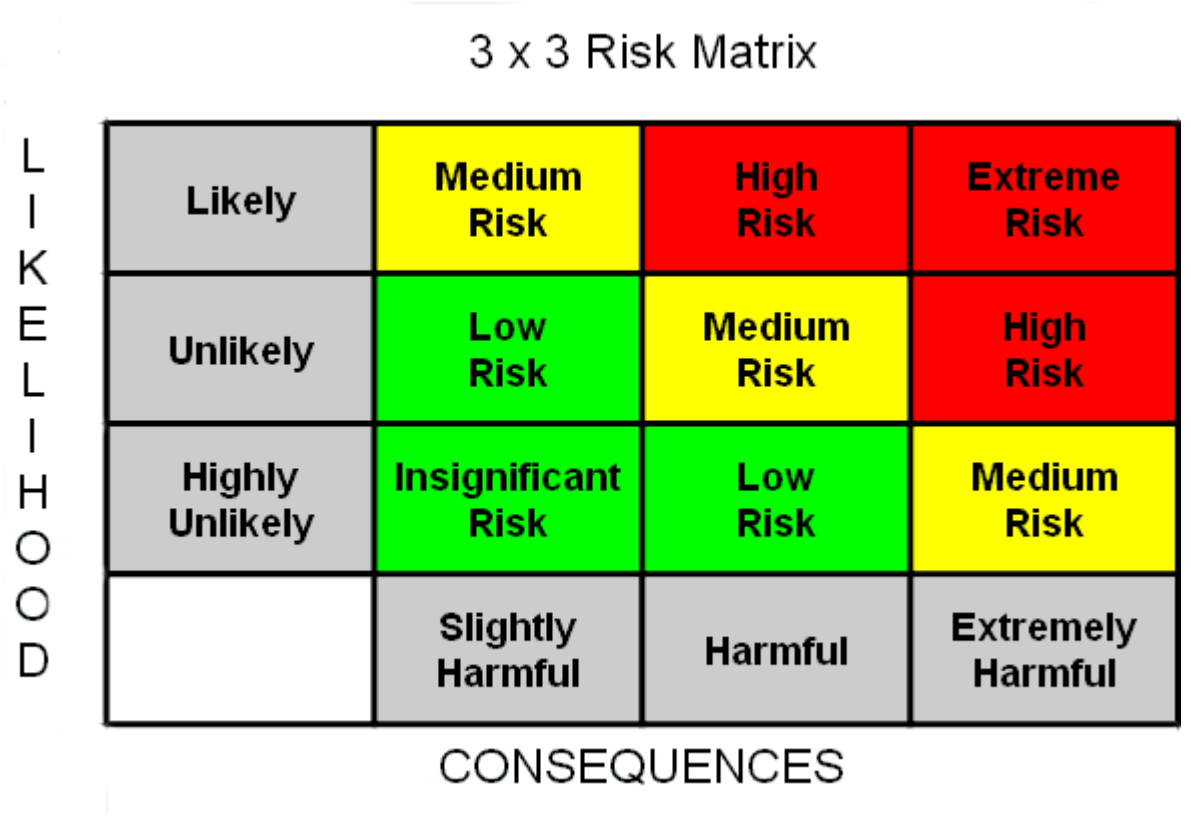
RISK MATRIX

- Each risk can now be prioritized
- The *very high* risks are dealt with first
  - These events are certain or likely to happen and will have severe negative impacts
  - These generally need to be done urgently
- We might not manage with the *low* risks
- We can prioritize management of the mid-range risks based on other criteria
  - For example, costs of a *high* risk mitigation may have to be deferred because of costs
  - Or a *medium* risk may be deferred because the skill sets to mitigate it might not be available.
- Establishes a way to triage risks

Likelihood	Harm severity			
	Minor	Marginal	Critical	Catastrophic
Certain	High	High	Very high	Very high
Likely	Medium	High	High	Very high
Possible	Low	Medium	High	Very high
Unlikely	Low	Medium	Medium	High
Rare	Low	Low	Medium	Medium
Eliminated	Eliminated			

COMMON RISK MATRICES

- A risk matrix is a visual tool
  - There is no official format
  - On the right is a common 3x3 form
- The example is qualitative
  - Useful as a first analysis
  - Often uses historical data and expert opinions to come to a preliminary decision

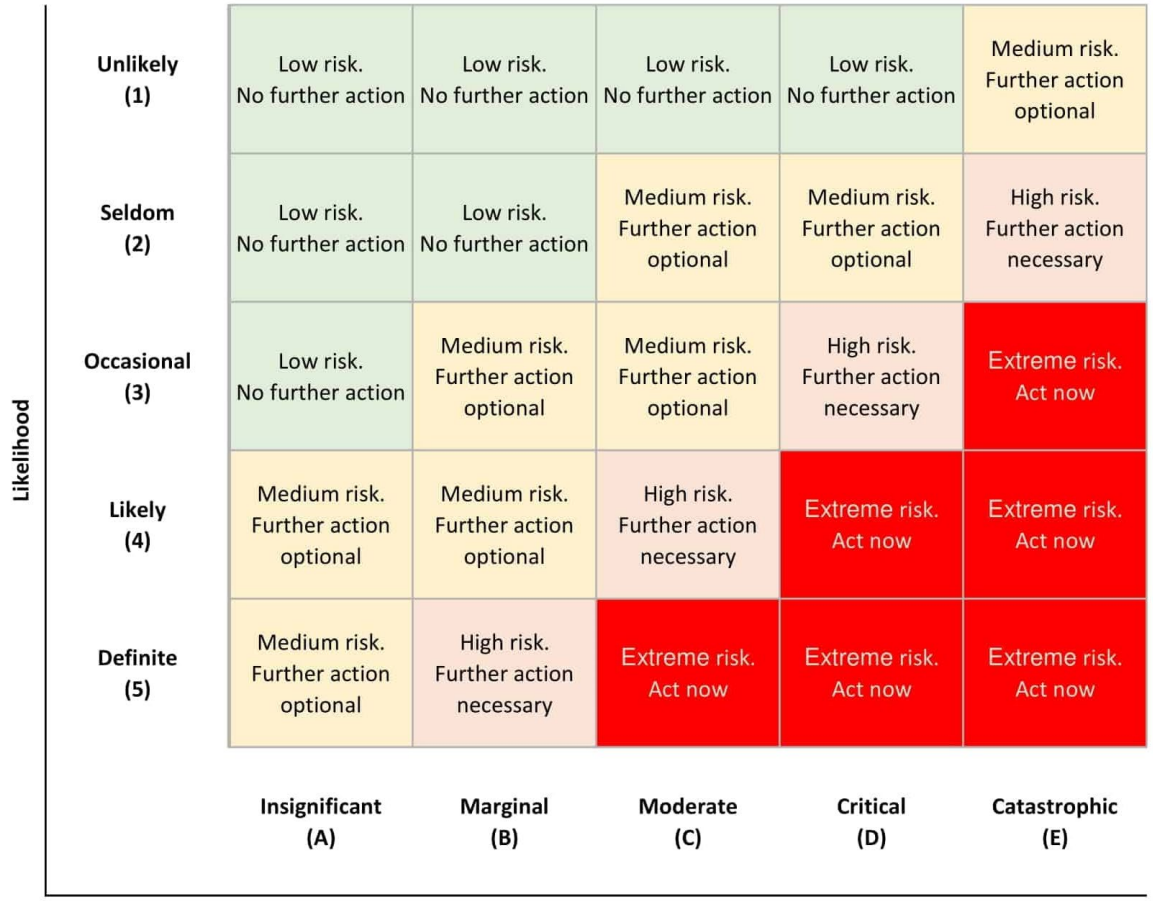


COMMON RISK MATRICES

- Another variant is the 4x4
- This matrix assigns a numerical value for both probability and severity
  - This produces a risk score ranging from 16 (4 x 4) to 1 (1 X 1)
- This is still qualitative
  - The values are not computed from data
  - They are still ordinal
  - Often used to support automation and data analysis

COMMON RISK MATRICES

- This is a 5x5 matrix
- Incorporates a risk management decision to prioritize responses
- These examples show there is no "correct" form of a risk matrix
  - They all express the idea of computing risk as a combination of likelihood and outcome
  - The actual risks will depend on how we choose to define and classify them
  - That is what we need to get right in a risk assessment



QUANTITATIVE RISK MATRICES

- Quantitative matrices use data to assign the frequency and outcome values
  - These values are derived from existing data
  - Often based on some mathematical model; a regression analysis for example
- The model might incorporate
  - Analyses of historical data to predict the likelihood of an event
    - This could be expressed as a probability of the event occurring
  - A set of impacts on affected populations based on historical occurrences
    - For example, historical records of the dollar value of damage for similar events
  - Results in a more comprehensive description of the risk
  - The next page shows a quantified risk matrix from the liquid natural gas industry
- No matter how detailed or precise the risk matrix is
  - It doesn't tell us how to manage risk or reduce the risk
  - Requires a standard set of concepts, procedures and strategies for responding to risk

LNG RISK MATRICES

CONSEQUENCES								INCREASING PROBABILITY (Likelihood) →				
INCREASING SEVERITY ↓		Category						A	B	C	D	E
		People	Asset / Production	Environment	Reputation	Community Relation	Security	Never heard of in the Oil & Gas Industry	Heard of in the Oil & Gas Industry	Has happened in the LNG Industry or more than once per year in the Oil & Gas Industry	Has happened at NLNG or once per year in the LNG Industry	Has happened more than once per year in NLNG
	0	No injury or health effect	No damage	No effect	No impact	No impact	No impact	A0	B0	C0	D0	E0
	1	Slight injury or health effect (FAC)	Slight damage (10k$ & no disruption to operation)	Slight effect (within fence, no exceedance)	Slight impact (E.g. public awareness)	Incidental problem	Minimal impact resolved internally	A1	B1	C1	D1	E1
	2	Minor injury or health effect (MTC, RWC<= 5days, food poisoning & dermatitis)	Minor damage (10k$ - 100k$ & brief disruption)	Minor effect (Minor impact but no lasting effect)	Limited impact (E.g. local / public media)	Threats of bodily harm to personnel, without action; Re-instatement of no go areas	Low impact resolved with Company dedicated GSAs	A2	B2	C2	D2	E2
	3	Major injury or health effect (LTI, RWC >5Days,)	Moderate damage (0.1 - 1.0M$ & partial shutdown)	Moderate effect (Limited Env. Impact that requires clean up)	Considerable impact (E.g.. region / state / public media)	Several days of blockade of local facilities, rivers, water pump station or gas supply station)	Medium impact resolved with support from Local GSAs	A3	B3	C3	D3	E3
	4	Permanent Total Disability (PTD) or up to 3 fatalities	Major damage (1.0 - 10.0M$ & partial operation loss)	Major effect (severe damage recoverable / extended exceedance)	Major Impact (E.g. extensive adverse media)	Severe damage to water supply or gas station reported in Nigerian media	Major impact resolved with support from State GSAs	A4	B4	C4	D4	E4
	5	More than 3 fatalities	Extensive damage (>10M$ & substantial operation loss)	Massive effect (widespread chronic effects / constant high exceedance)	Massive impact (E.g. extensive adverse media)	Impossible to operate without major military support	Massive impact resolved with support from National GSAs	A5	B5	C5	D5	E5

	NEGLIGIBLE
	LOW
	MEDIUM
	HIGH

RISK MATRIX

- Purpose of a risk matrix
  - Provides a visual summary of organizational risk exposure
  - Helps rank risks for treatment and monitoring
  - Enables stakeholder discussions by offering a common language
  - Useful when quantitative data are limited, such as strategic or emerging risks
- How it works
  - Identify a risk scenario
  - Assign a likelihood rating (1–5)
  - Assign an impact rating (1–5)
  - Cross-reference in the matrix
  - Determine the risk score and risk zone

RISK SCORING

- Assigning numeric values to likelihood and impact to produce a combined score for prioritization
- Likelihood - probability dimension
  - Likelihood captures the chance that the risk will materialize
  - It may reflect:
    - Historical frequency
    - Scenario analysis
    - SME judgment
    - Threat intelligence
    - Detection or failure rates

RISK SCORING

- Likelihood - probability dimension
  - Common 5-level descriptions:
    - Rare
    - Unlikely
    - Possible
    - Likely
    - Almost Certain
  - Likelihood may be expressed qualitatively (label) or semi-quantitatively (numeric mapping)

RISK SCORING

- Impact estimates the consequences if the risk occurs
  - Impact can be financial or non-financial:
    - Monetary loss
    - Reputational damage
    - Health and safety harm
    - Regulatory penalties
    - Operational downtime
  - Typical 5-level impact scale:
    - Negligible
    - Minor
    - Moderate
    - Major
    - Catastrophic

RISK SCORING

- Risk scoring formula
  - A common approach is
    - Risk Score = Likelihood × Impact
    - Example: Likelihood (4) × Impact (5) = 20
  - Scores are placed into categories such as
    - 1–5: Low
    - 6–15: Medium
    - 16–25: High
  - This facilitates risk prioritization by grouping similar scenarios

RISK SCORING

- Uses of risk scoring
  - Ranking risks for mitigation or investment
  - Supporting risk committees in decision-making
  - Triggering escalation thresholds
  - Simplifying complex discussions
  - Tracking changes over time (heat map movements)
- Limitations of risk scoring
  - Numeric values suggest false mathematical meaning (e.g., 4×5=20 is not “twice as risky” as 2×5=10)
  - Likelihood and impact scales are ordinal, not ratio scales, meaning the intervals are not equal
  - Assigning numbers does not make qualitative judgments quantitative

INHERENT RISK VS. RESIDUAL RISK

- Inherent risk
  - The level of risk before applying any controls, safeguards, or mitigation
  - It reflects a “raw” scenario assuming
    - No controls exist, or
    - Controls are completely ineffective
  - Purpose of inherent risk
    - Understanding the natural exposure of a process or system
    - Prioritizing high-threat areas before analyzing controls
    - Supporting resource allocation to high-exposure domains

INHERENT RISK VS. RESIDUAL RISK

- Residual risk
  - The level of risk that remains after controls have been applied
  - Controls may include:
    - Preventive (firewalls, access controls)
    - Detective (monitoring, logging)
    - Corrective (backup restoration, disaster recovery)
    - Procedural (policies, training)
  - Purpose of residual risk
    - Determining actual exposure after mitigation
    - Ensuring risk is within risk appetite or tolerance
    - Supporting decisions on whether additional controls are needed

INHERENT RISK VS. RESIDUAL RISK

- How to estimate inherent vs. residual risk
- Typical approach:
  - Evaluate inherent likelihood and impact
  - Identify relevant controls and assess their effectiveness
  - Adjust likelihood and/or impact downward to derive residual risk
  - Compare inherent vs. residual risk positions in the matrix

Risk Stage	Likelihood	Impact	Score
Inherent	5	5	25 (Extreme)
After preventive & detective controls	3	5	15 (Moderate to High)
After corrective controls	2	5	10 (Medium)

PITFALLS AND LIMITATIONS

- Risk matrices can have significant limitations
  - False precision
    - Assigning numbers (1–5) to qualitative judgments creates the illusion of mathematical validity
    - A “4” likelihood may be interpreted as objectively higher than a “3” likelihood instead of expressing an opinion
    - A risk score of 20 is not necessarily “twice as severe” as a score of 10
  - Scale intervals are unequal and subjective
    - This creates pseudo-quantification, which can mislead stakeholders
  - Ordinal scale problems
    - Likelihood and impact categories are ordinal, not interval scales.
    - You cannot meaningfully add, multiply, or average them
    - Risk scoring formulas (L × I) are mathematically invalid, but still widely used

PITFALLS AND LIMITATIONS

- Matrix distortion effects
  - Risk matrices often distort results because
    - The boundaries between categories are subjective
    - Risks of different natures can end up with the same score.
    - Visual placement may hide critical tail-risk scenarios
  - Example:
    - A low-frequency, catastrophic event may be scored the same as a high-frequency, moderate event, even though their real implications differ dramatically
  - Inconsistent SME judgments, qualitative matrices depend heavily on:
    - SME memory
    - Personal experience
    - Organizational culture
    - Introduces variability and cognitive bias, such as anchoring, availability, and optimism bias

PITFALLS AND LIMITATIONS

- Loss of uncertainty information because mtrices force one value for likelihood and one for impact, eliminating
  - Ranges
  - Distribution shapes
  - Confidence levels
  - Quantitative methods (like Monte Carlo or FAIR) retain uncertainty, whereas matrices compress everything into a single static box
- Poor support for decision-making in high-stakes environments
  - For capital allocation, insurance decisions, business continuity planning, or cyber budgeting, matrices:
    - Lack financial interpretation
    - Cannot model tail risks
    - Provide insufficient detail to justify large investments

PITFALLS AND LIMITATIONS

- False sense of objectivity
  - The color-coded output appears authoritative, but it often:
    - Reflects subjective opinion
    - Lacks statistical basis
    - Oversimplifies complex systems
  - Risk matrices work best as communication tools, not for rigorous measurement

Q&A AND OPEN DISCUSSION