# Risktec Solutions

risk management and assessment for business

## Uses, abuses and misuses of QRA

*"We should remember that risk assessment data can be like the captured spy: If you torture it long enough, it will tell you anything you want to know."*
*William Ruckelshaus (first administrator of U.S. EPA)*



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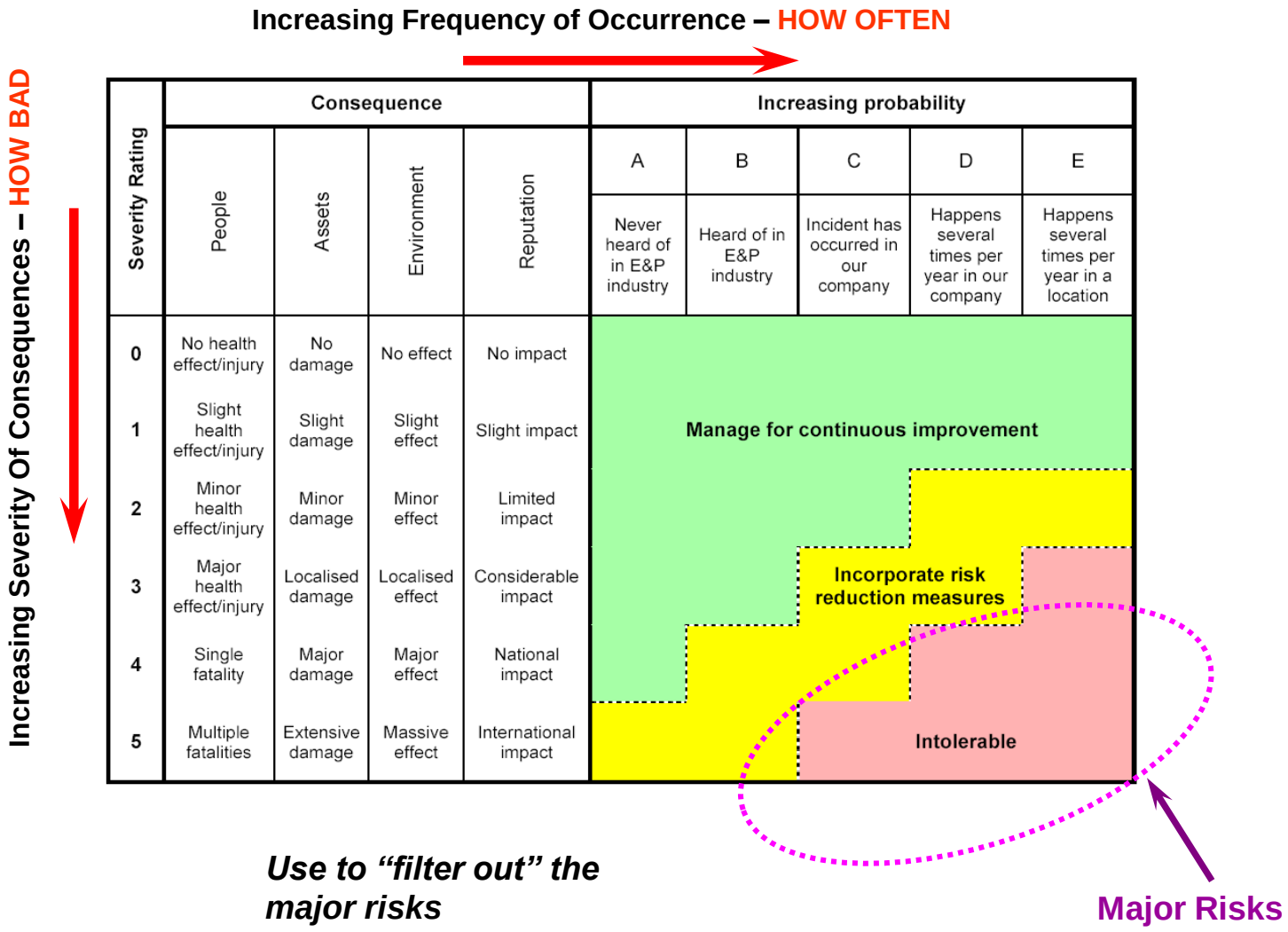
# Discussion points

- What is risk and what is a QRA?
- Why bother?
- Uses of QRA
- Misuses, abuses and uncertainty

# What is risk and what is a QRA?

- Risk is a combination of the consequences and likelihood of bad stuff happening
- What do you think when someone says QRA?
- It's just the expression of risk in a numerical measure – the chance of an explosion killing Fred the operator is 1 in 10,000 years
- Today we're going to discuss O&G safety related QRA, but it's not just this

# The QRA Process

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# Location Specific Individual Risk (LSIR)

Risk for a hypothetical individual who is positioned at a location for 24 hrs/day, 365 days per year – standard “yardstick”. Usually presented in the form of Risk Contours.


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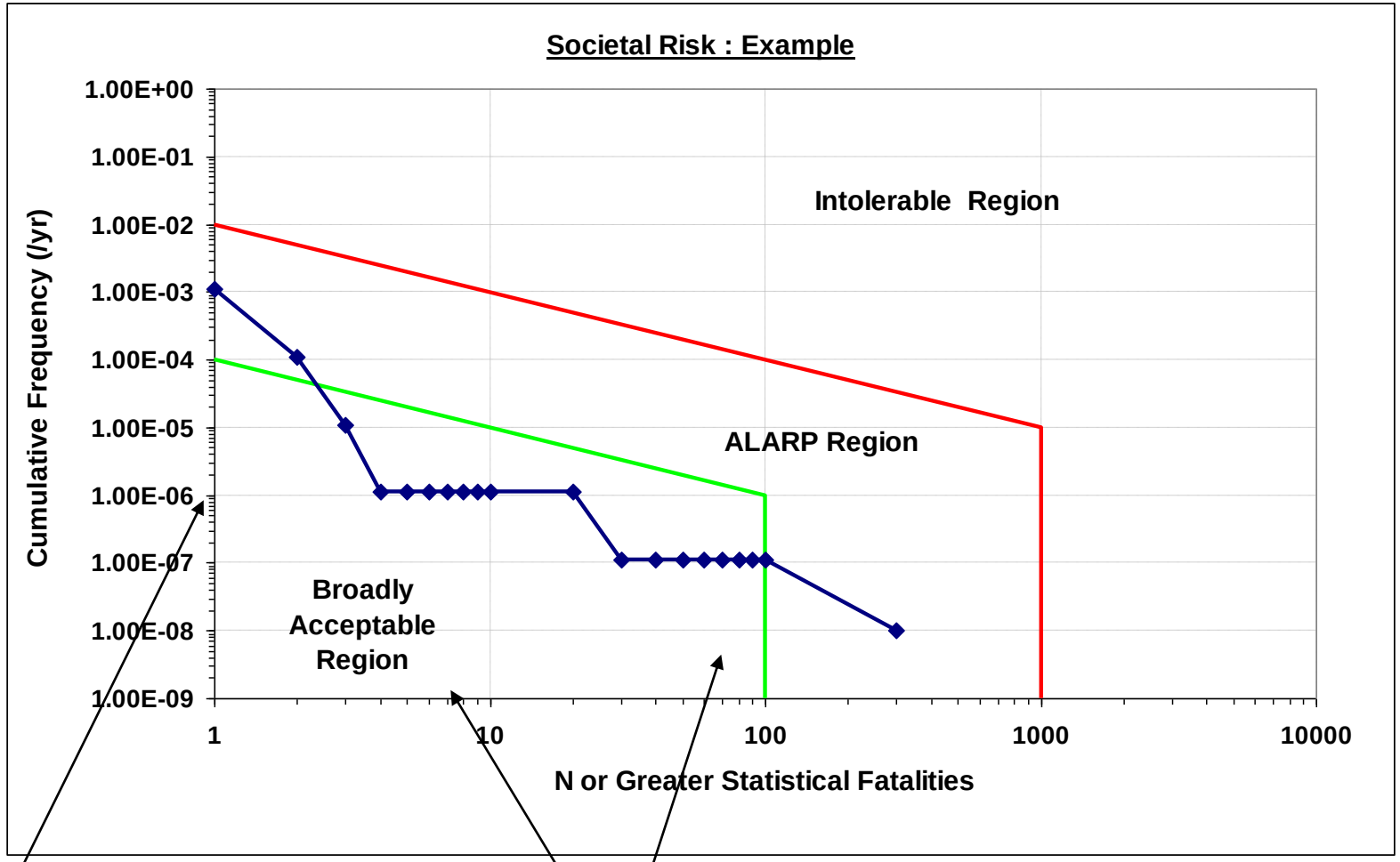
# Example Societal Risk FN Curve:




Societal Risk Profile

Societal Risk Criteria

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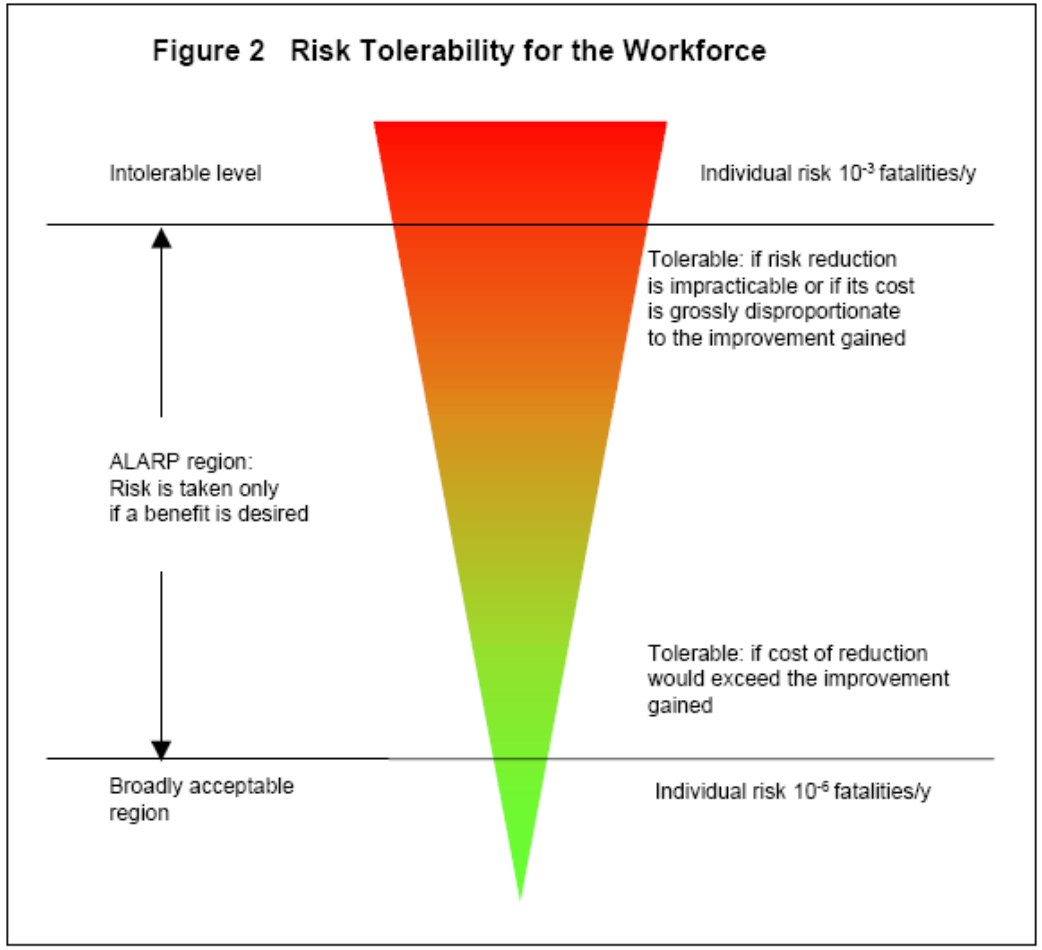
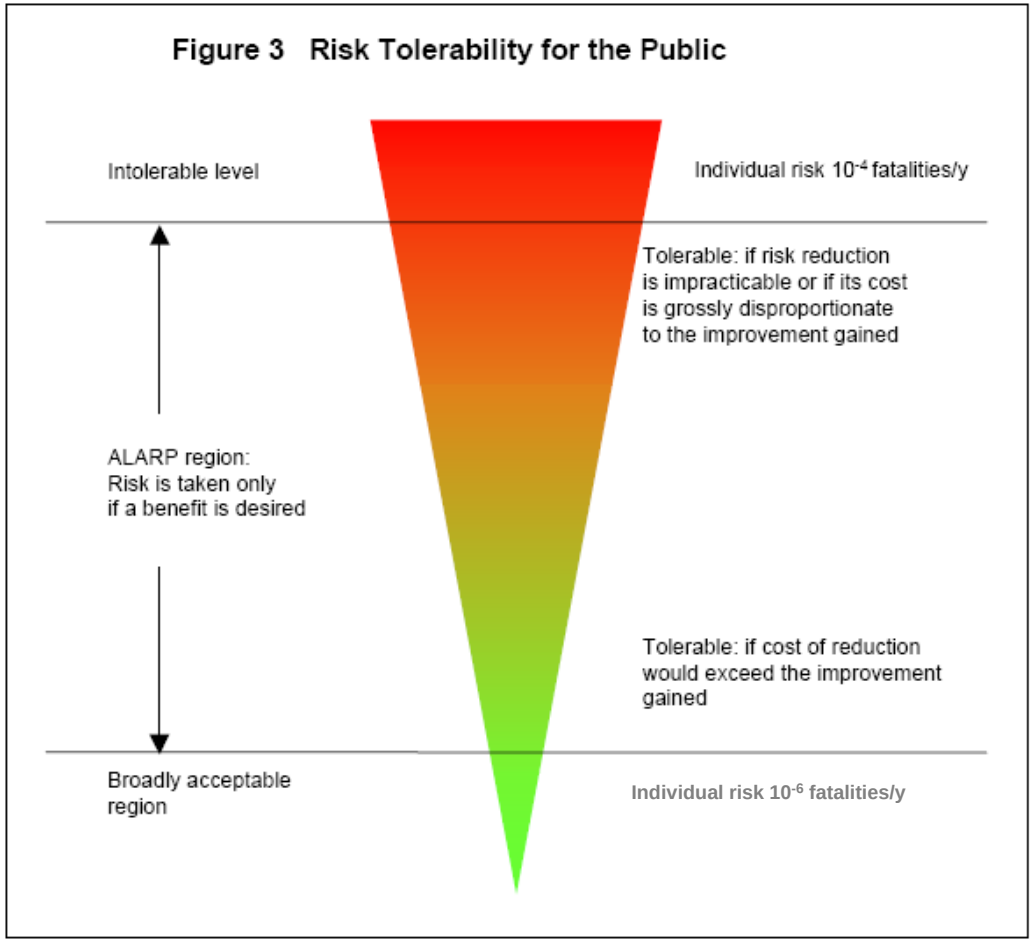
# Example (UK) Risk Criteria

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# Why bother

Isn’t my risk matrix good enough?

# Why bother to quantify risk?

- If you have high perceived risks
- If something is new, complicated or unusual
- Gives a better appreciation of low frequency, high consequence events
- Simpler approaches are imposing impractical requirements

# Why bother to quantify risk?

- Worst case credible consequence type assessments may not accurately reflect the risk
- Analyse many scenarios and also interactions of scenarios
- Integrated – can provide a holistic view of risks
- Identify risk contributions and risk reduction measures

# Uses of QRA



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# Uses of QRA

- Regulatory requirement (not in Canada, well apart from BC for LNG plants……..)
- Concept selection (Which is the lowest risk concept – good use for QRA, it's relative in nature)
- Engineering design – risk reduction measures
- Construction – SIMOPS risks from operating facilities

# Uses of QRA

- Emergency planning – identify likely scenarios
- Abandonment – more offshore, decommissioning options
- Building risk assessment – where to put manned / critical buildings
- Transportation risk – often a major contributor
- Land use planning – limited in N America

# Misuses, abuses and uncertainty



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# Misuses and Abuses

- We want a QRA now! Why, what for? Err, I'm not sure: Diving into quantification without doing sensible qualitative work first or defining the scope
- We've made the dodgy decision, without any real basis – now prove its OK with your fancy QRA model……..
- Expecting demonstration that risks quantitatively low justifies not following good practice
- Assessing risks to large groups of people in terms of individual risk measures and targets

# Misuses and Abuses

- Not considering all hazards: An operator has to drive around a lot of well pads.  His risk from hydrocarbons is low.
  - But what is his risk from driving? All this has to be considered too and can easily be the biggest risk contributor
- Working in the acid gas compressor enclosure is high risk.  OK, we'll send 5 different operators in to check it every day and their individual risk will be fine
  - No.  This is 'salami slicing' the risk.  The risk to the worker group should be considered

# Misuses and Abuses

- The risk is below our intolerable level – so is it OK if we don't do anything else
  - The ALARP principle normally stops this. Even if risks are below the intolerable levels, further risk reduction measures should be investigated. QRA allows these to be focussed on the main contributors to risk
- *Reverse ALARP:* It's really expensive to implement this element of normal good practice (say a shutdown system) and my QRA / cost benefit analysis shows it's not worth it
  - The ALARP principle should stop this. Normal good practice, code, standards, etc. are taken as a given and shouldn't be eroded on the basis of QRA.

# Misuses and Abuses

- Taking a generic QRA and applying it to other sites / systems uncritically
- Ignoring the things that are ‘too difficult’ to calculate quantitatively
- Believing the QRA can tell you everything.
- Believing that stating risk to lots of significant figures means the results are really accurate
  - At best QRA give an idea of the order of magnitude of risk and is best used comparatively
- Not considering uncertainty – more of this later

# Misuses and Abuses

- Using consultants, but being left with a model that you don’t understand
- Using generic data without adjusting – modify accordingly if appropriate
- Dodgy Cost Benefit Analysis – gold plating systems for the benefit of CBA when lower cost options exist

# Accuracy and uncertainty

- How accurate, or repeatable do you think QRA is?
  - In the early eighties the UK HSE reviewed QRA and concluded it was over conservative by approximately a factor of 2-10
  - QRA often compounds conservative assumptions
  - So it's important to use best estimates rather that a series of worst cases
- Comparison exercise (Italy, 1988-1990), 11 different teams completing an ammonia plant QRA
  - Considerable variability; due to different levels of details and different tools

# Accuracy and uncertainty

- How to cope with uncertainty?
- Complex uncertainty analysis techniques exist – e.g. Monte Carlo simulation.
- All complex uncertainty techniques are impractical for QRAs with any degree of complexity
- Identify the main influences to risk (leak frequency, manning exposure….)
- Vary these influencing factors and see the impact on risk
- Take a view on the results – perhaps take more conservative values

# Summary

- QRA is a powerful when used appropriately
- It’s only one part in the risk assessment and management process
- Get it in the correct context by doing the appropriate qualitative work first
- It’s prone to error, misuse and uncertainty – go into any analyses recognising the shortcomings
- Further reading: Good practice and pitfalls in risk assessment RR151, UK HSE

# Thank you for your attention

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