ProSafe 2012

Quantitative Risk Assessment
Linking in to Process Safety Management

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Outline

- What is a QRA?
- What is a QRA good for?
- Issues conducting QRAs
- What can it tell us
- Using the results

What is a QRA?

- QRA – Quantitative Risk Assessment
- Method for quantifying risk
- Assessment of the risk associated with potential hazardous events
- With suitable criteria, it can enables an assessment to be made of risk tolerability

What is it used for?

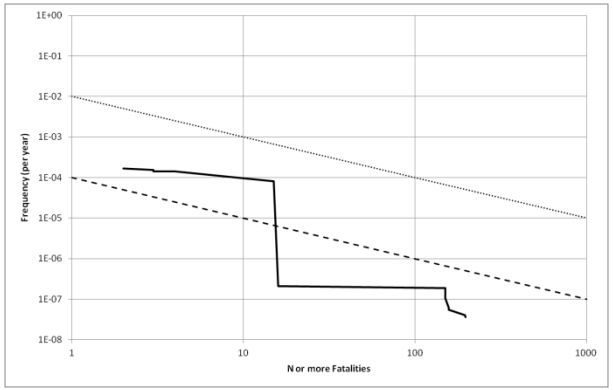
- Evaluates risk from hazardous facilities/activities to public and employees
  - Land-use planning around hazardous facilities
  - Assessment of risk exposure to on-site personnel
- Determination of risk tolerability against a numeric criteria
- Comparison of different process designs or operational modes

How is it done?

- Typical risk assessment approach used
  - Hazard Identification
  - Frequency Assessment
  - Consequence Assessment
  - Risk Assessment

QRA Outputs

- Individual risk contours
  - Injury
  - Fatality
- Societal risk graphs
- Numeric indices
  - PLL: Potential loss of life
  - IRPA: Individual risk per annum



What is it good for?

- Converting “fuzzy” risk concepts into numbers & diagrams that can be more readily understood
- Provides a cumulative estimate of risk from multiple sources
- Developing improved understanding of scenarios, causes and outcomes

What is it good for?

- Identification of high-impact events
- Identification of high-risk events
- Identification of factors contributing to high-risk events
- Input into risk-based improvement plans

What is it good for?

- Comparison of alternative process design or operational modes
  - Alternate process technologies
  - Assessment of site locations
  - Alternate storage arrangements
  - Alternate transport activities
  - Alternate locations of on-site buildings
  - Alternate combinations of risk controls

Issues Conducting QRAs

- Time & Cost
  - It can be a very large time-consuming exercise
  - Is a QRA truly needed?
  - Will an alternate (simpler) analysis achieve the same outcome?

Issues Conducting QRAs

- Definition of Scope
  - Key aspect specification of desired outcomes
  - The desired outputs from the model need to be clearly specified upfront
  - The model can then be developed with these in mind
  - Later updates / amendments can then be less time-consuming and costly

Issues with QRAs

- Suitability of input data
  - Site-specific data
  - Issues with frequency data
  - Consideration of operational issues
  - Consideration of human error

Issues with QRAs

- Variability of assumptions used
  - QRA model can be heavily dependent on assumptions
  - Different assumptions may give different results
  - Assumptions can be difficult to prove / disprove
  - Effect of multiple layers of conservative assumptions

Issues with QRAs

- Too much focus on the final number
  - Ticking a box for compliance
  - QRA results are presented as numbers & graphs
  - Often taken to be much more “accurate” than they truly are
  - Lack of understanding of the meaning of the results

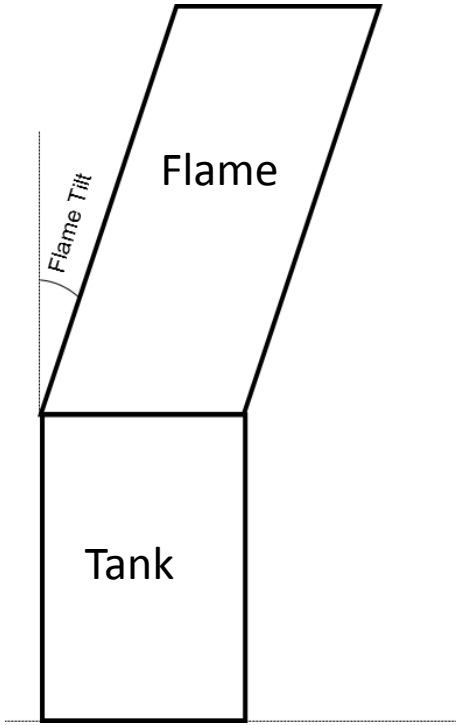
What can it tell us?

- Identification of major risk contributors
  - Determine from a review of the analytical results
  - Identify the key risk control measures
  - Incorporate management of key risk control measures into the SMS
  - Identify additional risk control measures
  - Rerun analysis to assess effects of additional risk reduction measures

What can it tell us?

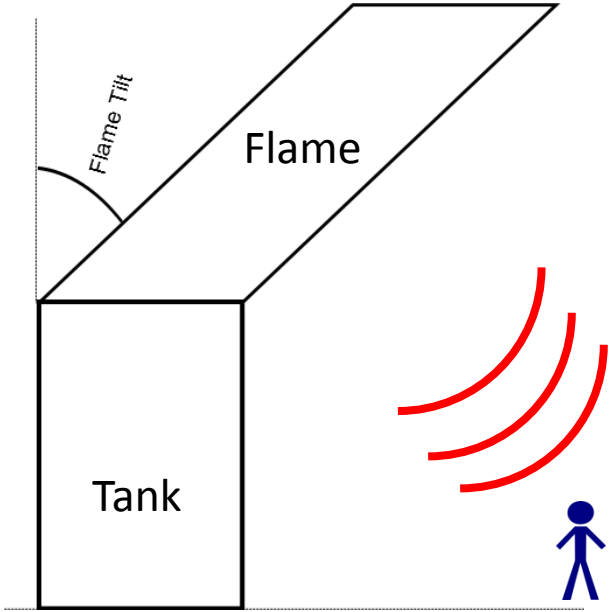
- A QRA can generate large amounts of consequence modelling results
- These may be used for emergency response planning
- Are the QRA results suitable for this purpose?
  - Appropriate assumptions?
  - A QRA is a probabilistic analysis

Fire Modelling – Wind Speed

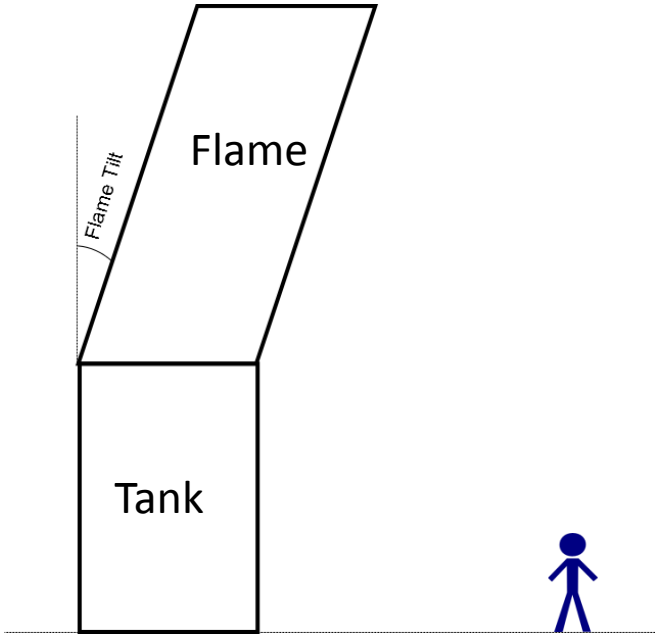


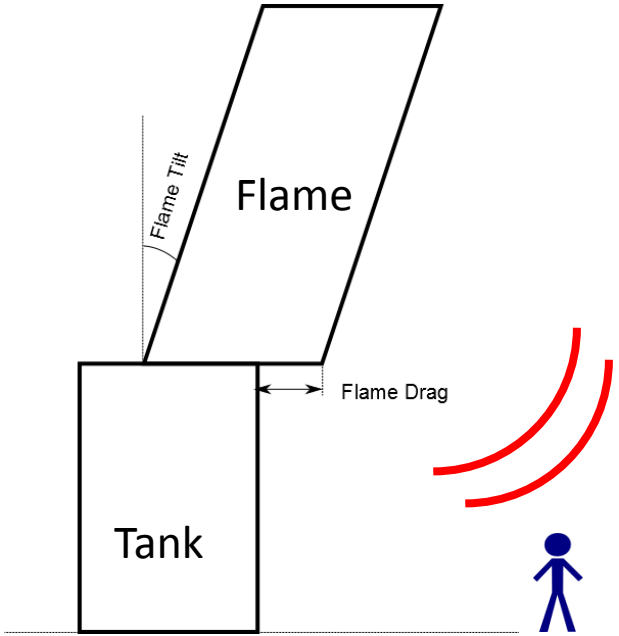
"average" wind speed

"90th percentile" wind speed



Fire Modelling – Flame Drag





Non-Process QRA

- Comparison of alternate drilling exploration program
  - Model developed to estimate “Potential Loss of Life”
  - Activities considered included:
    - Drilling
    - Air travel (helicopters & fixed wing)
    - Driving (Light vehicles)
    - Wildlife
    - Environmental factors (extreme heat & cold)

Non-Process QRA

- Benefits of additional safety standards were considered
  - Estimates of potential effectiveness of additional controls were made for each activity
  - Estimates were made for:
    - “Engineering” controls only
    - “Engineering” and “administrative” controls
  - Through this, the relative magnitude of the potential risk reduction could be estimated, allowing efforts to be prioritised

Keys for a Successful QRA

- Specification of Outputs
- QRA model must be designed with the required outputs in mind
- Validation of assumptions - avoid excess conservatism
- Understand the outputs and implications of the study

Keys for a Successful QRA

- Practical use of the outputs
  - Understanding of major hazards
  - Understanding of the risk profile
  - Identification of key risk controls
  - Management of key risk controls (through the SMS)
  - Identification and evaluation of risk reduction options

In Closing...

All modelling is wrong,

It's just that some modelling is useful.

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