

Quantitative Risk Assessment (QRA)

What is Quantitative Risk Assessment (QRA) ?

QRA is a structured approach to identifying and understanding the **risks** associated with hazardous activities such as the operation of a plant.

In Quantitative Risk Assessment (QRA) a numerical estimate is made of the probability that a defined harm will result from the occurrence of a particular event.

Quantitative risk assessments include a calculation of the single loss expectancy (SLE) of an asset.

Quantitative risk assessment (QRA) software and methodologies give quantitative estimates of risks, given the parameters defining them. They are used in the financial sector, the chemical process industry, and other areas. The study results shall also indicate the effects of accident scenario on the facilities outside the installation.

Quantitative risk analysis methods are based on statistical data and compute numerical values like

- Estimation of individual risks
- Aggregation of risks
- Identification of controls to mitigate risk

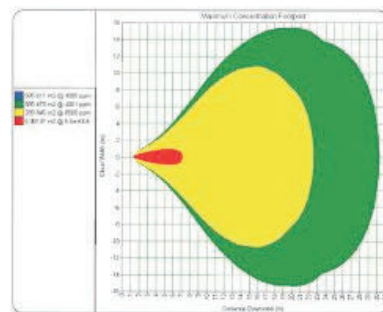
When to perform QRA ?

QRA is carried out

- For installations storing hazardous / toxic chemicals
- For installations processing hazardous / toxic chemicals
- For transporting hazardous material through pipe line

Steps in QRA study

- System Description – site location, process, inventory, environment, weather data, P&IDs etc.
- Hazard Identification – Toxic hazards, Fire hazards (Pool fire, jet fire) Vapor cloud formation, fire ball, BLEVE, Non ignited vapor cloud dispersion
- Failure case listing – based on the hazard distances calculated with respect to lower flammable limits (LFL) of the material, thermal radiation effects, blast over pressure effects and toxic effects
- Release consequence estimation – based on maximum credible accidents scenario
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- Frequency estimation – by using various data banks, fault trees, event trees & cause consequence diagrams (as required)
- Consequence Analysis - The consequences are estimated in terms of Lower Flammable Limit (LFL) distance, thermal radiation distances, blast overpressure distances and toxic hazard distances.
- Consequence modeling is carried out by using Softwares



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Steps in QRA study contd

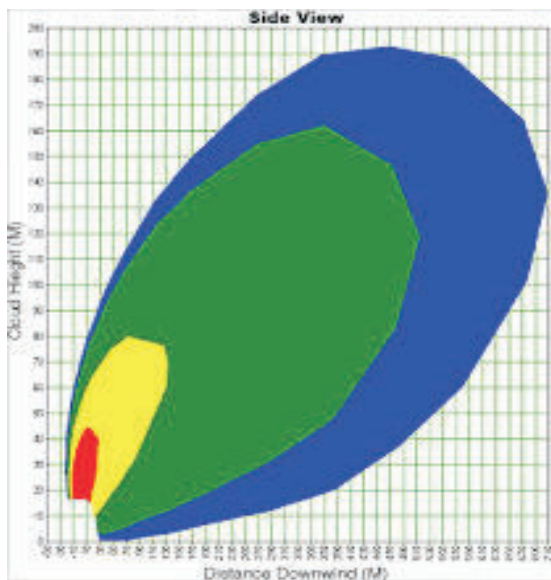
- Risk Analysis – define the criteria for tolerability of individual risk and societal risk so that the risk assessment can be made objectively by comparing the risk levels estimated for the project to those specified as tolerable.
- Individual Risk – estimated by considering detailed weather conditions, probable ignition sources identified, details of population & other facilities in nearby vicinity. Acceptance criteria – as per HSE executive, UK for individuals.
- Societal Risk - to provide a single measure of the chance of accidents that could harm a number of people in one go.

References

- NORSOK STANDARD - Z-013,
- Failure rate –base frequency *Purple book, TNO-Netherland*

Softwares

- Phast and Safeti from DNV GL - Integrated Consequence and Risk modeling aimed at the onshore petrochemical and chemical process industry
- Safeti Offshore from DNV GL - for Offshore structures with 3D real-time modelling.



Are you Looking for the Quantitative Risk Assessment (QRA)

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