



## Quantitative risk analysis to support process safety management

A quantitative risk analysis (Eng. QRA) calculates the external human risk of investment projects involving hazardous substances. It is based on effect calculations of undesirable releases that are generally only investigated in the context of obtaining an environmental permit for the company. However, there are a number of additional options relating to these calculations that can provide support to a company with regard to safety within the company.

Our risk analyses and effect calculations are only made using the most effective software (DNVGL, TNO, etc.).

### Your tailor-made solution

#### Building Risk Assessment

A Building Risk Assessment (BRA) aims to map the risks arising due to a major accident in the company on other buildings. In case of permanently occupied buildings, this aims to guarantee the welfare of the company's own employees and/or of temporary contractors.

#### Over-pressure calculations

Over-pressure calculations determine the overpressure that a particular building must be able to resist in order to remain intact as a consequence of an explosion on the company premises. This may include a separate study, or it may be an extension of a BRA.

#### Dispersion calculations

Dispersion calculations make it possible to determine the distance over which a dangerous gas/vapour cloud can spread. In a QRA, dispersion calculations are conducted according to pre-defined failure scenarios, but it is also possible to conduct these calculations in specific release scenarios, such as the opening of pressure safety valves.

#### Determination of heat radiation intensities

In case of fires in tank farms, the resulting heat radiation intensities can be quantified and used to create intervention cards with possible escape routes.

### Your result

Based on international standards, a BRA helps determine a safe site for the location of a control room or other vulnerable building, for example. Based on dispersion calculations, one can map possible escape routes to a "Safe Location" for the company's employees and for visitors. Our heat radiation calculations can also help understand the fire extinguishing media that would be required on the one hand, to limit the resulting heat radiation, and on the other to prevent the spread of fire to other tank farms.

### Please note

#### Legislations

Directive 2012/18/EU of the European Parliament and of the Council of 4th July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC Text with EEA relevance.

## Norms and Standards

Centre for Chemical Process Safety (CCPS):

- Guidelines for Chemical Process Quantitative Risk Analysis, 2nd Edition, AIChE, 1999.

Publication Series on Dangerous Substances (PGS):

- PGS1 (CPR 16E, Green Book), "Methods for the determination of possible damage– to people due to the release of hazardous materials", VROM, 2005.
- PGS2 (CPR 14E, Yellow Book), "Methods for the calculation of physical effects – due to the releases of hazardous materials (liquids and gases)", 3rd edition 2nd revision, VROM, 2005.
- PGS3 (CPR 18E, Purple Book), "Guidelines for quantitative risk assessment", VROM, 2005.

Process Safety Standards:

- API Standard 521 "Pressure-relieving and Depressuring Systems", 6th edition, American Petroleum Institute, 2014.
- API RP-752, "Management of Hazards Associated With Location of Process Plant Permanent Buildings", 3rd edition, American Petroleum Institute, 2009
- API RP-753, "Management of Hazards Associated With Location of Process Plant Portable Buildings", 1ste edition, American Petroleum Institute, 2007.
- PD 7974-X:2011, "Application of fire safety engineering principles to the design of buildings", British Standard Institution, 2011.

## In which situation?

This service is intended for:

- Industry
- Chemical industry
- Petrochemical industry
- SMEs with flammable and toxic products present in bulk