Ras Laffan Industrial City Quantitative Risk Assessment for Land Use Planning

CASE STUDY

The Challenge

Ras Laffan Industrial City (RLIC), located on the northeast coast of Qatar, is fully owned and operated by Qatar Petroleum. The facilities at RLIC process and export the North Field gas reserves of the State of Qatar. RLIC is expanding at a rapid pace including both infrastructure projects and port facilities to cope with the increasing demand for LNG, LPG and other liquid products.

Risktec was selected, from an international competition, to provide a quantitative risk assessment (QRA) for land use planning purposes. The objectives of the QRA were to quantify the "risk footprint" of RLIC, identify the risk "hot spots" and recommend protection and mitigation measures to reduce risk wherever practicable.

The unique technical challenges of the project included:

- How to ensure consistency in the analysis to enable fair comparison between the existing and future facilities, when all previous facility QRAs had been based on different data, models and rule sets?
- How to integrate so many large-scale facilities into a single QRA model and run what is one of the world's largest QRA models ever built?

The Solution

The study was initiated with site surveys and meetings with all stakeholder representatives with the purpose of acquiring existing QRAs and gaining an understanding of future planned developments. The hazards associated with each facility were screened against defined criteria, selecting only those which could affect people beyond the facility boundary – predominantly toxic gases such as hydrogen sulphide, but also fires and explosions in some cases. The physical effects for these hazards were modelled to ensure consistent treatment across all facilities. The facility-specific release frequencies were used directly and input, together with the physical effects, into one of the leading risk integration packages, Shell Shepherd.

Due to the sheer scale of RLIC, it was not possible to run the entirety of the QRA model as one. Instead, each facility, pipeline, tank farm and port was run separately. The results for each run were then combined in spreadsheets before presentation in Surfer, a risk contouring package.

Risk contours were presented on an image of RLIC and the risk "hot spots", together with the hazard contributors, were readily identifiable from the model contours. This provided RLIC with land use planning demarcations and also conclusions on pressings concerns such as the risk at the worker camps, fire and cooling water system impairment risk and inter-pipeline and tank escalation potential. The model was re-run for a range of recommendations to reduce risk, thus identifying the benefit from these proposed solutions.

The Benefits

Risktec's QRA for RLIC was the first to integrate the risk contribution from all facilities operating at RLIC together with common facilities and future expansions. Therefore, it was the first study to present a comprehensive "risk footprint" which could be used for land use demarcations and help RLIC better plan future developments. Additionally, the risk for critical systems and at locations of interest was quantified, which helped identify where further risk reduction was required. Sensitivity analysis provided the means to show the benefit of this risk reduction, to be passed forward for cost substantiation. Additionally, the QRA model provides a readily updatable platform for future expansion at RLIC and offers a cohesive risk model, enabling RLIC to understand and manage RLIC risks as a whole.