

QUANTITATIVE RISK ASSESSMENT (QRA)

WITH SUPERCHEMS™, QRA IS NOW MORE ACCURATE AND AFFORDABLE THAN EVER!

OVERVIEW

Quantitative risk assessment (QRA) involves the detailed estimation of the expected frequency and consequences of potential accidents associated with a facility or operation. The frequency of occurrence of hazardous events is estimated by employing a statistical approach utilizing available failure databases, Fault Tree Analysis (FTA) or layer of protection analysis (LOPA). The impacts of hazardous material releases are quantified by employing hazard consequence models.

The results of quantitative risk assessments can be compared with risk tolerability criteria or can be used to compare risks of alternatives. QRA often includes cost/benefit analysis of all or selected risk reduction alternatives. In these cases internal investment criteria may be applied to select measures for implementation. QRA is an invaluable method for making informed risk-based process safety planning decisions, as well as being fundamental to any facility-siting decision-making.

ioMosaic has a proven track record in performing QRAs. Our professionals have performed assessments on a wide range of facilities, such as refineries, chemical plants, pharmaceutical plants, tar sands, crude oil refineries, LNG facilities, and rail and marine transportation terminals.

QRA USING SUPERCHEMS™

ioMosaic has now added QRA capabilities to its SuperChems™ Expert software product. This additional functionality now makes SuperChems™ the most advanced tool in the industry for performing consequence analysis, quantitative risk analysis, and emergency relief system design—all on one platform!



Risk Contours, dispersion, radiation and explosive effects can be overlaid on maps

SUPERCHEMS™ QRA ADVANTAGES

- ◆ Broad range of models for modeling discharge, dispersion, thermal radiation and explosion
- ◆ Advanced multi-component discharge and dispersion modeling
- ◆ Comprehensive chemical database with over 3000 standard components
- ◆ Built-in probability data
- ◆ Customizable graphing and reporting features
- ◆ Consequence and risk results overlaid on site map
- ◆ User-friendly layout
- ◆ Combined QRA and ERS (Emergency Relief System) design tool

QRA USING SUPERCHEMS™

ioMosaic considers that QRA consists of two principal steps: **Preparation**, and **Implementation**.

SuperChems™ can help you with both steps:

Preparation:

- ◆ Define Meteorological and Topographical data in SuperChems™
- ◆ Visually define Population data in SuperChems™
- ◆ Visually define Ignition data in SuperChems™
- ◆ Define your Risk Tolerability Criteria

Implementation:

- ◆ Generate failure scenarios in SuperChems™
- ◆ Generate results in SuperChems™ (Graphical & Tabular)
 - Discharge
 - Dispersion
 - Toxic Effects
 - Radiation Effects
 - Explosion Effects
 - Individual Risk
 - Societal Risk
- ◆ Analysis of Results
 - Risk Ranking of Scenarios
 - Filtering of results
 - ‘What-if’ scenarios

ioMOSAIC'S QUALIFICATIONS

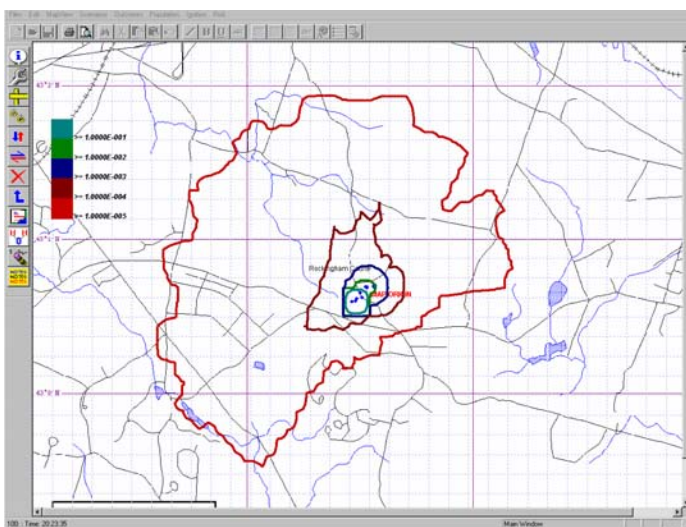
ioMosaic's risk analysts have performed hundreds of QRA studies, some examples of our project experience are as follows:

- ◆ Quantitative Risk Analysis of an ammonia transport terminal in Singapore
- ◆ Transportation quantitative risk analysis for a North American railway company
- ◆ Reliability, Availability, Maintainability (RAM) study of LNG-fueled power plant
- ◆ Quantitative Risk Analysis of argon purification operation for large international chemical company
- ◆ Quantitative Risk Analysis for large Canadian Refinery
- ◆ Ethylene and ethylene derivatives plant Quantitative Risk Analysis for client in the Middle East

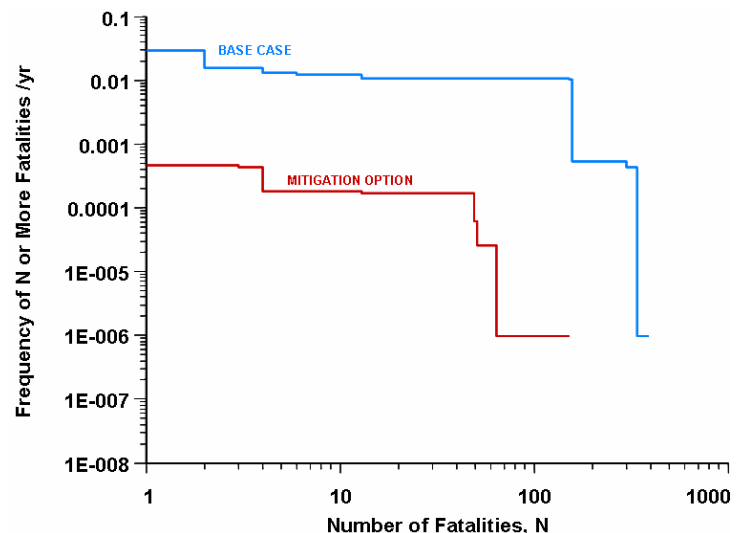
In addition, our risk analysts have authored and contributed to many DIERS and CCPS publications that provide guidance across a wide spectrum of safety and risk topics.

On each project, we put our knowledge and experience at your service, working closely with your staff to support and expand your company's capabilities and strengths. Our objective is to provide you with practical solutions that protect your profits and provide tangible business results.

SUPERCHEMS™ IS DESIGNED TO HELP YOU MANAGE YOUR DATA, AND CONDUCT YOUR QRA, AS ACCURATELY AND EFFICIENTLY AS POSSIBLE



Individual Risk Contours generated using SuperChems™



Societal Risk F-N Curves generated using SuperChems™

About ioMosaic

Founded by former Arthur D. Little Inc. executives and senior staff, ioMosaic Corporation is the leading provider of safety and risk management consulting services. ioMosaic has offices in Salem, New Hampshire and Houston, Texas.

Since the early 1970's, ioMosaic senior staff and consultants have conducted many landmark studies including an audit of the Trans-Alaska pipeline brought about by congressional whistle blowers, investigation of the Bhopal disaster, and the safety of CNG powered vehicles in tunnels. Our senior staff and consultants have authored more than ten industry guidelines and effective practices for managing process safety and chemical reactivity and are recognized industry experts in LNG facility and transportation safety.

ioMosaic Corporation is also the leading provider of pressure relief systems design services and solutions. Its pressure relief system applications are used by over 250 users at the world's largest operating companies. It holds key leadership positions in the process industries' most influential and active pressure relief system design, and chemical reactivity forums, and plays a pivotal role in defining relief system design, selection, and management best practices.

Safety & Risk Management Consulting Services

- ◆ Auditing
- ◆ Calorimetry, Reactivity, and Large-Scale Testing
- ◆ Due Diligence Support
- ◆ Effluent Handling Design
- ◆ Facility Siting
- ◆ Fire and Explosion Dynamics
- ◆ Incident Investigation, Litigation Support, and Expert Witness
- ◆ Liquefied Natural Gas (LNG) Safety
- ◆ Pipeline Safety
- ◆ Pressure Relief Design
- ◆ Process Engineering Design and Support
- ◆ Process Hazards Analysis
- ◆ Process Safety Management
- ◆ Risk Management Program Development
- ◆ Quantitative Risk Assessments (QRAs)
- ◆ Structural Dynamics
- ◆ Training

Software Products:

ioXpressKM™ (ioXpress™ Knowledge Manager is a web-based enterprise application for corporate electronic information management).

SuperChems™ (SuperChems™ is an advanced tool for pressure relief design, consequence analysis, and thermal hazards assessment).

HAZOPTimizer™ is a software product for recording and managing process hazard analysis.

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