

# IO MOSAIC STATEMENT OF QUALIFICATION

## SIMPLIFIED AND QUANTITATIVE RISK ANALYSIS

### OVERVIEW

Risk management addresses controlling of risk to protect people, the environment and company assets. It involves the systematic application of management policies and tools to analyze and assess potential impacts of uncertain future events, such as fires, explosions, toxic releases and natural events. The practice of risk management allows managers to anticipate and evaluate potential risk-based losses from such events and make responsible decisions.

There are several risk analysis tools used to assist in decision making; from relative risk ranking of risk reduction strategies to comparison of quantitative risk estimates to established risk tolerability criteria. ioMosaic's professionals are experienced in the application of simplified and quantitative methods of risk analysis and can provide guidance on the appropriate level of analysis for a give problem. Methods we have utilized for our clients include:

- ◆ Matrix risk ranking
- ◆ Level of protection analysis (LOPA)
- ◆ Event tree and fault tree analysis (FTA)
- ◆ Reliability/vulnerability analysis
- ◆ Quantitative risk analysis (QRA)

### SERVICES

#### Risk Matrix Development

The use of risk ranking matrices is widespread, but not well understood. ioMosaic's safety professionals have assisted our clients in developing effective and consistent risk matrices as a means to make risk-based decisions during process hazard analyses. A whitepaper on designing an effective risk matrix can be accessed through our website [www.iomosaic.com](http://www.iomosaic.com).

#### Level of Protection Analysis (LOPA)

LOPA is a simplified quantitative risk analysis technique that accounts for the number of independent levels (IPLs) and assigns a numerical risk reduction "credit" for different types of IPLs.



LOPA is a technique that is gaining popularity for performing the risk analysis required to identify the need for safety instrumented systems (SIS) under ISA Standard 84.01. One of our professionals was involved with the CCPS committee that wrote the book on LOPA. ioMosaic can perform LOPA to support SIS selection or other risk-based decisions and/or provide training.

#### Reliability/Vulnerability Analysis

A Reliability, Availability, Maintainability (RAM) study is a quantitative failure analysis of a complex system with the objective to: 1) enhance system reliability, 2) increase up-time (availability), and 3) to effectively integrate maintenance requirements to achieve optimal overall system performance (maintainability). During project design, the results identify system vulnerabilities that can be used to justify capital equipment costs that will increase uptime and eliminate continuous maintenance costs required to achieve the needed reliability/availability. For an existing facility, a RAM analysis is used to refocus maintenance activities to enhance system availability at current or reduced maintenance expenditures. In most applications of RAM study methodology, our experience has shown that the cost-benefit derived far exceeded the cost of the analysis.

#### Quantitative Risk Analysis (QRA)

QRA involves the most detailed estimation of the expected frequency and consequences of potential accidents associated with a facility or operation, utilizing hazard modeling and statistical



techniques. The frequency of occurrence of hazardous events is estimated by employing a statistical approach utilizing available failure databases or Fault Tree Analysis (FTA). The impacts of hazardous material releases are quantified by employing hazard consequence models. For such analyses, ioMosaic has the ability to perform detailed consequence modeling of vapor cloud, fire and explosion hazards using the state-of-science models in our proprietary SuperChems software. Examples of where our professionals have employed QRA to evaluate the risks include; refining tar sands crude oil, rail transshipping terminals for chemicals, oil and chemical marine terminals, and chemical pipelines.

### SELECTED STUDY EXPERIENCE

- ◆ For an international energy company, our professionals conducted a reliability, availability, maintainability (RAM) study of a 500mW combined cycle power plant fueled by LNG. The analysis encompassed the LNG unloading terminal, the power generation block, and balance of plant facilities. Applying failure analysis techniques, we determined the effective availability factor (EAF) of the power plant for each year of the project, taking into account lost output due to scheduled maintenance and forced outage. The results were used to assess the projected financial performance of the project.
- ◆ For a North American railway company, our professionals analyzed the risk of cargo transfer operations. These operations generally involve off-loading from rail cars to tank trucks, with hazardous materials (e.g., toxic, flammable, corrosive) being transferred at some locations. Our client was interested in understanding and quantifying the risk associated with this type of operation. A pilot quantitative risk assessment (QRA) of one transfer terminal was undertaken to provide the company with an appreciation of the approach and techniques involved, and to provide insight into possible improvements to risk management at the site. Based on the results of this assignment, the company decided to perform QRAs on two additional terminals.
- ◆ For a large international chemical company, our professionals conducted a quantitative risk assessment of two alternatives for argon purification under consideration. Hydrogen for the purification was supplied in one case by direct receipt, storage and transfer of liquid hydrogen and, in the second case, by dissociation of ammonia. The scope involved potential upsets associated with the unloading, storage, dissociation, transfer and purification activities for

the purpose of evaluating the relative risk levels between the two approaches. Results were presented in terms of societal risk profiles, risk contours, and maximum individual risk estimates.

### ABOUT US

ioMosaic Corporation is a leading provider of safety and risk technology consulting services and software solutions.

#### 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.

At ioMosaic, we are helping our clients discover practical and cost effective solutions to safety, risk, and business challenges.

### CONTACT US

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