

# IO MOSAIC STATEMENT OF QUALIFICATION

## LIQUEFIED NATURAL GAS (LNG) SAFETY

### PIONEERS OF LNG SAFETY

The 1970s witnessed tremendous activity in the LNG industry worldwide. Significant work was done in the siting and construction of export and import terminals and send-out facilities.

During this time, a team of consultants from Arthur D. Little Inc., rose to preeminence and became recognized leaders in environmental and risk management studies for siting of LNG facilities. The LNG expert knowledge and quantitative risk assessment (QRA) study experience retained by key individuals on that original team is now available through ioMosaic Corporation.



### SELECT CLIENT CASE STUDIES

A few of the most significant LNG studies are summarized below:

#### *Federal Energy Regulatory Commission*

ioMosaic Corporation is assessing FERC's cryogenic design review and inspection process for LNG facilities. This project includes all aspects of FERC's authority to approve the siting of new LNG facilities and to impose more stringent safety standards than those required under 49 CFR 193. Specific activities that are being assessed include: the design review process, siting and calculation of thermal radiation and flammable vapor exclusion zones, international LNG regulations, operator reporting during construction and operation, and FERC inspections during construction and operation.

#### *Major International Oil & Gas Company*

ioMosaic Corporation just completed a baseline reference document summarizing current and historical worldwide data on LNG properties and hazards, including spills on land and water, vapor dispersion, ignition sources, fires, explosions, rapid phase transition (RPT) and rollover, that will be an invaluable resource on LNG safety. Much of the information was available in our extensive LNG library and was supplemented by conducting an exhaustive literature search. The study also identified gaps and limitations in the existing data that could provide opportunities for future technology development.

#### *LNG Rollover Studies*

For several utilities companies, we investigated and analyzed a variety of operations that can lead to stratification of LNG, and eventually, to "LNG rollover". Using our findings and recommendations, facility owners were able to establish operating procedures and/or make design modifications to minimize the occurrence of dangerous "LNG rollover" events.

#### *Peneulas Power Project, Puerto Rico*

The Peneulas Power Project utilized a combined cycle power generation plant using seawater cooling and providing heat for a desalination unit. Initially fueled by distillate oil, the primary fuel would become LNG in a later phase of the project. ioMosaic staff conducted a Reliability, Availability and Maintainability (RAM) study to calculate values for expected capacity and availability to assist the project team in developing contractual guarantees.

Additionally, we performed a HAZOP study that included both the power plant and the LNG receiving, storage and vaporization facilities.

#### *Energy Project, India*

We performed a HAZOP study for a major energy project in Dabhol, India. The scope of this study included the ship unloading operations, storage, boil-off recovery, and LNG vaporization facilities. In addition to the LNG facilities, the HAZOP study performed a review of



fire protections systems. Recommendations to minimize possible loss of containment, mal-operation, failure of personnel safety systems, and loss of fire protection were generated by the HAZOP team based on risk. A separate HAZOP of the gas transmission pipeline from the LNG plant was also conducted.

## LNG RISK MANAGEMENT TRAINING

In an effort to educate LNG practitioners, regulators and the public, ioMosaic Corporation is conducting multiple offerings of a comprehensive LNG training program, **Managing LNG Risks with Confidence—Separating the Facts from the Myths**. This one-day course provides an overview of unique LNG hazards such as pool formation, dispersion, fire and explosion, etc., associated modeling techniques, and risk management methodologies. References are drawn to previous LNG incidents, large-scale test programs and applicable regulations throughout the discussion. This course is ideally suited to anyone working for or associated with LNG project development, operations, and safety and risk management. The course is conducted by some of the world's most foremost LNG specialists.

## STRATEGIC ALLIANCES

ioMosaic has strategic alliance with some of the world's leading LNG experts including:

### Dr. Elisabeth M. Drake, Emeritus Staff, MIT Laboratory for Energy and the Environment

Prior to working at MIT, she was a Vice President at Arthur D. Little, Inc., where she had been a staff member for over 25 years. During this period she was involved in many LNG consulting assignments for commercial and governmental clients worldwide. As a cryogenic specialist, she provided cryogenic expertise to the emerging LNG industry in the 1970s and became heavily involved in overall risk management of major LNG and LPG projects. She and R. Reed co-authored the definitive paper on rollover phenomenon in LNG storage tanks. From 1986-1988, she led Arthur D. Little's Environment, Health and Safety Practice.

## 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 Safety*
- ◆ *Pipeline Safety*
- ◆ *Pressure Relief Design*
- ◆ *Process Engineering Design and Support*
- ◆ *Process Hazards Analysis*
- ◆ *Process Safety Management*
- ◆ *Risk Management Program Development*
- ◆ *Quantitative Risk Assessments*
- ◆ *Structural Dynamics*
- ◆ *Training*

### Software Development:

- ◆ *Outsourcing Engineering*
- ◆ *Customized Software*
- ◆ *Process Safety Management Workflow*

### Software Products:

- ◆ *ioXpressKM*
- ◆ *SuperChems*

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

## CONTACT US

93 Stiles Road  
Salem, New Hampshire 03079  
U.S.A.

www.iomosaic.com  
Phone: 603.893.7009  
Fax: 603.893.7885  
Email: support@iomosaic.com

