

# IO MOSAIC STATEMENT OF QUALIFICATION

## RELIEF HEADER AND FLARE ANALYSIS

### OVERVIEW

Designing and upgrading relief systems are increasingly challenging issues that are frequently encountered in existing plants, due to expansion or debottlenecking of the capacity of the plant. Anytime the throughput of a plant is increased, the capacity of individual relief devices should be reviewed, as well as the impact on effluent handling or flare systems. The developed pressure due to increased flow in the effluent handling system must not exceed the allowable backpressure for the type of relief valve installed.

Another difficulty encountered in designing relief systems is that typically the individual relief devices are sized first. Then the inlet and exit losses are determined and finally the headers are sized for the worst-case, common-cause release scenario. Quite often this results in costly iterative computations before an optimum solution that meets all the design requirements is achieved.

ioMosaic Corporation has developed state-of-the-science software that can perform sizing calculations on multiple relief devices with associated inlet and outlet piping, and can simultaneously account for header and flare stack hydraulics. The radiation effects due to flaring can also be calculated simultaneously. By utilizing this software, our experienced professionals can achieve a high level of productivity and reduce the cost of designing or revalidating relief headers and flare systems.

### IO MOSAIC'S RELIEF SYSTEM DESIGN SOFTWARE

Our software tools are the industry standard for performing pressure relief design. In July of 2002, the AIChE Design Institute for Emergency Relief Systems (DIERS) User's Group selected our relief design software (SuperChems) as a replacement for the SAFIRE computer code.



SuperChems Expert is a sophisticated computer code capable of handling all the modeling requirements of pressure relief and effluent handling design, including the rating of two-phase headers and interlinked vessels. No special modeling efforts are required for different vessel geometries. For relief valves, the model utilizes standard lift characteristics as a function of overpressure and backpressure. When available, specific relief valve lift characteristic correlations can also be imported.

SuperChems Expert can handle the dynamics of a vessel under fire exposure that is venting to another vessel, which may also be under fire exposure. It will also handle the effects of reacting flows and backpressure buildup and their impact on the relief capacity and behavior of both vessels.

The two-phase header modules in SuperChems Expert can handle multiple inlets consisting of two-phase, and/or gas, and/or liquid flows. Reactions are also tracked in the header. SuperChems can also take the results all the way to the flare tip, and estimate the radiation footprints from a combined loading of several vessels venting into the header simultaneously.



## SELECTED STUDY EXPERIENCE

The following are selected examples of ioMosaic relief system assignments that involved relief header and flare analysis.

### LD Polyethylene Reactor Decomposition Containment

Our professionals assisted an engineering design contractor with the evaluation of the structural integrity of their proposed design of an ethylene decomposition containment system for a LD polyethylene reactor operating at 30,000 psig. The results of the SuperChems analysis indicated that the containment system would be subjected to severe loads during an ethylene decomposition event. The evaluation identified reaction force and internal stress issues for the reactor support structure and several piping components that needed to be addressed in the final design.

### Flare Relocation Study

This study was for a middle eastern petrochemical company and involved relocating existing flares for the olefins, ethyl benzene, and ethanol units. A fourth flare stack for a new ethyl benzene plant was also evaluated. All four flare stacks were suspended from the same support structure. Using SuperChems, we evaluated the radiation at various site locations for worst-case flaring events from each unit, and worst-case simultaneous flaring from all four units. For the three relocated flares, it was also necessary to evaluate the additional developed back-pressure due to extending flare headers to the new flare location. The final design involved a supported flare stack of 90 meters elevation.

### Gas Blow Through Analysis

For an independent oil company, we completed a complex analysis of a gas blow-through scenario from a Hydrocracker high-pressure system. The analysis had to consider simultaneous multiple gas blow-through to a low-pressure separator including one pathway through a hydraulic turbine. The system also included the pressure relief valve on the LP separator, the relief header and the flare stack. Using SuperChems Expert, and adding in a turbine module, we were able to obtain an exact solution of the pressure profile for the entire system and evaluate the adequacy of the relief valve.

## ABOUT US

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

### ioMosaic's Consulting Services:

- ♦ *Auditing*
- ♦ *Calorimetry, Reactivity, and Large-Scale Testing*
- ♦ *Due Diligence Support*
- ♦ *Effluent Handling Design*
- ♦ *Facility Siting*
- ♦ *Fire and Explosion Dynamics*
- ♦ *Incident Investigation and Litigation Support*
- ♦ *Pipeline Safety*
- ♦ *Pressure Relief Design*
- ♦ *Process Engineering Design and Support*
- ♦ *Process Hazards Analysis*
- ♦ *Risk Management Program Development*
- ♦ *Quantitative Risk Assessments*
- ♦ *Software*
- ♦ *Structural Dynamics*
- ♦ *Training*

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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