

AN ioMOSAIC SERVICE

PROCESS TECHNOLOGY EVALUATION AND ASSESSMENT

OVERVIEW

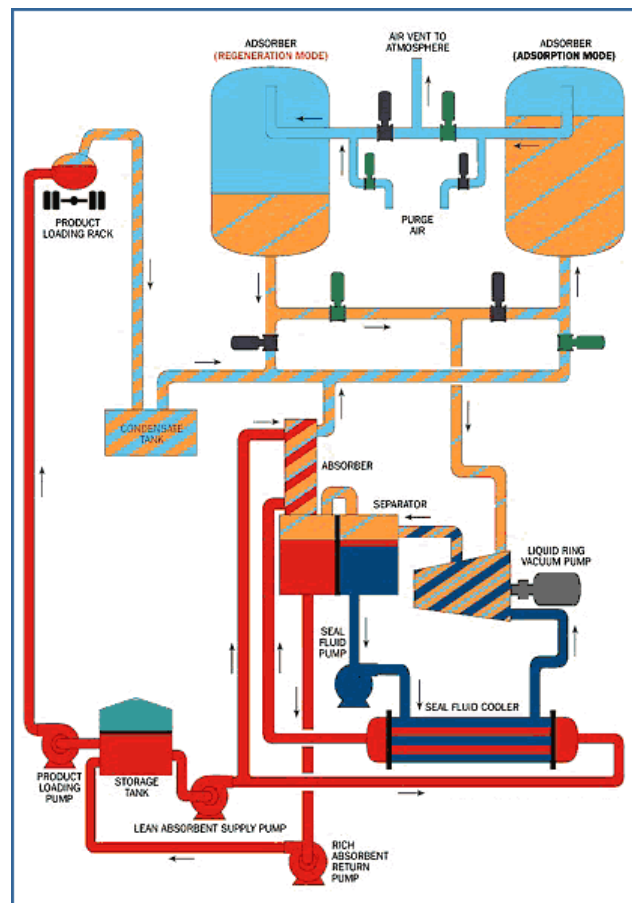
Often, companies in the process industries need impartial evaluations of process technologies for making strategic and tactical business decisions. Some of the situations that force this need include; outside technology acquisition (licensing), benchmarking internal technology developments, screening toll manufacturers, assessing scale-up potential and risk, and process selection for projects. Using the experience of our staff of senior process engineers and dynamic process simulation capability, ioMosaic Corporation provides comprehensive process evaluation solutions. Typical evaluation criteria we employ are:

TECHNOLOGY ROBUSTNESS

Robustness addresses process vulnerabilities to the variations and conditions encountered in a real processing environment. For catalyst promoted processes, the effect of fluctuations in raw material quality (composition, purity, and dryness) on yield, selectivity and life is of significance. Other process issues that can cause process upsets and loss of production include, propensity for equipment fouling and wear, foaming, corrosiveness of process materials, and extreme temperature, pressure and humidity conditions to name a few. Through prior experience and facilitation of process hazard analyses, our engineers have gained valuable insights on the design and operability issues of many processes.

TECHNOLOGY MATURITY

Quite often a new technology has attractive advantages over competing processes on-paper, but has only been operated at pilot plant scale or there is limited commercial scale experience. In which case, catalyst and equipment performance data for extended continuous operation is unavailable. We utilize our engineering staff's proc-



ess development experience coupled with knowledge of the potential vulnerabilities of the process steps to weigh the risk of unproven technologies.

SCALE & SCALE-UP

Scale of operation becomes an issue when the process under consideration has not been operated at the capacity required for a new project. For commercialized processes, this may result in exceeding the size of existing single train equipment such as compressors. For developmental processes, another issue is how will process performance be affected by scale-up to a much larger scale. Not all process parameters will scale linearly. In addition, for batch chemistry, the runaway and decomposition reaction hazards are



generally exacerbated at large scale. ioMosaic is the developer of sophisticated simulation software for evaluating scale-up problems. Our SuperChems™ computer program is a dynamic simulator capable of characterizing reaction kinetics and thermodynamics of scaled-up systems based on thermochemical test data.

OPERABILITY / MAINTAINABILITY

Electrochemical processes such as used for caustic/chlorine and aluminum production require periodic tear-down and rebuilding of the electrolytic cells. Cracking and catalytic dehydrogenation process for olefins production require frequent decoking of furnace tubes or catalyst beds. Processes that need more operator/maintenance intervention are more vulnerable to unscheduled outages and will generally require more staffing and maintenance resources than process which are more forgiving (e.g., less fouling or less aggressive on equipment). Our engineers have experience in preparing reliability/availability/maintainability (RAM) studies that allow quantification of the expected up time and annual production capacity of process design configurations.

PROCESS ECONOMICS

If done properly, this is usually the equalizing factor that accounts for all the known and suspected items that affect the processing costs. For developmental processes this may require independent estimates of raw material, catalyst and utility consumptions based on knowledge of the chemistry and thermodynamics of the process. Our engineers have considerable experience in preparing manufacturing cost structures for a large range of chemical and refinery processes.

PROCESS SIMULATION STUDIES

Maintaining up-to-date, accurate process simulation data is paramount to the safe, efficient operation of a plant and is a valuable aid to process optimization. ioMosaic offers our Process Simulation service as a standalone line of service, as part of an Emergency Relief System (ERS) Design project, or as part of our Process Technology Evaluation and Assessment services.

ioMosaic is able to combine the use of their leading edge ERS and dynamic simulation computer program SuperChems™, together with the industry standard process simulation tool, HYSYS®, to offer this complete service.

Using our considerable process expertise gained in the petrochemical, chemical, and pharmaceutical industries, ioMosaic can include the following as part of our Process Simulation studies:

- ◆ Development of heat and material balances, for existing operations
- ◆ Sensitivity analyses to identify the optimal design based on operating and business targets
- ◆ Assessment of equipment deficiencies, such as heat exchanger fouling, and column flooding
- ◆ Equipment sizing verification, and recommendation
- ◆ Evaluation of feed changes, upsets, and equipment downtime

LICENSING CONSIDERATIONS

Sometimes the deal maker or breaker is the licensing arrangement. Some important aspects are:

- ◆ Company experience and credibility (will they be in business as long as you will?)
- ◆ Technical support capability (are they convincing regarding technical issues?)
- ◆ Licensing terms (what's included in the base license and what is extra requiring annual fees?)

IO MOSAIC EXPERIENCE

Our senior process engineers have over 30 years of hands-on process engineering design and chemical plant operating experience through current assignments and prior employment at world-class engineering design and chemical manufacturing companies. In addition, they have conducted many process evaluations for process industry clients including Air Products, BOC, FMC, GM, Sunoco, and TVA.

A firm was planning to expand its sourcing of nitrogen trifluoride for supplying the semiconductor industry. Our engineers conducted a process evaluation of alternative technologies for manufacture of NF_3 , of which one was developmental. The analysis included pro forma manufacturing cost estimates as well as a rating on technical and commercial factors.

On another assignment, our engineers review the technical and operating capabilities and safety programs of a toll manufacturing company for a firm interested in outsourcing the production of a key chemical.

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.

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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).

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

