RIVER CITY ENGINEERING

THOMAS R. RUDDY II, Vice-President

SUMMARY OF QUALIFICATIONS

River City Engineering, Inc., Lawrence, Kansas USA 1998-Present

Process Engineering Consultant for the Oil & Gas Industry providing design and technical support for gas and liquids processing/handling and oil production projects.

- DTE Biomass Energy – Evaluation of three landfill biogas plants in Texas including simulation, plant data matching, equipment evaluation and performance tests. The first project involved expansion of an existing plant from 5 MMSCFD to 8 MMSCFD. The second project involved performance testing after the startup of a new plant. The third project involved due diligence before purchase.
- New Phase Energy – Evaluation of conceptual design for new biogas processing plants for digester gas at water treatment facilities.
- EMEA (ExxonMobil Exploration Argentina) – Conceptual design of multiple remote oil and gas production facilities in Argentina.
- OXY Dehydration Study – Expansion of 4-bed mol sieve dehydration system to 5-bed from capacity of 120 MMSCFD to 142 MMSCFD. Evaluation of all related equipment and timing/sequencing.
- XTO Means Compressor Station – Lead Process engineer/designer for grass roots CO2 treating and compressor station. Plant processes 50 MMSCFD of high CO2 gas from EOR fields in three trains of ~17 MMSCFD. Design was made for future expansion of up to 9 trains or 150 MNSCFD.
- Magellan Gasoline Storage Chilling – Evaluated cooling demand and designed chiller process for maintaining a new 600,000 bbl gasoline storage tank at 78F during filling, load out and maximum solar gain.
- Cheniere Sabine Pass LNG – Created dynamic simulations of new LNG facility fuel gas system after overpressure problems were detected during commissioning. Designed a vent gas system to alleviate the problem.
- Gas Processors Association – Conducted study of Solubility of Heavy Hydrocarbons in Cryogenic Fluids to update relevant sections of the GPSA Data Book.
- Noble Leviathan – Process Engineering support for new Floating LNG plant in the Eastern Mediterranean Leviathan field. Conceptual design, process evaluation.
- Cuulong (Vietnam) – Conceptual engineering study for two new offshore oil/gas production platforms offshore Vietnam as part of Block 15-1 development. Also executed study for reconfiguration of all platforms in Block 15-1 during future production rate declines.
- Atlas Pipeline Stonewall Gas Plant Expansion – Lead Process Engineer for expansion of 120 MMSCFD ethane recovery plant to 200 MMSCFD capacity.
- XTO Denver City Gas Plant – Lead Process engineer/designer for grass roots NGL recovery and CO2 removal gas plant from initial design through startup. Plant processes 25 MMSCFD of high CO2 gas from EOR fields to recover valuable liquids and condition CO2 for re-injection. Process combines refrigeration and membrane processing.
- ConocoPhillips LNG – Process design support and selection for nitrogen rejection technologies for LNG processes with high nitrogen feeds..
- Eltron Research – Process design and competitor evaluation for new process development for hydrogen generation and oxygen storage technologies.

- ConocoPhillips San Juan Gas Plant, NM – Evaluation of design and operating changes required for future feed rate increases or declines. Lead process engineer for replacement of inlet compression and associated equipment to process higher rates.
- Gas Processors Association – Survey and process/economic analysis of Mercury Removal Technology. Included presenting a paper at the GPA convention.
- University of Kansas Center for Environmentally Beneficial Catalysis – Process design and economic evaluation for various research and development projects including Hydroformylation and Alkylation.
- PPGPL (Trinidad) – Fractionation Train 3 project distillation tower inspections.
- Conoco - Process consulting/development support for Gas-to-Liquids facility (Synthesis Gas and Fischer-Tropsch) with full product separation and treating. Support included development of fully integrated HYSYS process models for material and energy balances and economic evaluations of various processing schemes.
- AmeriGas, Chesapeake terminal – Detailed engineering for converting the propane heater from direct fired to indirect heating using an intermediate heating medium.
- Petrozuata, Venezuela – Preliminary engineering for gas dew-pointing of associated gas from heavy oil production for export.
- Angola LNG – Slugcatcher design for an onshore LNG plant.
- Kuwait Pipeline – Evaluation of ambient heat effects on an above-ground flowline.
- Enersea – CNG/ Peak-shaving LNG comparison study.
- COP Chittim plant – Evaluation of heat exchange for relocating a fuel gas conditioner skid.
- MODEC Gabon - Provided process engineering assistance in troubleshooting processing problems following start-up of an offshore production unit mounted on a converted jack-up. Analyzed data and identified problems related to off specification crude oil, excess vapor rates, and heat exchanger fouling. Performed preliminary studies to determine changes necessary to expand capacity.
- DPI - Analyzed existing skid-mounted gas plants for use in new services/feed compositions. Calculated potential propane recovery levels and determined which pieces of equipment would have to be replace/retrofitted.
- ConocoPhillips - Preliminary process design support for sand removal on an offshore production platform.
- Preliminary process design and cost estimating support for an offshore gas production platform. Compared offshore acid-gas treating and liquids recovery to onshore alternatives. Included evaluation of pipeline configuration options.
- Various - SAFE Chart (API-14C) development and Process Hazards Analysis (PHA) for several gas plants.
- Various - Preparation and analysis of Cause & Effect (C&E's) diagrams.

PREVIOUS EXPERIENCE

C.W. Nofsinger, Kansas City, Missouri USA 1990-1992

Staff Process Engineer involved in the design and optimization of processing plants for a variety of clients. Responsibilities included process simulations, heat and material balances, process and engineering diagrams, cost estimates, and equipment specifications. Also performed laboratory and operations studies on crystallization pilot plant.

Major Projects:

- Universal Oil Products (UOP) - Prepared Schedule A design packages for two Catalytic Cracker Gas Recovery units.
- Goodyear Tire and Rubber - Prepared process study of an isoprene extraction plant which allowed Goodyear to process a new feedstock.

- A.E. Staley - Participated in the design of a new $35MM fructose crystallization process and expansion of an existing corn syrup refinery.
- Koch Refining - Prepared Schedule A design for a new crystallization unit to purify two specialty chemicals.

THOMAS R. RUDDY II

EDUCATION

University of Kansas
Lawrence, Kansas

B.S. Chemical Engineering (with Distinction), 1986-1990

University of Kansas Chemical Engineering Department, (M.S. Program) 1994-1997
Lawrence, Kansas

Research Assistant in Plasma Reactor Laboratory

- Performed experiments on plasma reactors to determine relationship of control variables to critical process conditions such as ion and electron concentrations in various plasma gases. Plasma reactors are used in the manufacture of semiconductors.
- Completed graduate level course in Thermodynamics, Kinetics, Statistics, Heat, Mass and Momentum Transport Phenomena, Engineering Calculations, and Plasma Processing.

PUBLICATIONS

Meng Li, Thomas Ruddy, Darryl Fahey, Daryle H. Busch, and Bala Subramaniam, “Terephthalic Acid Production Via Greener Spray Process: Comparative Economic and Environmental Impact Assessments with Mid-Century Process” ACS Sustainable Chemistry & Engineering, November 2013.

Madhav Ghanta, Thomas Ruddy, Darryl Fahey, Bala Subramaniam, “Is Ethylene Oxide from Ethylene and Hydrogen Peroxide More Economical and Greener Compared to Conventional Silver-Catalyzed Process?” Industry and Engineering Chemistry Research (Professor L. T. Fan Special Issue), March 2012.

Jing Fang, Hong Jin, Thomas Ruddy, Kent Pennybaker, Darryl Fahey, Bala Subramaniam, “Economic and Environmental Impact Analyses of Catalytic Olefin Hydroformylation in CO2-Expanded Liquid (CXL) Media”, Industry and Engineering Chemistry Research, March 2007.

Ruddy, T.R. and Pennybaker, K.A., “State of Mercury Removal Technology” GPA Project 051.1, July 2006.

Pennybaker, K.A., S.E. Wolverton, S.W. Chafin, T.R. Ruddy and C.W. Pritchard, "A Comparative Study of Ethane Recovery Processes," Proceedings of the Seventy-Ninth GPA Annual Convention, Atlanta, Georgia, March 13-15, 2000.

Pennybaker, K.A., and S.E. Wolverton, S.W. Chafin and T.R. Ruddy, "A Comparative Study of Propane Recovery Processes," Proceedings of the Seventy-Eighth GPA Annual Convention, Nashville, Tennessee, March 1-3, 1999.