Examples of Ingenero Projects

Asset Performance Analysis and Improvement Projects

Sr. No.	Project	Overview
1	Furnace runlength & throughput optimization	The project entailed analysis of maximizing throughput as determined by downstream constraints versus the impact of increased decokes. The conclusions from the analysis were implemented and $6.3 million/yr in benefits were realized.
2	Dephlegmator's & Expander performance evaluation and improvement	The project involved a root cause analysis of the insufficient chilling of hydrocarbon vapor in the Dephlegmators to recover ethylene. The root cause was shown to lie in inefficient expander performance. Solutions provided and implemented as part of the project provided $3.5 million/yr in benefits.
3	Evaluation of Demethanizer tower performance & Optimization	Root cause analysis of the high overhead C2 losses from the demethanizer was done. Optimum column operating parameters and strategy was suggested and implemented as part of the project, giving an impact of $0.5 million/year through reduced losses.
4	CGC turbine performance evaluation	The project results allowed gains in CGC turbine power, through some changes to insulation in the steam feed to the turbine, allowing ~$2 million/year in additional savings on an ongoing basis.
5	CGC compressor performance optimization	Optimal settings of CGC GV and ECV openings as a result of this project allowed incresed throughput by utilizing the possible 1.8 MW power increase enabled by the new settings, providing an additional annual benefit of ~ $2 million.
6	Expander Optimization to reduce Ethylene losses in tail gas and increase ethylene yield	Rerouting tail gas and liquids pumped into the JT recycle in an ethylene plant with minimum piping modifications coupled with optimal expander inlet temperature allowed running the expanders at full capacity and improvement in ethylene yield enabling increased profits of ~1 mil/yr.
7	C2 splitter operating philosophy review	C2 splitter operation philosophy was revisited & with the help of simulation it was deduced that for a given Ethylene Refrigeration Compressor (ERC) power (available power), operating C2 splitter at higher reflux and higher pressure is beneficial over operating at lower pressure and lower reflux.
8	Quench Tower Study & Optimization	Changes to quench water circulation flow, better utilization of cooling tower fans and changing the quality of quench water, as a result of the Quench tower study helped decrease the quench tower overhead temperature by ~ 15° F, allowing extra feed to be processed and enabling possible savings of ~$12 million.

9	Propane Condenser performance review	Extent of impact of plugging of leaked tubes on Propane Condenser performance was studied and exchanger design was revisited to understand the reason for tube leakage.
10	Change of column internals of Benzene tower	Root cause analysis of the high loss of benzene through the bottom of the column was performed with the help of a detailed column simulation. It was observed that mass transfer in the 30 ft random packing section at the bottom was inefficient due to channeling and maldistribution, resulting in higher energy requirement to meet desired bottom specs and also loss of benzene through the bottom. A more efficient structured packing was put in place, resulting in much lower benzene carryover and energy savings.
11	Material flow Diagrams for identifying bottlenecks	This logistics simulation model of the material flow process was designed for evaluating various alternatives for streamlining the flow of material into and within the manufacturing facility with a view to decongest the plant and improve the work efficiency.
12	Deethanizer Optimization	A simulation model of Deethanizer was developed to optimize its operation and suggested augmenting condenser capacity to enable increased reflux flow and thereby reduce propylene losses in overhead. Benefits estimated to be $ 1.07 mm/yr.
13	VCM Cracker thermal efficiency improvement	The possible improvement was quantified and ways to acheive optimum performance outlined.Potential benefit is ~ 0.2 MM Euros.

Capital Projects Support

	Project	Overview
14	Ethylene plant capacity expansion from 3.4 MMPPD to 4.1 MMPPD	Feasibility check of proposed process scheme for capacity expansion was done. Optimum sizing of proposed new equipment was determined and economic evaluation of proposed modifications was done. Rating of existing equipment at 4.1 MMPPD rates was done.Energy savings is estimated to be $ 5.2 mm/yr.
15	Economics of Radiant coil replacement in small furnaces	Evaluated economics of replacing radiant coils in small furnaces with ANK coils. Potential savings estimated to be ~ $2.5 million/yr on account of higher ethylene yields and reduced energy consumption due to replacement with ANK coil.
16	Improved Ethylene recovery from Demethanizer overhead	Explored options to improve ethylene recovery from Demethanizer. Suggested a new knockout pot for separation of condensed hydrocarbons from expander stages and recycling of it to Process Gas Compressors for recovery, providing savings of ~ $1 million/yr.

17	DMS Replacement by Sour AGRU feed.	Scheme to provide a side stream from sour feed (Acid Gas Removal Unit inlet) to sweet feed in furnaces. To utilize H2S present in sour feed in place of Dimethylene Sulphide(DMS). Objective was to reduce DMS injection rates by at least ~ 50 %.
18	Two stage condensation at Expander inlet (Cold box)	Revised process developed and engineered to carry out condensation across the chilling train (from –70°C to –120° C) in two steps, allowing a substantial gain in CGC power due to reduction of the recycles and improved methane separation. The estimated savings will be significantly higher if the additional power is utilized for throughput increase. ~ $2 million in annualized savings envisaged.
19	Determination / Retro-engineering of downstream capacity to cater to reactor / reaction changes.	Different configurations were considered to determine the operational and economic feasibility for addition of new tower to the existing system of fractionation. The analysis enabled confirmation of the investment decision and also enabled the right sizing of the capex.
20	Estimation of correct feed tray location in BD purification using simulation.	Analysis of alternate feed tray locations on the upstream column in the BD purification train. Change of feed tray location enabled capacity increase by 11%.
21	Scoping Study for producing high purity hydrogen and methane rich tail gas from Demethanizer overheads for the expansion case Demethanizer feed rate of 160 KLb/hr	Three new process schemes were evaluated at Demethanizer feed rate of 160 KLb/hr. Determined optimum hardware modifications (new expander compressor assembly, modifications in feed chiller train, new core exchangers and pump). Preliminary sizing and spec sheet for new equipment provided.
22	Ethylene plant capacity expansion from 65 tpd to 75 tpd ethylene production	A simulation model of an Ethylene facility was built using Hysys software for identifying hardware limitations at higher throughputs and evaluating various debottlenecking options,recycling philosophies etc. and arrive at the most economically attractive option.
23	Adequacy of Dryer regeneration system	Adequacy of Dryer Regeneration system hydraulics at increased ethylene capacity checked and suggested modifications to improve the hydraulics of the system.
24	Ecomomics of Additional cooling water cell	Economic impact of installing a new cooling water cell Inethylene plant was evaluated and optimum capacity of new cell was determined. The benefits realized due to increased production is $ 1.0 mm/yr.
25	Installation of additional heat recovery at VCM quench tower overhead	Basic Engineering package for the same, as per client requirements.

Energy Savings Projects

Sr. No.	Project	Overview

26	Study of energy loss in furnaces due to excess O2 content in flue gas and high stack temperature.	Fuel gas consumption in furnaces has an impact on the operating economies of furnaces. Excess fuel gas firing not only results in loss of fuel gas but also in excess soot formation, thereby reducing run length of furnaces. Studied High Load Fuel Gas Consumption, Fuel gas header pressure variation and Furnace Fuel Gas Firing Imbalance. ~ $5 million in benefits realized in one year as a result of this study.
27	Pinch Study	Pinch analysis of ethylene plant to identify energy saving opportunities and debottleneck Propylene Refrigeration (PR) system. Main Recommendations : Install new exchangers to recover heat from - 3rd, 4th and 5th stage discharge streams of CGC (preheat ethane feed) - Quench Water (use as reboiling medium in Deethaniser & secondary Deethaniser, preheat Caustic Tower feed and C2H2 reactor feed) - C2 splitter overhead vapor (preheat ethane feed) - ERC vapors (preheat Deethaniser feed) Identified saving potential $ 8.5 million/year (@ $8.61/MMBTU) ⊡ Reduction in steam usage by 100.8 MMBTU/hr ⊡ Reduction in PRC work by 8.16 MMBTU/hr

Statistical and Simulation Modeling Support

Sr. No.	Project	Overview
28	Statistical modelleing to predict Furnace run length, furnace Optimization and runlength Gain	Developed a statistical model to predict run length of furnaces. All process parameters input to the model. The model was then used for (a) target optimization by adjusting feed rate/dilution steam rate in pass A/B; (b) To plan decoke cycles to maximize feed utilization (c) Furnaces optimization to maximise yields. Runlength gain was achieved by close monitoring of Furnace parameters, feed and COT trim adjustment and burner management, utilizing the model. Savings of ~ $2.5 million/yr were achieved due to increased runlengths and reduced decoke cycles.
29	Reduction in Caustic consumption in caustic tower	Modelled caustic tower and helped in reduction of Fresh caustic consumption
30	Rationalization of tank farm. Using a customized LP program	Model built with a total of ~ 55 tanks, catering to 37 products. Utlilization of the model as part of an ongoing monitoring program, enabled product run time increase, more production with less number of product changeovers, reorganization of business plan, addition of 2 new tanks, etc.

31	Explosion hazard due to build up of methylacetylene (MA) concentration in C3 Splitter	The C3 Hydrogenation reactor is designed to remove undesirable methylacetylene (MA) & propadiene (PD) present in the raw C3 cut to meet the required product specifications. When reactor is under shutdown for regeneration or catalyst changeover activity, all the undesirable MA & PD pass onto C3 Splitter, resulting in their build up in C3 Splitter.This would lead to possible explosion hazard. A detailed model was built and used to perform an analysis of this explosion hazard and specific recommnendations were provided to avoid this hazard.
32	DSM (Decision Support Model) for CEO/ CFO use	Model was built and is deployed in assisting Strategic decision making for a multiple site and multi product company. Used for strategic decision making.
33	Furnace Conversion Optimization model	Developed excel based LP model for optimization of plant operation using Lindo software. Being used regularly to determine optimum furnace conversion targets and optimizing furnace operation for max profitabilty. Benefits realized is $ 1.0 mm/yr.In addition to optimization, LP model is a handy tool for what-if analysis, decision making for debottlenecking and feedstock evaluation.
34	Process Simulation Model and LP Optimizer for Oleochemicals plant	A LP model was developed for predicting the optimum blend of natural oils, plant throughput and product slate for maximizing profit based on raw material and product prices and other user-defined constraints such as a fixed volume of product stream, financial criteria etc.
35	Network Planning and Profit Optimization Model	This is a LP based model that determines the optimum number of warehouses and their locations and aids planning of production and distribution, based on demand and sales forecasts.
36	Distribution Network Optimizer	This model utilises LINGO software and is designed to determine the minimum Supply Chain Distribution cost subject to certain customer-related and legal constraints.
37	Wet Chlorinated Effluent Treatment Unit	A process simulation model was built and used for developing a scheme for separation of some desired components from Wet Chlorinated effluent.
38	Demand Forecasting	Developed statistical models for forecasting the demand of various Stock-keeping Units (SKUs) for a paint industry. The model included seasonal trends.
39	Operating Training Simulator (OTS)	This dynamic simulation model mimics transient operations such as start-ups and shut-downs, instrument failures etc. and is being used for training and performance evaluation of fresh operators.

Process Optimization Projects

Sr. No.	Project	Overview
40	Improving purity of JT Ethylene stream from existing 91mol% to 99 mol %	Existing C2 splitter found to be inadequate to process JT Ethylene stream. Determined optimum sizing for the new column (minimum of 40 trays & diameter of 4 ft) to achieve 99 % mol ethylene product purity.
41	C3 Splitter performance evaluation & optimization	Effect of C3(propane) vapor recycle draw on C3 splitter operation was studied. A decrease in vapor recycle draw was suggested to reduce propylene loss. Propylene loss from vapor recycle draw is in the range of 45 to 50 mol % (targetted propylene loss was 4 mol %) which leads to propylene loss of ~ 800 to 1000 kg/hr. The potential saving by reducing the propylene loss in vapor recycle stream is ~ 5.8 MM$ per annum.
42	C2 Splitter performance evaluation & optimization	A stand alone simulation model was prepared for optimization of column parameters to minimize the Ethylene loss from the bottom of the tower. The ethylene loss was mainly reduced through daily recommendations from optimization report by optimizing overhead ethane, Intermediate reflux and controlling the control tray temeperature. Resulting benefits realized: ~ $2 million/yr.
43	C2 Hydrogenation study to reduce Ethylene loss	The project analyzed the effect of independent parameters on the conversion and selectivity. To maximize the overall ethylene gain, the overall temperature difference was optimized, leading to reduction in Ethylene loss in C2 Hydrogenation. Benefits realized: ~ $1 million/yr.
44	Furnace Conversion Control scheme	Study of existing furnace conversion control scheme. Suggested a new control logic for achieving equal furnace coil outlet temperatures.
45	Optimization of process conditions.	More efficient production with reduced losses and reduced recycle, reduction in off spec production. ~ $4 million in benefits realized within two years.
46	Minimizing batch time	Conducted laboratory - scale trials for determining the optimum operating conditions for reducing batch time. The reaction involved bubbling of a gas through a liquid reactant in presence of solid catalyst particles.
47	Controller Tuning	Tuning of critical controllers in Ethylene plant was carried out at site to minimize the variation of process parameter, enabling steady operation. The savings due to improvements is estimated to $ 0.75 - $1.0 mm/yr.
48	Hydraulic Model for cooling water network	A 'Hydraulic Model' for the cooling water network of Ethylene plant was developed using Aspen simulation. The hydraulic model predicts distribution of cooling water flow in the network and helps in analyzing various operating scenarios and optimizing cooling water flows in the network.
49	Reduction of variable cost of production	More efficient production. Reduced energy consumption.

Basic and Detailed Engineering Projects

Sr. No.	Project	Overview

50	Assistance for development of Basic Engg. Package of Propylene Recovery Unit (PRU)	Scope of Work includes Process Simulation Model of PRU in Aspen Plus (2004.1), Heat & Mass Balance, Process Flow Diagram, Piping & Instrumentation Diagram, Heating & cooling Curves for Heat Exchangers, Column Sizing & Process Data Sheet for Columns.
51	Assistance for development of Basic Engg. Package for Condensate Recovery Unit	Scope of Work includes Process Simulation Model in Hysys (2004.2), Heat & Mass Balance, Heat Exchanger Sizing.
52	Pump & Control Valve Hydraulics for DHT, Sour Crude & Vacuum Unit.	Scope of Work includes PID review, Selection, Sizing and specifications of Control valves, Safety valves & Flow elements, Completed 60 Pump / Control Valve hydraulics in 10 days.
53	To Rate/Check the Existing Refineries (Nixon & Mermantau Refineries) for New Capacities	Scope of Work includes Simulation of two refineries in Aspen Plus (2004.1) for different capacities, Heat & Mass Balance, Equipment Adequacy checks viz., Furnaces, Columns, Pumps, Heat Exchangers (Air Cooled and Shell & Tube) & Vessels, To generate Process Data Sheets for new equipments, Relief Valve & Flare Header Sizing, Hazop Participation, Process Flow Diagram (Mark up), Piping & Instrumentation Diagram (Mark up), Adequacy check of Packages, To assist client for all Techno-Economical Activities.
54	Design of Anhydrous Ammonia Storage & Injection System.	Scope of Work includes Design Basis, Process Description, Process Flow Diagram, Line Sizing, Piping & Instrumentation Diagram, Process Data Sheet for Ammonia Vessel, Instrument Process Data Schedule, Control & Interlock Philosophy, Safety valve Sizing & Datasheet.
55	Assistance for Extended Basic Engineering for Propane Dehydrogenation (PDH).	Scope of Work includes Process Simulation Model in Aspen Plus (2006), Process Flow Diagrams, Line Sizing, Pump & Control Valve Hydraulics, Piping & Instrumentation Diagrams, Equipment Design & generate Process Data Sheet , Heat Exchanger Design, Control Logic & Interlock Philosophy, Relief Load Analysis.
56	Basic and Detailed engineering packages for Tetra Hydro Furan (THF) dehydration	Developed a process scheme for removal of moisture and some organic contaminants from spent solvent to enable recycling of the solvent. The efficacy of the developed process was demonstrated in laboratory scale trials and then the commercial scale plant was designed. Scope included PFD & PID development, equipment sizing, control philosophy, piping etc.
57	Virgin C5 + stream cracking facilities	Detailed engineering of modifications to an existing gas cracker to enable cracking of liquid feedstock. Scope included design of storage tank, stress analysis of critical piping, equipment foundation drawings, etc.
58	Feed Water Heaters and Surface Condenser for 40 MW Power Plant	Design of special heat exchangers using HTFS / HTRI software for thermal design and vibration analysis.Scope included mechanical design, general arrangement drawings and fabrication drawings. Computational Fluid Dynamics (CFD) was used for hydraulic analysis of steam condensation and elimination of non - condensables through the ejectors.
59	Process Design of Pinch Exchangers	Optimal process design of 5 new pinch exchangers determined and PFD mark-up and line list for proposed modifications provided.

60	Assistance for development of Detailed Engineering Package of Motor spirit Quality Up gradation Unit	Scope of work includes Process Datasheets, Pump Hydraulics, Pressure Profile Study, Instrument Datasheets, Technical Recommendation, Bid evaluation, Relief Valve Analysis and Flare header sizing.
61	Assistance for development of Detailed Engineering Package of Rubber Chemical Unit	Scope of work includes Heat Exchanger Design, Pump Hydraulics and Control Valve Sizing.
62	Assistance for development of Detailed Engineering Packages of Crude distillation, Vacuum distillation, Diesel hydrotreater, Diesel Dewaxing and Desulphurization units	Scope of work includes Pump Hydraulics, Pressure Profile Study, Line List, Instrument Datasheets, Relief Valve Analysis and Control Valve Sizing.
63	Assistance for development of Detailed Engineering Packages of Delayed Coker Unit	Scope of work includes Simulation Support on ProII, P&ID Development, Pump Hydraulics, Line List, Instrument Datasheets, Heat Exchanger and Air Coolers Design & Evaluation using HTRI, Relief Valve Analysis and Fired Heater Specification & Evaluation.
64	Assistance for development of Detailed Engineering Packages of Calcium Chloride Plant	Scope of work includes Heat & Mass Balance, P&ID Development, Pump Hydraulics, Line List, Instrument Datasheets, Heat Exchanger and Air Coolers Design & Evaluation using HTRI.
65	Assistance for development of Feed Package for Debutanizer	Scope of work includes Column Simulation using Hysys, P&ID and PFD Mark-Ups, Pump Hydraulics, Pressure Profile Study, Heat Exchanger Design & Evaluation using HTRI.
66	Assistance for Feasibility Study and development of Detailed Engineering Packages of LVGO Hot separator	Scope of work includes Simulation using Hysys, P&ID Mark-Ups, Pump Hydraulics, Line List, Instrument Datasheets, Control Valve Sizing, Relief Valve Analysis and Tie-In List.
67	Assistance for Flare network mitigation study	Scope of work includes identification of all overpressure scenarios, determining required relief rate for each scenario using simulation. Determining the relief device capacity and inlet/outlet piping pressure drops. Study of global scenarios. Relief Load Study and Flare Header Design.
68	Assistance for development of Detailed Engineering Packages of Vinyl Chloride Monomer Plant, Offsite and Utilities	Scope of work includes P&ID Development, Pump Hydraulics, Line List, Instrument Datasheets, Equipment Sizing and Process Datasheets.
69	Assistance for development of Detail Engineering Packages of Sulphur Recovery Unit, Alkylation Unit and Butamer Unit	Scope of work includes Pump Hydraulics, Line Sizing, Pressure Profile Study, P&ID Mark-Ups and Equipment Sizing and Process Datasheets.
70	Assistance for development of Procedures for Ethylene Plant	Scope of work includes Operating procedures, Start-Up and Shut-Down procedures, Emergency procedures and Interlock Philosophy.
71	Assistance for development of Basic Engineering Package of Methanol Plant	Scope of work includes Control Valve Sizing, Relief Valve Analysis and Line Sizing.
72	Basic Engineering Packages for Crude Distillation Unit, Vacuum Distillation Unit and Saturated Gas Plant for Refinery configuration of 0.3 MMBPD crude processing	Scope of work includes P&ID Development, Equipment Sizing and Process Datasheets, Pump Hydraulics, Pressure Profile Study, Line List, Instrument Datasheets, Relief Valve Analysis and Utility System Design.

73	Relief Device Study as per API guidelines for Repsol Petroleo, S.A. for Crude Distillation Unit and Vacuum Distillation Unit	Scope of work includes identification of all overpressure scenarios, determining required relief rate for each scenario using Petro-Sim simulator. Determining the relief device capacity and inlet/outlet piping pressure drops. Study of global scenarios.
74	Heat Exchanger for Crude Distillation Unit and Vacuum Distillation Unit for expanded capacity	Scope of work includes Heat Exchanger Sizing using HTRI and Process Datasheets.
75	Hazop Study for Delayed Coker Unit, Sulphur Recovery Unit, Fluid Catalytic Cracking Unit, Tankages and Utilities	Scope of work includes Chairing Hazop study and Report preparation.
76	Debottlenecking Study of VCM and EDC columns and Auxillaries	Scope of work includes Heat & Mass Balance, Simulation study using Aspen, Heat Exchanger Design & Evaluation using HTFS, Equipment Sizing and Process Datasheets, Column Adequacy Check.
77	Debottlenecking Study of HCL-Column Refrigeration System	Scope of work includes Heat & Mass Balance, Simulation study using Aspen, Heat Exchanger Design & Evaluation using HTFS, Equipment Sizing, Process Datasheets and Line Sizing.
78	Heat Exchanger for Kerosene Unit	Scope of work includes Heat Exchanger Sizing using HTFS and Process Datasheets.
79	Feed Package Review of Molten Sulphur storage & loading facility	Scope of work includes Feed Package Review report, Tank Vent Sizing, Heatting Coil Sizing.
80	Corrosion Risk Analysis Study and Material Selection Study for Condensate Stabilizer Unit and Condensate Pipelines	Scope of work includes Corrosion Risk Analysis and Material Selection Study as per API and Report preparation.

Relief System Engineering & Risk Analysis Projects

Sr. No.	Project	Overview
81	Relief Device Study as per OSHA guidelines for Valero refineries at Aruba, Mckee & Paulsboro	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios.
82	Relief Device Study as per OSHA guidelines for ConocoPhillips refineries at Borger, Ferndale, Los Angeles & Santa Maria	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios. Revalidation of the plant considering new throughput and compositions.

83	Relief Device Study as per OSHA guidelines for Marathon refineries at Canton & Texas City	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios. Revalidation of the plant considering new throughput and compositions. Flare network building and its analysis. Mitigations of all concerns of relief devices.
84	Relief Device Study as per OSHA guidelines for Exxon refineries at Beaumont	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios. Flare network building and its analysis. Mitigations of all concerns of relief devices.
85	Relief Device Study as per OSHA guidelines for Sunoco refineries at Eagle Point, Neal & Toledo	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios. Revalidation of the plant considering new throughput and compositions. Flare network building and its analysis. Mitigations of all concerns of relief devices. HIPPS study
86	Relief Device Study as per OSHA guidelines for Frontier refinery at El Dorado Crude section	PSV Study after Revamping
87	Adequacy check of safety relief valve system in Ethylene plant	Adequacy of existing safety relief valves was checked for 460 mmppy ethylene capacity. New safety valves and modifications in inlet and outlet piping suggested.
88	Relief device study as per OSHA guidelines for Marathon refineries at Robinson,Detroit,St.Paul and Ganyville	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios.
89	Relief device study as per OSHA guidelines for Chevron, Pascagoula	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios.
90	Relief device study as per OSHA guidelines for Exxon refining at Fawley, Joliet and Exxon, Singapore	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios.

91	Relief device study as per OSHA guidelines for Petronas refinery	All overpressure scenario identification on each equipment of refinery. Providing detailed rational for each scenario and determining the required relief rate calculations using PRO II / ASPEN, HYSYS simulators. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios. Revalidation of the plant considering new throughput and compositions. Flare network building and its analysis. Mitigations of all concerns of relief devices.
92	Relief study for Tessenderlo	Overpressure scenario identification for VCM plant. Providing detailed rational for each scenario and determining the required relief rate calculations using HYSYS simulator. Determining the relief device capacity and inlet outlet pressure drops. Detail study of all global scenarios.
93	Flammable substances inventory study	A study was done to determine the flammable substances in the ethylene unit and their inventory and documenting substances with an invemtory above the threshold quantity.