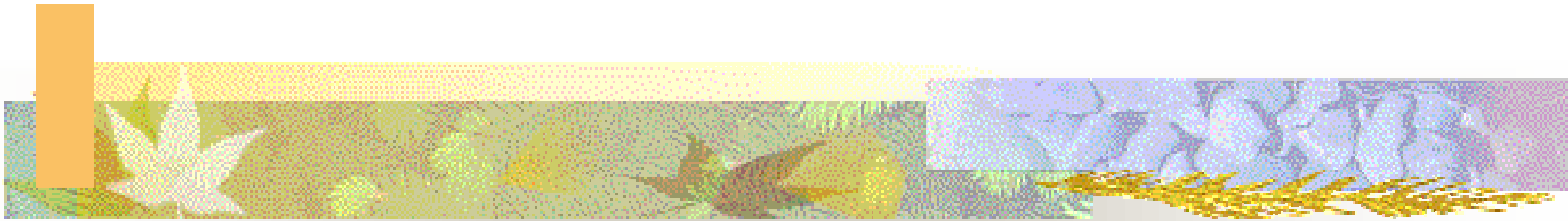


ETHYLENE PLANT REVAMP - TITAN'S EXPERINCE



Presented by

Tham Chee Mun - Titan Petrochemicals (M) Sdn Bhd

Sew Nyit Tong - Titan Petrochemicals (M) Sdn Bhd

Karl K. Kolmetz - Westlake Group





Highlights

- Objectives of revamp
- Preliminary studies
- Planning a load test
- To the limits
- Challenges



Objectives of The Revamp ...

- Health, Safety and Environmental Requirements
- Expansion of Nameplate
- Process Improvement
- Deviation From Original Design Basis





Health, Safety and Environmental Requirements ...

- Commitment to Occupational Safety and Health Act (OSHA) and Environment Quality Act (EQA)
- Address safety and operability aspects overlooked during Hazard and Operability Study (HAZOP)
- Examples:
 - Phasing out CFCs' in refrigeration
 - Reduce noise level





Expansion of Nameplate ...

- Escalation of monomer price and demand dictates the need to expand
- Revamp requires less initial capital compared to building a new plant





Process Improvement

- Better process integration for efficient energy consumption yet maintain a stable operations
- Replace old and inefficient equipments to lower overall energy usage
- To test out new and alternative technology that promises better energy efficiency



Deviation from Original Design

- Recovering the valuable by-products to increase product value
- Added ability to crack different feedstock
- To increase the plant flexibility to absorb the the changes in product distribution



Preliminary studies

- Theoretical Bottlenecks
- Reference Plant
- Acceptance Test Run Data
- Process Simulation



Identifying theoretical bottlenecks

- Tabulate maximum capacity of all equipments
- Scale up throughput to identify theoretical bottlenecks
- Cost estimation for initial feasibility study



Past experience of reference plant

- Reference plant using the same technology can help to identify potential bottlenecks
- Revamp proposal may be applicable to both ethylene units
- Both units of Titan Ethylene Plant applies the same Advance Recovery System (ARS)

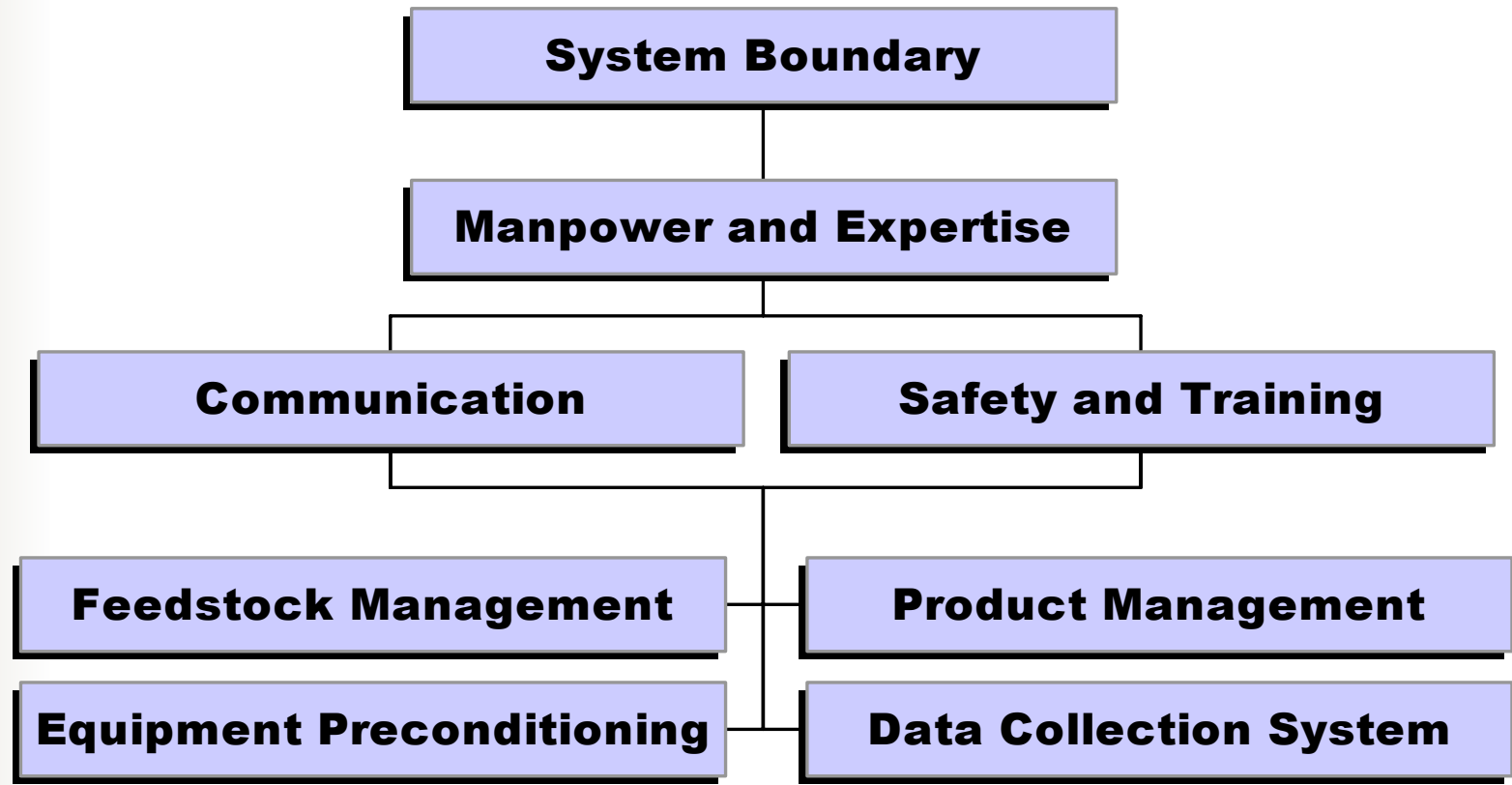


Acceptance Test Run Data

- The Acceptance Test Run data is the best baseline data of the unit
- Baseline should be the most optimized condition
- Any deviation from design should be resolved



Planning a load test





System Boundary

- To dissect the plant into individual sections
- Every section will need different feedstock and mode of operations to test its limits
- Furnace, quench, compression, depropanizers, ethylene recovery, propylene recovery, fuel gas system, C4 hydrogenation, pygas hydrogenation, aromatic plant, utilities, terminal



Manpower and expertise

- Multi-discipline team is assembled
- Process engineering, operations, laboratory, maintenance, engineering, planning analyst, shipping, etc.
- External support from JGC Corporation, Westlake Group, YPC and SPC



Communication

- Essential to be fast, clear and objective
- One dedicated channel of communication to update progress, voice concerns and disseminate instructions
- Communications across all departments and layers of management
- Faster decision making
- Establish “esprit de corp”



Safety and training

- Detailed written procedures
- Discuss critically all intended moves in a HAZOP fashion
- Ensure understanding of objectives, intended changes, potential limits and mitigation plan
- Target: Zero industrial accident and process upset



Equipment preconditioning

- Ensure no false bottlenecks are encountered
- Ensure sufficient and valid data to be collected
- E.g.- calibration of field and lab instruments, decoking of furnace, regeneration of dryers and reactors, etc



Data collection

- Manual logging is time-consuming and counter-productive
- Efficient automatic logging using InfoPlus 21 software
- Data can be downloaded into MS Excel spreadsheet for easy reference





TO THE LIMITS ...

- Furnace load test
- Critical tower hydraulic test
- Increase steam-to-oil ratio
- Increase rates
- Increase severity
- Change feedstock
- Mechanical performance check



Furnace load test

- First to be tested being the most expensive piece of equipment and the heart of the ethylene plant
- 1 furnace with 2 zones were tested
- Mechanical and metallurgical integrity was checked by Reliability.
- Limitation defined as maximum feed rate or mechanical constraints



Hydraulic test of critical towers

- After knowing furnace limitation, the recovery section must be able to sustain similar load
- No compromise of product quality
- Reflux rates were raised to test maximum liquid load on trays
- Helps to test actual tray efficiency



Increase steam-to-oil ratio

- To test the maximum heat removal capacity of the quench section
- To study the heat transfer performance of the quench oil/quench water circuit
- Sensitivity analysis of QO viscosity change to heat transfer performance



Increase furnace feed rates

- To test whether the overall bottleneck is at the cracked gas compressor (CGC) or the recovery section
- Best way of testing the capacity of the CGC is by providing a uniformly distributed cracked gas flow
- Limitation will be maximum governor speed on CGC or product splitters flooded





Increase cracking severity

- To test the fuel gas and hydrogen recovery section using high paraffinic naphtha at high cracking severity.
- Coil outlet temperature is increased
- Must not exceed capacity of front-end acetylene converter
- Limitation can be at the pressure control valves, dephlegmators, runback condensers, expanders or refrigerant compressors





Change feedstock

- To test the backend hydrogenation units and its associated fractionators
- Change to low paraffinic naphtha at low cracking severity





Mechanical performance check

- At high load situation, mechanical integrity of turbines and compressors must not be compromised
- Performance of units are critically evaluated
- Appropriate rotating equipment vendors were brought in





Challenges

- Consistency of Feedstock
- Integration of Titan Complex





Consistency of feedstock

- Planning of operations was difficult without knowing the feedstock quality before hand
- Wide array of feedstock available enabled every sections of the plant to be tested





Integration of Titan Complex

- Titan ethylene and polymer units are integrated in a symbiotic manner
- Outage of a polymer plant will force the ethylene unit to reduce load
- However, enabled us to test the capacity to produce cryogenic ethylene/propylene



Conclusion

- United and cooperative effort of all relevant parties is vital
- Fast, clear and objective communication is crucial
- Planning and coordination is essential





THANK YOU

