Project Management Symposium

Phillips 66 Wood River Refinery

Coker & Refinery Expansion Project

November 21, 2014

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Agenda

- Safety Fundamentals
- Wood River Refinery (WRR) Facts
- Coker & Refinery Expansion Project Overview
- Project Challenges & Outcomes
- Lessons Learned
- Best Practices & Other Practical Tips

Safety Fundamentals

"You Have the Time to Work Safely"

"You Have the Authority

& Responsibility to Stop Work"

Safety Fundamentals

Before starting any job, activity, or task; ask yourself these questions:

1) ***Have I done this work before & do I feel safe doing this work again (no red flags)?***
2) ***Am I committed to do the job the right way (no short-cuts)?***
3) ***Do I have the courage to stop my work or any other work I think is proceeding unsafely?***

If you answered *NO* to any of the above

DO NOT PROCEED WITH WORK &

CONTACT YOUR SUPERVISOR

WRR Facts

Largest refinery operated by Phillips 66

Total crude operating capacity of ~ 310 MBD

Produces 12.8 million gallons of products per day

~ 6.5 million gallons of gasoline per day

~ 4.2 million gallons of distillates per day

- Built in 1917
- 2,700 acres
- 875 Phillips 66 employees
- 400 routine contract workers

Borders four communities:

- Roxana
- South Roxana
- Hartford
- Wood River

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Coker & Refinery Expansion (CORE) – $3.8B Mega Project

New 65,000 B/D coker & associated units

Doubles processing capacity of price-advantaged, heavy crude

Increases gasoline & diesel yields

Asphalt flexibility enables additional heavy crude processing

Increases Cenovus integration with Canadian oil sands production

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CORE Project Facts

- 4,000 construction workers @ peak
- 175 miles of pipe =

  St. Louis to Indiana
- 100,000 yards of concrete =

  2 Empire State buildings
- 22,000 tons of steel =

  ½ Empire State building
- 3,000,000 feet of cable / wire =

  St. Louis to Dallas
- ~ 600 tie-ins to existing refinery

Brand new coker unit area under construction – Dec 2009

Module & Equipment Shipping

Modules:

Pipe Rack	102
Coker Complex	100
Sulfur Plant	40
Hydrogen Plant	16
Total	258

Module envelope: 60’ wide x 45’ tall x 210’ long

288 wheels under heaviest load

Equipment:

Heaviest: 1,953,000 Vacuum Tower

Longest: 200’ Hydrotreater Reactor

CORE Project Scope – New Units

- 65,000 B/D Delayed Coker & Coke Handling Facilities
- 105,000 B/D Vacuum Flasher
- 14,000 B/D Coker Naphtha Hydrotreater
- 85,000,000 SCFD Hydrogen Plant with 2,000# Compression
- 2 – 225 LTPD Sulfur Plants with Sour Water Stripper & Amine Treating

Coker Heaters & Coke Drums

Setting Vacuum Column

Coker Complex

Setting Hydrogen Plant Penthouse

Hydrogen Plant

Sulfur Complex

CORE Project Scope – Revamps / Re-starts

- Distilling Unit #1 – Metallurgy & equipment upgrades
- Distilling Unit #2 – Re-start idle Crude Unit
- Cat Cracker Unit #1 – Metallurgy upgrades
- Cat Cracker Unit #2 – Metallurgy upgrades
- Hydrocracker – Equipment modifications
- Hydrocracker Fractionator Column – Re-start idle Vacuum Flasher column
- Ultra Low Sulfur Diesel #1 – Unit expansion
- Ultra Low Sulfur Diesel #2 – Revamp & re-start idle hydrotreater

Distilling Unit #1 (DU1) Secondary Column Replacement

CORE Project Scope – Offsites & Utilities

- Waste Water Treatment Plant upgrades
- Caustic & ammonia unloading facilities
- Terminal upgrades & heavy haul road from Mississippi River to WRR
- New interconnecting piperacks
- New pipe bridges across State Hwy 111 & 3rd party railroad tracks
- Electrical feeders to new units *
- Expansion of propylene loading facilities
- New sulfur tank & loading rack
- New refinery air compressor
- Firewater tank, pumps & system upgrades
- Connection to Keystone Pipeline & crude tank farm piping modifications
- Diesel tank & diesel blender expansion

* Performed in conjunction with separate WRR 138kV Electrical Upgrade Project

Waste Water Treatment Plant Upgrades

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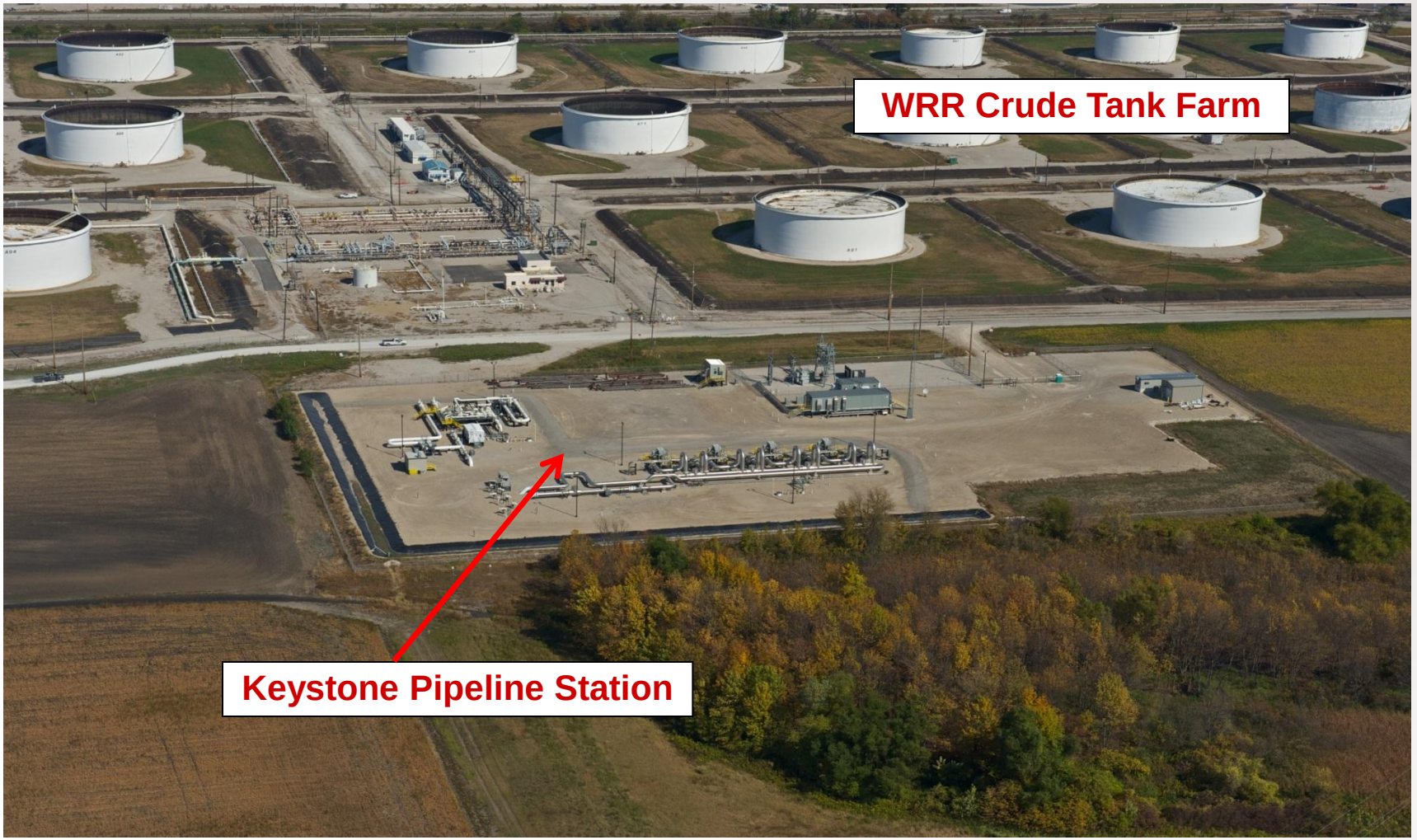
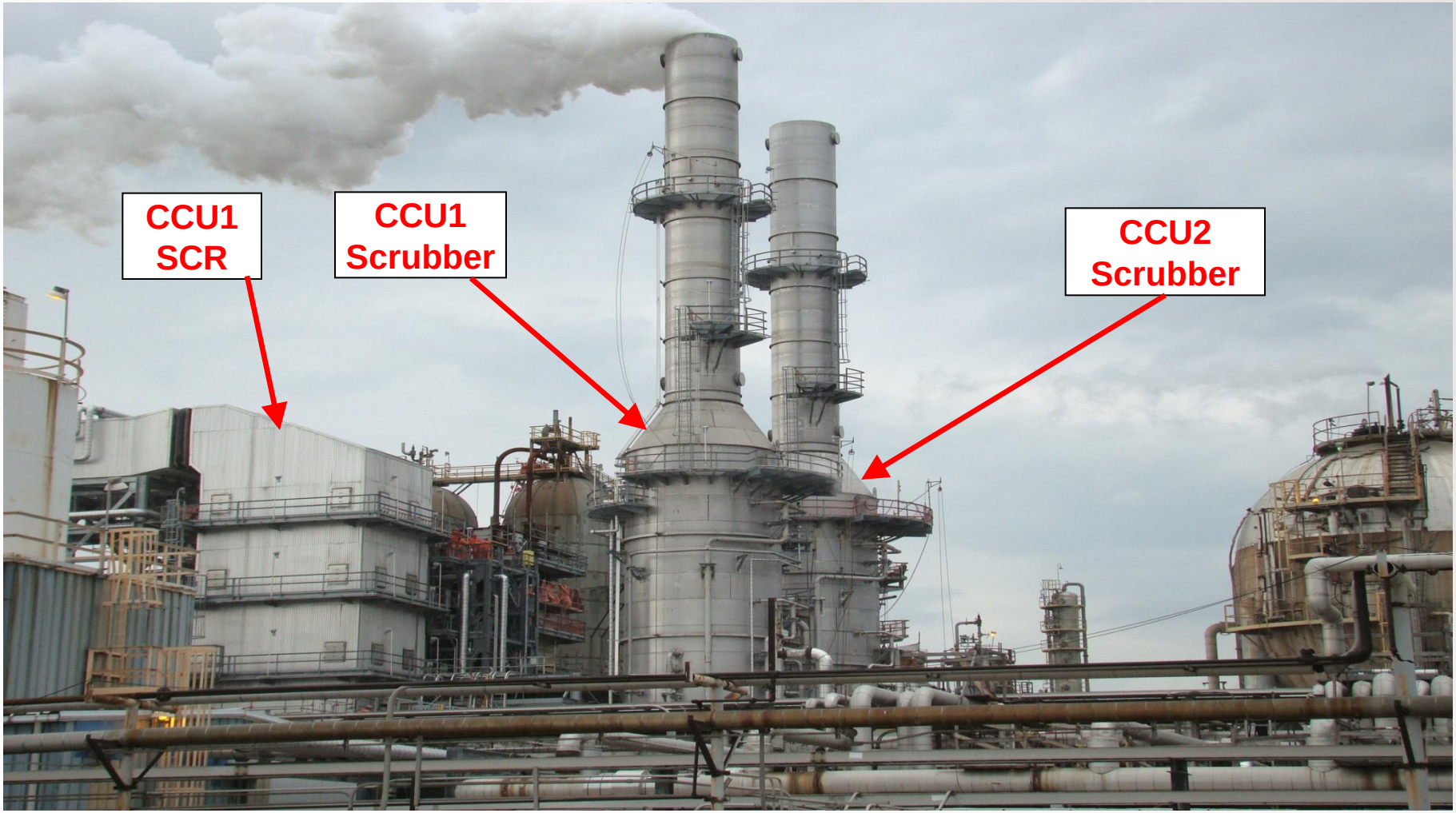
Keystone Pipeline Pumping Station



Cat Cracker Units #1 & #2 – Wet Gas Scrubbers & SCR's



Contracting Plan

	Coker Complex	Hydrogen Plant	Sulfur Complex	Revamp / Re-start Units	Offsites & Utilities
FEL	Fluor	CB&I	CB&I	Fluor	Fluor
Technology Providers	Coker – Coke Tech Hydrotreater – Axens Merox – UOP	CB&I	CB&I	None	None
Engineering & Procurement	Bechtel CB&I (Merox)	CB&I Fluor	CB&I	Fluor	Fluor
Module Fabrication	Gulf Marine Kiewit	CB&I	CB&I	None	Bay Limited
Construction	Bechtel Scheck Cherne	Cherne MC Industrial	URS Corrigan GRP	Cherne	Fluor MC Industrial GRP

CORE Project Challenges

- Difficult engineering & construction market @ authorization – booming economy with unprecedented commodity prices
- Difficult environmental & regulatory environment
- Very little company mega project experience & outside project professionals with mega project experience not readily available
- Labor availability in Midwest
- Heavy revamp work scope – significant work inside refinery operating units
- Significant Offsites & Utilities scope touching four corners of 2,700 acre refinery
- Managed additional FCC Wet Gas Scrubbers & 138kV Electrical Upgrade Projects
- Numerous deadlines to meet compliance dates & timing for unit turnarounds

CORE Project Outcomes

- Safety – TRIR 0.38 & LWCR 0.02 – 22.3 million work hours
- Timeline
  - March 2006 – Project development funding
  - May 2006 – Construction & operating permit application – final approval in September 2008
  - December 2007 – Full project funding approval
  - November 2011 – Coker Unit start-up – 11 months longer than @ authorization
    – Permit (+2), piling (+3), river shipping (+3), & field performance / rework (+3)
- Project capital costs 11% over authorization after adjusting for deferred work
- Revamp project work successfully completed during large turnarounds
- 300 modules & other heavy equipment off-loaded @ river, transported, & set flawlessly
- Good start-ups with mechanical & operational issues resolved during challenging 1st year
- 3rd party benchmarking ranked project as…..
  - World class in HSE performance & project execution performance
  - Least cost growth & second fastest of other major projects during same time period
  - Excellent in post FEL2 scope definition & adherence throughout project life cycle
  - Owner commitment to staff project with experienced operations personnel
  - Owner steering team & refinery management involvement in key decisions
  - Strong interface management between project areas

Safety – Lessons Learned

- *"Key to success"* – best performing areas had excellent craft engagement & ability to win *"hearts & minds"* of the crafts
- *"Key to success"* – owner has significant influence on safety performance by setting clear expectations & providing necessary support & resources
- Safety procedures *"bridging"* documents allow comparison of general contractor's safety procedures with owner requirements & enables contractor to utilize their established programs
- *"One-stop shop"* for craft orientation & training streamlines on-boarding process
- *"Key to success"* – member of PMT met with all crafts in small groups to discuss business objectives, project background & specific scope of work, & safety expectations
- Site-wide Safety Leadership Team, Area Safety Leadership Teams, & Craft Safety Teams engaged team members & effectively shared incident learnings & common safety trends across the site
- Proper balance of positive recognition & personal accountability to follow safety procedures achieved the best results
- Recognition programs aimed specifically at the crafts, participation in the safety program, & demonstrating desired behaviors are most effective
- Battling complacency by keeping the message fresh

Project Organization / Governance – Lessons Learned

- *"Key to success"* – adequately staffed, integrated project team (PMT) with highly involved owner members
- Project & construction management by owner reduced *"layers"* & allowed owner to be more involved in decision making – downside risk is adequately staffing the team
- Matrix organization with both vertical & horizontal integration has pros & cons
- Develop team charters & detailed roles & responsibilities using *"RACI"* charts
- *"Key to success"* – PMT effectively engaged stakeholders – Steering Committee & Refinery Management – in key decisions to ensure alignment
- Consider *"Deputy Project Director"* role when bringing in outside company project leadership – potentially less disruptive to project team & maintains effective communications with senior management

Project Execution Plan

- *"Key to success"* – final contracting strategy in place before FEL3 to allow adequate time to develop execution plans & organization to support the strategy
- *"Key to success"* – minimize all changes to scope, people, execution plan, & contracting strategy
- *"Is it safe? Does it work?"* – Commitment to scope adherence throughout project life cycle minimized changes & disruptions during project execution
- *"Key to success"* – continuously monitor & mitigate risks – develop detailed plans to reduce likelihood &/or consequence with contingency plans having *"triggers"* to initiate action
- Interdependency & complexity of risks, especially on mega projects, requires experienced subject matter experts to assess & mitigate
- *"Begin with the end in mind"* – develop information management plans to ensure documents are organized, stored properly for easy reference, & ready for turnover to the business unit at project completion

Project Development

- *"Key to success"* – *"Do the Right Project"* – clear business objectives lead to clear project objectives
- *"Key to success"* – structured project development process with funding gates ensures good scope definition & alignment before proceeding to next phase
- Document key scope decisions during project development to avoid recycle
- Early involvement from Operations (*"Prepare-to-Operate"*) team to identify scope
- Utilize structured process on strategic decisions to quantify & better understand risks to ensure alignment
- *"Cold eyes"* peer reviews improve project definition & planning

Engineering – Lessons Learned

- *"Freeze"* engineering standards during project development – subsequent updates can be reviewed on case-by-case basis with management approval
- *"Key to success"* – strong presence in EPC contractor's office during FEL & detailed engineering
- Utilize P&ID *"go-by's"* for similar equipment applications & pictures of *"what good looks like"* to improve design efficiency
- *"Key to success"* – interface tables were effective in documenting design & physical interfaces between areas
- Utilize tagging system during model reviews to document comments & ensure updates are incorporated into the model
- Emphasize *"no changes"* following model reviews to keep engineering on track

Quality – Lessons Learned

- *"Key to success"* – strict adherence to approved manufacturers & suppliers list – alternates must be approved
- Develop a quality surveillance program in FEL to establish the level of inspection required based on commodity & criticality
- *"Key to success"* – utilize inspection & test plans (*"ITP's"*) to define requirements & ensure alignment
- Document quality issues via Non-Conformance Report (NCR) to ensure resolution & share findings both internal & external to the project
- *"Key to success"* – routine presence @ fabrication facilities is key to quality product & on-time completion

Procurement / Contracts – Lessons Learned

- Flexible contracting strategies worked well & varied depending upon nature of work, timing, location, availability of contractors, interface with turnarounds, etc.
- *"Key to success"* – develop a detailed procurement plan to ensure equipment & material delivery to the module fabricators or field meet *"required at site"* dates
- *"Key to success"* – develop a contracting *"quilt"* & detailed contracting plan to ensure adequate resources & time in schedule to execute the plan
- Develop robust transportation plans (i.e. barge shipping, permitted loads, etc.) with risk mitigation & contingency plans
- Ensure warranties & performance guarantees extend past start-up & initial operation
- Material management keys – secure laydown areas, real time data entry system, proper indoor storage for appropriate items, & streamline process for procuring / issuing material
- Develop a surplus material plan early in the project to maximize value – attention to material storage requirements are key – re-deployment within the project provides best value

Construction – Lessons Learned

- *"Key to success"* – monthly Job Progress Meetings using Tripartite approach were effective – Business Managers, general contractors, & PMT present
- Staff experienced construction management on PMT in FEL
- Develop comprehensive site management, logistics, & shared services plans
- *"Key to success"* – modular construction successfully reduced field labor requirements by ~ 20%
- Have robust heavy haul / heavy lift plan in place, including critical lift procedures
- Significantly under-estimated the scale & cost for temporary facilities – need one owner & budget to manage & construct these facilities
- *"Key to success"* – plans for transporting crafts to work areas & location of break facilities critical to maximize *"time on tools"* & field performance
- Good material management plans & *"bag & tag"* methods to organize materials for the field improves performance
- Developed web-based craft forecasting & allocation tool still in use today
- *"Key to success"* – exit strategy for general contractors transitioned punchlist items & start-up support to local contractors to allow earlier demobilization

Modularization – Lessons Learned

- Drivers
  - Cost – not a strong driver although likely somewhat lower cost
  - Schedule – can be a driver especially with prolonged permitting
  - Field labor availability – modularization reduces field labor demands
- Define & ensure adherence to module *"envelope"* sizes – include module shipping envelopes in 3-D model for design check
- Consider module fabrication as an extension of site construction – not as a procurement purchase order
- Module-to-module fit-up went well – no need for *"field fit-up"* pieces
- Standardize module design & lifting lugs as much as possible
- Complete module work in shop – do not transfer work to site – rigorously check-out
- Projects with significant modularization should move from area to system construction completion relatively soon after module setting

Prepare-to-Operate – Lessons Learned

- *"Key to success"* – early staffing of Prepare-to-Operate team improved quality of project definition, commitment to *"no changes"*, & facilitated planning for commissioning & start-up
- *"Key to success"* – *"Eyes wide open"* document highlighted key aspects of refinery operation that would be significantly different following start-up of the new facilities
- Ensure general contractor has robust plan for monitoring construction completion to eliminate delays in walk-downs & system turn-over
- *"Key to success"* – *"Build-it-Clean"* program resulted in no foreign objects in equipment & piping via flushing, pipe ends capped at all times, etc. – program used in both the module shop & field
- Detailed commissioning & start-up plans should be developed early to ensure adequate budget, staffing, contractor support, & start-up materials

Project Controls

- *"Key to success"* – project controls including a detailed schedule should be in place, tested, & operating by authorization
- Align the work breakdown structure consistent with the execution plan & contracting strategy to optimize the Project Controls processes
- *"Key to success"* – quantity tracking tied to schedule progress drives performance
- Establish earned value *"Rules of Credit"* & periodically audit compliance to confirm schedule progress

Best Practices & Other Practical Tips

- *Safety fundamentals & craft engagement – win "hearts & minds"*
- *"Is it Safe? Does it Work?"*
- Tripartite approach
- Code of Excellence
- *"Eyes Wide Open"*
- Interface tables
- Document key project decisions
- Craft forecasting & allocation system
- Real estate agreements tracking spreadsheet
- Maximize *"Time on Tools"*
- Sponsor meetings
- *"Build it Clean"*