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**PBF Energy**

**Chalmette Coker 1 Restart and Unheading Project**

**Marie Wright / Alex Tajonar /Robert Mosley**





# Chalmette Coker 1 Restart Decision

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## Background

- **January 2020: implement MARPOL 0.5wt% sulfur Bunker Fuel Oil spec**
- **2010: Prior owner shut down Chalmette Coker 1 - CK1**
  - Began blending Resid Feed for CK1 into Bunker Fuel and Asphalt
- **2017: Decision to restart CK1 based on processing resid for MARPOL**
  - Major equipment was evaluated as “Go- No Go” to determine whether to progress restart project



# Overview

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## Unit Overview

- 1967: start-up - Bechtel Design
- 10-12 kBD: unit throughput
- August, 2010: unit shut down
- **Historically reliable unit**
  - 2 Small Coke Drums (20' D)
  - 15 -24 Hours Drum Cycle
  - Lower Pressure - 25 psig
  - Resid Feed
    - 18-30% CCR
    - 3.5-4.5% Sulfur
  - Steam Decoking / Pigging
  - Sponge / Shot / Transition Coke



# Work Scope

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- **Historical Constraints were evaluated to determine restart work scope**
  - Coker 1 ranges from 10 - 12 kBD - depends on crude slate
  - Coke morphology manageable - unit can process a variety of crudes
  - Offline decokes (pigging) conducted every two months
    - ❑ Crude oils caused inorganic fouling - perceived not be a future issue
  - Typical rate limits
    - ❑ Furnace TMT / duty limits
    - ❑ Wet gas compressor motor amps
    - ❑ Cycle time - as low as ~16 hrs, but typically 18-24 hrs
      - Sour Resid - high coke yield - drum outages
      - Sweet Resid - wet gas compressor limit
    - ❑ Heavy Gas Oil hydraulics
  - Historically - the unit ran reliably
    - ❑ Unplanned capacity loss: 1.1% - 3.6% demonstrated



# Scope Basis

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- **Scope basis**
  - Safety, reliability and environmental compliance
  - 2011 T/A work list, historical constraints, and major equipment conditions
- **Work Scope Considerations**
  - Refurbish existing equipment
    - Replace obsolete equipment
    - Evaluate lease vs. purchase equipment
    - Comply with regulatory changes since 2010
    - Refinery Sector Rule for Coker Venting
    - Operator Shelter for overpressure
- **Safety and Reliability Improvement Projects Evaluated**
  - Coke Drum Valve Interlocks
  - Coke Drum State of the Art Unheading Equipment
  - Reliability - electrical infrastructure / 2nd feed, feed tank, coke conveyor
- **RDS Engineering chosen as Engineering Contractor**



# Coke Drum Assessment Vital

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- **Coke Drums: only equipment that could jeopardize unit restart**
  - Cost and delivery
  - Reliability evaluation proved drums good
    - ❑ Reviewed prior operating data
    - ❑ Drum measurements completed
    - ❑ Obtained metallurgical samples from the drum and confirmed weldability
  - Recommendations to maximize reliability of drums
    - ❑ Install strain gauges, thermocouples, & accessible data 'logger'
    - ❑ Careful monitoring of cycle time vs. remaining life parameters
    - ❑ Regularly inspect the circumferential weld seams and skirt-to-shell weld



# Inspection Results: Key Equipment

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- **Heater**

- Cabin smoke test performed with minimal issues noted
- Convection section - retube due to inability to clean and inspect OD
- Radiant section - creep stress-rupture life calculations show end of life
  - Pig scoring also contributing factor

- **Fractionator**

- External CUI inspection complete with no major issues
- Internal inspection showed some tray replacements

- **Process piping**

- All piping external visual & targeted radiography/UT completed
- UT data analysis effort complete
- Piping identified for replacements/repairs based on data



# Inspection Findings

## Heater



Side wall radiant tubes



Burners



Roof/Shock Tubes

## Fractionator



### Corrosion Under Insulation

- Minimal pitting
- General scale corrosion



# Project Scope

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- **Safety Projects**

- Project improves unit to a “best in class” level on safety systems
  - ❑ Addresses prior Process Hazard Assessment (PHA) items
- Operator shelter blast zone compliance - installing blast resistant trailer
- Delta Valve State of the Art Automated coke drum unheading project
  - ❑ Includes Bottom Unheading with Center Feed and Top Unheading with Drill Stem Enclosure
  - ❑ Coke Drum Switching Valve interlocks

- **Environmental**

- Permit to restart approved
- Facilities will comply with new EPA Refinery Sector Rule
- Project will bring unit into compliance with NSPS Sub J - fugitive emissions



# Project Scope

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- **Refurbishment project includes**

- Detailed inspection and typical turnaround maintenance and upgrades
- Re-tubing full furnace includes new convection section
- Upgrade DCS to “state of the art” Honeywell controls
- Installing new furnace burner management system - PLC
- Replacing existing feed tank
- Replacing conveyor/crusher system
- Full Coke Drum Cutting Equipment and Controls Upgrade
- Replacing Fractionator Tray due to damage
- Replacing and upgrading Process Piping based on inspection

- **Electrical upgrade project**

- Provide dual unit feeds
- Replacing 480v system
- Install a new power distribution control building



# Coke Drum Switch Valve Interlocks Project

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- **All coke drum switch valves are manual**
  - Switch deck very crowded - poor ergonomics
- **Developed MOV / Interlocks Project**
  - Upgrading manually-operated isolation drum switching valves to motor-operated valves
  - Valves will be in new PLC interlock system
- **Conducted PHA to determine scope of valves to be interlocked**
- **Compared scope to other PBF Cokers to ensure consistency**
- **Completely redesigned switch deck**
  - Difficult to modify existing valves in place due to space constraints
  - Existing Deck will be demolished and replaced with new bigger deck
- **Developed control matrix based on Operator Drum Switch Procedures**



# Coke Drum Switch Valve Interlocks Project

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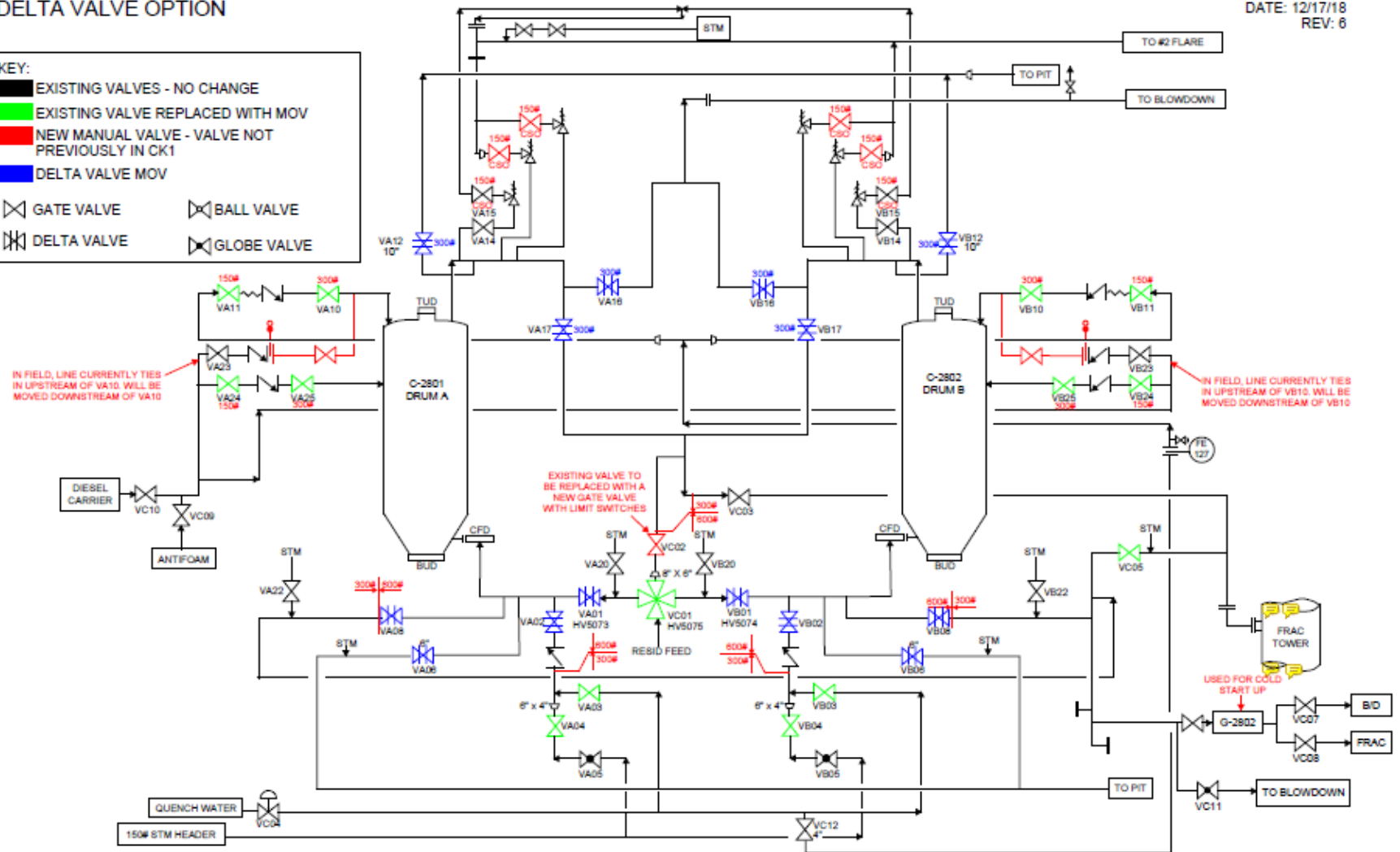
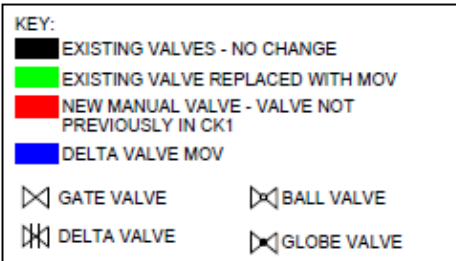
- **Replacing manual gate valves with motor-operated valves includes:**
  - Delta Valve isolation valves
    - Double block and steam purged alloy valves as supplied by Delta Valve
  - Isolation gate valves
- **Refurbishing Wilson Snyder Switch Valve**
  - Scope includes retrofitting existing valve plus spare
- **PLC-based control system with distributed HMI Control Panels for MOV Valve Operation from the field and the Central Control Building**
  - PLC to include isolation MOV's as well as BUD, TUD and CFD



# Coker 1 Interlock Valve Diagram

## COKE 1 (UNIT 28) INTERLOCK VALVE DIAGRAM DELTA VALVE OPTION

RDS JOB NUMBER: 18-1293-01  
DATE: 12/17/18  
REV: 6





# Delta Valve Isolation Valves

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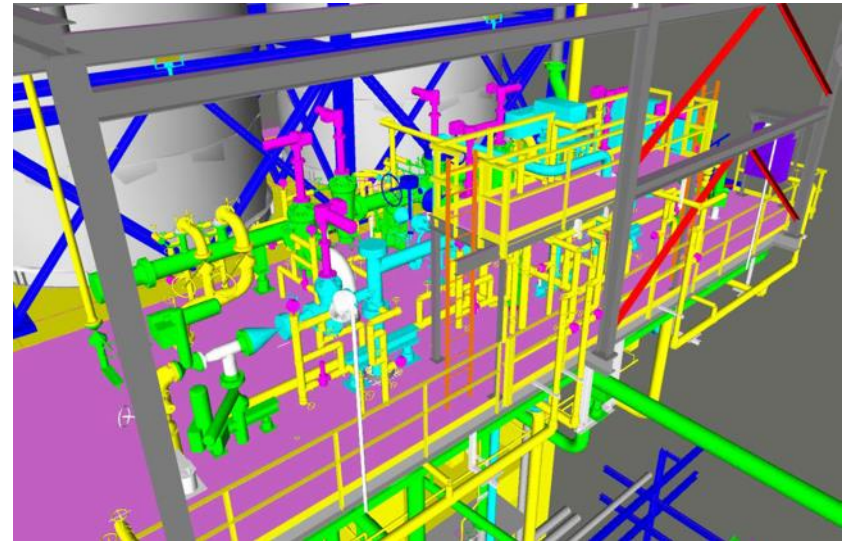
- **Decided to replace valve pairs with single Delta Valve Isolation Valve**
  - Delta Valve Isolation Valve considered double block and purge
    - Same concept as the BUD and TUD
  - One valve replaces two valves
  - Limited space on the deck - one Delta Isolation valve requires less space
- **Delta Valve Isolation Valves installations - blue valves on prior drawing**
  - Drain to Coke Pit
  - Coke Condensate
  - Top Vent
  - Coke Drum Vapor to Fractionator
  - Coke Drum Vapor to Blowdown
- **Replacing only one valve with Delta Valve Isolation Valves**
  - Feed Inlet Valve
  - Utility Header Valve



# Existing Switch Deck and 3D Model of New Deck



- **Existing deck to be demolished**
  - Very crowded area
- **New deck via 3D model**
  - Larger deck
  - No upper platforms
  - Improved ergonomics

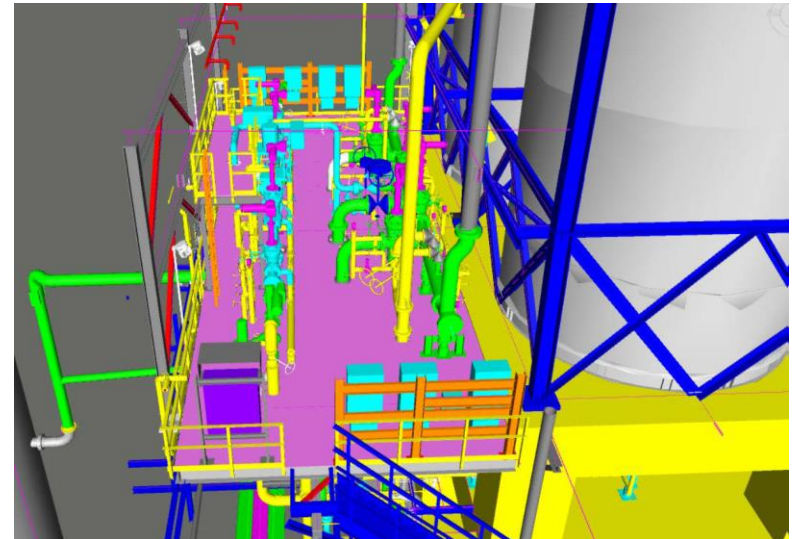




# Existing Switch Deck and 3D Model of New Deck

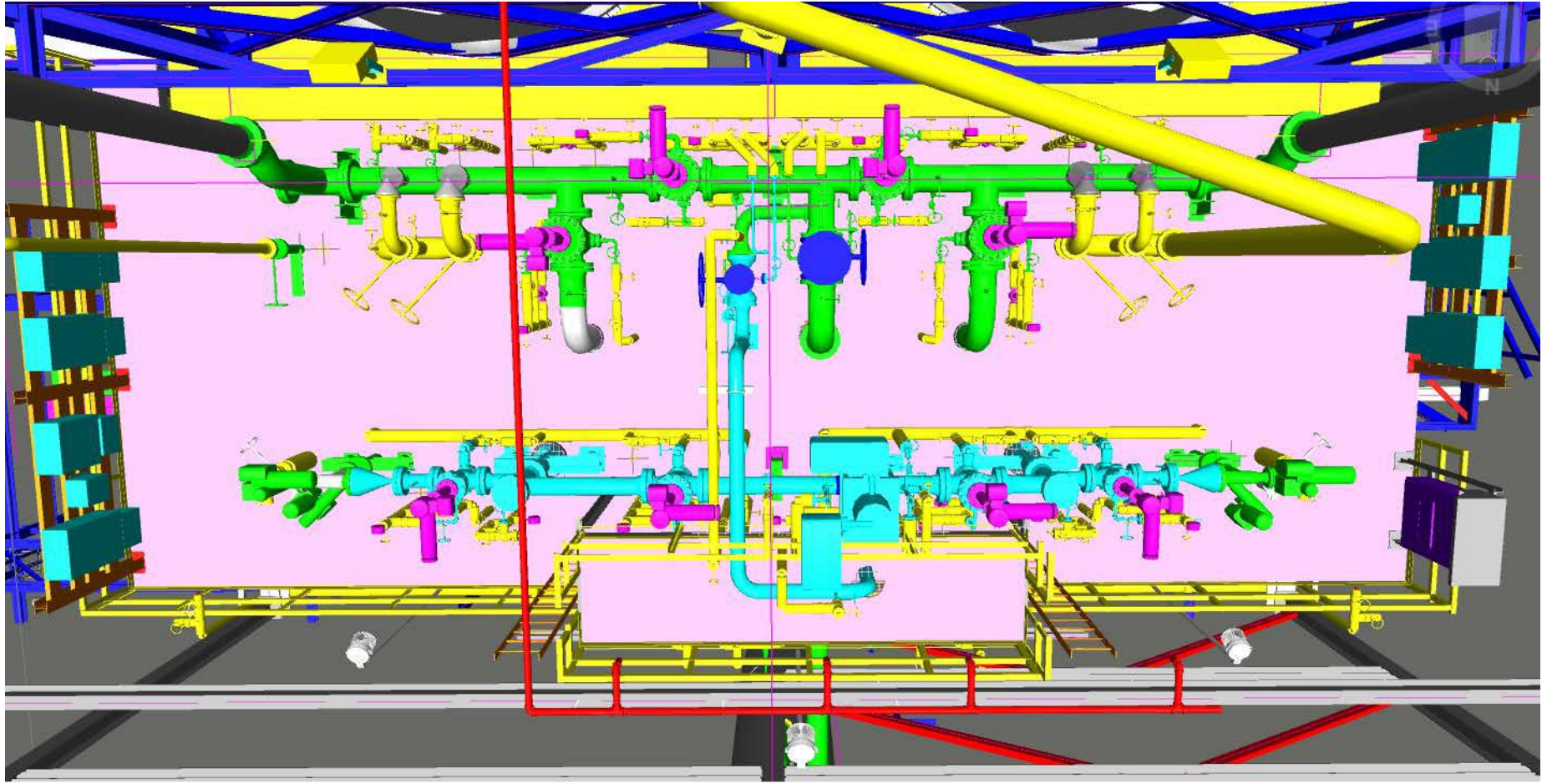


- Side view of existing deck
- 3D model shows better layout for switch valves





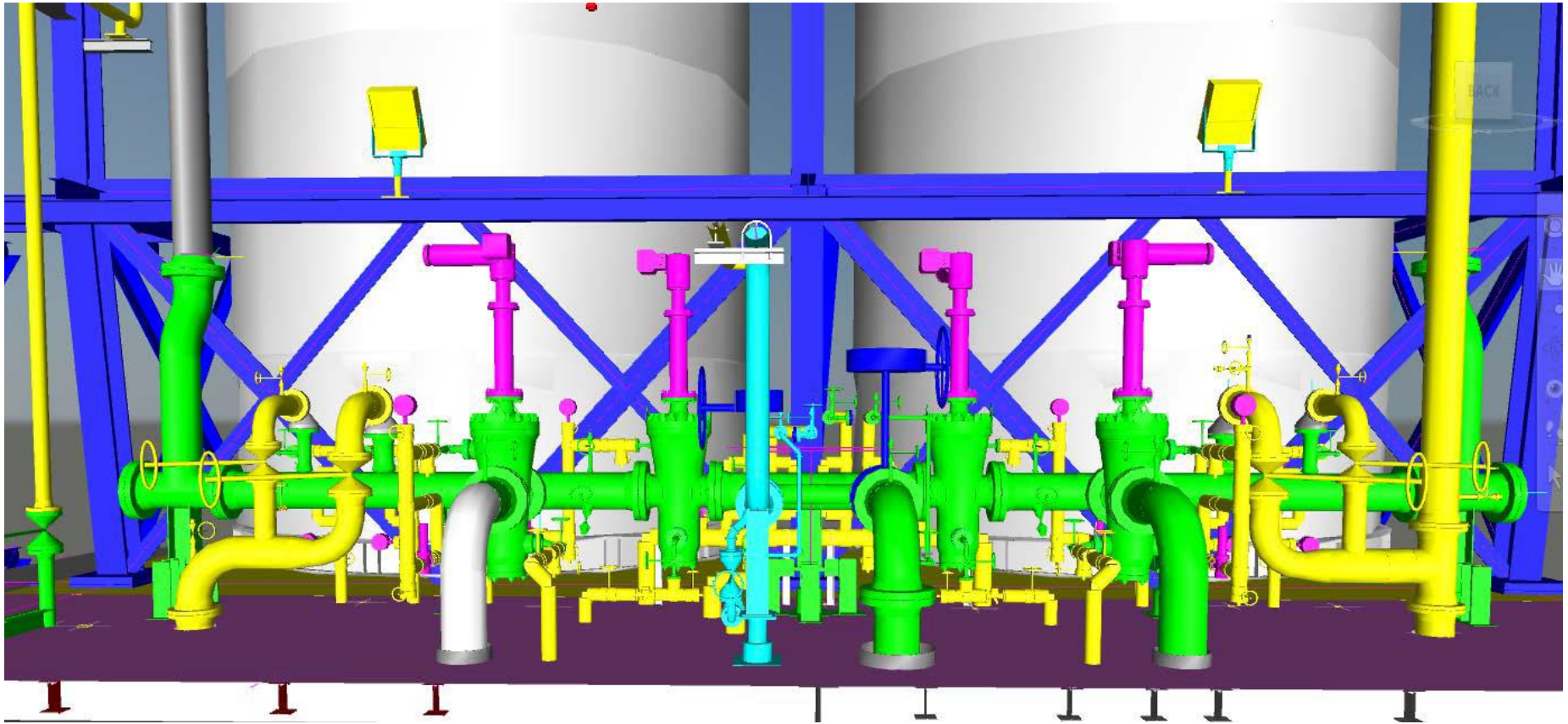
# Switch Deck Plan View





# Switch Deck Overhead Valves

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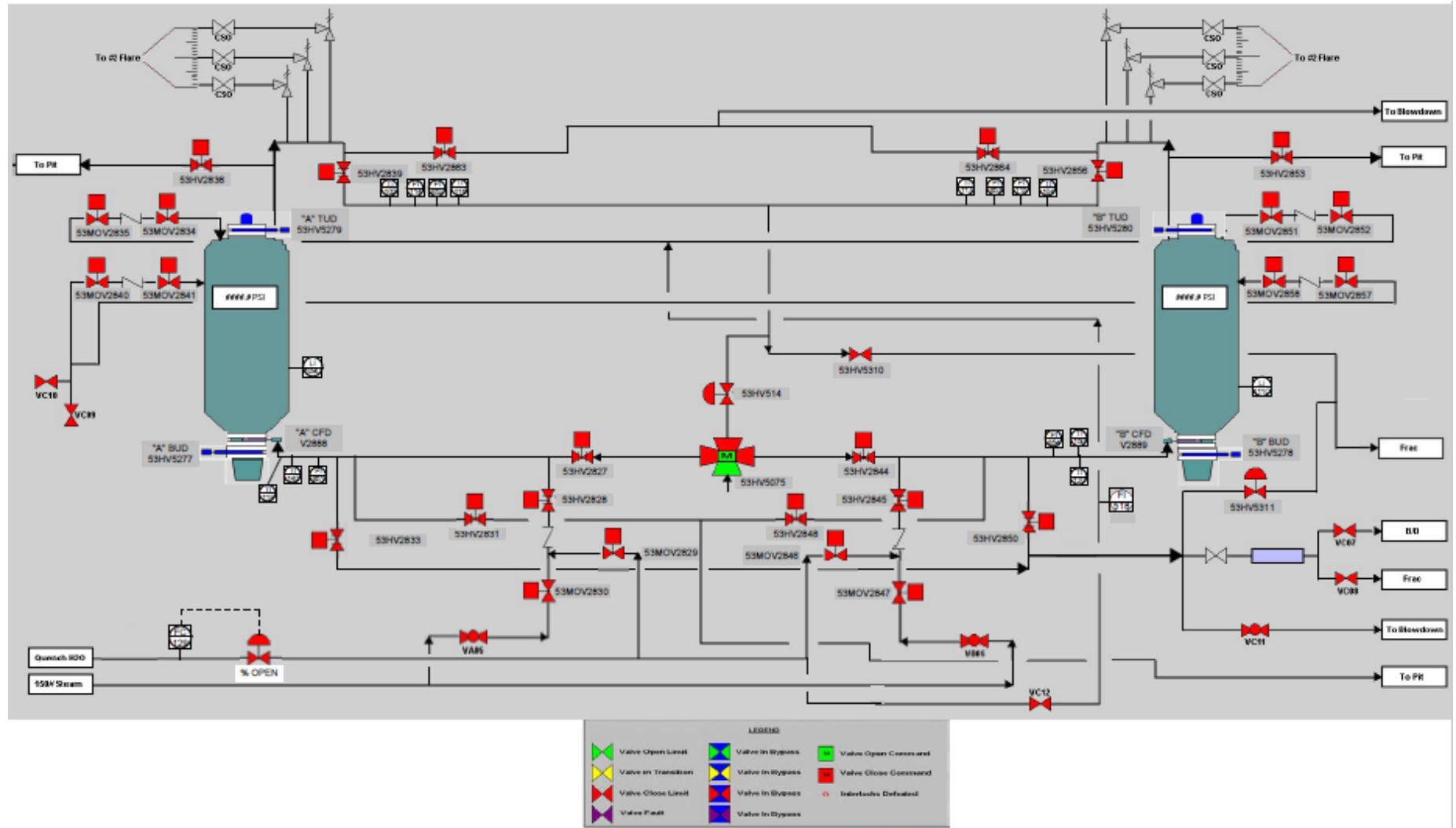
# HMI Control Panels

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- **Install five HMI Panels with graphic displays that can view all pages / valves**
  - Includes Drum Switch Valves, BUD, CFD and TUD
- **HMI Panels will be located at switch deck, top deck, ground level, PDC Building and DCS control room**
- **Operators will use touch screen to operate valves - open/close**
- **Valves will only be operated remotely from the panel**
- **Push button to be provided at the valve and to be locked out and used for maintenance issues only - key lock switch**
- **HMI's will have redundant power supply**



# HMI Drum Interlock Valve Schematic





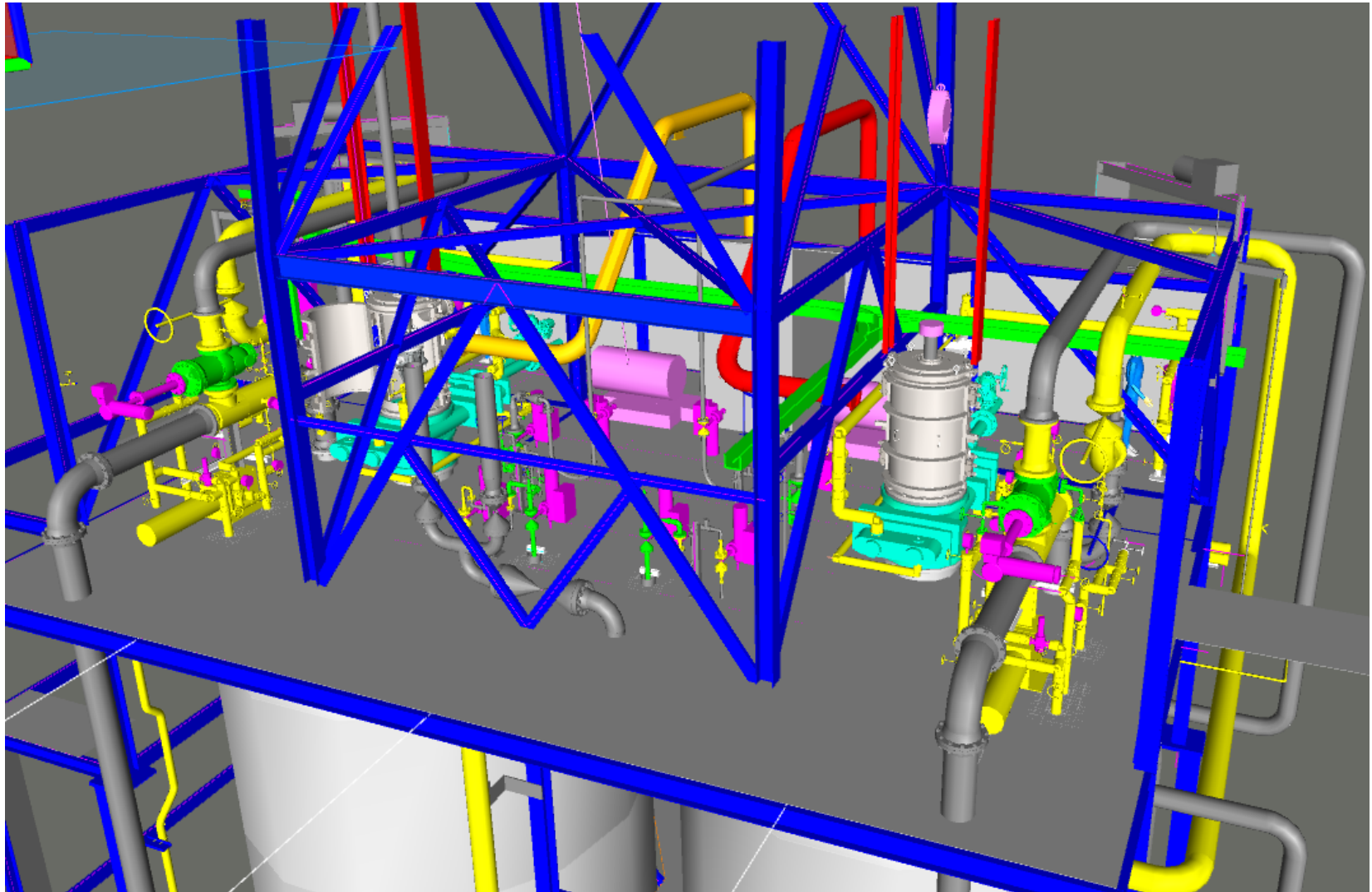
# PBF Delta Valve Unheading Projects

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- **PBF selected Delta Valve for corporate-wide Coker Safety Unheading Projects**
  - Project to include BUD, CFD, TUD and SGE - Stem Guide Enclosure
  - Project synergies to have the equipment sizes the same
  - Project will use RDS as Engineering Contractor for all units
- **Chalmette Coker 1: Install as part of re-start project - 1 drum pair**
- **Chalmette Coker 2: Install during next TA - 1 drum pair**
- **Paulsboro: TUD's only - install with opportunity slow downs - 2 drum pairs**
  - BUDs already installed
- **Torrance: Install during offline decokes or opportunity down time**
  - Six drum pairs
    - ❑ Drum pairs to be installed over several years time
    - ❑ One or two drums pairs per year

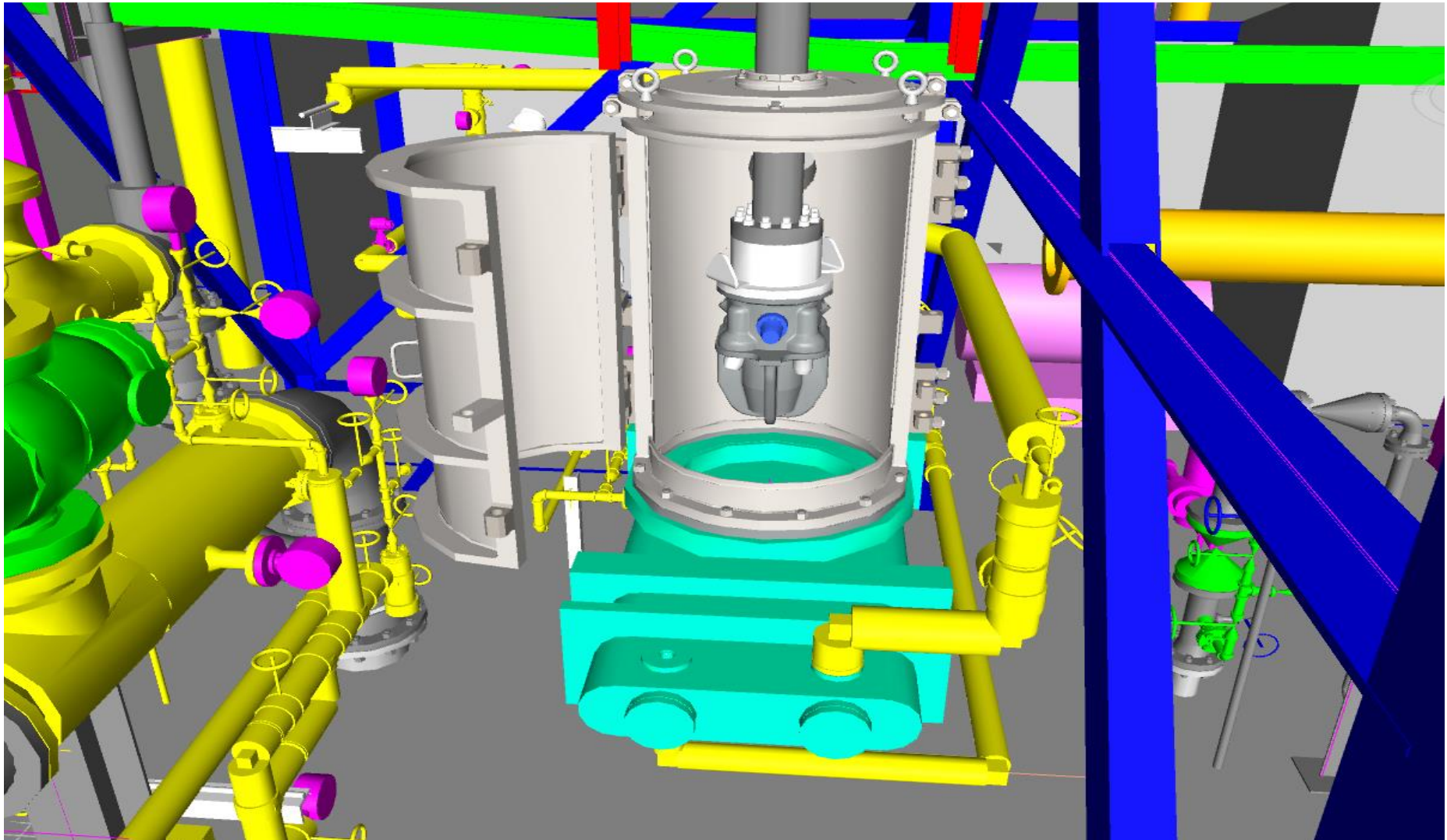


# Top Deck with TUD and SGE





# Drill Stem Guide Enclosure





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**Thank You!**  
***Questions?***