



VALERO WILMINGTON REFINERY





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Purpose



- Provide an Overview of the Valero Wilmington Refinery
- Present how the Alkylation Unit fits into this configuration
- Describe the Safeguards associated with operating the HF Alkylation Unit
- Address some of the questions that have been raised during the previous working group meetings



Key Facts



- Alkylation units are critical to produce California's required cleaner burning gasoline
- HF Alkylation is over 200 times more efficient than sulfuric acid alkylation and offers additional environmental and energy advantages
- Numerous federal and state agencies set rigorous safety standards for refinery operations
- Valero Wilmington Refinery's HF alkylation unit has operated safely for more than three decades with no off-site incidents since it was first built in 1982



Key Points



- Valero's Wilmington refinery ensures a safe, reliable HF alkylation operation through
 - Detailed operations training and procedures
 - Comprehensive mechanical integrity program
 - Extensive HF mitigation systems
 - Elite on-site Emergency Response Team



Wilmington Refinery Overview



- Commissioned in 1969 to refine local crudes with several major expansions prior to 2001
- One of the most energy efficient refineries in the United States
- One of the first refineries in California to produce CARB gasoline
- Valero acquired the refinery in 2001 and implemented numerous improvements





Wilmington Refinery Highlights

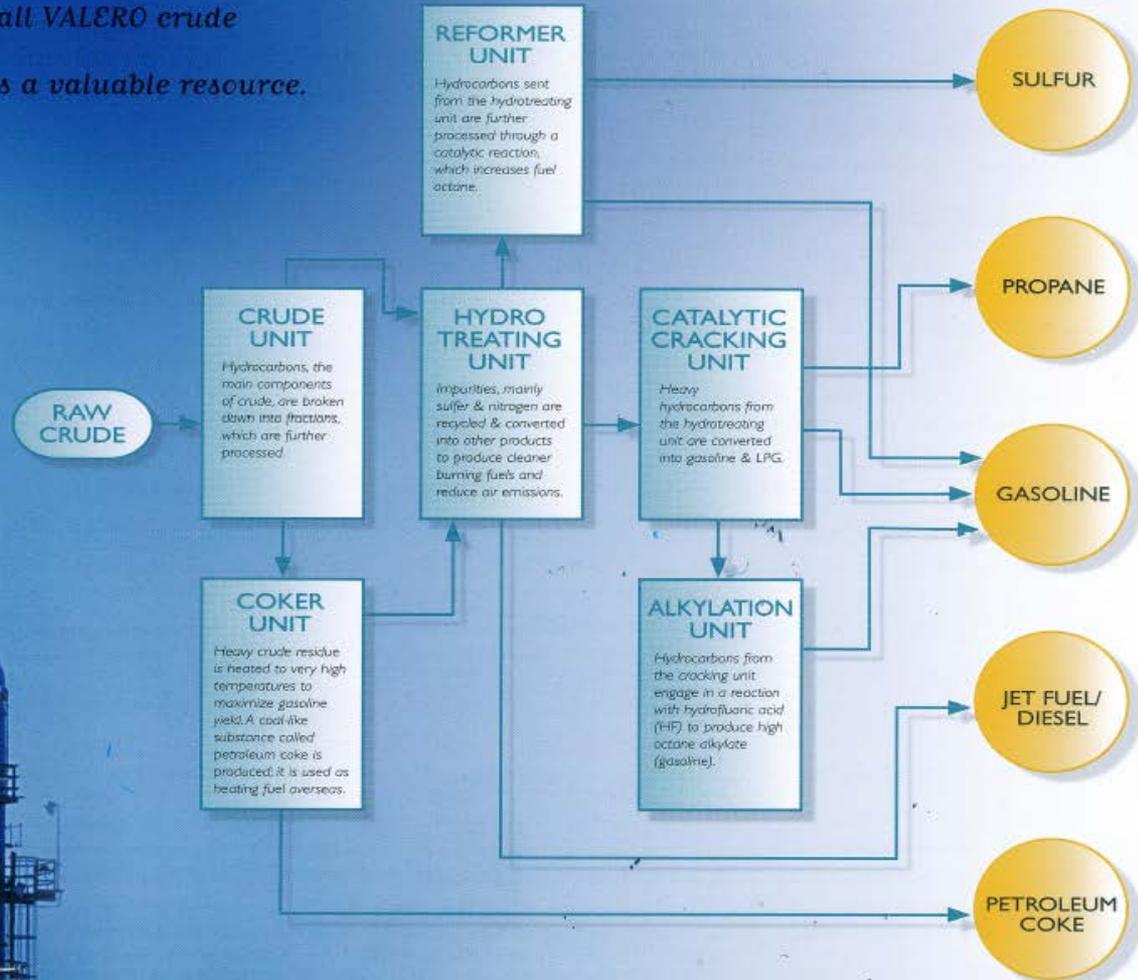


- Recognized as a Cal/OSHA VPP Star Site in November 2004 – first refinery in California
- Total throughput of 135,000 bpd
- Primary products are gasoline, diesel, jet fuel, LPG, fuel oil and asphalt
- Provides about 13% of fuels to SC market
- Staffed by 420 full-time employees and 150 continuing service contractors
- Alkylate is an essential blending component due to low vapor pressure, low sulfur, high octane, low aromatic and low olefin content



Wilmington Refinery Process Overview

98% of all VALERO crude becomes a valuable resource.





Basis for Alkylation Technology Selection



- HF alkylation was selected as the best alkylation technology for this refinery in 1982 because it was more compatible with the existing refinery configuration and resulting alkylation unit feedstocks
- HF technology has the benefit of being over 200 times more efficient than sulfuric acid alkylation
 - Minimizes air emissions from refinery equipment and truck transportation related to regeneration of spent acid
- In 2008, Valero made a major capital investment in the HF unit by incorporating the Reduced Volatility Alkylation Process, or ReVAP as a further risk reduction measure



Differences between HF and Sulfuric Acid Alkylation



- HF alkylation units regenerate spent acid within the process unit, minimizing acid consumption and need for fresh HF truck deliveries
- HF alkylation units efficiently process a wider range of feedstocks
 - Sulfuric alkylation units consume more acid to process these streams
 - C3 feeds to Sulfuric units produce lower alkylate yields and octane
- Sulfuric alkylation units use up to 200 times more acid and typically require offsite spent acid regeneration
- Sulfuric alkylation units high acid consumption results in up to 400 times more local truck traffic
 - Each fresh acid delivery corresponds to a truck of spent acid sent offsite
 - Significant increase in truck deliveries corresponds to increased mobile emissions



Safety Regulations



- Federal level
 - OSHA's Process Safety Management regulation
 - EPA Risk Management program regulations
- State level – more stringent
 - Cal-OSHA's Process Safety Management Regulation
 - California Accidental Release Prevention Program (CalARP)
 - New and Enhanced PSM Regulations
- These Set Standards to ensure the following are met on a daily basis
 - Procedures
 - Training
 - Mechanical Integrity
 - Safety
 - Emergency Response



Ensuring Safety in the Alkylation Process



- *Operating Procedures and Training*
- *Mechanical Integrity*
- *Mitigation Systems*
- *Emergency Response*



Procedures and Training



- Operating Procedures and Training Standards are key elements of OSHA's Process Safety Management (PSM) Regulation
- Applies to all refinery units including the HF Alkylation unit
- HF Unit Operators trained and tested on 68 unit specific procedures
 - Normal operations
 - Startup and Shutdown operations
 - Temporary operations
 - Maintenance, repair and special operations
 - Emergency procedures
- Procedures reviewed on annual basis
- Many require sign off at time of use
- Updated on lessons learned and industry events
- Additional procedures generated as needed



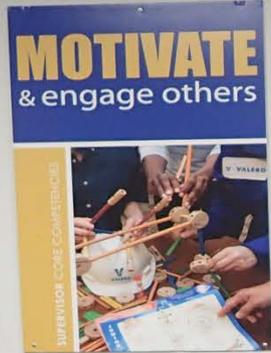
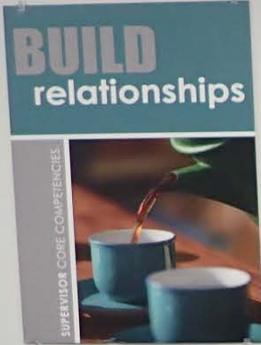
Training



- 12-Week Basic Operator Training Program for all new Operators
- Six-Month On the Job Training / Shadowing with Veteran Operators
- Pass Knowledge and Performance Based Tests
 - Draw unit Plot Plan
 - Draw unit Process Flow Diagram
 - Complete walkthrough with Area Manager including demonstration of unit emergency procedures
- Requalification Training on a 1 – 3 Year Interval
- Monthly Drills on Unit Upset and Emergency Scenarios



Training



Class Ground Rules

- Arrive on time
- Put cell phones away during class
- No PDAs / electronic media during class
- Actively participate in group activities and discussions
- Ask questions
- Listen to and respect others
- Respect contributions of classmates
- Only one conversation at a time.







Required Safe Work Practices



- Valero Refinery has developed and uses over 80 safety work practice procedures utilized for the following types of work which can take place in the HF Alkylation unit
 - General HF safety
 - Job Hazard Analysis
 - Safe Work Permit
 - Hot Work
 - Lock out Tag Out
 - Blinding
- Procedures are recertified annually
- Operators complete 36 training courses per year associated with their knowledge of these procedures



Mechanical Integrity



- Mechanical integrity programs are in place for every piece of equipment in the HF unit
 - Pumps
 - Valves
 - Heaters
 - Instrumentation
 - Vessels
 - Heat Exchangers
 - Pipes
 - Flanges
- HF Alkylation unit equipment inspection practices developed to comply with API 751 guidelines - “Recommended Practice for Safe Operation of Hydrofluoric Acid Alkylation Units.”
- All other programs aligned with industry standards and established manufacturers’ inspection codes



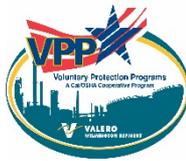
Mechanical Integrity – Valero Driven Programs



- Valero program for 100% Inspection of every carbon steel component in HF Alkylation Unit in HF Acid service
- Valero program with special emphasis on condition of raised face flange surfaces in HF Acid service
 - Flanges can be sources of small leaks
 - Identifies location of all flanges in acid service
 - Validates condition of flanges in the unit
 - Verifies that flanges are fit for continued service
 - Helps ensure proper gasket sealing
 - Prevents potential leaks



Mechanical Integrity



- **Preventative Maintenance ensures the reliability of rotating equipment**
 - Reliability engineers record pump repair history and oversee all repairs of rotating equipment in the HF Alkylation unit
 - Mechanics perform annual trip testing of the four general purpose steam turbines in the HF Alkylation unit
 - Reliability engineers take vibration data on all 70 pieces of rotating equipment every six weeks and issue work requests for equipment showing early indications of abnormalities
- **Developed critical instrument standards**
 - Includes basis for function testing these systems and instruments
 - Includes basis for other preventative maintenance steps
 - Prevents or mitigates potential acid leaks



Valero Wilmington Alky Mitigation Systems Prevention



- Mechanical integrity programs developed to prevent leaks
- Maintenance programs to prevent leaks
 - Flange torqueing protocols
 - Gasket use and installation protocols
- Seal-less pumps in concentrated acid service
 - Significantly reduces likelihood of leak
 - Reduces impact of any pump issues





Valero Wilmington Alky Mitigation Systems Detection



- Earliest detection via acid indicating paint
 - Acid indicating paint applied to all flanges and connections in acid or trace acid service
 - Changes color at levels that cannot be detected by sensors
 - Allows early repairs before any escalation to an actual leak



Valero Wilmington Alky Mitigation Systems Detection

- HF sensors throughout unit
 - 33 throughout unit and perimeters
 - Alarm at Control Room and Alky Change Room
 - Alarms to SCAQMD
- Cameras focused on unit to detect potential leaks from control room



Valero Wilmington Alky Mitigation Systems Rapid Acid Dump System

- Rapid Acid Dump System – event duration management
 - Remotely activated (control room or field)
 - Minimizes duration of any leak
 - Transfers entire inventory in less than 10 minutes



- Water Curtain mitigation
 - Remotely activated
 - Distinct elevations of the Acid Settler depending on area of leak (all can be operated simultaneously)
 - Separate curtain covers Rerun Column system
 - 5800 gpm each





Valero Wilmington Alky Mitigation Systems Water Mitigations





Valero Wilmington Alky Mitigation Systems Water Mitigations





Valero Wilmington Alky Mitigation Systems Water Mitigations





Valero Wilmington Alky Mitigation Systems Water Mitigations



HF Loading Water Curtain





Valero Wilmington Alky Mitigation Systems Water Mitigations



- Point and shoot water mitigation
 - Remotely controlled and activated
 - Allows concentrated water flow at point of leak
 - Supplements curtain
 - 4500 gpm
- Total mitigation water is 10,300 gpm





Valero Wilmington Alky Mitigation Systems Water Mitigations



- Pump Deluge Systems



- Unit Area Deluge Systems
- Portable Water Cannons

Valero Wilmington Alky Mitigation Systems Acid Isolations

- Remotely operated HF Isolation Trips
 - Allows isolation of process from any leak
 - Prevents continuous feeding of leak



- Acid Unloading Station Isolation Trip
 - Remotely operated
 - Tested prior to any truck off loading
 - Reviewed with truck drivers prior to off loading



Valero Wilmington Alky Mitigation Systems Event Minimization - Passive



- Diffusors on equipment associated with acid coolers
 - Further decreases any remaining aerosol effect of leak
- Inventory management baffle in acid settler
 - Significantly reduces acid volume leak potential
 - Passive mitigation
- Utilization of ReVAP (Reduced Volatility Alkylation Process)
 - Passive mitigation system – additive blended with acid to lower volatility
 - Implemented early 2008
 - Additive is part of delivered acid – reduces transportation risk





Emergency Response



- The Valero Refinery maintains a highly trained and certified Emergency Response Team staff
 - 110 trained and certified first responders
 - 22 first responders, including 2 emergency medical technicians (EMT's) per shift, 24 hours a day
- Valero Emergency Response Staff are experts in:
 - National Incident Management System (NIMS) command protocol
 - Hazardous Materials Response (technician level)
 - Live Fire Fighting
 - Emergency Medical (EMT)
 - Oil Spill (on-water or on-land pipeline) Emergency Response
- Valero invests over 13,000 person-hours of annual Emergency Response Training

- Unit Operators participate in annual HF Alkylation unit release drills
 - Focus on communication protocol
 - Safety steps are reinforced
 - Mitigation systems function tested
 - Coordinated with refinery ERT
- Valero ERT and Alkylation Unit Operators are trained by same agency as LA City Fire Department
- LA City Fire Department acknowledges Valero's expertise and ability to properly address HF release scenarios





Emergency Response – Drill Example





Key Points to Remember



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- HF Alkylation is over 200 times more efficient than sulfuric acid alkylation and offers additional environmental and energy advantages
- Numerous federal and state agencies set rigorous safety standards for refinery operations
- The Valero Wilmington Refinery HF unit was built in 1982 and has operated safely without any offsite impacts for over 34 years