



Torrance Refinery
MHF Alkylation Unit Safety Systems

AQMD Proposed Rule 1410 Working Group Meeting
May 18, 2017

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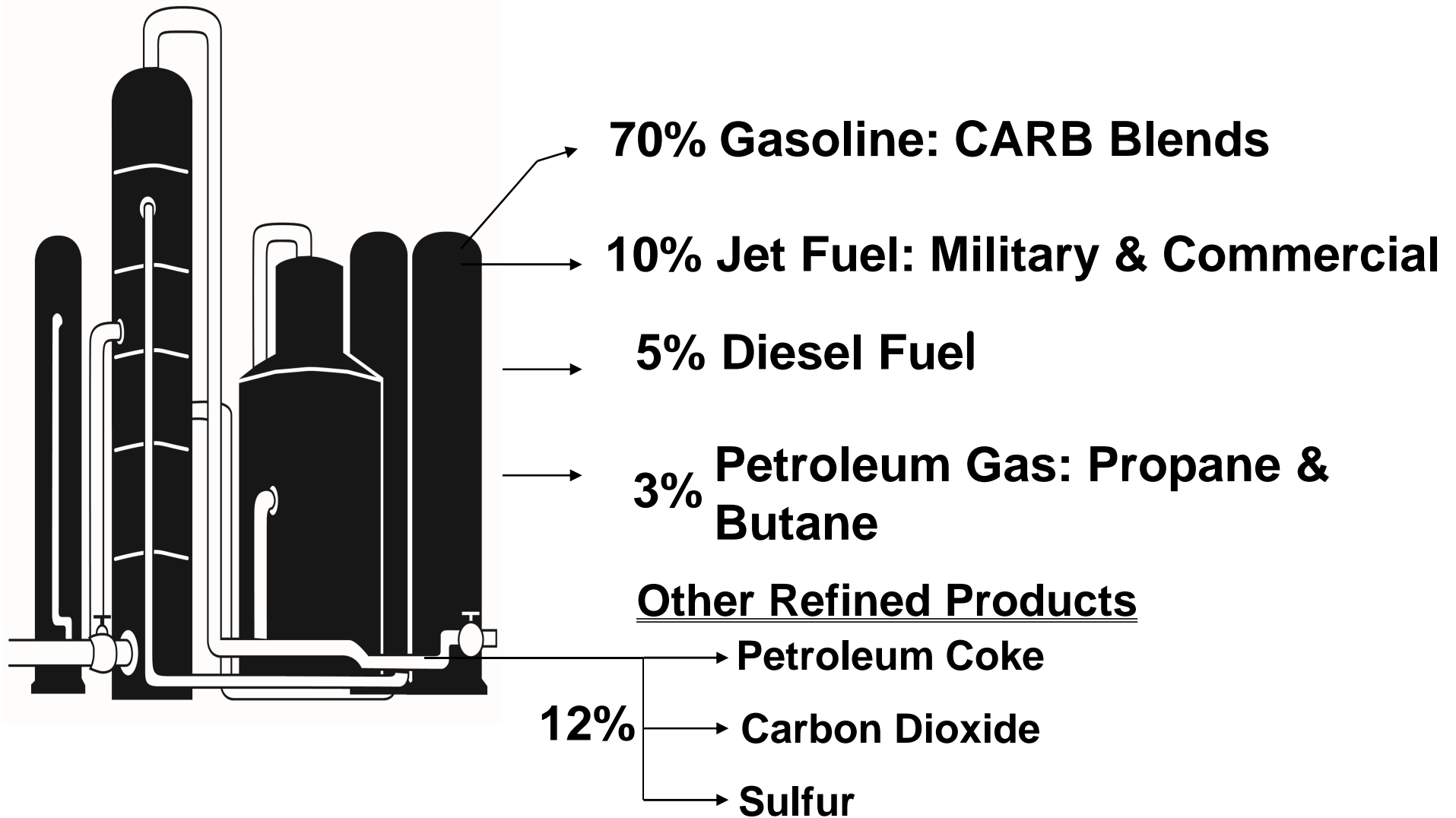
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Torrance Refinery Mission

- **Produce high quality fuel products in a safe, reliable and environmentally responsible manner – primarily for Southern California**
- **Comply with state, federal and local rules and regulations**
- **Earn the right to operate in this community**

Torrance Product Slate



The Alkylation Process

- **The alkylation process converts low-value liquid petroleum gases into a high octane gasoline ingredient called “alkylate”**
 - High octane hydrocarbons prevent auto-ignition of gasoline (knocking) in an engine
 - Refineries blend alkylate with other refined hydrocarbons to make gasoline
- **Alkylate is required to meet CARB gasoline standards – the world’s most stringent**
 - Provides high octane ratings and possesses cleaner-burning properties
 - Each barrel of alkylate allows blending of ~5 barrels of CARB gasoline
 - Alkylate is required to make every gallon of gasoline sold in California

Alkylation Unit Safety Systems

- **Preventive Safety Systems**
- **Incident Response Safety Systems**

Release Prevention and Monitoring Systems

- **Preventive Safety Systems**

- Specialized PPE and training required for all personnel entering the unit
- Robust inspection and audit program
 - Follow API 751 HF Recommended Practices
 - Industry standard practice recognized by OSHA and other agencies
- Two Operators stationed on unit each shift in contact with Console Supervisor
- Eight surveillance cameras with video playback
- Emergency simulation drills
 - Joint TORC and TFD drills
 - TORC and TFD both Hazmat trained
- Modified HF Acid
 - >50% Airborne Reduction Factor (ARF) per MHF chemistry
 - Online MHF Analyzer



Safety: Determining MHF's Airborne Reduction Factor

- **Airborne Reduction Factor (ARF): The percentage of HF that remains in a liquid state when MHF is released to the atmosphere**
 - ARF calculated using temperature, water %, additive %, and HF % in the unit acid stream
 - Refinery provides ARF results to Torrance Fire Department monthly
- **Rigorous testing performed in the 1990's shows that MHF catalyst, when combined with barriers at Torrance Refinery, provides 89% ARF**
 - Supplementary mitigation systems would contain a potential release on site
- **Torrance Refinery has been using MHF since 1997 with NO offsite release**

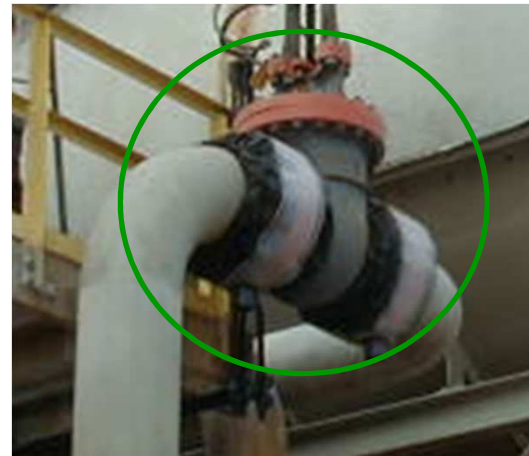
Modified Hydrofluoric Acid

- **Chemical mixture of HF Acid, additive, water, acid soluble oil and light hydrocarbons used in the alkylation process**
- **Both the additive and water separately create hydrogen bonds with HF**
 - Eliminates flash atomization of mixture in the event of a release
 - Atomization occurs when a substance disintegrates into small droplets when a pressurized liquid is released into the atmosphere
 - Prohibits a ground-hugging vapor cloud from forming
 - Promotes rainout, keeping a release in a liquid state
- **Extensively tested at low and high additive concentrations in 1990's**
 - Tests were performed at wide range of unit operating conditions, including current concentration levels



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Barrier technology (89% total unit ARF when combined with MHF chemistry)
 - Flange barriers



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Barrier technology (89% total unit ARF when combined with MHF chemistry)
 - Flange barriers
 - Settler belly pans



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Barrier technology (89% total unit ARF when combined with MHF chemistry)
 - Flange barriers
 - Settler belly pans
 - Acid circulation pump enclosures



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Water Mitigation
 - Nine remotely controlled water cannons
 - Used in tandem with console cameras to target a specific release point



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Water Mitigation
 - Nine remotely controlled water cannons
 - Local fire monitors



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - Water Mitigation
 - Nine remotely controlled water cannons
 - Local fire monitors
 - Deluge systems on major pumps
 - Fire sprays on vessels

Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - MHF sensors
 - 27 Point sensors
 - Open path lasers on unit perimeter

HF Point Sensors and Line of Sight Lasers

- **27 Point sensors located throughout unit and on perimeter**
 - Detect HF down to 0.1 parts per million (ppm)
 - Alarms internally at 2 ppm
 - Reported directly to AQMD at 6 ppm
 - In the process of completing a similar alarming system to TFD
- **Line of Sight Laser system on unit perimeter**
 - Detect HF down to 0.1 ppm per meter (ppm*m)
 - Alarm internally at 50 ppm*m and 75 ppm*m



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - MHF sensors
 - 27 Point sensors
 - Open path lasers on unit perimeter
 - Acid Evacuation System
 - Blast wall around fresh acid and AES storage vessels

Acid Evacuation System

- **Emergency system that removes all acid from the main unit to a storage drum located behind a blast wall**
 - 80% of acid is removed in ~2 min
 - The remaining 20% is transferred within 7 minutes from system activation
- **Automatic valves have battery backups to allow operation in the event of a power disruption**



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - MHF sensors
 - 27 Point sensors
 - Open path lasers on unit perimeter
 - Acid Evacuation System
 - Blast wall around fresh acid and AES storage vessels
 - Acid detecting paint

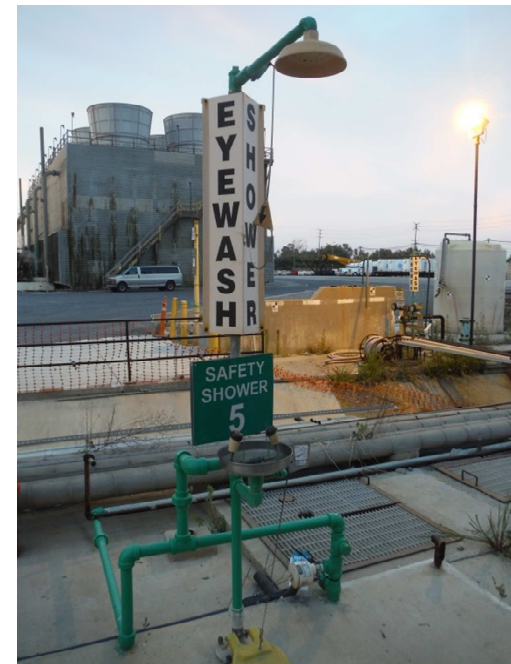
Acid Detecting Paint

- Painted on all flanges and connections in acid services
- Extremely sensitive and changes from yellow to red in the presence of HF
 - Will react to HF concentrations in the parts per billion (ppb) level



Emergency Response Safety Systems

- **Redundant response systems allow rapid response and mitigation to any potential loss of containment**
 - MHF sensors
 - 27 Point sensors
 - Open path lasers on unit perimeter
 - Acid Evacuation System
 - Blast wall around fresh acid and AES storage vessels
 - Acid detecting paint
 - Alarmed safety showers





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