Understanding a New Regulatory Environment

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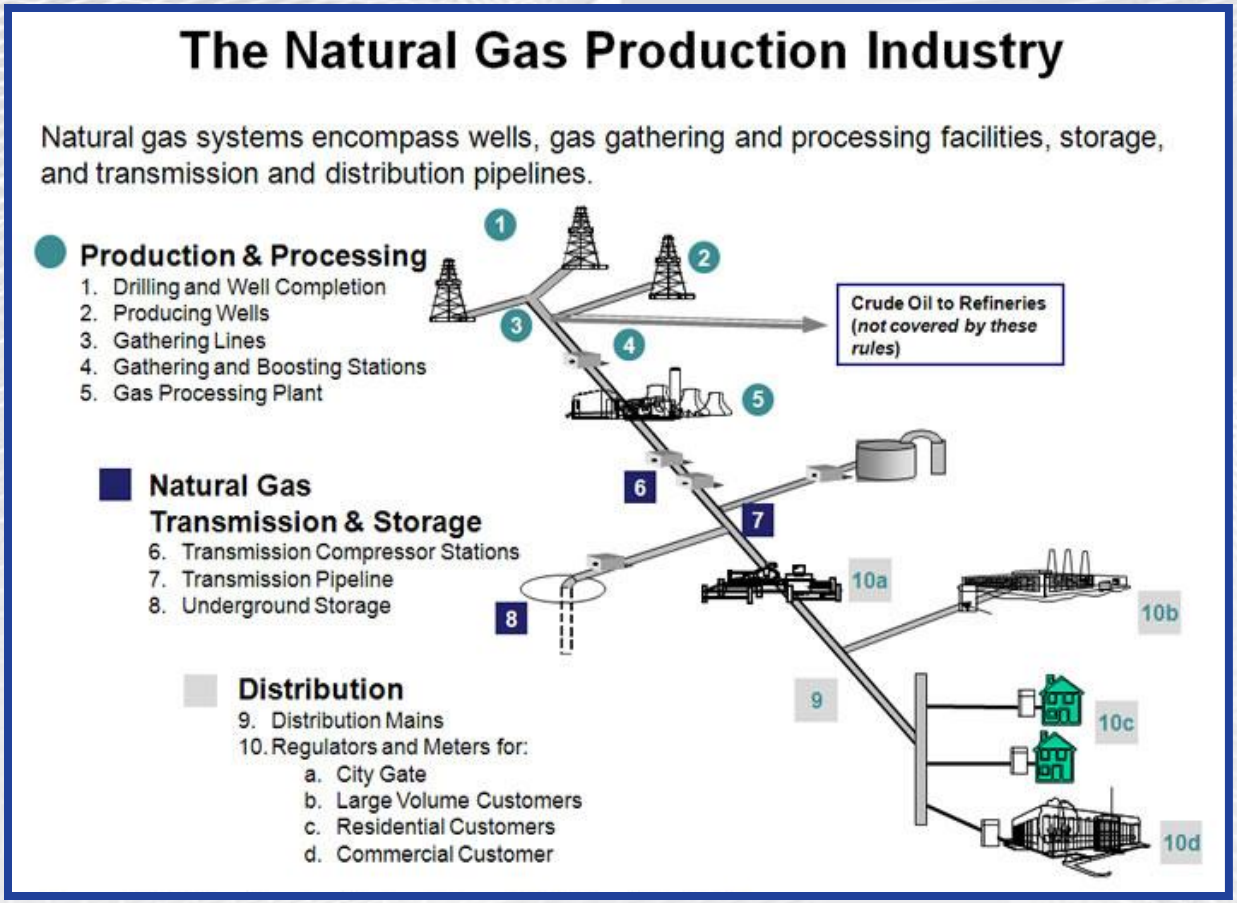
Regulations for Control

- New Source Performance Standards (NSPS, 40 CFR Part 60, Subpart OOOO) for crude oil and natural gas production, transmission and distribution. Ruling applies to new and modified affected facilities that commenced construction after August 23, 2011 “Quad O”
- National Emission Standards and Hazardous Air Pollutants (NESHAP, 40 CFR Part 63 subpart HH & HHH) directly impacts the oil and gas production and natural gas transmission and storage facilities. Revised rule, applies to existing and new affected facilities
- On August 2, 2013, the US EPA amended NSPS OOOO the final ruling to address petitions for reconsiderations. The update mostly addresses storage tank requirements
- www.epa.gov/airquality/oilandgas

- The ruling targets five source categories of oil and gas production:

NAICS Code	
211111-	Crude Petroleum and Natural Gas Extraction
211112-	Natural Gas Liquid Extraction
221210-	Natural Gas Distribution
486110-	Pipeline Distribution of Crude Oil
486210-	Pipeline Transportation of Natural Gas

- Expected to yield a 95% reduction in VOC's. VOC's in the presence of sunlight create ground level ozone (smog), causing detrimental health impact
- Expected to address methane releases from oil and gas production and processing. US is largest single methane source, and is approximately 40% of all methane released into atmosphere. Methane is also 20x more detrimental as a greenhouse gas than CO2.



The Natural Gas Production Process Diagram adapted from the American Gas Association and the EPA Natural Gas STAR Program

	Natural Gas Production Sites	Crude Oil Production Sites	Gathering & Boosting Stations	Natural Gas Processing Plants	Natural Gas Transmission & Compression	Underground Natural Gas Storage
Gas Wells	X					
Centrifugal Compressors			X	X		
Reciprocating Compressors			X	X		
Pneumatic Controllers	X	X	X	X		
Storage Tanks	X	X	X	X	X	X
Fugitive Components				X		
Control Devices	X	X	X	X	X	X
Natural Gas Sweeteners				X		

Affected Facilities per Industry Category

Standards for Storage Tanks

- Includes storage tanks located at well site, tank farms, gathering & boosting stations, NG processing facilities and compressor stations
- Targets sites with VOC emissions level of 6 tons per year or more. Record keeping if less than 4 TPY for more than 12 consecutive months
- Have until April 15, 2014 (Group 2) or April 15, 2015 (Group 1), to install necessary controls
- NSPS requires 95% VOC reduction, no visible emissions (EPA Method 22)

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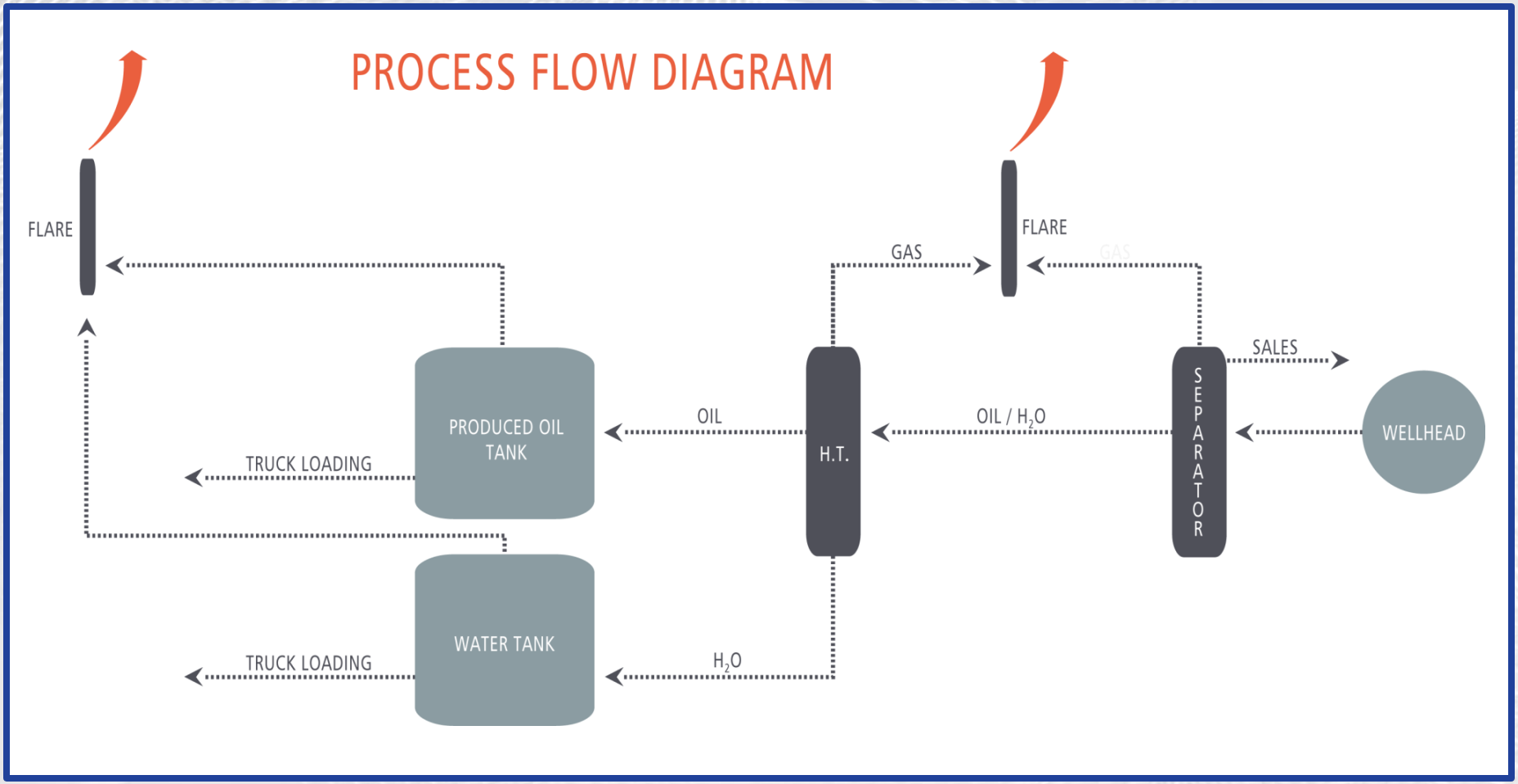
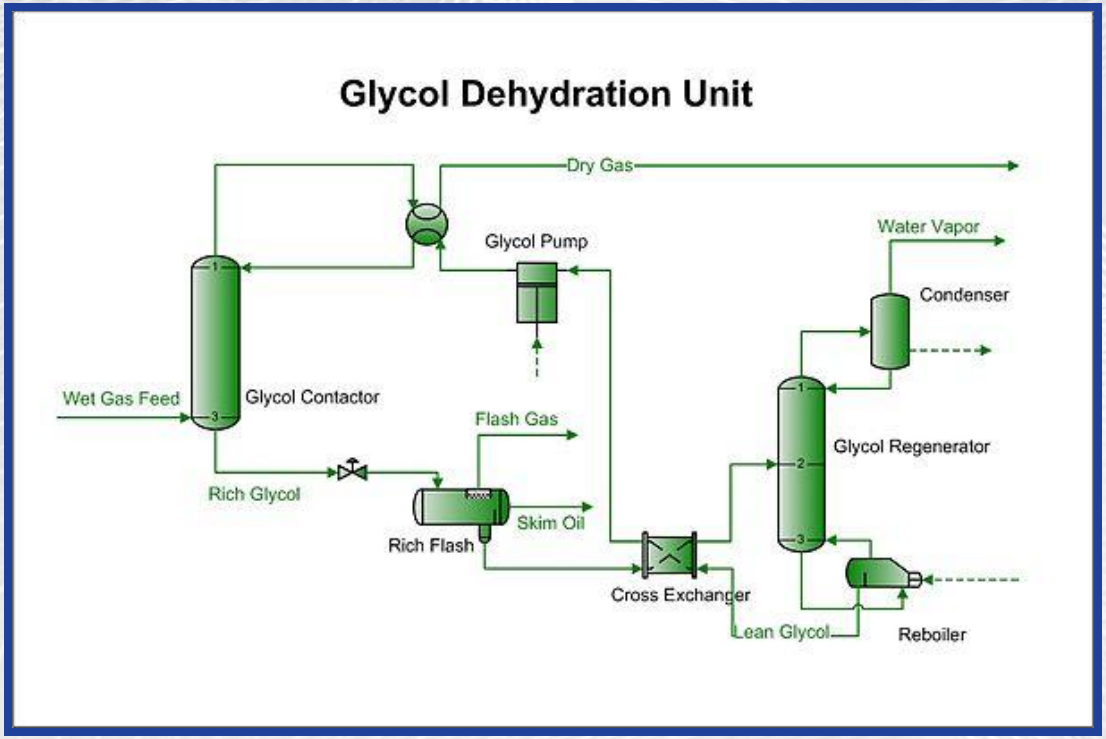
Low Pressure Flare

High Pressure Flare



Standards for Glycol Dehydrators



- Includes units located at well site, gathering & boosting stations, NG processing facilities and compressor stations
- Subject to NESHAP, large units must meet same existing standards (less than 1 TPY benzene compliance option, as opposed to 95% reduction control)

Glycol Dehydrator Thermal Oxidizer

- A 99.9% or greater destruction efficiency for thermal oxidizers
- Guaranteed to meet unit-specific BTEX emissions for new and existing glycol dehydrator units
- Can be vertically or horizontally fired combustion units
- Flares are guaranteed 98% or greater VOC reduction efficiency

Standards for Natural Gas Well Operations at the Well Site

- Affects newly hydraulically fractured or refractured natural gas wells drilled after August 23, 2011
- Phase 1 requires flaring (Completion Combustion Device (CCD), or capture of gases)
- Phase 2 requires Reduced Emission Completion (REC), also known as Green Completion, and is not in effect until January 1, 2015 (with exceptions)

Standards for Natural Gas Well Operations at the Well Site

- A Completion Combustion Device (CCD), otherwise known as a flare, requires reliable pilot and ignition source over the duration of the flowback period (typically 3-10 days) and must meet 95% VOC reduction

- Portable flare system designs, either open or enclosed flames, can increase flexibility to address multiple well sites without any foundation requirement and allow for management of multiple well sites

Flare Options- Open Flame

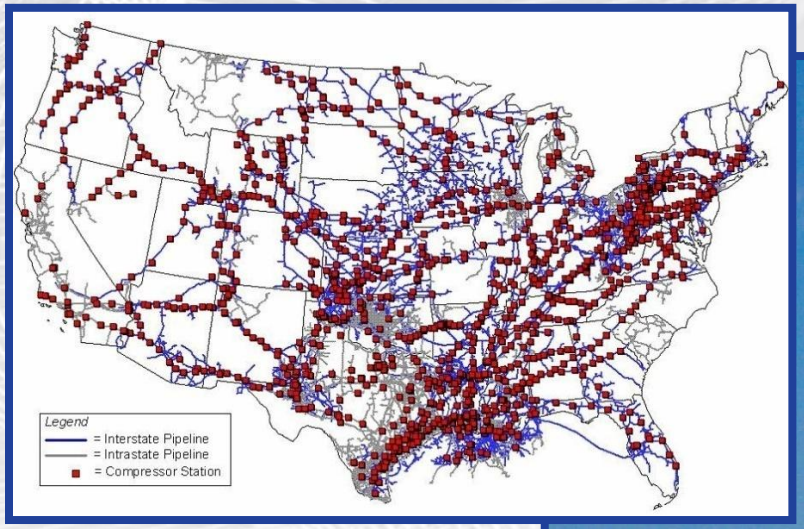
- Engineered flare system design
- High pressure vents off separator
- Low pressure vents off the tanks
- Combination flare for both streams
- Multiple Flares for scalability

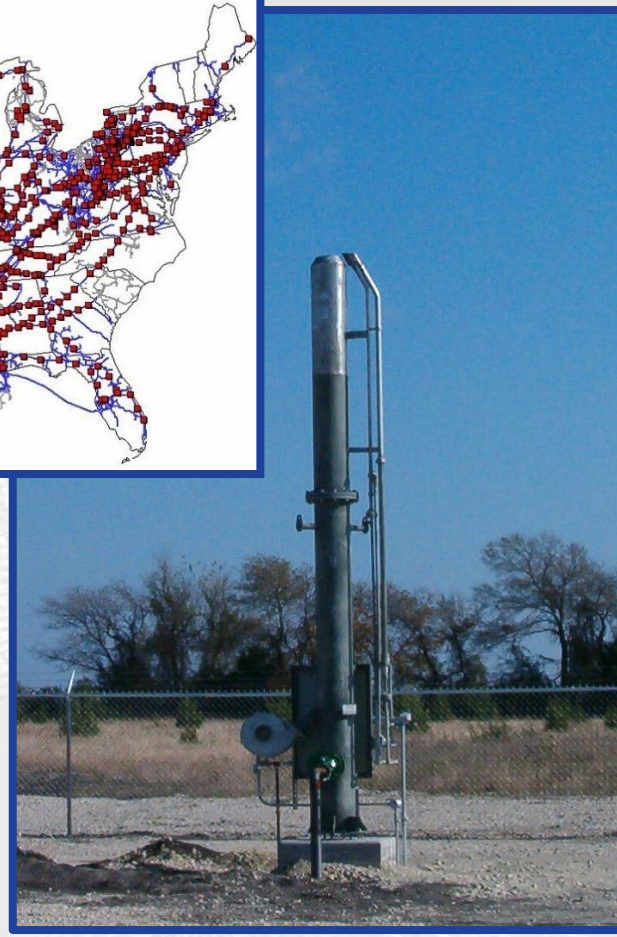
Flare Options- Enclosed Flame

- Low pressure vents off of:
  - Crude Tanks
  - Condensate Tanks
  - Water Tanks
  - Tank Batteries
- Auxiliary Equipment recommended for prevention of liquid carry-over and flashback

Standards for Compressor Stations

- Used for pipeline blowdown, emergency, or maintenance
- Used for low pressure flow of tank vapors
- ESD scenarios for compressor shutdowns
- Initial compliance was required by October 15, 2012 or upon initial startup thereafter





Gas Processing Plant Facilities

- EPA regulations require additional controls if assist media is being utilized for smokeless operation, such as air blowers for air-assisted flare systems.
- http://www.tceq.texas.gov/airquality/stationary-rules/stakeholder/flare_stakeholder.html
- Affected facility operators need to remain aware of both the newly published and likely forthcoming regulations and consider a potential engineered flare system design that would meet requirements for new facilities

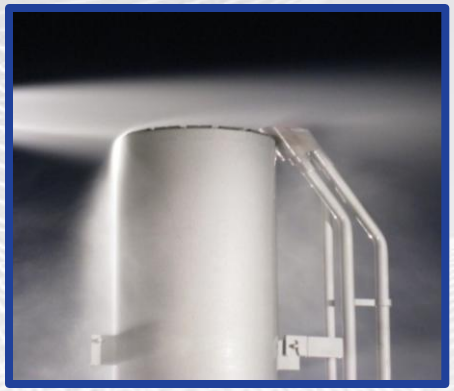
Engineered Flare System Design

- Critical to get it right the first time, no field development, proven field design
- Durable Materials of Construction (MOC), refinery-grade robust design

Engineered Flare System Design

- Optimal for unmanned applications
- Designed for installation in remote operations and monitoring, as required to meet standards
- Combination HP / LP design to optimize performance and cost

Engineered Flare System Design



- Pilot should be designed per API 537 and tested to industry standards to ensure flare will meet environmental performance requirements
- Stable flame in minimum wind speeds of 150 mph with 10 inches of rain/hour
- Ability to reignite automatically without operator interface or electric power
- Ability to monitor for the presence of a flame and record for environmental records verification
- Continuous Burning Pilot Flame required by NSPS during “ALL” times of operation

Pilot Flame Issues

- Sage Inspection in Permian Basin
  - 46% of sites with pilot flame loss
    - 101 Combustors
    - 119 Flares
- Possible Causes
  - Poorly Designed Pilots
    - Does it Meet API 537?
  - Insufficient Pilot Gas
  - Liquids in Pilot/Flare Gas
- Existing Solutions
  - Monitoring Equipment
    - IR Camera
    - Thermocouple
    - Flame Ionization
  - Datalogging
  - Liquid Knock-Out/Scrubber
  - Redundant Systems

Using Engineered Equipment to Meet New Regulations

- Single Well or Pad Site Flare Systems
- Gathering, Compressor, and Booster Station Combustion Systems
- Natural Gas Processing plant combustion systems

Engineered Flare System Design

- Local service and support capabilities for installation, start-up, and operator training
- Resources to manage multiple temporary flare applications
- Engineering support for optimizing flare system design for the affected facility

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