Airgas
an Air Liquide company

RSR- SSM IMPACTS

COMPLIANCE AND OPTIMIZATION

'If you think Compliance is expensive, try non-compliance'

Paul McNulty, former U.S. Deputy Attorney General

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RSR for Flares - Overview

Refinery Sector Rule- Flares Overview

- **Most Comprehensive Rule Revision by EPA to Date**
  - Multiple sections applying to Fence line, Storage, Venting
  - Flare section focus:
    - Full combustion of Hazardous Air Pollutions (HAPs)
    - Increased Destruction Removal Efficiency (DRE)
- **Requirements to Monitor Net Heating Value (NHV)**
  - Installation of new monitoring systems
  - Must be ≥ 270 Btu adjusted NHV at flare tip in 15 minute blocks
  - Performance Spec and NHV calculation definitions
- **Requirements to Control NHV**
  - Startup, Shutdown & Malfunction (SSM) exemptions eliminated

■ 37. The appendix to subpart CC is amended by adding table 12 to read as follows:

Appendix to Subpart CC of Part 63—Tables

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"Table 12 Normalized Certificate of Analysis"

TABLE 12—INDIVIDUAL COMPONENT PROPERTIES

Component	Molecular formula	MW_i (pounds per pound-mole)	CMN_i (mole per mole)	NHV_i (British thermal units per standard cubic foot)	GPA	LFL_i (volume %)
Acetylene	C_2H_2	26.04	2	1,404	NHV	2.5
Benzene	C_6H_6	78.11	6	3,591		1.3
1,2-Butadiene	C_4H_6	54.09	4	2,794		2.0
1,3-Butadiene	C_4H_6	54.09	4	2,690		2.0
iso-Butane	C_4H_{10}	58.12	4	2,957	3000	1.8
n-Butane	C_4H_{10}	58.12	4	2,968	3011	1.8
cis-Butene	C_4H_8	56.11	4	2,830		1.6
iso-Butene	C_4H_8	56.11	4	2,928		1.8
trans-Butene	C_4H_8	56.11	4	2,826		1.7
Carbon Dioxide	CO_2	44.01	1	0		∞
Carbon Monoxide	CO	28.01	1	316		12.5
Cyclopropane	C_3H_6	42.08	3	2,185		2.4
Ethane	C_2H_6	30.07	2	1,595	1619	3.0
Ethylene	C_2H_4	28.05	2	1,477	1499	2.7
Hydrogen	H_2	2.02	0	1,212[a]	274	4.0
Hydrogen Sulfide	H_2S	34.08	0	587		4.0
Methane	CH_4	16.04	1	896	909	5.0
Methyl-Acetylene	C_3H_4	40.06	3	2,088		1.7
Nitrogen	N_2	28.01	0	0		∞
Oxygen	O_2	32.00	0	0		∞
Pentane+ (C5+)	C_5H_{12}	72.15	5	3,655		1.4
Propadiene	C_3H_4	40.06	3	2,066		2.16
Propane	C_3H_8	44.10	3	2,281	2315	2.1
Propylene	C_3H_6	42.08	3	2,150	2182	2.4
Water	H_2O	18.02	0	0		∞

[a] The theoretical net heating value for hydrogen is 274 Btu/scf, but for the purposes of the flare requirement in this subpart, a net heating value of 1,212 Btu/scf shall be used.

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RSR for Flares - NHV Control

SSM Impacts

NHV CONTROL

- Startup, Shutdown & Malfunction (SSM) exemption eliminated with RSR
- "The Rule now applies at all times"
- Potentially challenging to comply during major nitrogen purge events and steam outs
- Supplemental fuel gas likely needed to maintain 270 Btu during high N2 flow purging and steam out events

PRINCIPLE OPTIONS-

Any individual or combination of

- Internal Supplemental Fuel Gas
- Reduce Purge Flow
- Thermal Oxidizers
- External Supplemental Fuel Gas

NHV CONTROL-
Internal Supplemental Fuel Gas

- Natural Gas, Light Ends (Fuel Gas), Hydrogen
- Challenges
  - Sufficiently available fuel gas
  - Proximity of fuel gas to flares
  - Capital cost for engineering, piping & infrastructure
  - Necessity to "dial back" purge flow to maintain compliance
- Potential Impacts
  - Ability to maintain compliance
  - Extended turnaround project cycle time
  - Increased turnaround costs - labor, rentals
  - Opportunity cost for major unit downtime

NHV CONTROL-

Dial Back Flow Rate

- High Demand - Hydrocracker Purge
- 60%+/- Dial Back
- Extend project from 1 day to 3
- Opportunity Cost for Production Unit
- Extended Project/ Turnaround Time & Costs

Thermal Oxidizer

- No to low emissions
- Large footprint
- Infrastructure

  > Piping to divert flare stream

  > High energy demand

External Supplemental Fuel Gas (ESFG*)

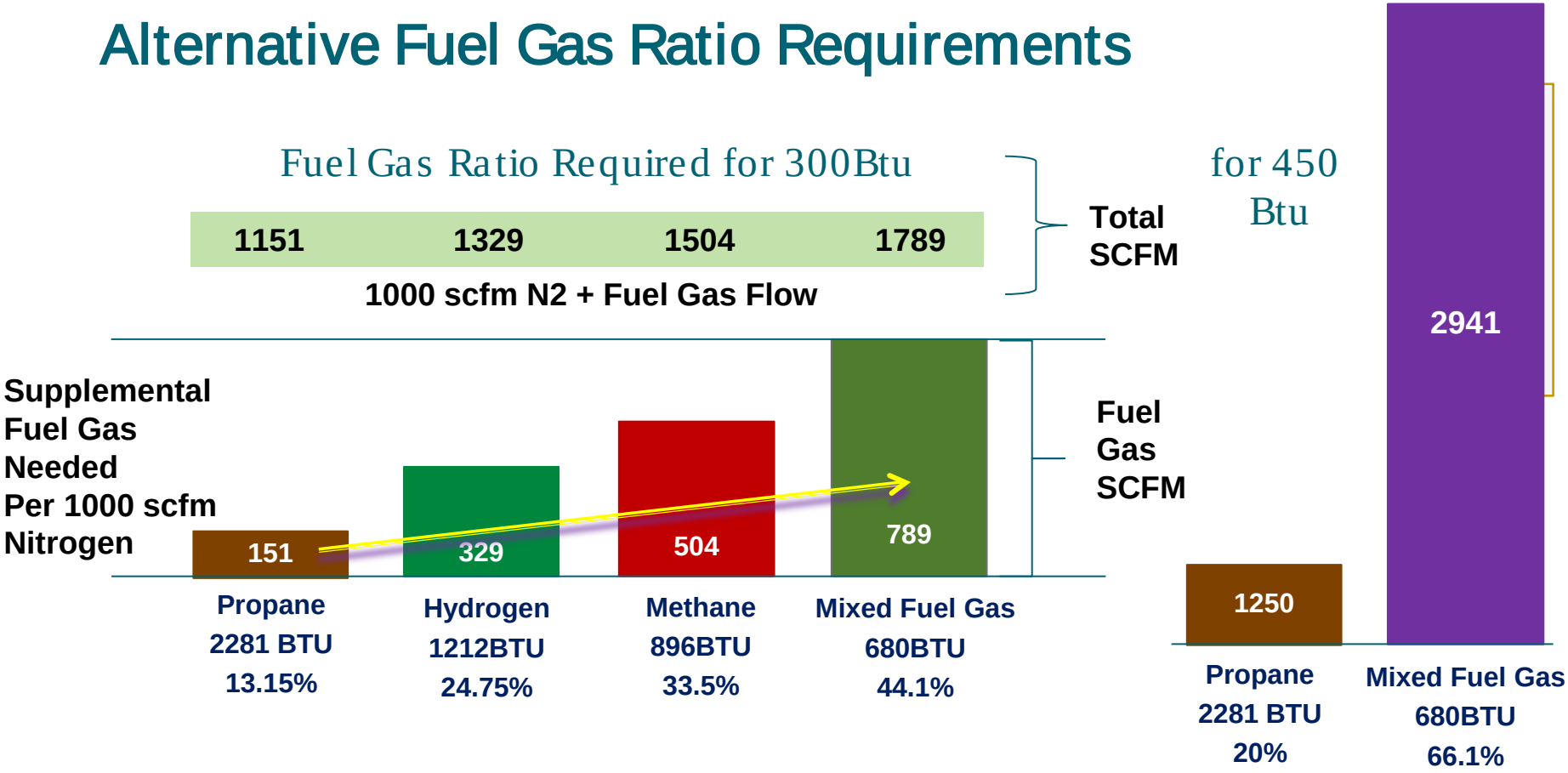
PROJECT BASED

- Single point connection
- Plug and Play
- No utility set up for power, water, steam or gas
- Low capital
- Process downtime and turnaround project time
- Lower gas volume requirements vs. optional fuels

COMPLIANCE

- Ability to stay above required NHV levels
- EPA compliant flow monitoring and low sulfurs fuel

Alternative Fuel Gas Ratio Requirements



External Supplemental Fuel Gas (ESFG)

Liquid Fuel Gas Supply

Trailer Mounted Vaporization

Control Manifold with EPA Compliant Flow Monitoring

Thank you