



VIZION OPTICAL SYSTEM

Optical Flare Compliance and Emissions Control

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ZEECO VIZION

**Compliance Through Optical
Control**

- Smokeless control
- Combustion compliance
- Emissions optimization

SMOKELESS FLARE CONTROL

How are you automating?



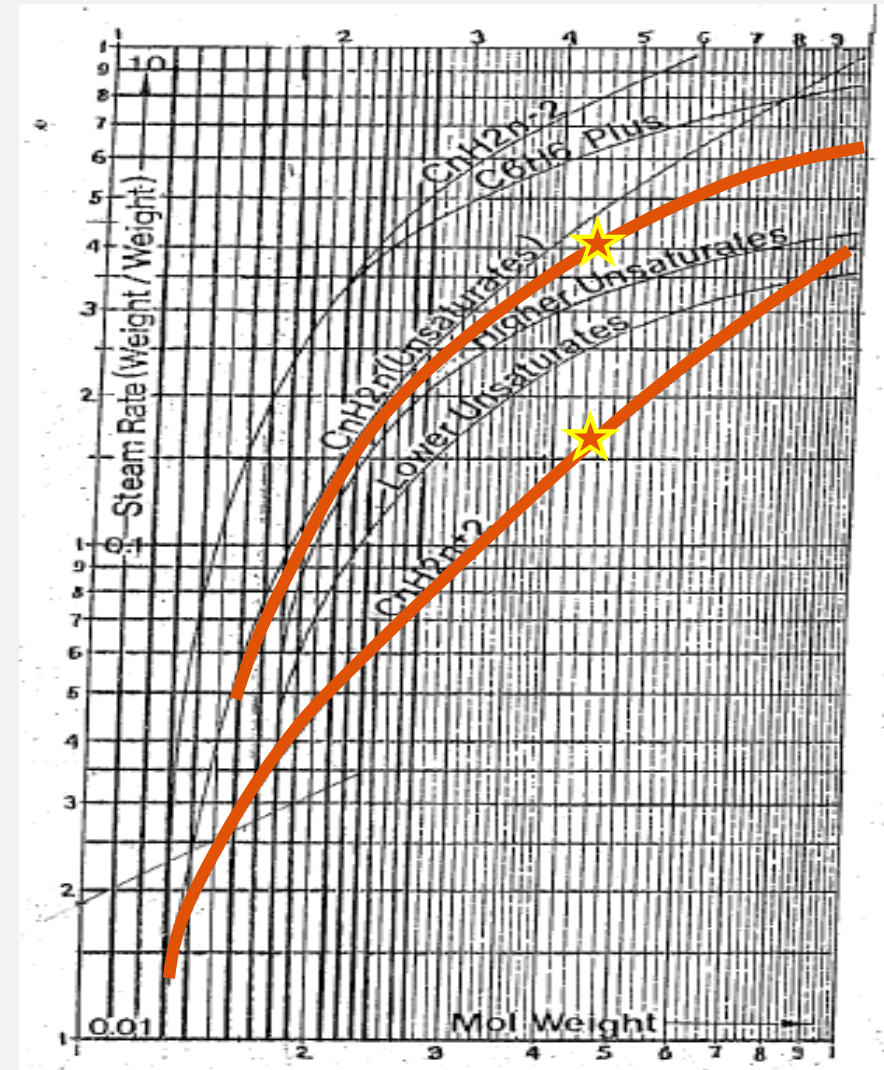
THE FEAR WITH FLARE OWNERSHIP

ZEECO



SMOKELESS INJECTION UNDERSTANDING

- Steam or air injection is utilized for the purpose of smokeless flaring (induces air)
- Minimum flow rate specified for cooling/warming purposes
- Over application harmful
 - Incomplete combustion
 - Capping and internal burning



SMOKELESS INJECTION UNDERSTANDING

- Without speciation, control is imprecise
- More complex plants require
 - More input measurements
 - Quick speciation methods
- Besides information limitations, what is turndown?

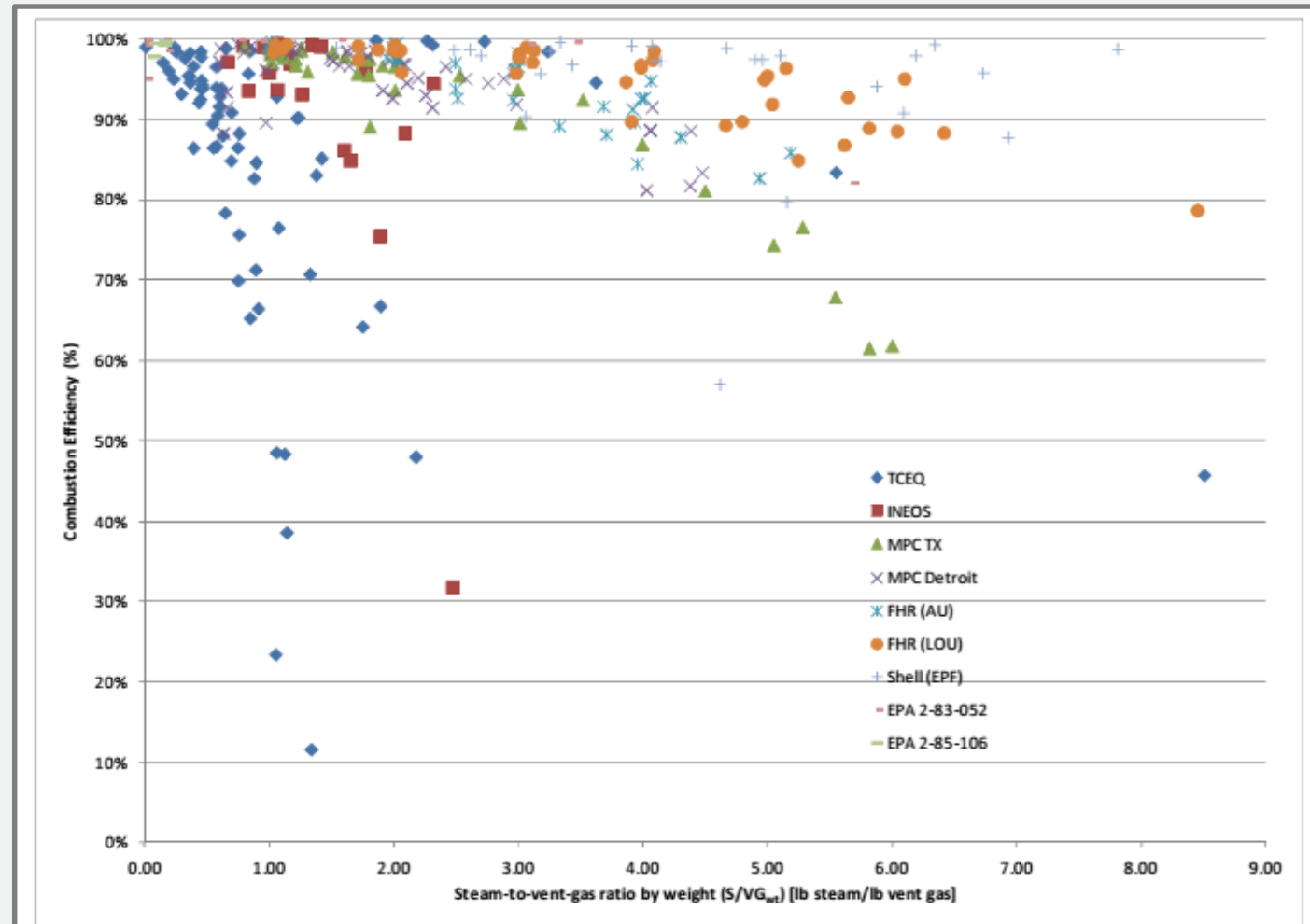
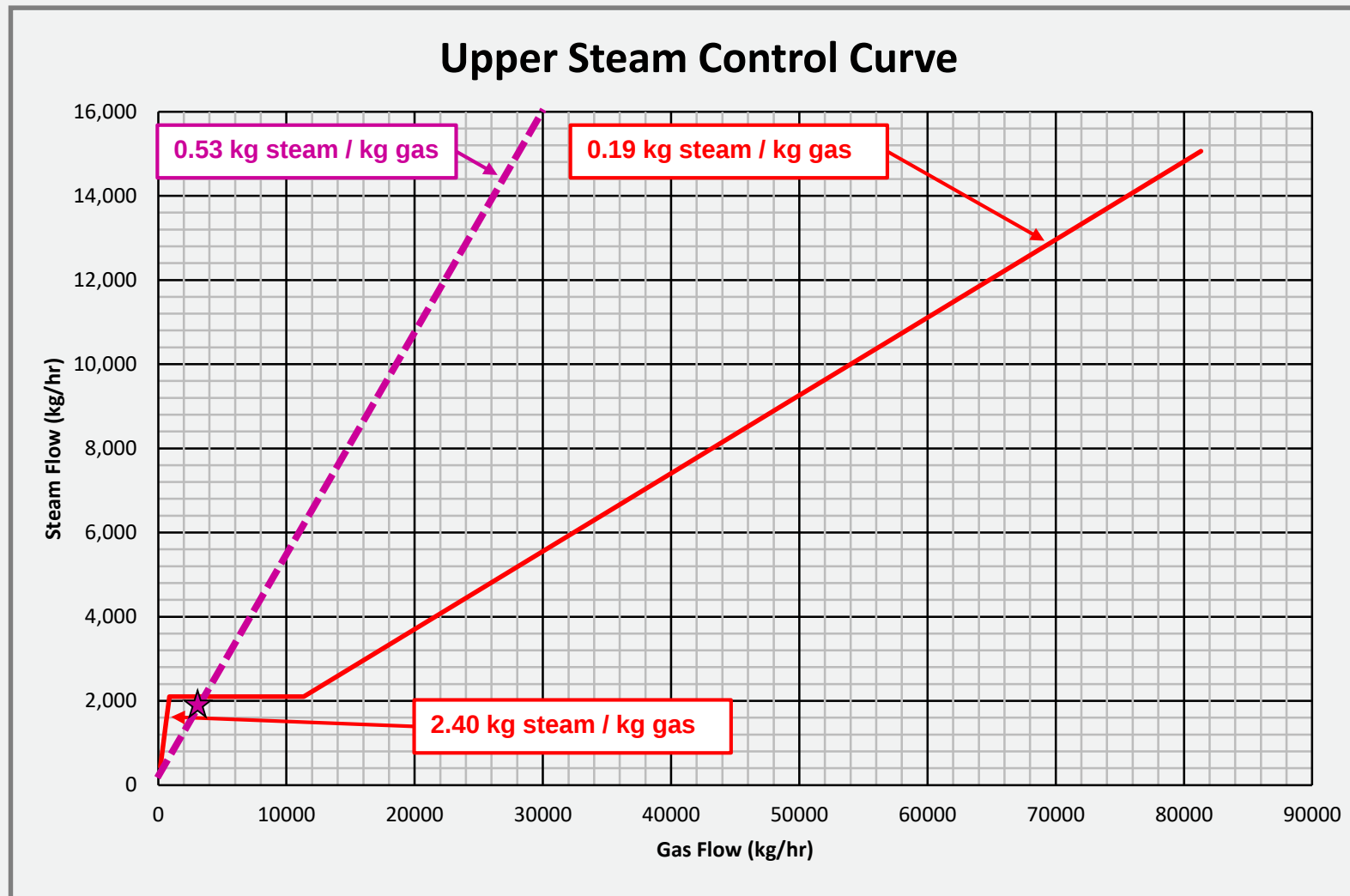


Figure 3-15. Combustion Efficiency vs. S/VG by weight

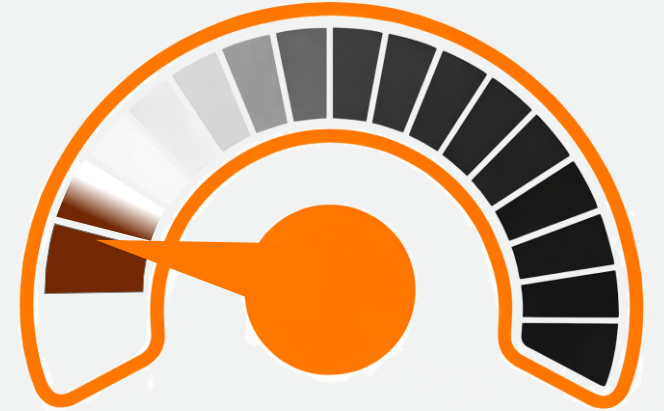
SMOKELESS INJECTION TURNDOWN



SMOKELESS CONTROL: UNDERAERATION



SMOKELESS CONTROL: OVERAERATION



SMOKELESS CONTROL: IDEAL



INTRODUCTION TO SIMPLIFIED VISR

- Multi-spectral IR imager assessing combustion zone
 - Spectrums investigate combustion contributors
 - Direct observation and quantification of combustion
- Tested by EPA in 2022, EPA methods applicable
- Suitable for short-term flare studies and long-term continuous monitoring



VIZION (S-VISR) CAPABILITIES

› Combustion Performance Outputs

- Measured directly, remotely, autonomously, and continuously
- Smoke Index (SI): 0-10 for the level of smoke
- NHVcz/NHVdil: BTU/scf or BTU/ft²
- Flare Destruction Efficiency (DRE) derived in brackets:
 - $\geq 92\%$, $> 95\%$, $> 98\%$, $> 99\%$, and $> 99.5\%$
- Presence of flame: binary YES or NO
- Flame Stability (FS): 0 to 100% (measure of fluctuation in radiance)
- Flame Footprint (FF): flame cross section area (ft² or m²)
- Fractional Heat Release (HR): heat released in MWIR region, BTU/min or MMBTU/hr.
 - Can be calibrated to estimate flare gas flowrate

› Data sent to DCS or PLC

- Display or closed-loop control of flare
- Utilize NHV and SI outputs to control for optimal conditions



INTERFACE: SMOKE CONTROL

- Smoke Index: 0-10
- 1.0-1.5 Insipient Smoke Point (ISP)
- Control to below ISP
- **AUTOMATED** control
 - PV for PID loop
- Binary YES/NO for visible emissions

The screenshot displays the ZEECO VISION interface, which is divided into several sections. At the top, the ZEECO VISION logo is visible. The main content area is organized into four primary panels. The top-left panel, titled 'Data Quality Indicators', lists various metrics: Frame Rate (719 FPS), Sensor T (34.6 C°), Flame Pixels (646), Edge Pixels (14), Data Cubes (6), Cube Yield (100 %), and Flame Stability (95). The top-right panel, titled 'User Inputs', contains fields for Distance (m) (30), Flare Type (Air Assisted Flare), Ambient T (C°) (20), and Relative Humidity (%) (85), along with an 'UPDATE FACTORS' button. The bottom-left panel, titled 'Event Recording', features a 'Name of Event' field (Test 1) and 'START EVENT' and 'DELETE EVENT' buttons. The bottom-right panel, titled 'Display Settings', includes an 'Enable Aiming Mode' toggle and a 'RESET BACKGROUND' button. A central video feed shows a dark scene with a bright, glowing point of light, likely representing a flare. A red rectangular box highlights the 'Smoke Index' and 'Visible Emissions' fields in the top-left panel, which show values of 0.4 and NO, respectively.

Data Quality Indicators			
Frame Rate	=	719	FPS
Sensor T	=	34.6	C°
Flame Pixels	=	646	
Edge Pixels	=	14	
Data Cubes	=	6	
Cube Yield	=	100	%
Flame Stability	=	95	

User Inputs			
Distance (m)	Flare Type	Ambient T (C°)	
30	Air Assisted Flare	20	
Relative Humidity (%)			
85	UPDATE FACTORS		

Event Recording	
Name of Event	
Test 1	
START EVENT	DELETE EVENT

Display Settings
☐ Enable Aiming Mode
RESET BACKGROUND

INTERFACE: QUANTIFIED COMBUSTION

➤ Live NHV_{CZ} and NHV_{dil}

➤ **AUTOMATE** CZ

- Avoid overaerating
- Enrich stream

➤ Path to direct compliance

The screenshot displays the ZECCO VISION interface, which is divided into several sections:

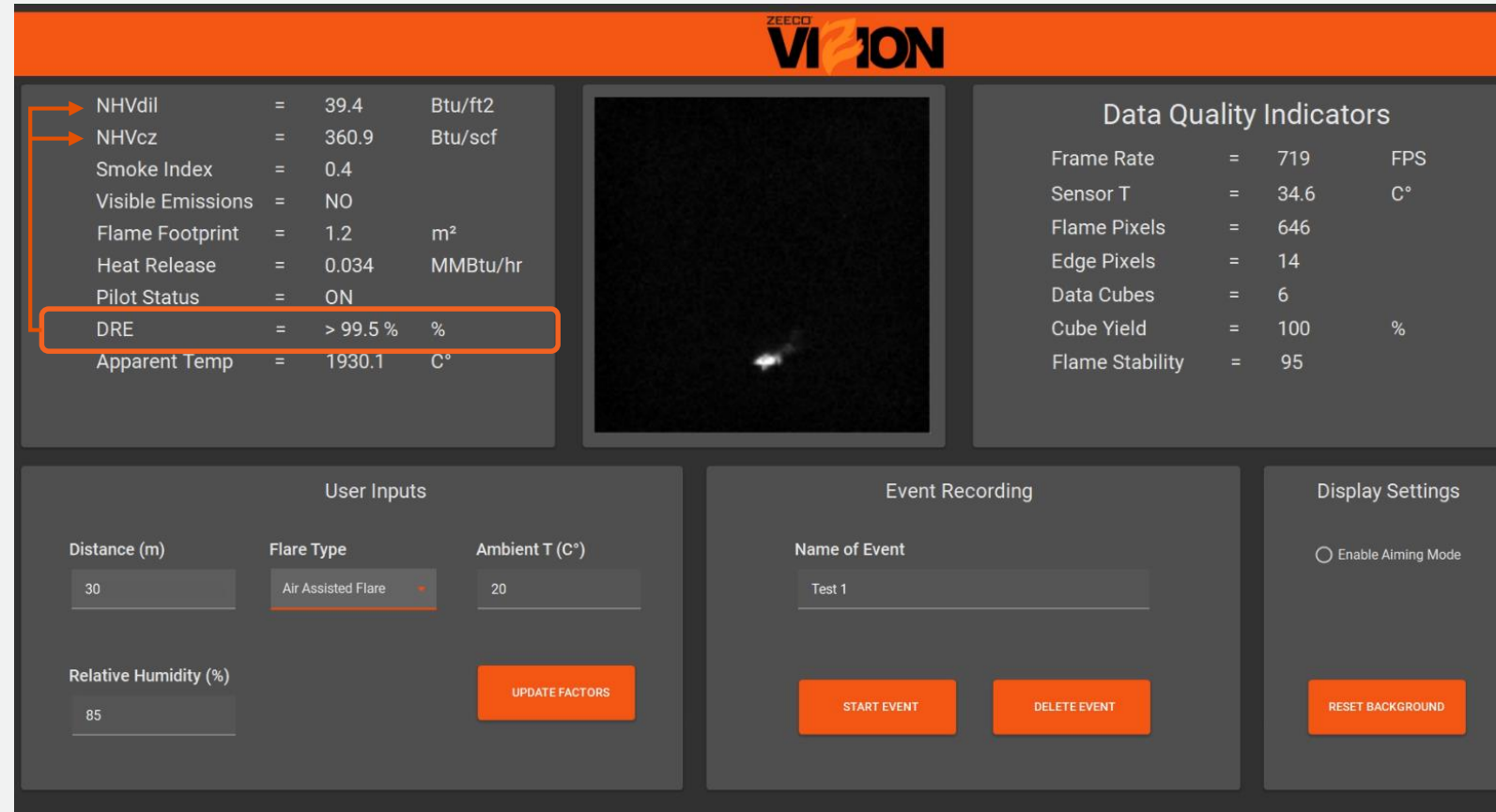
- Top Header:** ZECCO VISION logo.
- Left Panel (Metrics):** A list of combustion parameters with their values and units. The first three items (NHVdil, NHVcz, and Smoke Index) are highlighted with an orange border.

Parameter	Value	Unit
NHVdil	39.4	Btu/ft2
NHVcz	360.9	Btu/scf
Smoke Index	0.4	
Visible Emissions	NO	
Flame Footprint	1.2	m²
Heat Release	0.034	MMBtu/hr
Pilot Status	ON	
DRE	> 99.5 %	%
Apparent Temp	1930.1	C°
- Center Panel:** A live video feed of a combustion flame.
- Right Panel (Data Quality Indicators):** A list of quality metrics.

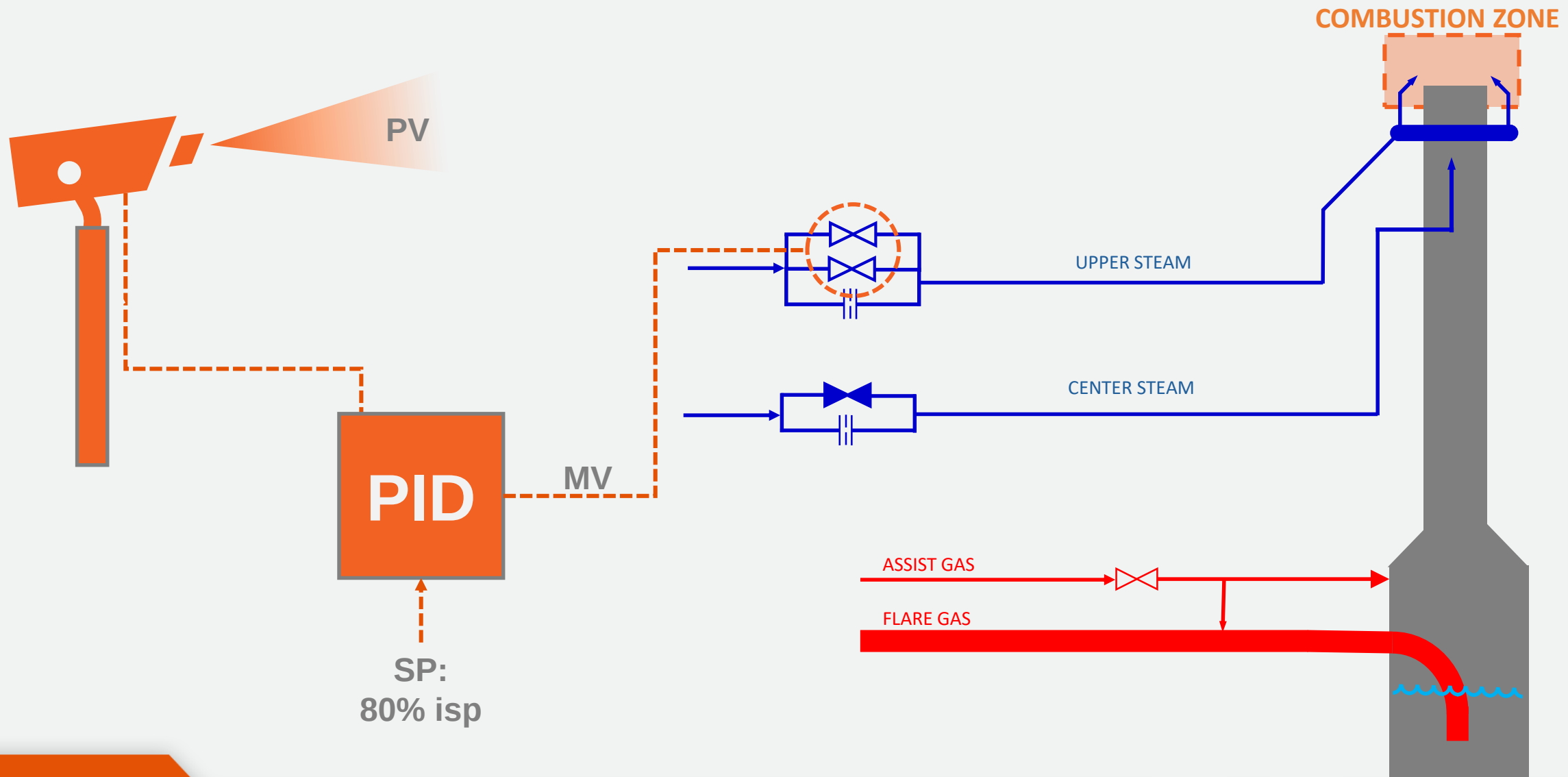
Metric	Value	Unit
Frame Rate	719	FPS
Sensor T	34.6	C°
Flame Pixels	646	
Edge Pixels	14	
Data Cubes	6	
Cube Yield	100	%
Flame Stability	95	
- Bottom Section:** Controls and settings.
 - User Inputs:** Fields for Distance (m) (30), Flare Type (Air Assisted Flare), Ambient T (C°) (20), and Relative Humidity (%) (85). An orange button labeled "UPDATE FACTORS" is present.
 - Event Recording:** A field for "Name of Event" (Test 1) and two orange buttons: "START EVENT" and "DELETE EVENT".
 - Display Settings:** A radio button for "Enable Aiming Mode" and an orange button labeled "RESET BACKGROUND".

INTERFACE: QUANTIFIED COMBUSTION

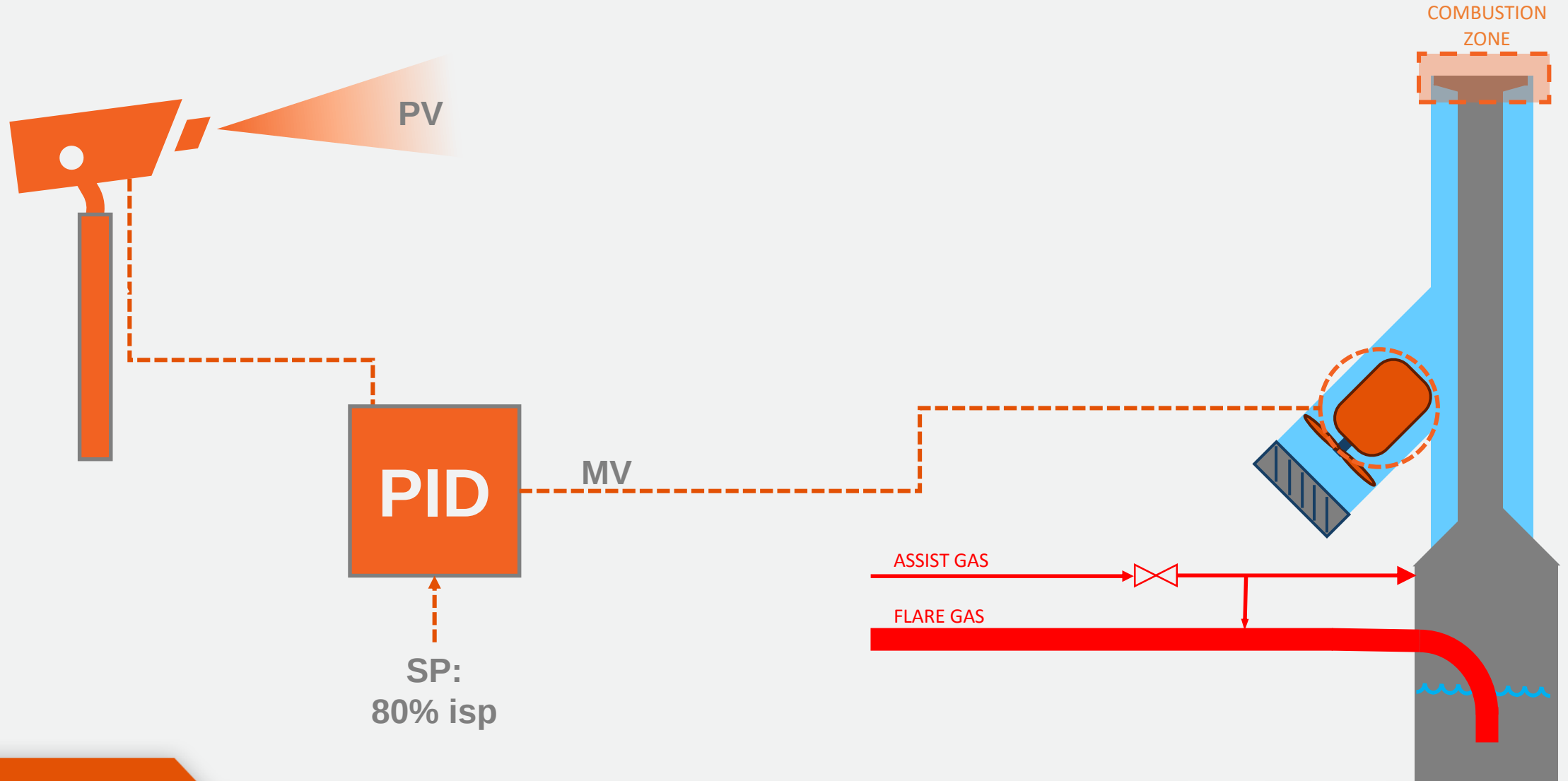
- Live DRE brackets
- **QUANTIFY** combustion
 - Meet/exceed permit performance
 - Automate control to maximize
- Path to methane mitigation



STEAM LOOP CONTROL



AIR FLARE LOOP CONTROL



COMBUSTION COMPLIANCE

Advent of new regulations

OVER-AERATION



63.670: FLARE FLAME COMBUSTIBILITY

- More descriptive than S/HC
- Parameters mimic Lower Flammability Limit, but measurable
- Assesses “health” of CZ, showing over-aeration

$$NHV_{cz} = \frac{Q_{vg} \times NHV_{vg}}{(Q_{vg} + Q_s + Q_{a,premix})}$$

$$NHV_{dil} = \frac{Q_{vg} \times Diam \times NHV_{vg}}{(Q_{vg} + Q_s + Q_{a,premix} + Q_{a,perimeter})}$$

- Does not assess smoke

STEAM ASSIST - $NH V_{CZ}$

- Empirical control parameter
 - Not CE or DRE
- Measure by proxy
 - Available transmitters
 - Exclude CZ query
- Combustion threshold
 - Not smokeless
 - Not optimal

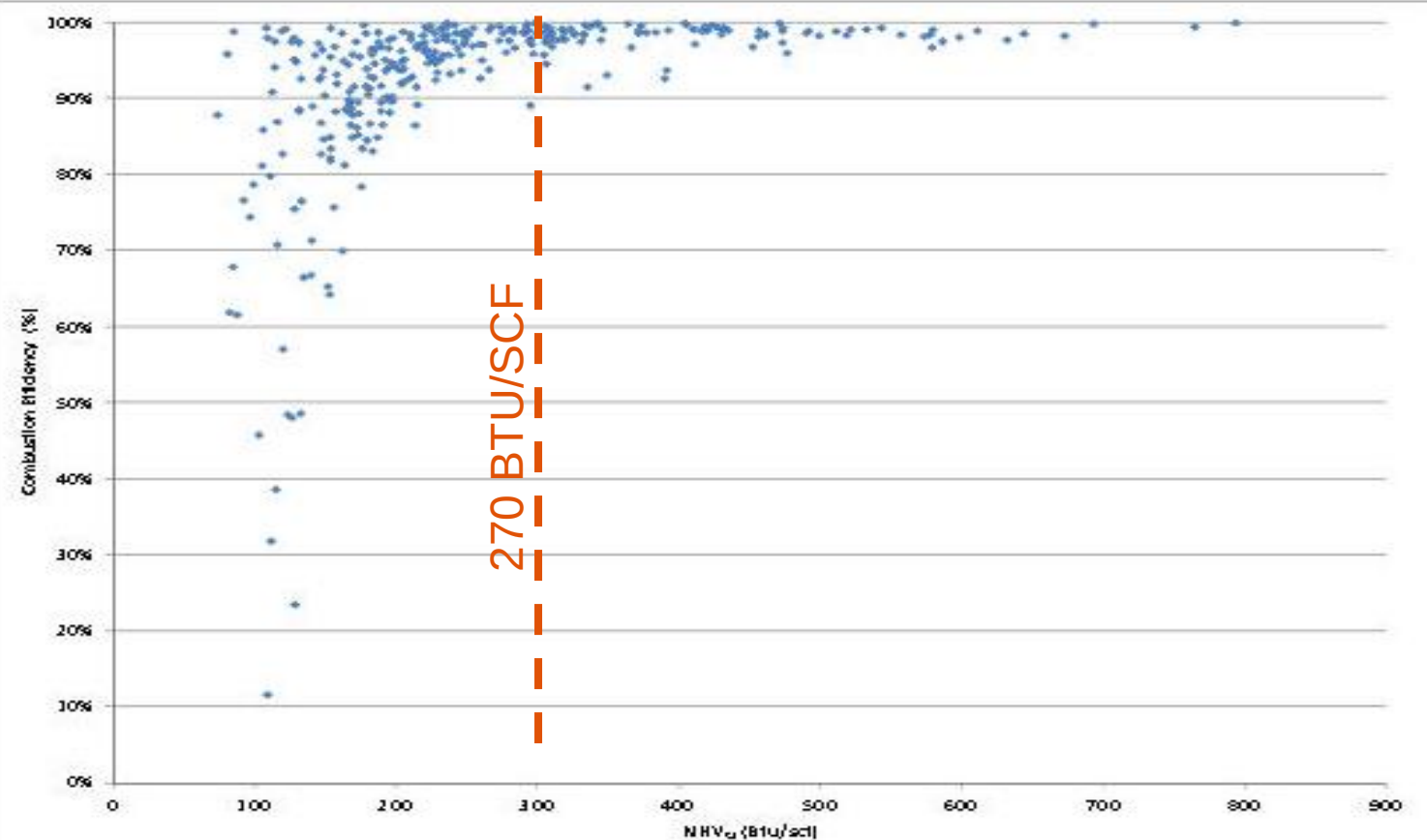
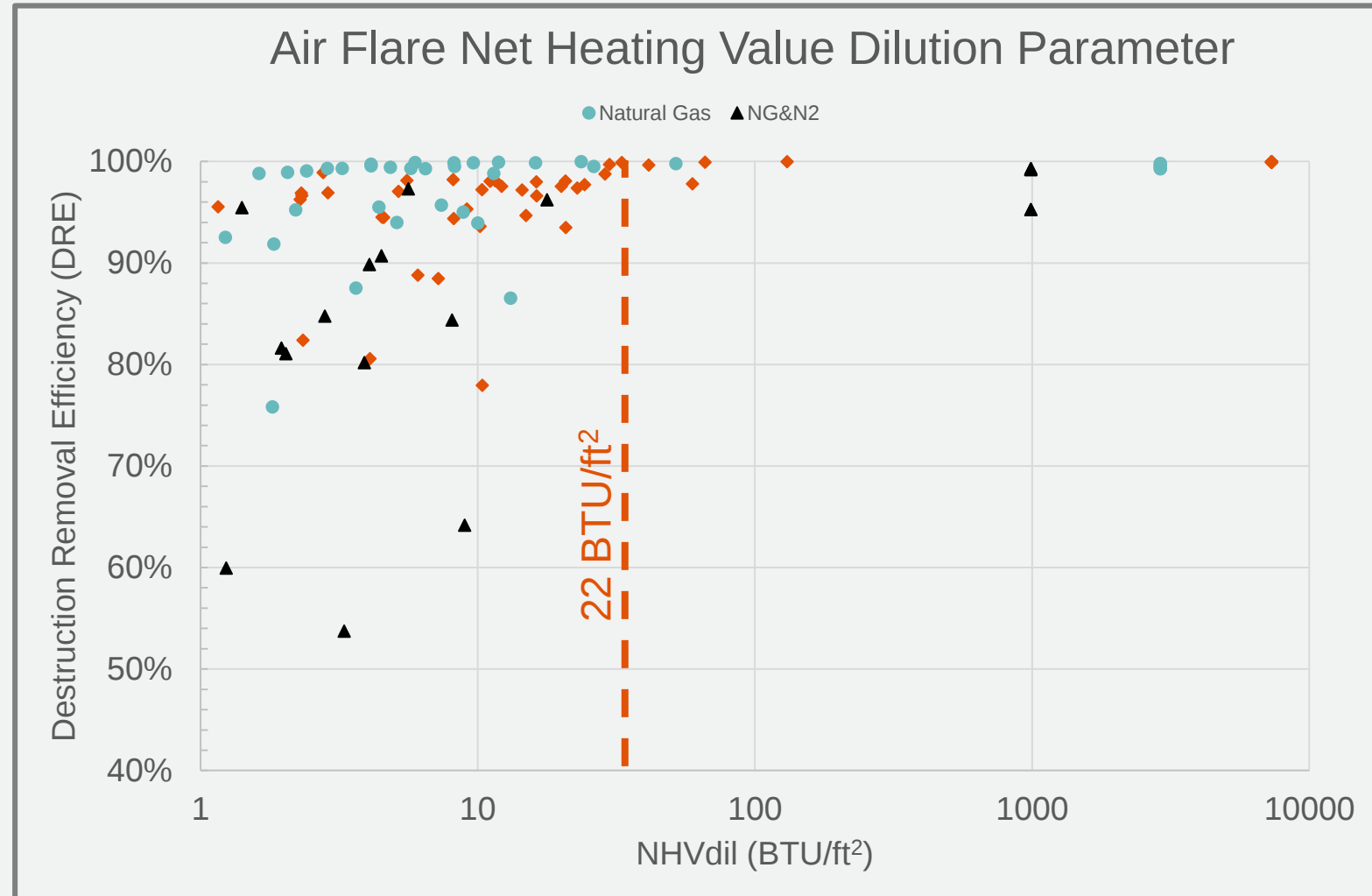


Figure 3-13. Combustion Efficiency vs. $NH V_{CZ}$

AIR ASSIST - NHV_{DIL}

- Empirical control parameter
 - Not CE or DRE
- Measure by proxy
 - Available transmitters
 - Exclude CZ query
- Combustion threshold
 - Not smokeless
 - Not optimal



EMISSION OPTIMIZATION

Exceeding regulations based on operation

REPORT FEWER UNBURNT HYDROCARBONS

EXAMPLE CASE

- Assume flaring rate of 10,000 to 20,000 lb/hr occurs 1.5% of the year
- Remainder of the year, flare operates at purge rate
 - Zeeco ViZion
 - Confirm 99.5% Destruction Efficiency
 - Conventional, Indirect Methods
 - Assume 98.0% Destruction Efficiency



➤ ~350 TPY Reduction CO₂e Emissions

METHANE MITIGATION

➤ § OGMP 2.0

- Level 3 Quantification methodology
 - Measure flare flow and composition
 - Inventory at 98% DRE
 - Limited to non-assisted flares
- Level 4 Quantification methodology
 - Direct measurement of DRE allowed with applicable technologies
 - VISR (ViZion) technology listed
 - Inventory up to 99.5% DRE
 - (75% reduction methane emissions)





BURNERS

FLARES

THERMAL OXIDIZERS

VAPOR CONTROL

RENTALS

AFTERMARKET