FUGITIVE EMISSIONS SUMMIT AMERICAS

2022

Reducing Fugitive Emissions From Control Valves

Fugitive Emissions Summit Americas

Kyle Daniels
President and CEO, Clarke Valve

Agenda

1. Project Scope
   Downstream Refinery Applications
2. Control Valve Fugitive Emissions
   Oil and Gas Industry
3. Dilating Disk Valve
   Patented Technology
4. Fugitive Emissions Results
   Clarke Valve Installation at Eni

Project Scope

Downstream Installations

- Raw Oil – SV6-RF300-CV308
- Stabilized Oil – SV6-RF300-CV71
- Water – SV4-RF150-CV308
- Natural Gas) – SV2-RF150-CV71
- Amine – SV2-RF300-CV20

The 5 valves were installed in
February 2020

Actuation Package

- Emerson FieldQ Pneumatic actuator
- DVC Positioner

Certificates

- Directive 2014/68/EU
- ATEX
- ISO 15848-1/Amd.1FE B-CC2-SSA1-t(−29°C,120°C)-CL150
- ISO 15848-2

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Project Objective

Raw Oil

6” RF300 CV308

- ✓ **Monitor** valve performance from a process control and fugitive emissions standpoint.
- ✓ **Install, observe and measure** Clarke Valve’s controllability and ability to plug and play into Eni operations.

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Project Objective

The 5 valves were installed in February 2020

Natural Gas	Amine	Stabilized Oil	Produced Water
			
			
2” RF150 CV71	*2” RF300 CV20*	*6” RF300 CV71*	*4” RF300 CV308*

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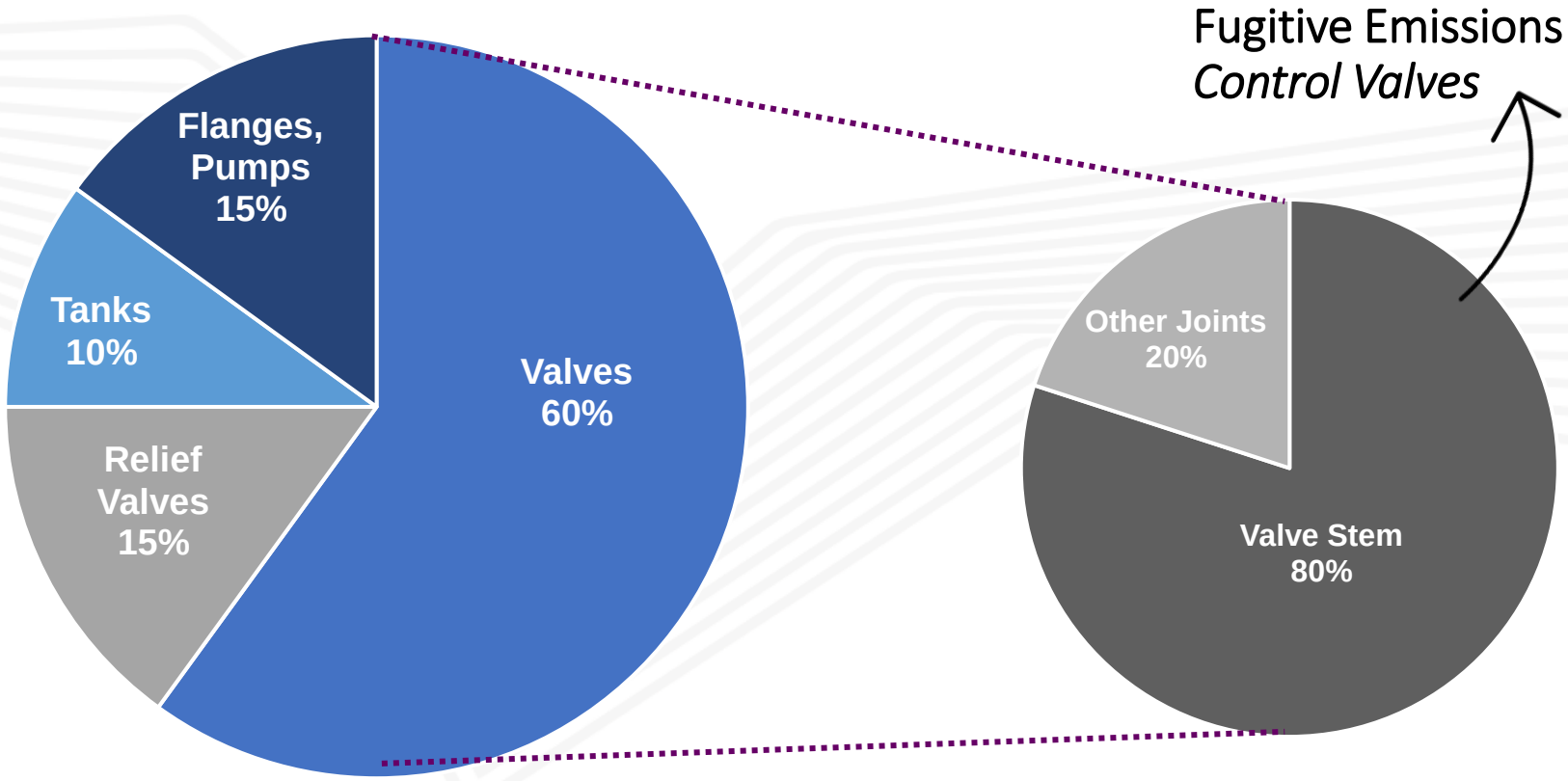
Addressing a Key Source of Fugitive Emissions: *Control Valves*



Fugitive emissions from valve stems are considered to account for approximately **60%** of the total fugitive emissions of a refinery.

Source: *Monitoring and Containment of Fugitive Emissions from Valve Stems – Electrical Conductivity and Gas Adsorption Measurements on Metal Oxides - Department of Chemical and Biological Engineering University of British Columbia, Vancouver, BC, Canada*

Addressing a Key Source of Fugitive Emissions: *Control Valves*

Table 3.2 – Equipment component counts at a typical refinery or chemical plant.

Component	Range	Average
Pumps	10 – 360	100
Valves	150 – 46,000	7,400
Connectors	600 – 60,000	12,000
Open-ended lines	1 – 1,600	560
Sampling connections	20 – 200	80
Pressure relief valves	5 – 360	90

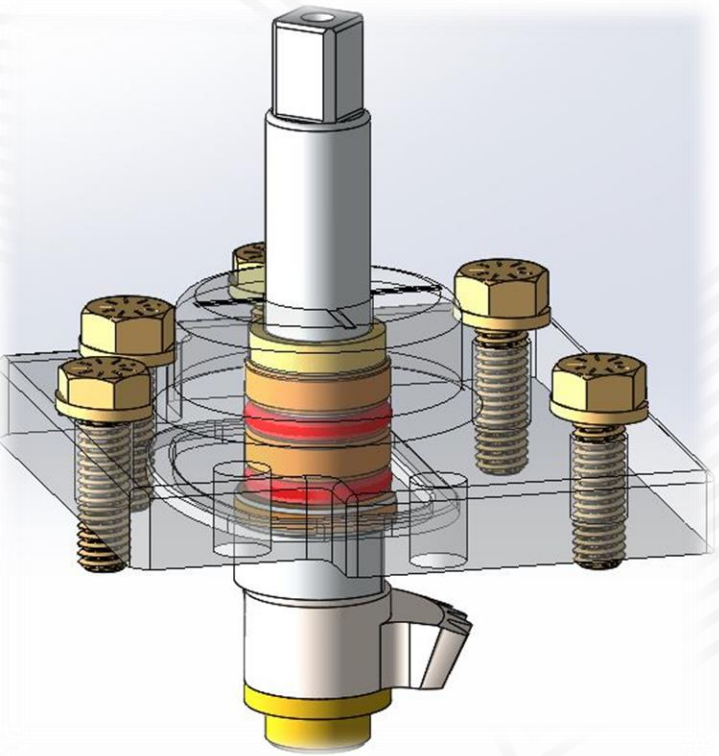
Source: "Cost and Emission Reductions for Meeting Percent Leaker Requirements for HON Sources." Memorandum to Hazardous Organic NESHAP Residual Risk and Review of Technology Standard Rulemaking docket. Docket ID EPA-HQ-OAR-2005-0475-0105.

Table 3.3 – Uncontrolled VOC emissions at a typical facility.

Component	Average Uncontrolled VOC Emissions (ton/yr)	Percent of Total Emissions
Pumps	19	3
Valves	408	62
Connectors	201	31
Open-ended lines	9	1
Sampling connections	11	2
Pressure relief valves	5	1
Total	653	

Source: Emission factors are from Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995, and equipment counts in Table 3.2.

Stem Seal Technology: *ISO and API Certified*



ISO 15848-1
AM CC3

API 641
Group A

Yarmouth Research and Technology, LLC

Test Data Summary - Body Seal

Cycle Number	Nom.Temp (C)	Leakage - PPMv Avg.	Max.
0	20	1	1
20,000	20	1	1
60,000	20	0	1
100,000	20	1	1
Maximum Leakage:		1	1
Maximum Allowable:		50	50

Test Data Summary - Operating Actuator Pressure

Cycle Number	Nom.Temp (C)	Operating Actuator Pressure (psig)
0	20	70
100,000	20	69

Packing Retorque Notes:

Adjustment Number	Static Leakage Readings before Tightening (PPMv) Avg.	Max.	Before Adjustment Nut Torque (ft-lb)	After Adjustment Nut Torque (ft-lb)	Operating Actuator Pressure (psig) Before Adjustment	After Adjustment
1						
2						
3						
	50	50	<- Maximum Allowable Leakage			

Nut Torque at End of Test: (ft-lb)	N/A	Top	N/A	Bottom

Performance Class:
ISO FE AM - CC3 - SSA 0 - tRT - Class 300 - ISO 15848-1

Results
The valve met the requirements of the performance class stated above.

Certified By

Matthew J. Wasielewski, PE
President and Manager
Yarmouth Research and Technology, LLC

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Body / Bonnet Leakage

Cycle Number	Bonnet Temp - (F)	Pressure (psig)	Leakage (PPMv) Avg.	Max.
0	81	600	1	2
610	80	600	14	16

Valve Operating Torque

Operating Torque First Cycle:	10	in-lb
Operating Torque Last Cycle:	10	in-lb

Results

Number of Mechanical Cycles Completed:	610	
Number of Thermal Cycles Completed:	3	
Maximum Static Leakage Throughout Test:	18	PPMv
Maximum Dynamic Leakage Throughout Test:	20	PPMv
Maximum Body/Bonnet Leakage Throughout Test:	16	PPMv

Final Test Results:	PASS

Qualifications of similar valves according to para. 11 of test standard per

Valve Group:	A

Test Notes:

Certified By

Matthew J Wasielewski, PE
President and Manager
Yarmouth Research and Technology, LLC
Test Technician: Jesse Jarvi

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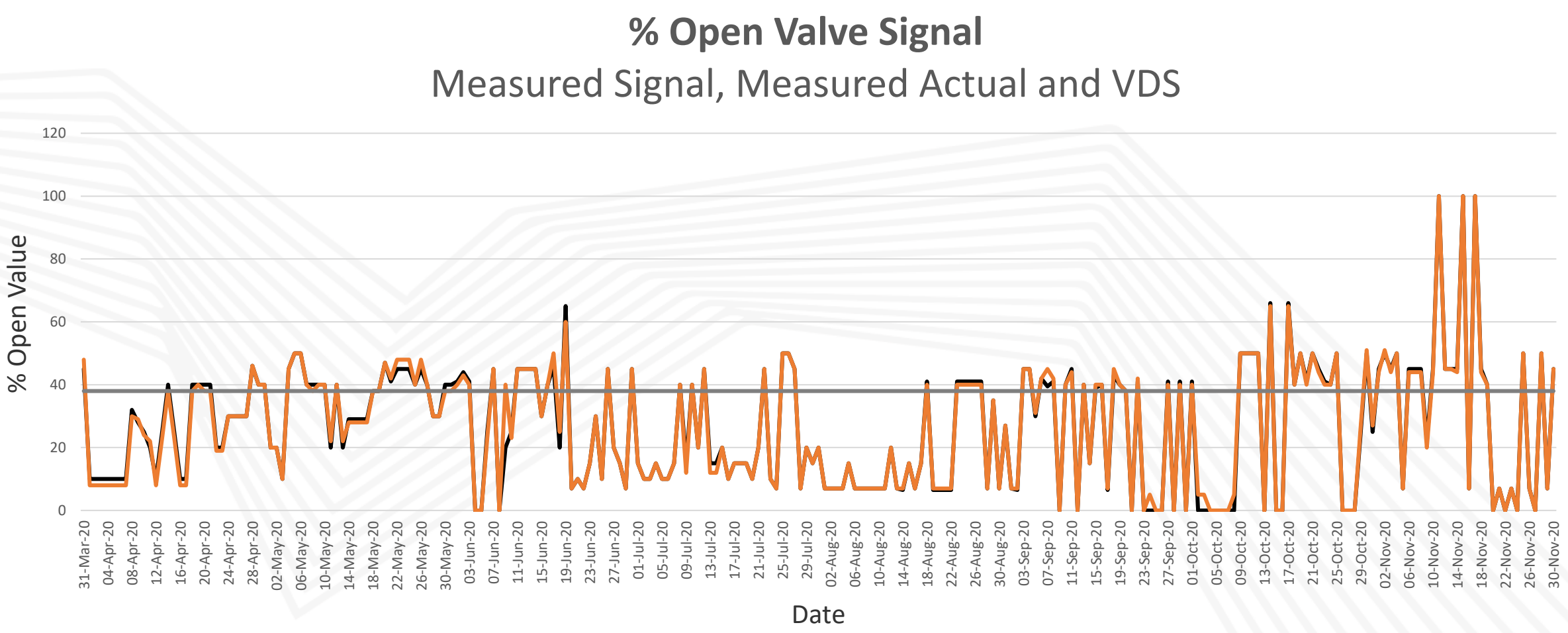
Performance Results



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120-LV 22 March-November 2020

Fugitive Emissions Measurements
Executive Summary of Findings

Eniprogetti team monitored the sources according to the methodology reported both in EPA 435/1995 reference (EPA Method-21) and UNI EN 1544 standard.

By using a certified portable FID/PID analyzer (Thermo Fisher Scientific mod. TVA2020 Toxic Vapor Analyzer), the monitoring concerned four valves, one was temporarily out of service. ***No emission were pointed out.***

Equipment Tag	Fluid	FID/PID Detector	Results	Results
			November 2nd, 2020	May 23rd, 2022
120-LV-22	Raw Oil	FID	**0 ppm**	**0 ppm**
120-LV 51	Stabilized Oil	FID	**0 ppm**	**N/A**
42-PV-04A	Produced Water (Hydrocarbon contaminates)	FID	**N/A**	**0 ppm**
120-PV-504	Natural Gas	FID	**0 ppm**	**0 ppm**
230-LV-01	Amine (MDEA)	PID	**0 ppm**	**0 ppm**

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