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Date: 28th January 2022
Your Ref: YP3930EX

Gary Evans,
Technical Specialist Industry Regulation,
Natural Resources Wales,
Plas Gwendraeth,
Heol Parc Mawr,
Cross Hands,
Carmarthenshire,
SA14 6RE

Dear Mr Evans,

EPR – Improvement programme requirements

Permit number:	YP3930EX/V007
Company:	Valero Energy Ltd
Installation:	Pembroke Refinery
Reference:	IC35

In response to Improvement Condition 35 (IC35) of the above permit, please find attached our Annual Flaring report which addresses the points made in these Improvement Conditions.

IC35: To reduce emissions to air from flaring, the Operator shall carry out and produce an Annual Flaring report to Natural Resources Wales that details the following:

- Minimum flare loading (baseload loading)

And for flaring events above an agreed threshold level (flaring event), it shall detail –

- Duration of each flaring event
- Quantity and nature of material flared at each event, and
- Root cause(s) of each flaring event

The Annual Flaring report shall summarise the frequency of these flaring events and identify ways to reduce the frequency, magnitude and duration of flaring events, considering the techniques identified in BAT 55 and BAT 56 for the refining of mineral oil and gas. The findings of this work is the basis for an annual flare minimisation plan. Pre-notified flaring events do not need to have a root cause investigation. The Operator shall implement the minimisation plan to a timetable agreed with Natural Resources Wales.

If you have any questions or comments, please do not hesitate to contact me.

Yours sincerely,

A.P.Waterman

Andy Waterman
Manager Environmental Engineering

cc: Karen Muehlbauer
cc: Mark Phair

Valero Energy Ltd
Annual Flaring Report 2021

This annual flaring report addresses the points made in the Improvement condition IC35. A flaring event is established when the daily average flare flow reading exceeds set values. These values are the 2018 average hourly flare flows, for each of the three flares, plus two standard deviations, shown below in Table 1.

Table 1: Table outlining the 2018 average hourly flare flows, plus two standard deviations.

Flaring System	Sour	Sweet	Acid
2018 Flows (Te/h)	1.9	4.0	1.1

The minimum flare loading that occurred in 2021 for each flare can be seen below in table 2. These values are the average of the hourly flare flow readings, over the entire year, excluding flaring events, plus two standard deviations.

Table 2: Table outlining the 2021 average hourly flare flows, plus two standard deviations.

Flaring System	Sour	Sweet	Acid
2021 Flows (Te/h)	1.4	3.9	1.1

The flaring events recorded in 2021 along with the duration of each flaring event, the quantity and nature of the material flared as well as the root cause can be seen below in Tables 3, 4 and 5. In addition, a graph illustrating the number of flaring events that occurred each month, across the year of 2021 can be seen below in Figure 1.

To reduce the frequency, magnitude and duration of flaring events within 2021 the following have been implemented.

- Increased daily focus on flare minimisation.
- 02-PV-077 valve overhauled to reduce potential passing to flare.
- Overhaul of PSV's on C&O units during TAR reducing passing to flare.

In summary, to reduce the frequency, magnitude and duration of the flaring events observed in 2021 the following will be reviewed.

- Establishment of a cross functional shift team to review the reduction of baseline flaring.
- Investigation into potential overhauling of valves on flare systems for Refining units.
- Investigation into potential trial of alternative valves on C&O units giving improved shut-off and reduced passing to flare.
- Progress planned cleaning of overhead fin fans within Refining and C&O units to reduce potential for flaring.
- Review of the number of spare fin fan banks on critical systems before the summer period.

Table 3: Table outlining the flaring events of the sour flare in 2021.

Sour Flare				
Date	Average Flare Flowrate [Te/h]	No of days above threshold	Nature of material flared	Root cause(s) of flaring event
	Limit 1.9			
07/01/2021	2.56	1	HC	Wet gas compressor tripped FCCU
24/01/2021	3.17	6	HC and Steam	FCCU shutdown procedure
01/02/2021	2.09	1	HC and Steam	FCCU/ ULSG (05-F-504) shutdown procedure
02/02/2021	4.23	76	Steam / Water	Sour flare blinded and routed to Sweet flare due to TAR of units
16/04/2021	1.92	2	HC	Sour flare included Sweet flare for period
19/04/2021	1.81	1	HC	Tartan propane sample point leak worsened. Rundown blocked in and on total reflux with propane going to off gas.
21/04/2021	2.00	1	HC	Tartan propane sample point issues
23/04/2021	2.35	2	HC	Sour flare included Sweet flare for period
27/04/2021	1.98	1	HC	Sour flare included Sweet flare for period
28/04/2021	1.56	1	HC	Sour flare flow no longer includes sweet flare flow and is running on purge gas only until C&O start-up.
10/05/2021	1.94	1	Nitrogen + Hydrogen	ULSG catalyst sulphiding - once through H2 purge due to 05-C-501 seal problems
20/05/2021	2.45	4	HC	C&O start up activities
24/05/2021	15.17	1	HC	C&O start up activities; WGC trip
25/05/2021	2.03	2	HC	C&O start up activities
20/09/2021	1.95	1	HC	Sweet Flare excess FCCU olefin rundown to Sphere 835 due to reduced Alky circ.
28/09/2021	4.51	1	HC	FCCU Trip
29/09/2021	12.74	2	HC	FCCU Start-up
04/10/2021	4.98	2	HC	Unit upset, lost level in our LCGO tray on the main frac excess flaring due to this
07/10/2021	4.72	1	HC	Pump 02-P-205 on LCGO reflux cavitating. Falling LCGO level in main frac, De-but flaring.

Table 4: Table outlining the flaring events of the sweet flare in 2021

Sweet Flare				
Date	Average Flare Flowrate [Te/h]	No of days above threshold	Nature of material flared	Root cause(s) of flaring event
	Limit 4.0			
18/01/2021	4.80	1	HC and Steam	Butamer leak on compression suction line, HTU2 shutdown, ULSG Phase 2 shutdown.
19/01/2021	4.61	1	HC and Steam	Isom shutdown.
24/01/2021	4.41	1	HC and Steam	Butamer shutdown procedure.
29/01/2021	4.85	1	HC and Steam	Refining units shutdown procedures
31/01/2021	2.26	1	HC and Steam	Refining units shutdown procedures
03/02/2021	4.67	1	HC and Steam	FCCU purging activities (02-F-319)
14/04/2021	1.78	1	Olefins	Decommissioning Sphere 837
17/04/2021	1.87	12	Steam / Water	Sweet flare shutdown.
24/05/2021	10.69	1	HC	Benzene unit flaring due to 2 fin-fans being O.O.S; Butamer start-up activities
25/05/2021	7.52	3	Olefins	FCCU online but Alky offline, storing olefins in spheres and going to flare when over pressurising.
30/05/2021	5.36	3	HC and Olefins	Benzene unit flaring, 2 fin-fans O.O.S. Stored olefins in spheres going to flare when over pressurising due to high ambient temps.
04/06/2021	4.18	1	HC and Olefins	Benzene unit flaring, 2 fin-fans O.O.S. Stored olefins in spheres going to flare when over pressurising due to high ambient temps.
13/06/2021	4.88	3	HC and Olefins	C3 Spheres flaring due to 1 VRU available. Benzene unit having cooling fan issues.
25/06/2021	4.42	1	HC and Olefins	Iso-butane spheres flaring due to hot run down from the units and no cooling available.
30/06/2021	4.17	1	HC and Olefins	Isobutane sphere 838 flaring due to high ambient temps
16/07/2021	5.31	7	HC and Olefins	Heat wave. High ambient temperatures caused gas expansion within spheres which were vented to the flares.
07/09/2021	5.34	1	HC and Olefins	Heat wave. High ambient temperatures caused gas expansion within spheres which were vented to the flares.
12/09/2021	6.20	2	HC and Olefins	Excess FCCU olefin rundown to Sphere 835 due to Alky shutdown - leak on 04FT234A threaded joint
15/09/2021	5.43	7	HC and Olefins	Excess FCCU olefin rundown to Sphere 835 due to Alky shutdown - leak on 04EA101 fin fan header
24/09/2021	4.23	3	HC and Olefins	Butamer low rate due to start-up flaring from spheres/ Isom driers/ CCR
29/09/2021	4.72	2	HC	Excess LPG as Butamer offline and Alky on recirc;

				ISOM feed surge drum high drum output due to reduced feed
17/10/2021	4.54	2	HC	Off gas compressor 09-C-101 on back of HTU1 offline for scheduled maintenance routing off gas to sweet flare. Spheres intermittently flaring due to IC4 import & C3 R/D temp from alky high.
26/11/2021	5.09	1	HC	Over pressurisation of FG header, 35PC103.OP is 15% open to flare, intermittent blowdown from Spheres and Butamer.
28/11/2021	5.77	1	HC	Alky Start-up/ Spheres/ Butamer
02/12/2021	5.45	2	HC	Spheres/ Butamer offline. C&O unit start up. Additionally, hot rundown temperatures to olefin sphere contributed to high flaring.

Table 5: Table outlining the flaring events of the acid flare in 2021.

Acid Flare				
Date	Average Flare Flowrate [Te/h]	No of days above threshold	Nature of material flared	Root cause(s) of flaring event
	Limit 1.1			
21/01/2021	2.69	9	HC and nitrogen purge	Alky shut down and prep activities
06/02/2021	0.07	105	Steam / Water	Alky flare shutdown
24/05/2021	1.36	2	HC & N2	Alky start-up activities, nitrogen purges, etc
27/05/2021	1.43	20	HC & N2	Alky start-up activities, nitrogen purges, etc
16/06/2021	1.27	5	HC & N2	Settler venting due to 04-LV-181 performance
17/09/2021	1.22	4	HC & N2	Butamer reactor purging to Acid flare
22/09/2021	1.16	1	HC (C3)	High back-pressure on propane rundown

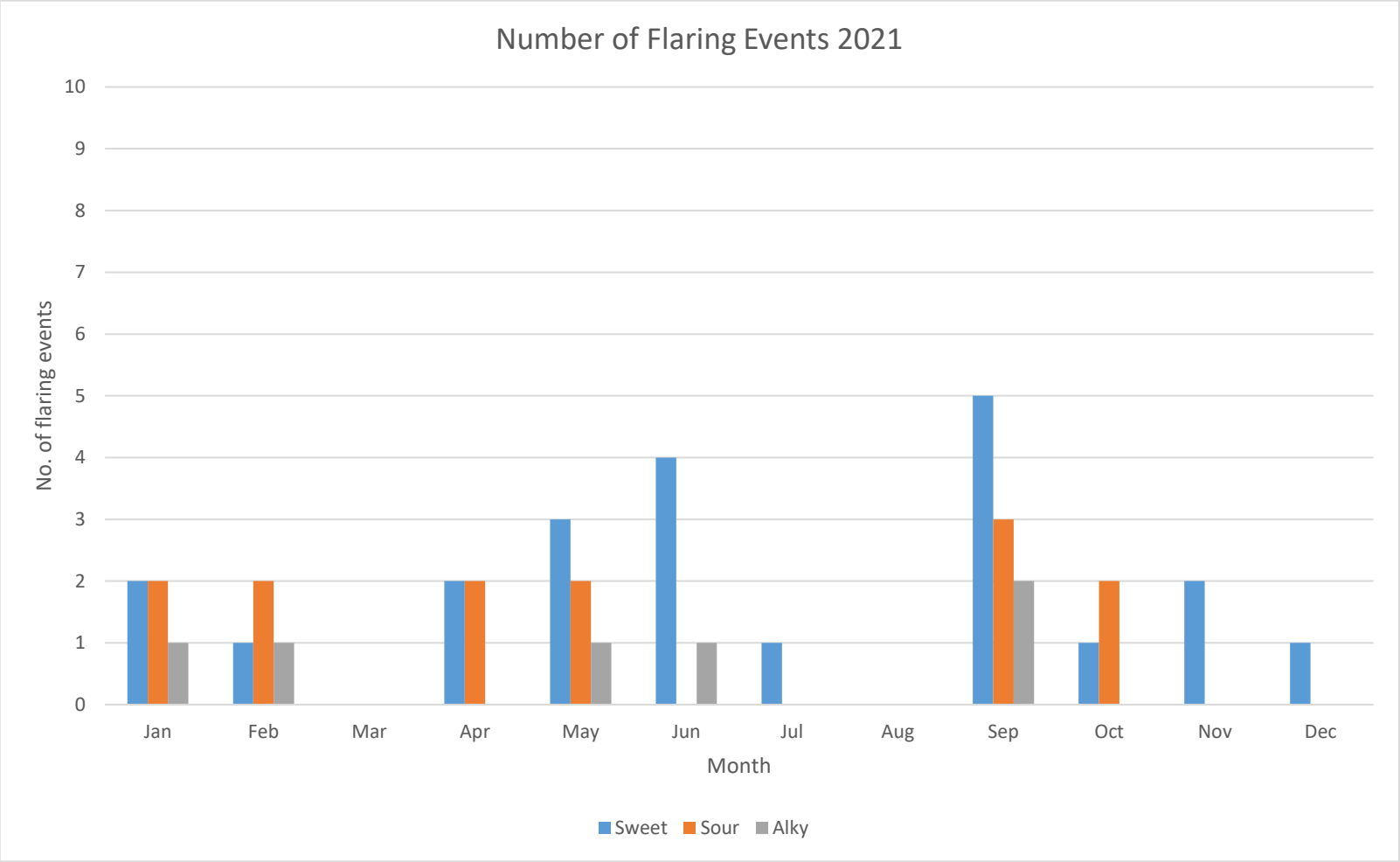

Figure 1: Bar chart illustrating the number of flaring events, for each flare during 2021.