Notice of variation with introductory note

Environmental Permitting (England & Wales) Regulations 2010

Valero Energy Limited

Pembroke Refinery
Pembroke
Pembrokeshire
SA71 5SJ

Variation application number

EPR/YP3930EX/V002

Permit number

EPR/YP3930EX

Pembroke Refinery
Permit number EPR/YP3930EX

Introductory note

This introductory note does not form a part of the notice

The following notice gives notice of the variation of an environmental permit.

The requirements of the Industrial Emissions Directive (IED) 2010/75/EU are given force in England through the Environmental Permitting (England and Wales) Regulations 2010 (the EPR) (as amended).

This Permit, for the operation of large combustion plant (LCP), as defined by Articles 28 and 29 of the Industrial Emissions Directive (IED), is varied by Natural Resources Wales to implement the special provisions for LCP given in the IED, by the 1 January 2016 (Article 82(3)). The IED makes special provisions for LCP under Chapter III, introducing new Emission Limit Values (ELVs) applicable to LCP, referred to in Article 30(2) and set out in Annex V.

The Operator was unable to join the TNP and has chosen to operate this LCP under the ELV compliance route. This is a change from the previous operating regime which was Large Combustion Plant Directive NERP compliance.

The variation notice uses updated LCP numbers in accordance with the most recent DEFRA LCP reference numbers. The LCP references have changed as follows:

- LCP48 is changed to LCP371; 295.4 MW net thermal input
- LCP49 is changed to LCP373; 262.1 MW
- LCP50 is changed to LCP374;50.9 MW
- LCP51 is changed to LCP375; 287.1MW and
- LCP52 is changed to LCP372; 86.3 MW.

The rest of the installation is unchanged and continues to be operated as follows:

The purpose of the site is to process crude oil into its component parts to produce fuels and feedstocks for sale into various markets. The processing of crude oil involves a series of inter-linked processes, as follows:

a) *De-salter:* this unit removes water and water-soluble salts from the crude oil prior to it being transferred to the crude distillation unit (CDU). The crude is water washed and additives are used to break any oil/water emulsion that could potentially form. The separation of the oil and water phases is carried out by means of an electrical field. This ensures that the maximum amount of water and salts are removed from the crude oil. The salt water is then sent to the site's effluent treatment plant. The water used within the desalter is often recirculated process water from other parts of the site.

b) *Crude distillation unit (CDU):* The CDU functions to separate crude oil by distillation into the generic fractions of naphtha, kerosene, light diesel, heavy diesel, LPG and fuel gas. The unit comprises several separate distillation columns. There are a series of heat exchangers within the unit which enables heat energy to be recycled e.g. heat energy released by condensing distillates is used to pre-heat incoming crude oil stream. Around 45% of the crude oil feed to the CDU remains undistilled and this bottom product passes on to the vacuum distillation unit (VDU) for further processing. A significant amount of sour water is produced within the CDU (via stripping steam operations). Sour water is high in impurities such as H_2S and NH_3. The sour water is stripped with steam to remove these impurities. The H_2S and NH_3 removed are burnt in the crude charge heater.

b) *Vacuum distillation unit (VDU):* The main purpose of the VDU is to re-distill the bottom product from the CDU into suitable feedstock for the Fluidised Catalytic Cracking Unit (FCCU). The distillation is carried out under partial vacuum conditions. Three overhead products are produced - diesel product, light vac gas oil, heavy vac gas oil leaving a heavy bottoms product referred to as vac residue. The vacuum gas oils are passed to the FCCU and the diesel product is passed to the hydrotreater while the vac residue passes to the visbreaker unit for further processing. The VDU has an associated Sour water stripper unit which removes from sour gas from the VDU water effluent stream. The sour gas removed is used as fuel within the VDU.

c) *Visbreaker unit (VBU):* The VBU uses a process of thermal cracking to break down the complex compounds which make up the heavy feed of vacuum residue into lighter oil in the diesel range, products in the LPG and naphtha ranges and a heavy residual oil. This residual oil is blended with similar oils from other process units to produce a fuel oil suitable for industrial processes. This fuel is also used as refinery fuel oil (RFO). The diesel produced on the VBU is sent to one of the hydrotreaters, the naphtha is sent to the Unifiner, the LPG is sent to one of the Merox units and any gas produced is added to the refinery fuel gas (RFG) system.

d) *Hydrotreaters:* There are 2 hydrotreaters on site. Both units reduce the sulphur content of diesel by passing the diesel through a catalyst bed in the presence of hydrogen. The sulphur is removed as H2S which is then absorbed into a solution of diethanolamine which will be processed within the amine and sulphur recovery units.

e) *Unifiner:* The Unifiner unit removes any impurities such as metals, sulphur, nitrogen and water from naphtha before feeding the heavier fractions to the platformer unit. The process occurs in the presence of excess hydrogen over a nickel-molybdenum catalyst and produces hydrogen, LPG and a naphtha stream. The naphtha is subsequently separated into light and heavy naphtha fractions. Hydrogen is sent to the hydrotreater, LPG is sent to the CDU, the light naphtha is sent to the isomerisation unit while the heavy naphtha is sent to the Platformer unit.

f) *Merox units:* The Merox unit converts the mercaptans in kerosene to disulphides. This reduces the odour and corrosivity of the kerosene.

g) *Platformer unit:* The Platformer unit comprises the Catalytic Reformer unit (CRU) and the Continuous Catalytic Regeneration Unit (CCR). The CRU comprises a 3-stage high temperature process using platinum catalyst which produces aromatic hydrocarbons from paraffins and naphthalenes in heavy naphtha which has been hydrotreated in the Unifiner to remove sulphur, nitrogen and unsaturated compounds. This conversion produces a high octane stream known as platformate while benzene, LPG and hydrogen are produced as by-products. The platinum catalyst is continuously regenerated in the directly linked CCR.

h) *Hydrogen Recovery Unit (HRU):* This unit uses pressure swing absorption to recover hydrogen from RFG.

i) *Isomerisation unit (ISOM):* The ISOM unit converts C5 and C6 straight chain hydrocarbons into their isomers in the presence of hydrogen and a platinum catalyst. The catalyst is activated by means of a chlorocarbon and as a result the off-gases are acidic. These are neutralised in a caustic scrubber before they are sent to the LPGRU. The isomerised hydrocarbon is used in gasoline blending.

j) *Fluid Catalytic Cracking Unit (FCCU):* The FCCU unit breaks down the heavy complex and long chain hydrocarbons from the CDU and VDU to produce lighter oils and gases that can be used as LPG or gasoline for blending. The main feedstock is vacuum gas oil although this may be supplemented by higher fractions from the CRU or VDU bottoms. The unit has a 3-stage cyclone system to abate emissions of particulate (catalyst) to air. The catalyst is thermally treated to remove any hydrocarbon/carbon deposited on its surface during the process before being recycled to the cracking unit.

k) *Ultra low sulphur gasoline unit (ULSG):* The ULSG reduces the sulphur content of naphtha streams from the FCCU. Naphtha feeds are processed in 2 catalytic distillation columns and a fixed catalyst bed along with hydrogen to form ultra low sulphur naphtha and H_2S. The ultra low sulphur naphtha is routed to storage through a caustic prewash and the naphtha Merox unit. H_2S is absorbed into the amine stream and transported back to the amine recovery unit for processing.

l) Alkylation unit: This unit combines short-chain alkenes from the FCCU with iso-butane from the Butamer unit to form C7 and C8 branched hydrocarbons known as alkylate. The reaction is catalysed by Hydrofluoric acid.

m) Butamer unit: The Butamer unit is used to increase the iso-butane content of the butane stream feedstock for the alkylation unit. The reaction section is a fixed bed catalytic process for the conversion of n-Butane to iso-Butane.

n) Amine recovery and sulphur recovery units (ARU and SRU): The ARU and SRU work in combination to convert acid gas (H_2S/SO_2) from refinery gas streams into elemental sulphur which is sold as a feedstock into the chemical industry. Acid gas from the various refinery processes is absorbed into diethanolamine at source. The diethanolamine is then transferred to the ARU where the acid gas is removed under vacuum. The acid gas is then transferred to the SRU where the acid gas is converted to elemental sulphur in the presence of an alumina catalyst and steam in a 3-stage Claus convertor and Superclaus (as per IC24 in original IPPC permit QP3033LW).

o) Waste water treatment facility (WWTP): All process water, surface water and ballast water at the site is treated in the on-site WWTP. The WWTP consists of equalisation basins to ensure that the feed to the WWTP is fairly consistent, API to remove oil and suspended solids from the feed, DAF unit to further remove oil and suspended solids and a biological treatment plant. After treatment the water is discharged into the Milford Haven waterway.

The schedules specify the changes made to the permit.

The status log of a permit sets out the permitting history, including any changes to the permit reference number.

Status log of the permit		
Description	**Date**	**Comments**
Application QP3033LW	Duly made 21/09/2006	
Additional Information Received		Confirmation of site boundary.
Certificate of Incorporation	18/08/06	
Details on combustion units	24/01/07	
Site plan	24/02/07	
Response to Schedule 4 notice issued 08/12/06	02/02/07	
	09/02/07	
	20/03/07	
	12/04/07	
Response to Schedule 4 notice issued 02/04/07	01/05/07	
Response to Schedule 4 notice issue 02/05/07	25/05/07	
Response to Schedule 4 notice issued 04/01/07	15/06/07	
Historical data on emission to water	19/06/07	
Annual VOC emissions	16/07/07	
Historical data on emissions to air	16/07/07	
Historical data on carbon monoxide releases to air	17/09/07	
Sulphur dioxide emissions from sulphur recovery unit	21/09/07	
Letter justifying request for higher annual mass limit	25/09/07	

Status log of the permit		
Description	**Date**	**Comments**
e-mail detailing methods used for monitoring emissions to water e-mail detailing SO2 releases from SRU and % efficiency e-mail detailing effluent temperature e-mail on volumetric flows of A9/A10 flue e-mail on H2S concentration in Refinery fuel gas	04/10/07 15/10/07 16/10/07 17/10/07 01/11/07	
Permit determined	20/12/2007	Permit issued
Variation application ERR/QP3033LW/V002	Duly made 13/08/10	
Variation issued ERR/QP3033LW/V002	11/09/10	
Notified of change of company name and registered office address	26/08/11	
Variation issued EPR/QP3033LW/V003	21/09/11	
Variation application EPR/QP3033LW/V004	06/01/12	
Variation issued EPR/QP3033LW/V004	05/04/12	
Variation determined EPR/QP3033LW/V005	26/03/13	
Transfer application EPR/YP3930EX/T001 (full transfer of permit EPR/QP3033LW)	Duly made 18/09/13	
Transfer determined EPR/YP3930EX	01/01/14	Permit transferred to Valero Energy Limited company No 8566216 as of 01/01/14, from Valero Energy Limited company No 145197
Regulation 60 Notice sent to the Operator	08/10/15	Issue of a Notice under Regulation 60(1) of the EPR. Natural Resources Wales initiated review and variation to vary the permit.
Regulation 60 Notice response	06/11/15	Response received from the Operator.
Job Aid – PP-HES-JBA-0004	15/12/15	Supporting documentation
Variation determined EPR/YP3930EX/V002	23/12/15	Varied permit issued.

Other Part A installation permits relating to this installation		
Operator	**Permit number**	**Date of issue**
Valero Energy Limited	Waste Management licence EPR/YB3997TZ/T001	01/01/2014

End of introductory note

Notice of variation

The Environmental Permitting (England and Wales) Regulations 2010

The Natural Resources Body for Wales ("Natural Resources Wales") in exercise of its powers under regulation 20 of the Environmental Permitting (England and Wales) Regulations 2010 varies

Permit number

EPR/YP3930EX

Issued to

Valero Energy Limited ("the operator")

whose registered office is

11 Old Jewry

7th Floor

London

EC2R 8DU

company registration number **8566216**

to operate a regulated facility at

Pembroke Refinery

Pembroke

Pembrokeshire

SA71 5SJ

to the extent set out in the schedules.

The notice shall take effect from 01/01/2016

Name	Date
	**23/12/2015**

Victoria Seller

Authorised on behalf of Natural Resources Wales

Schedule 1 – conditions to be deleted

The following conditions are deleted following a Natural Resources Wales initiated variation

Table S4.3(b) shall be deleted:

Table S4.3(b) LCPD Annual limits (Excluding start up and shut down except where otherwise stated).				
Substance	**Medium**	**Limit (including unit)**		**Release Points**
Particulate matter, Sulphur dioxide and Oxides of nitrogen	Air	Assessment year	LCP NERP Limit	Stack 1 - A1/A2 (LCP Ref 48)
		01/01/08-31/12/08 and subsequent years until 31/12/15	Emission allowance figure shown in the NERP Register as at 30 April the following year	
Particulate matter, Sulphur dioxide and Oxides of nitrogen	Air	Assessment year	LCP NERP Limit	Stack 6 – A3/A4 (LCP Ref 49)
		01/01/08-31/12/08 and subsequent years until 31/12/15	Emission allowance figure shown in the NERP Register as at 30 April the following year	
Particulate matter, Sulphur dioxide and Oxides of nitrogen	Air	Assessment year	LCP NERP Limit	Stack 7 – A5/A6 (LCP Ref 50)
		01/01/08-31/12/08 and subsequent years until 31/12/15	Emission allowance figure shown in the NERP Register as at 30 April the following year	
Particulate matter, Sulphur dioxide and Oxides of nitrogen	Air	Assessment year	LCP NERP Limit	Stack 8 – A7/A8/A9/A10 (LCP Ref 51)
		01/01/08-31/12/08 and subsequent years until 31/12/15	Emission allowance figure shown in the NERP Register as at 30 April the following year	
Particulate matter, Sulphur dioxide and Oxides of nitrogen	Air	Assessment year	LCP NERP Limit	Stack 9 – A11/A12 (LCP Ref 52)
		01/01/08-31/12/08 and subsequent years until 31/12/15	Emission allowance figure shown in the NERP Register as at 30 April the following year	

Schedule 2 – conditions to be amended

The following conditions are amended as detailed, following a Natural Resources Wales initiated variation

Condition 3.1.1 shall be amended to:

3.1.1 There shall be no point source emissions to water, air or land except from the sources and emission points listed in schedule 4 tables S4.1(a), S4.1(b), S4.1(c), S4.1(d), S4.1(e), S4.2 and S4.3.

Condition 3.1.3 shall be amended to:

3.1.3 Total annual emissions from the emission points, including LCP, set out in tables schedule 4 S4.1(a), S4.1(b), S4.1(c), S4.1(d), S4.1(e) and S4.2 of a substance listed in schedule 4 table S4.3a shall not exceed the relevant limit in that table.

Condition 3.6.1 shall be amended to:

3.6.1 The operator shall, unless otherwise agreed in writing by Natural Resources Wales, undertake the monitoring specified in the following tables in schedule 4 to this permit:

(a) point source emissions specified in tables S4.1(a), S4.1(b), S4.1(c), S4.1(d), S4.1(e), S4.1(f) and S4.2; and

(b) process monitoring specified in table S4.4.

Condition 3.6.4 shall be amended to:

3.6.4 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 4 tables S4.1(a), S4.1(b), S4.1(c), S4.1(d), S4.1(e), S4.2 and S4.3 unless otherwise specified in that schedule.

Condition 3.7 shall be amended to:

3.7 Monitoring for the purposes of the Industrial Emissions Directive Chapter III

3.7.1 If the monitoring results for more than 10 days a year are invalidated within the meaning set out in condition 3.7.7, the operator shall:

(a) within 28 days of becoming aware of this fact, review the causes of the invalidations and submit to the Natural Resources Wales for approval, proposals for measures to improve the reliability of the continuous measurement systems, including a timetable for the implementation of those measures; and

(b) implement the approved proposals.

3.7.2 All monitoring required by this permit shall be carried out in accordance with the provisions of Annex V of the Industrial Emissions Directive.

3.7.3 Continuous measurement systems on emission points from the LCP shall be subject to quality control by means of parallel measurements with reference methods at least once every calendar year.

3.7.4 Unless otherwise agreed in writing by the Natural Resources Wales in accordance with condition 3.7.5 below, the operator shall carry out the methods, including the reference measurement

methods, to use and calibrate continuous measurement systems in accordance with the appropriate CEN standards.

3.7.5 If CEN standards are not available, ISO standards, national or international standards which will ensure the provision of data of an equivalent scientific quality shall be used, as agreed in writing with Natural Resources Wales.

3.7.6 Where required by a condition of this permit to check the measurement equipment, the operator shall submit a report to Natural Resources Wales in writing, within 28 days of the completion of the check.

Table S1.2 Operating techniques is amended to:

Table S1.2 Operating techniques

Description	Parts	Date Received
Application	PCC Application for Pembroke Refinery PPC Supplementary Technical Report: Volume 1 PCC Application for Pembroke Refinery PPC Supplementary Technical Report: Section 2.1 and 2.2 Controls: Volume 2 Application Site Report (Desk Study): Volume 3 of the PPC Application.	21/08/06
Response to Schedule 4 Notice dated 04/01/07	Response to questions 5, 12, 14, 16, 17, 18, 21, 22, 28 and 29.	15/06/07
Variation Application EPR/QP3033LW/V004	Document entitled “Technical poroposal Natural Gas Pipeline” dated 23 November 2011	06/01/12
Variation Application EPR/YP3930EX/V002	Supporting documentation: Job Aid – PP-HES-JBA-0004	15/12/15

Table S4.1 shall be amended to S4.1(a), S4.1(b), S4.1(c), S4.1(d) and S4.1(e):

Table S4.1(a) Point source emissions to air – Steam Plant LCPs [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A1/A2 (stack 1 – 91.5m above ground level) A3/A4 (stack 6 – 91.5m above ground level)	Sulphur dioxide	LCP371 and LCP373 boiler plant fired on 100% RFG	35 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			38.5 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			70 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP371 and LCP373 boiler plant fired on 100% RFG	300 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			330 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181

Table S4.1(a) Point source emissions to air – Steam Plant LCPs [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			600 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Dust	LCP371 and LCP373 boiler plant fired on 100% RFG	5 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			5.5 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			10 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Sulphur dioxide	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	1000 mg/Nm^3 Emission limit values calculated in accordance with Article 40(3) of IED	Calendar monthly mean	Continuous	BS EN 14181
			1100 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			2000 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181

Table S4.1(a) Point source emissions to air – Steam Plant LCPs [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A1/A2 and A3/A4	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	300-450 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			330-495 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			600-900 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Dust	LCP371 and LCP373 boiler plant fired on >0% and ≤50% RFO	5-50 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			5.5-55 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			10-100 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Sulphur dioxide	LCP371 and LCP373 boiler plant fired on >50% and ≤100% RFO	1000 mg/Nm3 Emission limit values calculated in accordance with Article 40(3) of IED	Calendar monthly mean	Continuous	BS EN 14181

Table S4.1(a) Point source emissions to air – Steam Plant LCPs [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			1100 mg/Nm3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			2000 mg/Nm3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP371 and LCP373 boiler plant fired on >50% and ≤100% RFO	450 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			495 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			900 mg/Nm3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Dust	LCP371 and LCP373 boiler plant fired on >50% and ≤100% RFO	50 mg/Nm3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			55 mg/Nm3	Daily mean of validated hourly averages	Continuous	BS EN 14181

Table S4.1(a) Point source emissions to air – Steam Plant LCPs [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			100 mg/Nm3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A1/A2 and A3/A4	Carbon monoxide	LCP371 and LCP373 boiler plant	-	-	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A7/A8/A9/ A10 (stack 8 – 158.5m above ground level) A7/A8 – crude distillation unit A9– vacuum distillation unit A10 - visbreaker unit	Sulphur dioxide	LCP375 fired heaters on 100% RFG	35 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			38.5 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			70 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP375 (crude distillation unit) fired heaters on 100% RFG	300 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			330mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			600 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Dust	LCP375 fired heaters on 100% RFG	5 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			5.5 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			10 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A7/A8/A9/A10	Sulphur dioxide	LCP375 fired heaters on any VDU off gas in combination with RFG	1000 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			1100 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			2000 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP375 fired heaters on any VDU off gas in combination with RFG	300 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181
			330 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			600 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Dust	LCP375 fired heaters on any VDU off gas in combination with RFG	5 mg/Nm^3	Calendar monthly mean	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			5.5 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			10 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Sulphur dioxide	LCP375 fired heaters on >0% and ≤50% RFO	1000 mg/Nm^3 Emission limit values calculated in accordance with Article 40(3) of IED	Calendar monthly mean	Continuous	BS EN 14181
			1100 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			2000 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP375 fired heaters on >0% and ≤50% RFO	300-450 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			330-495 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			600-900 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A7/A8/A9/A10	Dust	LCP375 fired heaters on >0% and ≤50% RFO	5-50 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			5.5-55 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			10-100 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Sulphur dioxide	LCP375 fired heaters on >50% and ≤100% RFO	1000 mg/Nm^3 Emission limit values calculated in accordance with Article 40(3) of IED	Calendar monthly mean	Continuous	BS EN 14181
			1100 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			2000 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP375 fired heaters on >50% and ≤100% RFO	450 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181

Table S4.1(b) Point source emissions to air – Black Oils Stack LCP [>100 MWth] and permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
			495 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			900 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Dust	LCP375 fired heaters on >50% and ≤100% RFO	50 mg/Nm^3 Emission limit values calculated in accordance with Article 40(2) of IED	Calendar monthly mean	Continuous	BS EN 14181
			55 mg/Nm^3	Daily mean of validated hourly averages	Continuous	BS EN 14181
			100 mg/Nm^3	95% of validated hourly averages within a calendar year	Continuous	BS EN 14181
A7/A8/A9/A10	Carbon monoxide	LCP375	-	-	Continuous	BS EN 14181

Table S4.1(c) Point source emissions to air – White Oils LCP [≥ 50 MWth <100 MWth] and permitted before 07/01/14						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A12 – platformer (stack 9 – 162m above ground level)	Sulphur dioxide	LCP372 fired heaters on 100% RFG	38.5 mg/Nm^3		At least every 6 months	BS EN 14791
A12	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP372 fired heaters on 100% RFG	330 mg/Nm^3		At least every 6 months	BS EN 14792
A12	Dust	LCP372 fired heaters on 100% RFG	5.5 mg/Nm^3		At least every 6 months	BS EN 13284-1
A12	Carbon monoxide	LCP372 fired heaters on RFG	-	-	At least every 6 months	BS EN 15058

Table S4.1(d) Point source emissions to air from C&O LCP [≥50 <100MWth], permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A6 (stack 7 – 167.3m above ground level)	Sulphur dioxide	LCP374 heaters fired on 100% RFG	38.5 mg/Nm^3	-	At least every 6 months	BS EN 14791

Table S4.1(d) Point source emissions to air from C&O LCP [≥50 <100MWth], permitted before 07/01/13						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A6	Oxides of nitrogen (NO and NO_2 expressed as NO_2)	LCP374 – heaters fired on 100% RFG	330 mg/Nm^3	-	At least every 6 months	BS EN 14792
A6	Dust	LCP374 heaters fired on 100% RFG	5.5 mg/Nm^3	-	At least every 6 months	BS EN 13284-1
A6	Carbon monoxide	LCP374 heaters fired on 100% RFG	-	-	At least every 6 months	BS EN 15058

Table S4.1(e) Point source emissions to air (not Chapter III) Not LCP						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A5a (stack 7 - 167.3 metres above ground level)	SO_2	FCCU Catalyst Regenerator	4600mg/Nm^3	Hourly mean	Continuous	BS EN 14181
	NO_x		No limit set	Hourly mean	Continuous	BS EN 14181

Table S4.1(e) Point source emissions to air (not Chapter III) Not LCP						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
	Dust		No limit set	Hourly mean	Continuous	BS EN 14181
	CO		No limit set	Average over sampling period	6-monthly	ISO 12039
A6A (Stack 7 - 167.3 metres above ground level)	SO_2	SRU	25,000mg/Nm^3	Hourly mean	Continuous	BS EN 14181
A6A (Stack 7 - 167.3 metres above ground level)	SO_3	SRU	No limit set	Average over sampling period	6-monthly	BS EN 14181
A11 (Stack 9 - 162 metres above ground level)	Sulphur dioxide	Hydrotreater 1 and Unifiner	No limit set	Average over sampling period	Annually	BS6069-4.4:1993
	Oxides of nitrogen (as NO_2)		No limit set	Average over sampling period	Annually	ISO 10849: 1996
	Dust		No limit set	Average over sampling period	Annually	BS ISO 9096
	Carbon monoxide		No limit set	Average over sampling period	6-monthly	ISO 12039
A13 (Stack 9 - 162 metres above ground level)	Sulphur dioxide	Hydrotreater 2	38.5mg/Nm^3	Average over sampling period	6-monthly	BS EN 14181

Table S4.1(e) Point source emissions to air (not Chapter III) Not LCP						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
	Oxides of nitrogen (as NO_2)		330mg/Nm^3	Average over sampling period	6-monthly	BS EN 14181
	Dust		5.5mg/Nm^3	Average over sampling period	6-monthly	BS EN 14181
	Carbon monoxide		No limit set	Average over sampling period	6-monthly	BS EN 14181
A14 (CCR vent)	Hydrogen chloride	Continuous Catalytic Regenerator (Platformer)	No limit set	Average over sampling period	6-monthly	US EPA Method 26
A15 (Acid flare)	Sulphur dioxide, nitrogen oxides, Carbon monoxide, dust	Flares		No monitoring required during normal operation		
A16 (Sour flare)	Sulphur dioxide, nitrogen oxides, carbon monoxide, dust	Flares		No monitoring required during normal operation		
A17 (Sweet flare)	Sulphur dioxide, nitrogen oxides, carbon monoxide, dust	Flares		No monitoring required during normal operation		

Table S4.1(e) Point source emissions to air (not Chapter III) Not LCP						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)-these limits do not apply during start up or shut down.**	**Reference period**	**Monitoring frequency**	**Monitoring standard or method**
A18 (Benzene VRU)	VOC, benzene	Benzene ship loading VRU	No limit set	Average over sampling period	6-monthly (during loading)	BS EN13649
A19 (Stack 10 - 70 metres above ground level)	Sulphur dioxide	ULSG	No limit set	Average over sampling period	6-monthly	BS6069-4.4:1993
	Oxides of nitrogen (as NO_2)		No limit set	Average over sampling period	6-monthly	ISO 10849: 1996
	Dust		No limit set	Average over sampling period	6-monthly	BS ISO 9096
	Carbon monoxide		No limit set	Average over sampling period	6-monthly	ISO 12039
A20 (Road loading VRU)	VOC	Road tanker loading VRU	No limit set	Average over sampling period	6-monthly (during loading)	BS EN13649
Vents from oil storage tanks	VOC	Storage tanks	No limit set	No monitoring required		
Floating roof tanks	VOC	Storage tanks	No limit set	No monitoring required		
Process Relief valves	VOC, Sour gas	Refining process	No benzene to be vented No Class A VOC to be vented	No monitoring required		
Sour flare, Sweet flare, Alky flare combined	Flares	SO_2	3.1Te SO_2/hour equivalent	During periods of flaring		

Table 4.1a shall be amended to S4.1(f):

Table S4.1(f) Point source emissions to air – emission limits and monitoring requirements						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)**	**Reference Period**	**Monitoring frequency**	**Monitoring standard or method**
A1, A2, A3, A4, A5, A6, A7, A8, A9/A10, A11, A12, A13, A19	Sulphur dioxide	Site operations	Bubble 1910mg/Nm^3	Hourly mean	Continuous	As agreed in response to IC7

Table S5.1 shall be amended to:

Table S5.1 (a) Reporting of monitoring data - LCP			
Parameter	**Emission or monitoring point/reference**	**Reporting period**	**Period begins**
Oxides of nitrogen	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Oxides of nitrogen	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Carbon monoxide	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Carbon monoxide	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Sulphur dioxide	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Sulphur dioxide	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July
Dust	A1, A2, A3, A4, A7, A8, A9, A10	Every 3 months for continuous monitoring	1 January, 1 April, 1 July, 1 October
Dust	A6, A12	Every 6 months for periodic monitoring	1 January, 1 July

Table S5.1 (b) Reporting of monitoring data – non-LCP			
Parameter	**Emission or monitoring point/reference**	**Reporting period**	**Period begins**
Emissions to air (spot sample) – SO_2 Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (continuous) – SO_2 Parameters as required by condition 3.6.1.	A5, A6A	Every 3 months	1 January, 1 April, 1 July, 1 October
Emissions to air (hourly bubble) – SO_2 Parameters as required by condition 3.6.1.	Combined emissions from Stack 1, Stack 6, Stack 7, Stack 8, Stack 9, Stack 10	Every 3 months	1 January, 1 April, 1 July, 1 October
Emissions to air (spot sample) – SO_3 Parameters as required by condition 3.6.1.	A6A	Every 12 months	1 January
Emissions to air (spot sample) - NO_x Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (continuous) - NO_x Parameters as required by condition 3.6.1.	A5	Every 3 months	1 January, 1 April, 1 July, 1 October
Emissions to air (spot sample) – Dust Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (continuous) – Dust Parameters as required by condition 3.6.1.	A5	Every 3 months	1 January, 1 April, 1 July, 1 October
Emissions to air (spot sample) - CO Parameters as required by condition 3.6.1.	A11, A13, A19	Every 12 months	1 January
Emissions to air (spot sample) – HCl Parameters as required by condition 3.6.1.	A14	Every 12 months	1 January
Emissions to air (spot sample) - VOC Parameters as required by condition 3.6.1.	A18, A20	Every 12 months	1 January
Emissions to water – flow, temperature Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October

Table S5.1 (b) Reporting of monitoring data – non-LCP			
Parameter	**Emission or monitoring point/reference**	**Reporting period**	**Period begins**
Emissions to water – pH Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October
Emissions to water – suspended solids Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October
Emissions to water – ammonia Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October
Emissions to water – sulphide, fluoride, cyanide Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October
Emissions to water – iron, nickel, copper, zinc, arsenic, chromium, lead Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October
Emissions to cadmium, mercury Parameters as required by condition 3.6.1	W1	Every 3 months for periodic monitoring	1 January, 1 April, 1 July, 1 October

Table S5.4 shall be amended to:

Table S5.4 Reporting forms				
Media/ parameter	**Reporting format**	**Starting Point**	**NRW recipient**	**Date of form**
Air & Energy	As agreed with NRW	01/01/16	SI	31/12/15
LCP	As agreed with NRW	01/01/16	SI	31/12/15
Air	As agreed with NRW	01/01/16	SI	31/12/15
CEMs	As agreed with NRW	01/01/16	SI	31/12/15
LCP	As agreed with NRW	01/01/16	SI	31/12/15
Air	As agreed with NRW	01/01/16	SI	31/12/15

Table S5.4 Reporting forms				
Media/ parameter	**Reporting format**	**Starting Point**	**NRW recipient**	**Date of form**
Air	As agreed with NRW	01/01/16	SI	31/12/15
Water	As agreed with NRW	01/01/16	SI	31/12/15
Multi-fuel firing	As agreed with NRW	01/01/16	SI	31/12/15

Schedule 3 – conditions to be added

The following conditions are added following a Natural Resources Wales initiated variation

Condition 2.3.5 shall be added:

2.3.5 For the following activities: LCP371, LCP372, LCP373, LCP374 and LCP375. The end of the start-up period and the start of the shutdown period shall conform to the specifications set out in the Job Aid – PP-HES-JBA-0004.

Condition 2.3.6 shall be added:

2.3.6 For the following activities: LCP371, LCP372, LCP373, LCP374 and LCP375. The following conditions apply where there is a malfunction or breakdown of any abatement equipment:

Unless otherwise agreed in writing by Natural Resources Wales:

(i) if a return to normal operations is not achieved within 24 hours, the operator shall reduce or close down operations, or shall operate the activities using low polluting fuels;

(ii) the cumulative duration of breakdown in any 12-month period shall not exceed 120 hours; and

(iii) the cumulative duration of malfunction in any 12-month period shall not exceed 120 hours.

Condition 3.7.7 shall be added:

3.7.7 Where Continuous Emission Monitors are installed to comply with the monitoring requirements in schedule 4, tables S4.1(a), S4.1(b), S4.1(c), S4.1(d) and S4.1(e); the Continuous Emission Monitors shall be used such that:

(b) for the continuous measurement systems fitted to the LCP release points defined in tables S4.1(a), S4.1(b), S4.1(c), S4.1(d) and S4.1(e) the validated hourly, monthly and daily averages shall be determined from the measured valid hourly average values after having subtracted the value of the 95% confidence interval;

(c) the 95% confidence interval for nitrogen oxides and sulphur dioxide of a single measured result shall be taken to be 20%;

(d) the 95% confidence interval for dust releases of a single measured result shall be taken to be 30%;

(e) the 95% confidence interval for carbon monoxide releases of a single measured result shall be taken to be 10%;

(f) an invalid hourly average means an hourly average period invalidated due to malfunction of, or maintenance work being carried out on, the continuous measurement system. However, to allow some discretion for zero and span gas checking, or cleaning (by flushing), an hourly average period will count as valid as long as data has been accumulated for at least two thirds of the period (40 minutes). Such discretionary periods are not to exceed more than 5 in any one 24-hour period unless agreed in writing. Where plant may be operating for less than the 24-hour period, such discretionary periods are not to exceed more than one quarter of the overall valid hourly average periods unless agreed in writing; and

(g) any day, in which more than three hourly average values are invalid shall be invalidated.

IC32 shall be added to table S1.3:

Table S1.3 Improvement programme requirements		
Reference	**Requirement**	**Date**
IC32	'For LCPD LCP 48, 49, 50, 51 and 52 (now LCP 371, 373, 374, 375 and 372 under IED). Annual emissions of dust, sulphur dioxide and oxides of nitrogen including energy usage for the year 01/01/2015 to 31/12/2015 shall be submitted to Natural Resources Wales using form AAE1 via the NERP Registry. If the LPCD LCP was a NERP plant the final quarter submissions shall be provided on the RTA 1 form to the NERP Registry.'	28/01/16

The following definitions shall be added to Schedule 7 – interpretations:

"RFG" means refinery fuel gas.

"RFO" means refinery fuel oil.

"VDU off gas" means gases produced from a residue in the vacuum distillation unit.