

## Natural Resources Wales permitting decisions

### Normal Variation and Consolidation – Valero Energy Ltd.

We have decided to issue the variation for Valero Refinery in Pembroke operated by Valero Energy Ltd.

The permit number is EPR/YP3930EX.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

### Purpose of this document

This decision document:

- Explains how the application has been determined
- Provides a record of the decision-making process
- Shows how all relevant factors have been taken into account
- Justifies the specific conditions in the permit other than those in our generic permit template.

Unless the decision document specifies otherwise we have accepted the applicant's proposals.

### Structure of this document

- Assessment of Valero Energy Ltd against the published BAT conclusions for the Refining of Mineral Oil and Gas
- Annex 1 – Decision Checklist regarding relevant BAT Conclusions

# Assessment of Valero Energy Ltd against the published BAT conclusions for the Refining of Mineral Oil and Gas.

## 1. Our decision

We have issued a variation, which will allow the operator to operate the installation, subject to the conditions in the varied permit.

The variation does three things:

- it consolidates the original permit to reflect changes made through earlier variations;
- it brings the permit into line with our modern regulatory template; and
- it varies the permit where appropriate to reflect the outcome of our statutory review and incorporate Best Available Techniques (BAT) and associated Emission Limit Values (ELV's).

We consider that, in reaching this decision, we have taken into account all relevant considerations and legal requirements and that the permit will continue to ensure that a high level of protection is provided for the environment and human health.

The original permit, issued on the 20<sup>th</sup> December 2007, ensured that the installation, employed Best Available Techniques (BAT) and ensured a high level of protection for human health and the environment. We have altered the permit as a result of the statutory review, and we are confident that the new requirements will deliver a superior level of protection to that which was previously achieved.

## 2. The legal framework

The consolidated variation notice will be issued under Regulation 20 of the EPR. The environmental permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the IED;
- subject to aspects of other relevant legislation which also have to be addressed.

We consider that, in issuing the consolidated variation notice, it will ensure that the operation of the installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

### **3. How we reached our decision**

#### Requesting information to demonstrate compliance with BAT Conclusion techniques

We issued a Notice under Regulation 60(1) of the Environmental Permitting (England and Wales) Regulations 2016 on 16th March 2016 requiring the operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the relevant BAT Conclusions document.

- Describes the techniques that will be implemented before 28/10/2018, which will then ensure that operations meet the revised standard, or
- Justifies why standards will not be met by 28/10/2018, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or
- Justifies why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.
- Where their permitted activity involves the use, production or release of a hazardous substance, as defined in Article 3(18) of the Industrial Emissions Directive, Valero Energy Ltd were required to carry out a risk assessment considering the possibility of soil and groundwater contamination at the permitted installation with such substances. Where risk of such contamination is established prepare a baseline report containing information necessary to determine the state of soil and groundwater contamination so as to make a quantified comparison with the state upon definite cessation of the activity. Valero Energy Ltd have a copy of a consequent baseline report.

- Where their permitted activity involves the use, production, storage or release of a priority hazardous substances, as defined by the Water Framework Directive, Valero Energy Ltd were required to carry out a risk screening assessment considering the presence of priority hazardous substances at the permitted installation. Where a risk of these substances is established the operator is to sample the effluent and screen for the priority hazardous substances. If these substances are found to be present in the effluent stream, then assessment using the H1 tool and potential detailed dispersion modelling will be required to demonstrate that the effluent discharge will not have a significant impact to the receiving water.
- Where the compliance with the BAT conclusions leads to the substantial refurbishment or installation of new combustion plant with an aggregate thermal input of greater than 20MWth, which generates more than 100kWth of heat, Valero Energy Limited must provide sufficient technical and commercial evidence to demonstrate compliance with Article 14, Paragraph 5 of Directive 2012/27/EU on Energy Efficiency. This must include an assessment of the technical feasibility and costs of installing a combined heat and power (CHP) system or providing district heating and, where this assessment shows that the costs are not disproportionate to the benefits, proposals to incorporate these measures into your plant.

Where the operator proposed that they were not intending to meet a BAT standard that also included a BAT Associated Emission Level (BAT-AEL) described in the BAT Conclusions Document, the Regulation 60 Notice requested that the operator make a formal request for derogation from compliance with that AEL (as provisioned by Article 15(4) of IED). In this circumstance, the Notice identified that any such request for derogation must be supported and justified by sufficient technical and commercial information that would enable us to determine acceptability of the derogation request.

The Regulation 60 Notice response from the operator was received on the 27<sup>th</sup> May 2016.

We considered that the response contained sufficient information for us to commence determination of the permit review. The operator made no claim for commercial confidentiality. We have not received any information in relation to the Regulation 60 Notice response that appears to be confidential in relation to any part.

## 4. Key issues/Regulation 60 response

BAT Conclusions for the Refining and Mineral Oil and Gas were published as a Commission Implementing Decision (2010/75/EU) in the Official Journal of the EU on 8<sup>th</sup> October 2014. There are 58 BAT Conclusions. This annex provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This should be read in conjunction with the permit/variation notice issued.

A detailed response was received from Valero Energy Ltd. Where the operator has concluded that they have achieved BAT, and we are in agreement, no further information/justification has been sought by Natural Resources Wales.

## 5. Changes we have made

### Improvement Conditions

Based on the information provided in the Regulation 60 response, we consider that we need to set improvement conditions. These conditions are set out below. We are using these conditions to require the operator to provide Natural Resources Wales with details that need to be established or confirmed during operations.

The company have outlined they follow the techniques outlined within the BREF. This improvement condition is required to provide further detail on the response outline under BAT 56.

### 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 flaring)

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 are 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

Improvement conditions 36 and 37 are included to provide a detailed operating procedure for both management of Nitrogen Oxides and Sulphur Dioxide from the installation for approval by NRW.

#### IC36

A written procedure shall be submitted to Natural Resources Wales for approval detailing the methodology for monitoring Nitrogen Oxides to air utilising the refinery bubble principle as outlined in the Refinery BREF under: -

BAT Conclusion 57.

To achieve an overall reduction of NO<sub>x</sub> emissions to air from combustion units (using Refinery Fuels), and fluid catalytic cracking (FCC) units, BAT is to use an integrated emission management technique as an alternative to applying BAT 24 and BAT 34.

Where appropriate the procedure shall contain dates for the implementation of individual measures. The notification requirements of condition 2.5.2 shall be deemed to have been complied with on submission of the plan. The procedure shall be implemented by the operator from the date of approval by Natural Resources Wales. shall be implemented by the operator from the date of approval by Natural Resources Wales.

#### IC37

A written procedure shall be submitted to Natural Resources Wales for approval detailing the methodology for monitoring Sulphur to air utilising the refinery bubble principle as outlined in the Refinery BREF under: -

BAT Conclusion 58.

To achieve an overall reduction of SO<sub>2</sub> emissions to air from combustion units (using Refinery Fuels), fluid catalytic cracking (FCC) units and waste gas sulphur recovery units, BAT is to use an integrated emission management technique as an alternative to applying BAT 26, BAT 36 and BAT 54.

Where appropriate the procedure shall contain dates for the implementation of individual measures. The notification requirements of condition 2.5.2 shall be deemed to have been complied with on submission of the plan. The procedure shall be implemented by the operator from the date of approval by Natural Resources Wales.

The company have outlined in their submission of BAT 10 compliance that new equipment was purchased to undertake the monitoring of certain parameters and the improvement condition has been included to clarify the methodology used for compliance of the BAT Conclusion.

#### IC38

The Operator shall submit for approval monitoring techniques and methods used for emissions monitoring to water compared with BAT Conclusion 10. A written report summarising the findings shall be submitted to Natural Resources Wales, along with a timetable for implementing improvements.

#### IC39

The operator shall submit, for approval by Natural Resources Wales, a report setting out progress to achieving the BAT 52 by the deadline of derogation.

1. Associated targets / timelines for reaching compliance by December 2026.

The first report due on the 1<sup>st</sup> December 2020, with a progress report every 2 yrs until completion.

The report shall address the following BATc: 52

Valero provided a change to their operation for Ethanol Deliveries and Blending on the 15<sup>th</sup> August 2017 (detailed below) and the IC below is included for the company to demonstrate that the control measures are installed on the operation.

## IC40

The Operator shall submit a report confirm the operating techniques and controls installed to minimise environmental impact on the Ethanol Delivery and Blending Operations. A written report summarising the findings shall be submitted to Natural Resources Wales, along with a timetable for implementing improvements.

### **Operational Changes**

The company provided additional information on the 15<sup>th</sup> August 2017 outlining a change to the operations for Ethanol Delivery and Blending operations at the road tanker loading facility.

The process at Pembroke Refinery which allow blending of ethanol into gasoline which is shipped from the Pembroke Rack. Standardising gasoline blends at Pembroke will allow optimal use of blending and storage facilities and adding ethanol at the RTW during road tanker loading will align operation to that at Valero's various UK and Ireland terminals.

An environmental impact review was carried out with the purpose to describe, identify, and mitigate potential risks to the environment. The company provided a document (Road Tanker Ethanol Project – 15/8/2017) that steps through a basic process description while summarising the key environmental impact mitigations of the RTW Ethanol Blending Project to be installed at Valero's Pembroke Refinery.

The activity will be compliant with:

- The Energy Institute report: Guidance for the storage and handling of fuel grade ethanol mixtures at petroleum distribution installations.
- The Shell DEP 31.06.11.11 applies to loading facilities for bulk road vehicles.

The company are also including additional controls:

- The gasoline loading rack is already a bunded area complete with isolated sump. This sump will contain any small leaks during disengaging of the loading arm from the tanker.
- The existing pipework is carbon steel. In ethanol service, this is prone to stress corrosion cracking. As part of this project, all carbon steel pipework containing ethanol at E99 will be upgraded to stainless steel.

- Ethanol has the ability to swell seals and lead to loss of containment. Any seals associated with pumps, valves, instruments and flanges will be installed or upgraded with those that are suitable for ethanol service.
- Firefighting foam has already been upgraded to the alcohol resistant Tridol C6 Ultra 1-3 by Angus. This foam type is designed to lower the environmental impact without reducing performance.
- Any release of ethanol would be collected in a dedicated isolated sump system. This will prevent a direct, uncontrolled path of ethanol to the Waste Water Treatment Plant.

The information provided for this change in operation clearly outlines the controls in place to minimise any environmental effect, however NRW will require a response to an improvement condition detailing the operating techniques and controls installed as part of the project.

### **Emissions to Water**

As part of our delivery of the Water Framework Directive requirements, we need to identify and assess the impact of all sources of hazardous pollutants to surface waters from regulated industry. The company provided emissions data for the following hazardous pollutants: cadmium, mercury, nickel, lead, benzene, polyaromatic hydrocarbons and any other relevant substances. The emissions monitoring for these substances are carried out using the methods and standards described in the M18 guidance on “Monitoring of discharges to water and sewer”. With reference to our guidance document H1 Annex D1 “Assessment of hazardous pollutants within surface water discharges”, the company carried out the following assessments:

Phase 1 Part A screening tests for mercury, cadmium, nickel, lead, benzene, polyaromatic hydrocarbons and any other relevant substances.

Phase 1 Part B screening tests for the following priority hazardous pollutants: mercury, cadmium, polyaromatic hydrocarbons and any other relevant priority hazardous substances.

The substances were screened out by the Phase 1 screening tests and therefore there was no need to carry out Phase 2 modelling, as described in H1 Annex D1.

The company used the H1 electronic screening tool to present the emissions data and to carry out the Phase 1 screening tests and a copy was provided as part of the response to the Notice.

The specific BAT Conclusions on water emissions were also reviewed based on the Refining and Mineral Oil and Gas BREF and the following changes are made to the ELV's for emissions to water taking into account BAT Conclusions 10, 11, 12 and 13 from the BREF.

BAT AELs have been amended for the following parameters. (BAT AELs)

- Hydrocarbon Oil Index            2.5mg/l (Annual)
- Total Nitrogen                        25mg/l (Annual)
- COD                                        125mg/l (Annual)
- Suspended Solids                    25mg/l (Annual)
- Lead                                        0.003mg/l (Annual)
- Mercury                                  0.001mg/l (Annual)
- Cadmium                                 0.008mg/l (Annual)
- Benzene                                  0.05mg/l (Annual)

The Permit as detailed above requires an improvement condition (IC38) response from the operator to review all monitoring methods for the new permitted parameters and limits.

### **Emissions to Air**

There were changes to the ELV's for emissions to air taking into account BAT Conclusions from the Refining of Mineral Oil and Gas BREF.

The tables below outline the parameters and approach taken to implement dynamic permitted limits to the Valero refinery taking into account BAT 57 and BAT 58.

IED compliant permit

Release point (and duty)	Parameter	ELV EPR Monthly mean mg/Nm <sup>3</sup>	ELV daily mean mg/Nm <sup>3</sup>	ELV 95 <sup>th</sup> ile of hourly means in a year mg/Nm <sup>3</sup>
A1 LCP ({RFG} gas only)	SO <sub>2</sub>	35	38.5	70
	NOx	300	330	600
	Parts	5	5.5	10
	CO	-	-	-
A2 LCP (RFG, VDU and MFF)	SO <sub>2</sub>	1000 <sup>#</sup>	1100	2000
	NOx	300-450*	330-495*	600-900*
	Parts	5-50*	5.5-55*	10-100*
	CO	-	-	-
A5 GT (NG fired new plant)	SO <sub>2</sub>	-	-	-
	NOx	50	55	100
	Parts	-	-	-
	CO	100	110	200

Notes

\* Emission limit values calculated in accordance with Article 40(2) of IED

# As a residue is burnt then ELV applied in accordance with Article 40(3) of IED.

BATc Compliant permit

Release point (and duty)	Parameter	A <sup>5</sup>	B <sup>5</sup>	C <sup>5</sup>	D <sup>5</sup>
		ELV EPR Monthly mean mg/Nm <sup>3</sup>	ELV daily mean mg/Nm <sup>3</sup>	ELV 95 <sup>th</sup> ile of hourly means in a year mg/Nm <sup>3</sup>	ELV IED monthly mean mg/Nm <sup>3</sup>
A1 LCP ({RFG} gas only)	SO <sub>2</sub>	35	38.5	70	35 or bubble limits apply see note 1
	NO <sub>x</sub>	300	330	600	150 or bubble limits apply see note 2
	Parts	(5)	5.5	10	5
	CO	-	-	-	100
A2 LCP (RFG, VDU and MFF)	SO <sub>2</sub>	1000 <sup>#</sup>	1100	2000	600 or bubble limits apply see note 1
	NO <sub>x</sub>	300-450*	330-495*	600-900*	300 or bubble limits apply see note 2
	Parts	(5-50*)	5.5-55*	10-100*	5-50*
	CO	-	-	-	100
A3 SRU	SO <sub>2</sub>	-	-	-	98.5% efficiency equivalent or bubble limits apply see notes 1,6 & 7
A4 FCCU	SO <sub>2</sub>	-	-	-	800 or bubble limits apply see notes 1,7 & 12
	NO <sub>x</sub>	-	-	-	700 or bubble limits apply see notes 2 & 7
	Parts	-	-	-	50

A5 GT (NG fired new plant)	SO <sub>2</sub>	-	-	-	If bubble limits applied see notes 1, 3 & 4
	NO <sub>x</sub>	50 (Note 2,3 & 9)	50 (Note 10)	100 (Note 9)	50 or bubble limits apply see notes 2, 3 & 4
	Parts	-	-	-	-
	CO	100	110 (Note 10)	200	100
A6 (Non-LCP) plant	SO <sub>2</sub>	-	-	-	35 or bubble limits apply see note 1
	NO <sub>x</sub>	-	-	-	150 or bubble limits apply see note 2
	Parts	-	-	-	5
	CO	-	-	-	100

#### Notes

- \* Emission limit values calculated in accordance with Article 40(2) of IED
- # As a residue is burnt then ELV applied in accordance with Article 40(3) of IED.
- 1 To apply bubble limits (column D and associated notes), the operator needs to have an approved SO<sub>2</sub> bubble management plan that meets BATc 58 (monitoring plan, flue gas flow rate measurement, a data management system and a template spread sheet to calculate the bubble ELV and compliance with the bubble ELV) and to use the ELVs for each release point in the bubble from column D.
- 2 To apply bubble limits (column D and associated notes), the operator needs to have an approved NO<sub>x</sub> bubble management plan that meets BATc 57 (monitoring plan, flue gas flow rate measurement, a data management system and a template spread sheet to calculate the bubble ELV and compliance with the bubble ELV. and to use the ELVs for each release point in the bubble from column D
- 3 As GT ELVs are set to the standard dry gas 15% oxygen reference conditions, if this release point is to enter the bubble, then the ELVs and the CEMS data need to use standard dry gas 3% O<sub>2</sub> reference conditions rather than 15%.
- 4 If this release point is to be used the SO<sub>2</sub> (BATc 58) Bubble then the ELV that needs to be applied is 35 mg/Nm<sup>3</sup> using the standard dry gas 3% O<sub>2</sub> reference conditions.
- 5 Application of limits for combustion plant - If a bubble limit is applied, compliance is against the limits in columns A, B & C. If IED limits apply, then compliance is against the limits in Columns B, C & D.
- 6 Release point A6A must have an equivalent concentration limit to the 98.5% efficiency limit for SRU when utilised within the SO<sub>2</sub> (BATc 58) Bubble.
- 7 Reference conditions for these releases are standard dry gas 3% O<sub>2</sub> reference conditions when applying the relevant bubble limits.
- 8 Limits apply at >70% Load.
- 9 For single cycle gas turbines having an efficiency greater than 35 % – determined at ISO base load conditions – the emission limit value for NO<sub>x</sub> shall be  $50\eta/35$  where  $\eta$  is the gas turbine efficiency at ISO base load conditions expressed as a percentage.
- 10 For single cycle gas turbines having an efficiency greater than 39 % – determined at ISO base load conditions – the emission limit value shall be  $BAT-AEL\eta/39$  where  $\eta$  is the gas turbine efficiency at ISO base load conditions expressed as a percentage.
- 11 Limits apply when Dry Low NO<sub>x</sub> system is operating.
- 12 When the sulphur in the total FCCU feedstocks are > 0.5% w/w sulphur as a monthly mean, then the BATAEL should be increased to 800 mg/m<sup>3</sup> as a monthly mean.

## Derogation of BAT 52

A derogation from the BREF BAT conclusions is requested for technical reasons. Pembroke's 2km berth infrastructure and multiple gasoline products results in a Vapour Recovery Unit (VRU) installation of much higher capital cost than expected under the Refinery Reference Document (BREF).

Several options were identified to achieve BAT. The first option of vapour destruction was discounted as it is less efficient overall requiring a natural gas feed and resulting in higher CO<sub>2</sub> emissions.

A further option of placing the VRU at the far end of the jetty near the Victorian Fort was discounted due to additional infrastructure cost and the impact on the Pembrokeshire National Park.

For the preferred option a Benefit Cost Ratio (BCR) of 0.11 was calculated by comparing the capital expenditure vs environmental damage by moving compliance from October 2018 to the next BREF update and compliance cycle, expected to be 2026. (This derogation request is time limited to 2026)

BAT compliance may require new piles: berths are located in the Milford Haven Special Area of Conservation (SAC). The damage of installing new piles may outweigh the benefits of NMVOC abatement for the longer term. Derogation to 2026 provides time for Pembroke refinery to review major infrastructure projects (such as berth upgrades), which may help to reduce the cost of compliance; and also, to fully assess if new piles are required, and if required to complete full environmental damage impact assessments of any new piles.

### System Description

Gasoline (and blend components) are exported via three gasoline sea lines which may be directed via valves to two loading arms per berth. Gasoline is produced to meet over thirty different product specifications for the global market. This flexibility is key to the refinery survival, and this requires segregation to avoid product contamination.

## Technical Assessment

1. Air Pollutant emissions of VOCs from ship vents with the potential to form local ground level (tropospheric) ozone. For the majority of the loading period, ship vented VOC concentrations are expected to be relatively low (with respect to equilibrium content of the ships compartment) due to the stratified ship compartment vapour. Peak emissions occur toward the end of loading due to higher VOC concentrations in the vapour released.
2. Noise: associated with ship venting is considered negligible
3. Visual plume from ship vents is considered negligible
4. Odour of VOCs from ship vents is considered negligible

## NRW assessment

### Is the technology proposed, BAT?

The proposed technology to be installed in 2026 or next BREF cycle are two VRU's with accompanying safety equipment. In order to reduce the cost of this unit the rationalisation of the jetty needs to be carried out, this is a significant piece of work and changes the way, sea going vessels can be handled at the jetty.

The technology is considered BAT; the rationalisation of the jetty will also make the operation more efficient which is also a BAT consideration.

### Article 15 (4) tests

#### Is there a cost benefit analysis?

Yes, the cost benefit analysis uses the European Environment Agency Damage costs. The UK regulators are currently developing a finalised procedure for derogations that is likely to use a site-specific damage cost, this will differ from that used by Valero in this cost benefit analysis, however it is unlikely to be higher than the EEA costs (see full explanation below), therefore we are of the opinion that the approach taken is precautionary.

#### Are there geographical or local environmental reasons for derogation?

No geographical reasons have been identified for derogation from BAT 52

#### Are there technical reasons for derogation?

**Yes**, there are technical reasons.

1. Pembroke's berth infrastructure is more than 2km long. Berths 7 & 8 (berths 2, 7 & 8 currently exceed the 1 million m<sup>3</sup> per annum of products loaded with an RVP above 4kPa [Reference 1]) are the furthest from the refinery foreshore. Berths 7 & 8 were designed to handle the majority of domestic gasoline exports, and alternate berth occupancy levels prevents simply moving the gasoline exports to closer berths.
2. Around 90% of gasoline made in the refinery is moved across the jetty, rather than by road or pipeline transmission; and the refinery has no connections to the rail network. Thus, making the implementation of the BAT 52 operationally challenging.
3. Pembroke refinery manufactures multiple gasoline products (over thirty different grades since 2012) for the UK, European and International markets. Using vapour recovery before rationalising the use of the jetty berths can result in product contamination. Large export volume, low RVP (Reid Vapour Pressure) gasoline products are most at risk of being off-specification (due to high RVP content) caused by absorption of high RVP UK and European grade vapours. Each compartment is tested independently and any high in RVP will be in breach of the product specification, even if the whole ships aggregate quality is acceptable. This is important as vapour recovery techniques absorb the VOC's which are then returned into the gasoline blend that is being loaded. So as a one smaller cargo of high RVP export is completed those peak VOC's will typically be absorbed and returned into a different ship's compartment of the other (larger) export, the addition of these high RVP fractions increases the potential to be off-specification. Counteracting this by continually swapping absorbent to each smaller, higher RVP, co-current export will add significantly to the business cost with shipping delays. This results in the need for multiple VRU's and a high business cost.

If we allow the derogation will there be a breach of Environmental Quality Standard?

There are no air quality management zones in the area for VOC. There is no evidence to suggest that environmental quality standards are being adversely impacted by this release. The UK has reached its targets for reducing NMVOC under the National Emissions Ceilings Directive to date a 4% reduction is required by 2020 and this is on target to be achieved by a reduction in solvent use.

NMVOC do have a role in the production of ground level Ozone however there is no evidence to suggest this source has a localised impact.

Does the derogation breach any applicable limit in the Annexes to the Directive?

The limits in the Annexes to the Directive do not apply to this type of operation.

Will the derogation result in any significant pollution?

No significant pollution will be caused; the VOC release is currently limited as much as possible to ensure product specification is maintained by keeping the ships hold as enclosed as possible shortening the time for equilibrium to be reached. There are no indications that the release of VOC in the locality is causing an environmental impact. The area now has one oil refinery where once there was 4, this has resulted in an overall reduction in the emissions from this sector.

NM VOC does have a role in ground level ozone production but due to the refineries location it is not having an effect locally. There is a monitoring station at Narberth for NM VOC and Ozone, the air quality at this site is good and considered a background site. There have been no complaints relating to VOC release at the Valero Jetty.

Is a high level of environmental protection achieved?

As the emissions from the site as a whole are reducing due to the tightening of emission limits and the current standards will be maintained in the interim then a high level of protection is achieved. Valero have committed to installing vapour recovery by 2026.

Does the cost benefit analysis use recognised figures for harm where they exist?

The harm that would be avoided by implementing the BAT has been valued in the cost-benefit analysis by using European Environment Agency figures because there are no suitable UK damage costs available. It must be noted that these damage costs have not been produced with this in mind. Nevertheless, they are likely to be conservative because of the higher Value of a Statistical Life (VOSL) generally derived on the Continent compared with the United Kingdom.

UK regulators are currently looking at how to derive site specific costs of harm, but these will not be available for this derogation. Such site-specific damage costs will take into account ground level concentrations of pollutants and the impact these will have. Given the geographic location of the Pembroke refinery and the population density of the surrounding area, it is reasonable to believe that the site-specific damage costs would be lower than those envisaged by the European Environment Agency.

Is the derogation time limited?

The derogation is for a period of 8 years, which is within one BREF cycle.

Does the cost benefit analysis use costs that can be verified.

The costs set out in the application and used in the cost-benefit analysis are considered to be reasonable and to be as accurate as possible at this stage of project evaluation. They are significantly higher than those envisaged in the BREF because of the length of the loading jetty which requires very long pipe runs, the reliance of the refinery upon shipping for the distribution of their product and the complexity of the refining process which is greater than that usually found within the European Union.

The weighted average cost of capital included in the cost-benefit analysis (in-line with the Spackman Approach used in the UK) is higher than that envisaged in the BREF, but even adopting the BREF value the Cost-Benefit Ratio would only increase from 0.11 to 0.13.

NRW recommendation

NRW agree that the technical reasons for the derogations are valid. Article 15(4) states that a derogation may apply **only** where an assessment shows that achieving the AEL's would lead to disproportionately higher costs compared to the environmental benefits.

NRW are satisfied that there are disproportionately higher costs compared to the environmental benefits.

The derogation request for BAT 52 is approved on the grounds that it meets the criteria for derogation as stated in Article 15(4) of the Directive.

## 6. Conclusion

We consider that the installation already employed what used to be BAT, and that the operator has achieved significant improvements in performance since the permit was originally granted. The revised BREF and its BAT-AELs provide the opportunity to consider further environmental improvements.

Coupled with the consolidation and modernisation of the permit, we believe this variation provides a sound basis for ongoing regulation of the installation. The Sector Review provides the opportunity to consolidate and modernise the permit.

We believe this variation provides a sound basis for ongoing regulation of the installation and we are satisfied that the operator is currently achieving or will be achieving all relevant BAT by 2026.

We believe that we have ensured compliance with all relevant legal requirements in carrying out this review and making our determination on the variation.

## Annex 1: Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for the Refining of Mineral Oil and Gas, were published as a Commission Implementing Decision (2010/75/EU) in the Official Journal of the EU on 8<sup>th</sup> October 2014. There are 58 BAT Conclusions. This checklist provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This annex should be read in conjunction with the consolidated variation notice.

All BAT Conclusions arising are listed by number in order below;

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
<p><b>General BAT conclusions</b></p> <p>The BAT mentioned in this section apply to all installations covered by these BAT conclusions (non-ferrous metal industries)</p>		
1.	BAT is to implement and adhere to an environmental management system (EMS).	Operator uses a combination of the listed techniques and is compliant with the BAT conclusion. Regulation 60 response contains sufficient detail.
2.	BAT is to use energy efficiently on-site.	Operator uses a combination of the listed techniques and is compliant with the BAT conclusion. Regulation 60 response contains sufficient detail.
3.	BAT is to prevent or reduce dust emissions from the storage and handling of dusty materials using one or a combination of methods.	Operator uses a combination of the listed techniques and is compliant with the BAT conclusion. Regulation 60 response contains sufficient detail.
4.	BAT is to monitor emissions to air with a specific frequency and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Operator compliant. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
5.	BAT is to monitor the relevant process parameters linked to pollutant emissions, at catalytic cracking and combustion units by using appropriate techniques.	Operator compliant. Regulation 60 response is sufficient.
6.	BAT is to monitor diffuse VOC emissions to air from the entire site by using a range of techniques.	Operator compliant. Regulation 60 response is sufficient.
7.	BAT is to operate the acid gas removal units, sulphur recovery units and other waste gas treatment systems with a high availability and at optimal capacity.	Operator compliant. Regulation 60 response is sufficient.
8.	BAT is to reduce ammonia emissions to air when applying selective catalytic reduction (SCR) or selective non-catalytic reduction (SCNR) techniques.	Not currently applicable to the operation at the Pembroke Refinery.
9.	In order to prevent and reduce emissions to air when using a sour water steam stripping unit, BAT is to route the acid off-gases from this unit to an SRU or any equivalent gas treatment system.	Operator compliant. Regulation 60 response is sufficient.
10.	BAT is to monitor emissions to water by using the monitoring techniques and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Monitoring is carried out to a number of the required standards specified. Regulation 60 response outlines that the operator is currently reviewing the methods and parameters required to fully comply with this conclusion. The operator has specified that the methods are partially achieved but will be fully achieved by the 28 <sup>th</sup> October 2018.
11.	In order to reduce water consumption and the volume of contaminated water, BAT is to use all the techniques outlined.	Operator compliant. Regulation 60 response is sufficient.
12.	In order to reduce the emission load of pollutants in the waste water discharge to the receiving water body. BAT is to remove insoluble and soluble polluting substances by using all of the techniques given below.	Operator compliant. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
13.	When further removal of organic substances or nitrogen is needed, BAT is to use an additional treatment step as described in Section 1.21.2	<b>BAT is currently partially achieved</b> but will be fully achieved by 28 <sup>th</sup> October 2018. The refinery is currently reviewing the potential to modify the Waste Water Treatment Plant aeration basins and control scheme based on the Simultaneous Nitrification - Denitrification (SNdN) process.
14.	In order to prevent or, where that is not practicable, to reduce waste generation, BAT is to adopt and implement a waste management plan that, in order of priority, ensures that waste is prepared for reuse, recycling, recovery or disposal.	Operator compliant. Regulation 60 response is sufficient.
15.	In order to reduce the amount of sludge to be treated or disposed of, BAT is to use one or a combination of the techniques.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
16.	In order to reduce the generation of spent catalyst waste, BAT is to use one or a combination of the techniques given below.  Spent solid catalyst management.  Removal of catalyst from slurry decant oil.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
17.	BAT is to reduce noise emissions by using one or a combination of the following techniques: -  (i) Make an environmental noise assessment and formulate a noise management plan as appropriate to the local environment. (ii) Enclose noisy equipment/operation in separate structure/unit. (iii) Use embankments to screen the source of noise. (iv) Use noise protection walls	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
18.	In order to prevent or reduce VOC emissions, BAT is to apply the techniques given below;  (i) Techniques related to Plant Design (ii) Techniques related to plant installation and commissioning (iii) Techniques related to plant operation	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
19.	In order to prevent hydrofluoric acid (HF) emissions to air from the hydrofluoric acid alkylation process, BAT is to use wet scrubbing with alkaline solution to treat incondensable gas streams prior to venting to flare.	Operator compliant. Regulation 60 response is sufficient.
20.	In order to reduce emissions to water from the hydrofluoric acid alkylation process, BAT is to use a combination of techniques given below;  (i) Precipitation/Neutralisation step (ii) Separation step	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
21.	In order to reduce the emissions to water from the sulphuric acid alkylation process, BAT is to reduce the use of sulphuric acid by regenerating the spent acid and to neutralise waste water generated by this process before routing to waste water treatment.	BAT not applicable to the Refinery
22.	In order to prevent and reduce the emissions of hazardous substances to air and water from base oil production processes, BAT is to use one or a combination of the techniques	BAT not applicable to the Refinery
23.	In order to prevent and reduce emissions to air from the bitumen production process, BAT is to treat the gaseous overhead by using one of the techniques specified.	BAT not applicable to the Refinery
24.	In order to prevent or reduce NOX emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques given below. (i) Process optimisation (ii) Low-NOx CO oxidation promoters (iii) Specific additives for NOx reduction.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
25.	In order to reduce dust and metals emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques given below.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
26.	In order to reduce SOx emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
27.	In order to reduce CO emissions to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.  Valero operate as a full combustion mode not partial burn.
28.	In order to reduce emissions of polychlorinated dibenzodioxins/furans (PCDD/F) to air from the catalytic cracking process (regenerator), BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
29.	In order to reduce emissions to air from the coking production process, BAT is to use one or a combination of the techniques given below	BAT not applicable to the Refinery
30.	In order to reduce NOx emissions to air from the calcining of green coke process, BAT is to use selective non-catalytic reduction (SNCR)	BAT not applicable to the Refinery
31.	In order to reduce SOx emissions to air from the calcining of green coke process, BAT is to use one or a combination of the techniques given below	BAT not applicable to the Refinery
32.	In order to reduce dust emissions to air from the calcining of green coke process, BAT is to use one or a combination of the techniques given below	BAT not applicable to the Refinery
33.	In order to reduce water consumption and water from the desalting process, BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
34.	In order to prevent or reduce NOx emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below	BAT is currently partially achieved but will be fully achieved by 28 <sup>th</sup> October 2018.  The main technique used at Valero is the optimisation of the combustion units.

BAT Conclusion No	Summary of BAT Conclusion requirement	<b>Status</b> <b>One of the following:</b> Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
		Low NOx burners have been installed where practicable in fired heaters, however the steam plant boilers configuration doesn't make it applicable for retrofitting.  Valero have outlined that the BAT will be achieved utilising the integrated emission management programme as outlined in BAT Conclusion 57.
35.	In order to reduce dust emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
36.	In order to reduce SOx emissions to air from the combustion units, BAT is to use one or a combination of the techniques given below	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
37.	In order to reduce carbon monoxide (CO) emissions to air from the combustion units, BAT is to use a combustion operation control	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
38.	In order to reduce emissions to air from the etherification process, BAT is to ensure the appropriate treatment of process off-gases by routing them to the refinery fuel gas system.	BAT not applicable to the Refinery
39.	In order to prevent upset of the biotreatment, BAT is to use a storage tank and an appropriate unit production plan management to control the toxic components dissolved content. (e.g. methanol, formic acid, ethers) of the waste water stream prior to final treatment.	BAT not applicable to the Refinery
40.	In order to reduce emissions to air of chlorinated compounds, Bat is to optimise the use of chlorinated organic compounds used to maintain catalyst activity when such a process is in place or to use non-chlorinated catalytic systems.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
41.	In order to reduce sulphur dioxide emissions to air from the natural gas plant, BAT is to apply BAT 54	BAT not applicable to the Refinery
42.	In order to reduce nitrogen oxides (NOx) emissions to air from the natural gas plant, BAT is to apply BAT 34	BAT not applicable to the Refinery
43.	In order to prevent emissions of mercury when present in raw natural gas, BAT is to remove the mercury and recover the mercury-containing sludge for waste disposal.	BAT not applicable to the Refinery
44.	In order to prevent or reduce waste water flow generation from the distillation process, BAT is to use liquid ring vacuum pumps or surface condensers.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
45.	In order to prevent or reduce water pollution from the distillation process, BAT is to route sour water to the stripping unit.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
46.	In order to prevent or reduce emissions to air from distillation units, BAT is to ensure the appropriate treatment of process off-gases, especially incondensable off-gases, by acid gas removal prior to further use.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
47.	In order to reduce emissions to air from the products treatment process, BAT is to ensure the appropriate disposal of off-gases, especially odorous spent air from sweetening units, by routing them to destruction, e.g. by incineration.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
48.	In order to reduce waste and waste water generation when a products treatment process using caustic is in place, BAT is to use cascading caustic solution and a global management of spent caustic, including recycling after appropriate treatment, e.g. by stripping.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
49.	In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use floating roof storage tanks equipped with high efficiency seals or a fixed roof tank connected to a vapour recovery system.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
50.	In order to reduce VOC emissions to air from the storage of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
51.	In order to prevent or reduce emissions to soil and groundwater from the storage of liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
52.	In order to prevent or reduce VOC emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds, BAT is to use one or a combination of the techniques given below to achieve a recovery rate of at least 95%.	<p>BAT is currently partially achieved.</p> <p><b>Derogation requested by operator</b> The Refinery can meet the requirement for vapour recovery for loading/unloading operations where annual throughput is &gt; 5000 m<sup>3</sup>/yr at the Refinery Road Tanker facility.</p> <p>The Refinery cannot currently meet the requirement for vapour recovery for sea-going vessels on berths with an annual throughput &gt;1 million m<sup>3</sup>/yr. The Refinery will be submitting a time limited derogation.</p>
53.	In order to reduce emissions to water from visbreaking and other thermal processes, BAT is to ensure the appropriate treatment of waste water streams by applying the techniques of BAT 11.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
54.	In order to reduce sulphur emissions to air from off-gases containing hydrogen sulphides (H <sub>2</sub> S), BAT is to use all of the techniques given below.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
55.	In order to prevent emissions to air from flares, BAT is to use flaring only for safety reasons or for non-routine operational conditions (e.g. start-ups, shutdown).	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.

BAT Conclusion No	Summary of BAT Conclusion requirement	Status One of the following: Not Applicable, Currently Compliant, Compliant in the future (within 4 years of publication of BAT conclusions), Not Compliant
56.	In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use the techniques given below.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
57.	In order to achieve an overall reduction of NOx emissions to air from combustion units and fluid catalytic cracking (FCC) units, BAT is to use an integrated emission management technique as an alternative to applying BAT 24 and BAT 34.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.
58.	In order to achieve an overall reduction of SO2 emissions to air from combustion units, fluid catalytic cracking (FCC) units and waste gas sulphur recovery units, BAT is to use an integrated emission management technique as an alternative to applying BAT 26, BAT 36 and BAT 54.	The operator uses a combination of techniques listed and is therefore fully compliant with the BAT conclusion. Regulation 60 response is sufficient.