

## Natural Resources Wales Permitting Decisions

# Valero Energy Limited (Pembroke Refinery)

## Decision Document

## Application for a Substantial Variation

**The application number is: PAN-023559**

**The permit variation number is: EPR/YP3930EX/V008**

**The Operator is: Valero Energy Limited**

**The Installation is located at: Pembroke Refinery, Pembroke, Pembrokeshire, SA71 5SJ.**

### 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 operator's proposals.

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## Glossary of acronyms and definitions used in this document

AEL-Associated Emission Limit

BAT- Best Available Techniques

BAT 52. - BAT Conclusion 52 from the BAT Conclusion for the Refining of Mineral Oil and Gas (published 28 October 2014)

BAU- Business as usual

BCR-Benefit cost ratio

BRef- BAT Reference document (Refining of mineral oil and gas requires)

CBA-Cost benefit analysis

Defra-Department for Environment, Food & Rural Affairs

ELV-Emission Limit Value

EPR-Environmental Permitting Regulations (England and Wales) 2016

IED-Industrial Emissions Directive (2010)

NMVOC- Non-methane volatile organic compounds

NPV-Net Present Value

NRW-Natural Resources Wales

RVP - Reid Vapour Pressure

VRU-Vapour Recovery Unit

# 1. Executive summary

## 1.1. Reasons for the Variation

Valero Energy Limited (referred to as “the operator”) have applied for derogation on a Best Available Technique (BAT) Conclusion, BAT 52 of the Refining of Mineral Oil and Gas and the Associated Emission Limit (AEL) for the installation permit for Pembroke Refinery (EPR/YP3930EX).

BAT 52 of the Best Available Techniques Reference document (BRef) for the Refining of Mineral Oil and Gas, requires operators to prevent or reduce Non-Methane Volatile Organic Compound (NMVOC) emissions to air from loading and unloading of volatile liquid hydrocarbons. This BAT is applicable to the site’s loading and unloading operations at the shipping berths on the jetty.

Valero have applied for a derogation under article 15 (4) of the Industrial Emissions Directive on this BAT Conclusion and the Associated Emission Limits (AELs). The derogation has been requested on the basis that the cost of installing and operating the Vapour Recovery Unit (VRU) on site for the capture of NMVOCs and benzene outweighs the cost in terms of environmental impacts from the emissions of these pollutants. As such, the cost of compliance is significantly disproportionate to the environmental gains achieved from the use of a VRU.

The operator was previously granted a derogation on BAT 52 after the BRef review of the permit in 2018 with an end date of December 2026. The operator has applied for a permit variation to extend the derogation for BAT 52 to 2040 (under article 15(4) of IED) on the basis of significant cost to environmental benefit as outlined in the cost benefit analysis.

We have decided to grant a new derogation for BAT 52 and the associated emission limits but have extended to 2034 or at the next sector relevant BRef review (whichever is sooner).

## 1.2. Changes to the installation

The derogation is to continue to use the shipping berths without applying BAT 52 to reduce NMVOCs. As a result of the cost benefit analysis, the site will continue without installing vapour recovery units to abate NMVOCs and therefore there will be no changes to the site. The variation will extend the existing derogation on BAT 52. from 2026 to 2034.

There are no changes to the operation of the installation or any other permit condition as a result of the derogation.

## 1.3. Our decision

We are minded to issue the derogation for Pembroke Refinery operated by Valero Energy Limited.

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.

We have granted the derogation against BAT 52 but only to the year 2034 or if a new BRef is published (whichever is sooner). We have decided not extended to 2040 as this is considered too far ahead and alternative technologies may emerge that could allow the achievement of BAT 52. **Section 11** of this decision document details our reason for this.

## 2. Receipt of the application

The application was received on 17/10/2023. In order for us to be able to consider the application duly made, we needed more information. We requested the following:

- Details on what information is considered confidential

A letter requesting this information was sent to the operator on 09/11/2023. Upon receipt of this information, on 16/11/2023, we were able to consider the application duly made. This means we considered it was in the correct form and contained sufficient information for us to begin our determination, but not that it necessarily contained all the information we would need to complete that determination.

## 3. Confidential information

A claim for commercial or industrial confidentiality has been made. We have accepted the operators claim for commercial confidentiality and the relevant information has been excluded from the public register. The decision was taken in accordance with our guidance on commercial confidentiality. A notice confirming this was issued to the operator on 23/05/2024.

## 4. Legislation

The derogation is applied under Article 15 (4) of the Industrial Emissions Directive 2010/75/EU (IED). IED is integrated into law in England and Wales through the Environmental Permitting Regulations 2016 (EPR). IED Article 15 (3) sets out the requirement for the competent authority to set emission limit values that ensure that under normal operating conditions, the emissions do not exceed the emission levels associated with the best available techniques as laid down in the decisions on BAT conclusions for the relevant industrial sector.

Under Article 15 (4) of IED, the competent authority can set less strict emission limit values where the cost of compliance with the emission limits as set out in BAT is disproportionate to the cost of environmental damage:

*“Article 15(4) By way of derogation from paragraph 3, and without prejudice to Article 18, the competent authority may, in specific cases, set less strict emission limit values. Such a derogation may apply only where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:*

*a) the geographical location or the local environmental conditions of the installation concerned; or*

*(b) the technical characteristics of the installation concerned.”*

Valero energy Limited has applied for the derogation to BAT conclusion 52 due to the technical characteristics (point (b) above) of the installation leading to a disproportionate cost of compliance.

Article 15(4) outlines the conditions and test for a derogation to be granted by the competent authority. Details on the derogation test under article 15(4) are discussed in detail in [Section 8.2 of this decision document](#).

The derogation is integrated into the permit through an operator initiated permit variation. The variation will be issued, under Regulation 20 of the Environmental Permitting (England and Wales) Regulations 2016 (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 Industrial Emissions Directive 2010/75/EU;
- subject to aspects of the Well-Being of Future Generations (Wales) Act 2015 and the Environment (Wales) Act 2016 which also have to be addressed.

We address the legal requirements directly where relevant in the body of this document. NRW is satisfied that the decision on this application is consistent with its general purpose of pursuing the sustainable management of natural resources (SMNR) in relation to Wales and applying the principles of SMNR.

Environment Wales Act 2016 – Biodiversity and resilience of ecosystems duty Section 6 of the Environment Wales Act 2016 requires that we seek to maintain and enhance biodiversity in the exercise of our functions, and in so doing promote the resilience of ecosystems, in a manner that is consistent with the proper exercise of our functions. NRW is satisfied that in this case we have taken into account and had due regard to this duty in so far as it is consistent with the function of determining an application for an EPR permit

As the EPR regulator in Wales, NRW are required to determine any duly made permit application. This means that we must decide either to grant, or to refuse the variation based upon an objective assessment of the proposals against the detailed legal requirements of EPR. Our public participation statement<sup>1</sup> gives more information on what can, and cannot, be taken into account when making our permitting decision.

The application, and this decision document, only considers the permitting of the facility under EPR as described throughout the document. We only assess the installation and its impacts and cannot take into consideration indirect impacts which are not as a direct result of activity within the installation boundary.

## 5. Consultation

### 5.1. Consultation on the Application

We have carried out consultation on the application in accordance with the Environment Permitting Regulations (EPR), our statutory Public Participation Statement (PPS) and our Regulatory Guidance.

A copy of the application is available on the public register for anyone to view. We advertised the application to the public by a notice placed on our website directing people to the public register, advising them of how they could arrange for copies to be made if required and how they can provide comments.

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<sup>1</sup> [Natural Resources Wales / Public participation: how you can take part in our permit and licence consultations](#)

We also consulted with the following bodies:

- Health and Safety Executive
- Public Health Wales
- Pembrokeshire Council Planning Department and Pembrokeshire Council Environmental Health (sent via Enquires at Pembrokeshire council)

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly.

The consultation started 26/04/2024 and ended on 29/05/2024.

A summary of consultation comments and our response to the representations we received can be found in Annex 1. We have taken all relevant representations into consideration in reaching our decision.

## **5.2. Draft Permit Consultation**

We are now carrying out consultation on our draft decision. This consultation will begin on 28/04/2025 and ends on 28/05/2025.

A summary of consultation comments and our response to the representations we received can be found in Annex 1. We have taken all relevant representations into consideration in reaching our final decision.

## **6. Further information received during determination**

Further information was requested during determination by way of a formal request for information (also known as a Schedule 5 Notice). This required the operator to provide further information relating to the following;

1. Revised cost benefit analysis- The initial cost benefit analysis showed a reduction of NMVOCs at 94.1% not the required 95% as outlined in BAT 52. The operator was asked to either provide a revised cost benefit analysis or provide an explanation
2. If cost of Greenhouse gas emissions were considered for the Business As Usual (BAU) case.

3. If ozone formation was considered under business as usual in the cost benefit analysis.
4. If there were any other alternative methods considered to reduce NMVOCs.

The Schedule 5 Notice was sent on 16/08/2024 with a deadline for response of 06/09/2024.

The operator's response to the Schedule 5 Notice was provided on 30/08/2024. The additional information supplied satisfied the requirements of the Schedule 5 Notice.

A copy of the information notice and e-mails requesting further information were placed on our public register as were the responses when received.

## 7. The Installation

### 7.1. The permitted activities

The regulated facility is currently an installation which comprises the following activities listed in Part 2 of Schedule 1 to the Environmental Permitting Regulations and "directly associated activities".

Reference	Activity listed in Schedule 1 of the EPR (2016) and Description
A1	S1.1 A(1)(a) –Burning any fuel in an appliance with a thermal input of 50 megawatts <i>Boiler Plant-(Refinery fuel oil storage and supply, boilers and abatement plant including: (i) 1 x 63.9 MW(th) boiler [designated B1] (ii) 2 x 63.8 MW(th) boilers [B2, B3] (iii) 1 x 78.9 MW(th) boiler [B4] (iv) 3 x 62.7 MW(th) boiler [B5, B6, B7] (v) 1 x 24.9 MW(th) boiler [B8] (vi) 1 x 74 MW(th) boiler [B9] (vii) 1 x 137 MW(th) natural gas fired cogeneration plant. From receipt of fuel to emissions of combustion products.</i>
A2	S1.2 A(1)(d) – Refining mineral oils <i>Refining mineral oil – primary operations</i>
A3	S1.2 A(1)(d) – Refining mineral oils

	<i>Refining mineral oil – secondary operations – oil movements and blending</i>
A4	<p>S1.2 A(1)(e) – The loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of – (i) Crude oil (ii) Stabilised crude petroleum</p> <p><i>Handling and processing crude oil (From receipt of crude to operation of crude distillation unit including: (i) jetty operations (ii) Crude distillation unit (typical throughput capacity 13,360,300 m<sup>3</sup>/year) and 3 crude heaters (48.6MW(th) [H21], 52.7MW(th) [H22] and 58.5MW(th) [H23]) Crude storage (storage capacity – 538,625 m<sup>3</sup>))</i></p>
A5	<p>S4.2 A(1)(a)(v) – Producing inorganic chemicals such as – non-metals, metal oxides, metal carbonyls, or other inorganic compounds</p> <p><i>(Sulphur recovery and production- Removal of sulphur from aqueous waste stream by use of: (i) amine recovery unit (nominal throughput capacity – 185 m<sup>3</sup>/hr/train; 2 trains) (ii) FCCU sour water stripper (nominal throughput capacity – 32 m<sup>3</sup>/hr) (iii) CDU waste water stripper (nominal throughput capacity – 30 m<sup>3</sup>/hr (iv) VDU waste water stripper (nominal throughput capacity – 55 m<sup>3</sup>/hr) (v) SRU 1 (nominal throughput capacity - 80 tonnes of sulphur/day). (vi) SRU 2 (nominal throughput capacity - 80 tonnes of sulphur/day). (vii) tail-gas incinerator (viii) Sulphur storage prior to export</i></p>
A6	<p>S5.3 A1 (a) Disposal of hazardous waste (other than by incineration or landfill) in a facility with a capacity of more than 10 tonnes per day</p> <p><i>From receipt of ballast water, through treatment (oil recovery operations) to disposal of treated water and solid waste.</i></p>
A7	<p>S5.4A(1)(a)(i) Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day by biological treatment</p>

	<i>Removal of oil and other chemicals from process water by action of aerobic/anaerobic bacteria within bio-cell.</i>
A8	S5.4 A(1)(ii) Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day by physico - chemical treatment <i>From formation of waste water stream, discharge into site drainage systems to discharge of effluents to Milford Haven waterway including interceptors, DAF units and clarifiers.</i>
A9	S1.2 Part B (a) – Blending odorant for use with natural gas or liquefied petroleum gas  Odorising LPG (or natural gas)  <i>From feed to unit to discharge for storage or export</i>
A10	S1.2 Part B (b) – The storage of petroleum in stationary storage tanks at a terminal, or the loading or unloading at a terminal of petrol or from road tankers, rail tankers or inland waterway vessels  <i>Loading petrol into road tankers</i>

Directly associated activities

- A11 Flaring of gases
- A12 Cooling water systems
- A13 Lagoons
- A14 Oxygen or nitrogen generation
- A15 Surface water drainage
- A16 Water treatment
- A17 Storage of Hazardous Waste
- A18 Demineralisation Plant

Together, these listed and directly associated activities comprise the Installation with the site's primary activity being the Refining of mineral oils (A2).

## 8. Operation of the installation

### 8.1 Installation activities and assessment of Best Available Techniques

The site's primary activity is the processing of crude oil into its component parts to produce fuels for sale into various markets. The processing of crude oil involves a series of inter-linked processes which include unloading of crude, treatment and process of crude (including De-salter, Crude distillation unit, Vacuum distillation unit, Visbreaker unit, Hydrotreaters, Unifiner, Merox units, Platformer unit, Hydrogen Recovery Unit (HRU), Isomerisation unit (ISOM), Fluid Catalytic Cracking Unit (FCCU), Ultra-low sulphur gasoline unit (ULSG), Alkylation unit, Butamer unit, Amine recovery and sulphur recovery units). The permit also covers the Waste water treatment facility and the Cogeneration Plant.

As the primary activity of the site is processing of oils, the site is considered to be in scope of the BAT conclusions for the Refining of mineral oils. The most recent set of BAT conclusions for this sector were published on 28 October 2014. The derogation requested relates to the NMVOC emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds from the ships on the jetty. At present the site receives crude oil and processes it into various fuel products which are exported via the jetty to shipping berths. This is covered as part of the permitted activities of the site under activity A4 under table S1.1 of the permit (see Section 7).

### 8.2 Relevant BAT conclusion for the site

The operator has applied for a derogation to the requirements to prevent or reduce NMVOC emissions to air from loading and unloading of volatile liquid hydrocarbons with an associated emission level for NMVOC. The requirement forms part of BAT 52. of the best available techniques for industrial emissions, for the refining of mineral oil and gas, published 28 October 2014<sup>2</sup>.

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<sup>2</sup> [COMMISSION IMPLEMENTING DECISION - of 9 October 2014 - establishing best available techniques \(BAT\) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, for the refining of mineral oil and gas - \(notified under document C\(2014\) 7155\) - \(2014/738/EU\) \(europa.eu\)](#)

The requirement of BAT 52 is as follows:

*BAT 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 %.*

Technique	Description	Applicability (1)
Vapour recovery by: (i) Condensation (ii) Absorption (iii) Adsorption (iv) Membrane separation (v) Hybrid systems	See Section 1.20.6*	Generally applicable to loading/unloading operations where annual throughput is > 5 000 m <sup>3</sup> /yr. Not applicable to loading/unloading operations for sea-going vessels with an annual throughput < 1 million m <sup>3</sup> /yr
(1) A vapour destruction unit (e.g. by incineration) may be substituted for a vapour recovery unit, if vapour recovery is unsafe or technically impossible because of the volume of return vapour		

\* A copy of the description of 1.20.6 can be seen in Annex 2 of this document

As outlined in the table above, BAT 52 is only applicable for sea-going vessels where the annual throughput is above 1 million m<sup>3</sup> per year. At Pembroke refinery three berths (Berths 2, 7 and 8) currently exceed 1 million m<sup>3</sup> per annum of products loaded with an RVP (Reid Vapour Pressure) above 4 kPa. As such BAT 52 applies for the loading at these berths. Table 16 of the BAT conclusions outline the BAT associated emission limits (AEL) for vapour recovery.

Table 16 from the BAT conclusions for the Refining of Mineral Oil and Gas, published 28 October 2014

Parameter	BAT-AEL (hourly average) (1)
NMVOC	0,15-10 g/Nm <sup>3</sup> (2) ( 3)
Benzene (3)	< 1 mg/Nm <sup>3</sup>

(1) Hourly values in continuous operation expressed and measured according to European Parliament and Council Directive 94/63/EC (OJ L 365, 31.12.1994, p. 24).  
(2) Lower value achievable with two-stage hybrid systems. Upper value achievable with single-stage adsorption or membrane system.  
(3) Benzene monitoring may not be necessary where emissions of NMVOC are at the lower end of the range.

Following the publication of the BAT conclusions in 2014 for the Refining of Mineral Oil and Gas, the Pembroke Refinery installation was subject to a BRef review and the operator demonstrated how they either currently comply with the relevant BAT conclusions or will comply with the BAT conclusions within 4 years of the BRef publication. During this review the operator applied for a derogation to BAT 52 under article 15(4) of IED. The derogation was granted in July 2018 for a period of 8 years, which at the time, was considered to be approximately one BRef cycle. This original derogation is due to end December 2026.

The operator has applied to extend the derogation on BAT 52 beyond 2026 with a proposed date of 2040. As part of this derogation application, the operator supplied a cost benefit analysis and a description of the current site circumstances. These are detailed in [section 10](#) of this decision document.

## 9. Derogation Test

For a site to be granted a derogation, it must satisfy the requirements of Article 15(4) of IED. We have gone through the following derogation test as outlined in Article 15(4) of IED to ensure that the proposal meets these requirements and the granting of the derogation is legal:

- Article 15(4) outlines the two reasons on why an application for a derogation may be made;
  - (a) the geographical location or the local environmental conditions of the installation concerned; or
  - (b) the technical characteristics of the installation concerned.
- The competent authority shall document in an annex to the permit conditions the reasons for the application of the first subparagraph including the result of the assessment and the justification for the conditions imposed.
- The emission limit values set in accordance with the first subparagraph shall, however, not exceed the emission limit values set out in the Annexes to this Directive, where applicable.
- The competent authority shall in any case ensure that no significant pollution is caused and that a high level of protection of the environment as a whole is achieved (See [Sections 12 and 13](#) for information on how this was addressed).
- On the basis of information provided by Member States in accordance with Article 72(1), in particular concerning the application of this paragraph, the Commission may, where necessary, assess and further clarify, through guidance, the criteria to be taken into account for the application of this paragraph.
- The competent authority shall re-assess the application of the first subparagraph as part of each reconsideration of the permit conditions pursuant to Article 21

### **9.1 Are there any geographical location or local environmental conditions reasons for the derogation**

There are no geographical or local reasons for the derogation.

### **9.2 Are there reasons due to the technical characteristics of the installation concerned.**

There is a technical characteristic of the installation which means the achievement of BAT 52 requirements and the associated BAT-AELs may be difficult without significant investment. This is owing to the use of the jetty to export the fuel products to ships.

83% of the fuel produced at the installation is exported through the jetty rather than road or pipeline. The site also does not have any rail line or connection to the rail network and as such most of the fuel products are exported to other markets by ship.

Due to the large volumes exported, low Reid Vapour Pressure (RVP) are at risk of being contaminated with high RVP products<sup>3</sup>. (Any VRUs that would be installed at these berths, would concentrate NMVOCs absorbed from a High RVP and could risk high RVP being absorbed into ship compartments for low Reid Vapour Pressure export. Any such contamination would result in an entire ship load being rejected (due to breach of contract) even with segregation of compartments. Swapping absorbent after each run would add significant business cost and delays. As such the site would require multiple VRUs which add additional business costs given the scale of the jetty. As a result of these factors, the implementation of the BAT techniques is more technically challenging than most refineries and would result in more significant costs than expected.

**9.3 The competent authority shall document in an annex to the permit conditions the reasons for the application of the first subparagraph including the result of the assessment and the justification for the conditions imposed**

The derogation and the outline on how we came to grant the derogation is integrated into the permit (under section Derogation). A copy of this can be seen in [Annex 3](#) of this document.

**9.4 The emission limit values set in accordance with the first subparagraph shall, however, not exceed the emission limit values set out in the Annexes to this Directive, where applicable.**

None of the emission limits set out in the Annex to IED are relevant for the sector where this BAT conclusion/AEL applies.

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<sup>3</sup> **Reid vapour pressure (RVP)** is a common measure of the volatility of gasoline and other petroleum products. The higher the RVP, the more volatile the fuel, which means it evaporates more easily. The lower the RVP, the less volatile the fuel, which means it is less likely to evaporate.

## 9.5 The competent authority shall re-assess the application of the first subparagraph as part of each reconsideration of the permit conditions pursuant to Article 21

We have set the condition in the derogation that it must be reviewed when a permit review is undertaken as a result of new BRef and BAT Conclusions being published for the site's primary activity (Refining of Mineral Oils (or any other in-scope BRef)).

## 9.6 Time limitation on derogation

The operator applied for the derogation to last until 2040. However, we have decided to set a time limit on the derogation to the 1 December 2034 or next BRef review cycle, if a new BRef for Refining of Mineral Oils (or any other in-scope BRef) is published before this date.

Our reason for the above derogation deadline is as follows:

- 1) 2034 sets an 8 year period after the end of the current derogation (December 2026). This was a precedent set by the previous derogation (granted 2018 with a deadline of 2026), which was based on the time taken for a complete BRef cycle.
- 2) Defra may revise the damage cost of NMVOC and benzene to the environment prior to 2040. This could change cost benefit ratio and cost of compliance against environmental damage may change and the derogation would need to be reconsidered.
- 3) New technology or developments in existing technologies, including low carbon technologies (such as alternatives to natural gas-fired Combined Heat and Power (CHP) for providing the power for the VRU) may occur over the next decade and could make compliance with BAT 52 more achievable.
- 4) Any sector relevant BRef publication would trigger the need for the operator to reassess the whole site against the associated new BAT conclusions and BAT-AELs. including the jetty activities. The operator will need to consider new BAT techniques which may be applicable for this activity.

## 10. BAT technologies and Cost Benefit Analysis

### 10.1 Proposed derogation and solutions used for the cost benefit analysis

As part of this derogation, the operator has compared different operational options in the report and the cost benefit analysis (CBA). These are as follows;

- Business as usual (no change to site operations)
- Use Vapour Recovery Unit from year 1 (2024) to comply with BAT 52.
- Derogation of BAT 52 until 2040 (with installation of Vapour Recovery Units by 2040).

The following sections outline in detail the different options and how these were factored into the cost benefit analysis.

#### 10.1.1 Business as usual

In “business as usual” (BAU) scenario, the Operator assumes the site will continue as it has been previously been operating without the use of abatement techniques to remove the NMVOCs or benzene from the gas streams.

For the BAU option, the Operator used 2023 as year 0 and had projected the cost until 2080. The operator included turn around years, which are years when there would be partial shutdown of the site due to maintenance or installation of equipment, in the CBA for BAU.

#### 10.1.2 Use Vapour Recovery Unit (VRU) from Year 1 (2024)

The operator outlined that the most plausible route to achieving BAT 52 would be the installation of two VRUs. The VRUs would work by using adsorption and absorption techniques (BAT 52 ii and iii which would fall under BAT 52 v.). Vapours from the process would be captured via the ship’s vapour manifold which would be connected to a capture arm on the dock and transfer via the jetty from the berths to the VRUs.

The Operator identified that the heat generated from the adsorption of NMVOCs onto the carbon bed could lead to a risk of combustion of the carbon bed under air or oxygen atmosphere.

To mitigate this the vapours from the shipping lines would need to be purged with nitrogen (assumed to be 99+%). The ships are also purged with nitrogen to reduce the oxygen content to <5%. The purging equipment as well as the increase volume (through using nitrogen purge done on every VRU run) would require a higher capital cost which has been included in the CBA.

As outlined in [Section 9.2](#) the use of a single VRU for multiple berths could mean that low Reid Vapour Pressure (RVP) products are at risk of being contaminated with high RVP products. This could result in breach of contract and the whole shipload being rejected as out of specification. As such, the site would require multiple VRUs (at additional cost) to eliminate the risk of contamination.

The cost benefit analysis calculated the derogation from 2023 up to 2063 on the assumption that the VRU will have a 40 year lifespan. The operator considered the costs of installing the VRU including the installation costs of an associated nitrogen purging system. The operator also included costs of replacing the carbon bed within the VRU every 15 years. The VRU would also require a CHP plant that would be fired on natural gas to operate. The damage cost and global warming potential of the combustion products from the CHP have been factored into the CBA.

The initial cost benefit analysis showed the reduction of NMVOCs by 94.1% rather than the 95% minimum required by BAT 52. The Operator clarified that this was in error due to including nitrogen inertion for the smaller ship exports which diluted the export but reduced the % in recovery. The revised CBA took this into account and showed a 95% recovery.

### **10.1.3 Vapour Recovery Unit (Derogation)**

For the derogation application, the operator proposed to operate the site as is (BAU) until 2040, when the installation of the Vapour recovery units would occur and they would apply the BAT-AEL for NMVOCs and benzene. The cost benefit analysis

calculates the derogation scenario on this basis.. The remaining cost benefit analysis was calculated to 2080 on the assumption that the equipment will last 40 years and factored in VRU carbon bed replacement every 15 years.

#### 10.1.4 Consideration for other techniques to achieve BAT-AEL

The Operator had considered the following alternative methods for achieving the BAT-AELs but these were dismissed as not comparable to the benefits offered by the adsorption – absorption technique using VRUs.

- Thermal oxidiser – The operator outlined that they investigated the use of a thermal oxidiser as a lower capital cost alternative to the techniques outlined in BAT 52<sup>4</sup>. to achieve the BAT-AEL for NMVOC and benzene emissions. However this method was dismissed on the basis that the environmental damage (through the emissions of CO<sub>2</sub> and consumption of natural gas required to run the thermal oxidiser) was significantly more than achieved through the application of VRU (adsorption-absorption). In addition, the use of a thermal oxidiser was only allowed if BAT was not technically feasible or safe. Neither applied as the VRU was possible and was not unsafe in the operation of the site.
- Condensation (BAT 52. (i)) was initially considered as a possibility but was dismissed on the basis that the capital cost to utilise this technique was far higher than the adsorption – absorption techniques (BAT 52 ii and iii).

The use of adsorption – absorption technique (hybrid) was considered the only feasible technique, with all other BAT techniques being considered not feasible due to high capital cost when compared to adsorption-absorption.

#### 10.2 Cost benefit tool

The operator submitted a cost benefit analysis (CBA) to support their derogation application, using the Environment Agency's CBA tool [Industrial Emissions Directive derogation: cost-benefit analysis tool - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/444444/Industrial_Emissions_Directive_derogation_cost-benefit_analysis_tool_-_GOV.UK.pdf).

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<sup>4</sup> [Best Available Techniques \(BAT\) Reference Document for the Refining of Mineral Oil and Gas \(europa.eu\)](https://europea.eu)

We have assessed the completed tool against the guidance: [IED derogation cost-benefit analysis tool: user guide - GOV.UK \(www.gov.uk\)](#) .

The tool has the carbon price, energy cost and estimated cost of damage (from NMVOC and benzene) built in. The tool uses Air quality appraisal: damage cost guidance<sup>5</sup> by Defra's Interdepartmental Group on Costs and Benefits to estimate the environmental damage cost of NMVOC and benzene.

The cost benefit analysis took into account the three scenarios (outlined in [Section 10.1](#) of this document):

- 1) Business as usual (BAU) – no change to site operations and no compliance with BAT-AELS over a 40 year period;
- 2) Use Vapour Recovery Units from year 1 (2023) to comply with BAT 52; and
- 3) Derogation of BAT 52 until 2040 (with installation of Vapour Recovery Units by 2040).

The operator took the following factors into account in the CBA when calculating the costs of the VRU (compliance with BAT) and business as usual scenarios:

- The operator took into account turnaround years (TAR) when there is reduced export due to plant shutdown and extensive maintenance. Emissions for both VRUs (BAT) and derogation scenarios are reduced during those years (2024, 2027, 2033, 2034 and 2039) to reflect the reduction in output due to downtime;
- Any additional fuel requirements to power the vapour recovery units; and
- Cost of installing equipment (vapour recovery units and associated equipment including for nitrogen purge).
- Energy and environmental cost from running natural gas fired combined heat and power

The emission (in tonnes) from fugitive NMVOC and benzene emissions are shown in the table below.

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<sup>5</sup> [Assess the impact of air quality - GOV.UK](#)

Table 1: Emission of NMVOC and Benzene under BAU and BAT-AEL

	NMVOCs Tonnes/year		Benzene Tonnes/year	
	Normal year	Turnaround year*	Normal year	Turnaround year*
BAT-AEL (Use of VRUs with at least 95% capture)	54	35	0.0065	0.0042
Business as Usual (BAU)**	1085	65	8.3	5.4

\*The turnaround years (TAR) have been used for when the Valero plant is down due to maintenance and as such the emissions for both BAT and derogation are reduced during those years (2024, 2027, 2033, 2034 and 2039) to reflect the reduction in output due to downtime.

\*\*Business as usual BAU is term used for situation where the site is operating as it had previously done without compliance to BAT or associated emission levels.

Valero applied for a derogation until 2040 and stated that by 2040, their exports may drop below the threshold where BAT 52 applies, however for the purposes of the CBA assessment, it is assumed that exports will continue at the current levels after 2040.

### 10.3 Overview on Cost benefit analysis

The cost benefit analysis showed that the cost of applying with the BAT-AEL would cost £69.9 million, which comprises the:

- Upfront cost of installing the vapour recovery units (£65.2 million).
- Greenhouse gas emissions cost, for powering the vapour recovery unit (using natural gas) giving a cost of £6.5 million until 2040.
- Benefit from reduction of NMVOC and benzene emissions of £1.76 million until 2040.

The environmental cost of greenhouse gases emitted as a result of using natural gas to provide the energy to run the vapour recovery units (including the nitrogen purging)

would outweigh the benefits gained from complying with the emission limit at BAT-AELs.

The upfront cost of £65.2 million with additional cost from the greenhouse gases (natural gas) required to provide energy for the vapour recovery unit (including nitrogen purging) brings the total cost to £71.7 million with an environmental benefit of £1.8 Million .

Overall compliance with the BAT-AEL in 2026 will require significant investment and the cost of installing and running the VRUs to achieve BAT significantly outweighs the environmental benefits achieved from the reduction of emissions of NMVOC and benzene to the emission limits associated with BAT 52.

The BCR for Valero's submission was calculated to be 0.03 (after taking into account the 95% reduction and nitrogen). In line with derogation guidance, anything below 0.45 can usually be considered as "disproportionate".

## 11. Setting the derogation

We have granted the derogation on the basis of the evidence provided, but we have set a different time limit to the one the operator proposed. We have set a deadline of 2034 rather than 2040. We made this decision for the following reasons:

- 2034 is 8 years after the current derogation ends in 2026. This was a precedent set when the existing derogation was issued in 2018. Eight years is considered an equivalent of one BRef review cycle. The next BRef review may revise the emission limits and operating techniques that the site will need to comply with. As such the site as a whole including the derogation would need to be reassessed against any new published BAT techniques.
- 2040 was considered too far ahead for the derogation. Emerging technologies in both decarbonisation and other techniques could develop over the next

decade which decrease the cost of compliance (such as alternative fuels for natural gas) and make compliance with BAT 52 more feasible.

- Cost of environmental damage from NMVOCs and benzene might be revised in the future. Any changes may change the cost benefit ratio.

An outline of derogation has been integrated into the permit as required by IED Article 15(4). A copy of the outline of the derogation is presented in the [Annex 3](#) of this document.

## 12. Environmental Risk Assessment

In line with our guidance, the operator has provided an environmental risk assessment with the application which identifies the sources of key risks from the Installation/Derogation, possible pathways and receptors. This risk assessment and further assessments provided by the operator and/or completed by NRW will be discussed in further detail below.

### 12.1. Assessment of impact on air quality

The main emissions from the loading and unloading of petroleum products are:

- NMVOC;
- Benzene; and
- Local ozone formation as a result of NMVOC emissions.

Under the derogation, whilst there would be no additional emissions to the environment, the operator would continue to release NMVOCs and benzene at the existing levels.

### Emissions of NMVOC and Benzene

The venting of NMVOC and benzene are minimal for the majority of the loading. The peak emissions of NMVOCs and benzene occur towards the end of loading process from shipping berths. The nature of these emissions are considered fugitive rather than point source. The tonnages of NMVOCs and benzene for the two different

scenarios (compliance with BAT-AELs using VRUs against derogation scenario) are outlined in [Table 1 in Section 10.2](#) of this document.

In terms of in-combination impact, previously there were 4 refineries in the area and currently Valero is the only one. Defra background maps<sup>6</sup> show that the background emissions of benzene have been decreasing locally (Pembrokeshire) and nationally over the last 15 years and the background and the data of 2023 did not show exceedances above 5 µg/m<sup>3</sup> in the area around the refinery.

As the site will continue to operate as it currently has been, the granting of the derogation is unlikely to result in any increase in background emissions of NMVOC and benzene in the area. We are satisfied that there is a low risk that the emissions would lead to an exceedance of environmental standards in the area.

#### Ozone Formation

Ozone formation could occur locally as a result of the emissions of NMVOC from the ship vents during loading. The emissions of NMVOCs from loading is relatively low for the majority of the loading process, with the peak NMVOC emissions occurring towards the end of the process. The potential for formation of ozone would occur over a short period and is unlikely to lead to any significant local exceedance. Background data from Defra shows that background emissions of ozone in the area (around Milford Haven and Pembrokeshire) do not exceed the environmental standards<sup>7,8</sup>.

#### Emission limits

As a result of granting the derogation there will be no new vapour recovery units installed that would have a channelled/point source emission with an emission limits for non-methane volatile organic compounds and benzene from the loading of ships on the jetty. As such the emissions of NMVOC and benzene would be through fugitive emissions and emission limit will not be set for NMVOC and benzene.

## 12.2. Fugitive emissions

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<sup>6</sup> [UK Ambient Air Quality Interactive Map](#)

<sup>7</sup> [Home | DataMapWales](#)

<sup>8</sup> [UK Ambient Air Quality Interactive Map](#)

There are no changes to fugitive emissions at current levels as a result of granting the derogation.

### **12.3. Assessment of odour impact**

There are no changes to the site that would increase the risk of odour impact as a result of this Derogation being granted.

### **12.4. Noise and vibration assessment**

There are no changes to the site which increase the risk of noise or vibration as a result of this Derogation being granted.

The operator noted that for the situation where a VRU is installed, there is a potential for additional noise sources as a result of the nitrogen purging equipment associated with the VRU.

### **12.5. Global warming potential**

Emissions of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases differ from those of other pollutants in that, except at gross levels, they have no localised environmental impact. Their impact is at a global level and in terms of climate change.

Global Warming Potential (GWP100) emissions as carbon dioxide equivalents (CO<sub>2</sub>e) have been estimated by the operator in accordance with the relevant guidance<sup>9</sup> The GWP of the emissions of NMVOCs and benzene as a result of emissions from the installation and the GWP of the fuel requirements of the vapour recovery units, were factored in the cost benefit analysis.

## **13. Impact on European Sites, SSSIs and non-statutory nature conservation sites**

The shipping berths, where the emissions of NMVOCs and Benzene occur, are located within the following designated sites:

- Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation (SAC);

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<sup>9</sup> [Assess the impact of air emissions on global warming - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-global-warming)

and close to the:

- Milford Haven Waterway Site of Special Scientific Interest (SSSI).

In addition the following European Sites are located within 10 km and the following SSSI and non-statutory nature conservation sites within 2 km of the site

- Skomer, Skokholm and the Seas off Pembrokeshire (SPA)
- Castlemartin Coast (SPA)
- Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru (SAC)
- Broomhill Burrows (SSSI)

On the basis that the derogation is to continue to run the site as it currently operates, there is no change to any potential impact from the proposal on any of the designated sites. Under the derogation, site operations will remain the same and will not lead to any changes that could cause adverse effects to the SAC and damage to the SSSI. As there are no changes in operation under the derogation, a habitats risk assessment was not required.

## **14. The Permit Conditions**

### **14.1. Use of bespoke conditions**

We have outlined the requirement and limits of the derogation in the permit. A copy of which is outlined in Annex 3 of this decision document.

We have updated the permit template to the latest version. We have amended the formatting in table S3.1 but there are no changes to any conditions, monitoring requirements or emission limits (apart from a corrections to one of the emission parameters for LCP652 (point A24) which is detailed in section **14.2 Emission Limits**).

There are no other changes to the permit as a result of the derogation.

### **14.2. Emission Limits**

Article 14(3) of IED states that BAT conclusions shall be the reference for permit conditions. Article 15(3) further requires that under normal operating conditions; emissions do not exceed the emission levels associated with the best available

techniques as laid down in the decisions on BAT conclusions. However with the granting of the derogation under article 15(4), the operator will not be required to meet the emission limits for NMVOCs and benzene as set out in the BRef for Refining of Mineral Oil and Gas on the basis of cost the benefit analysis.

There is an existing VRU for emission point A18) which is for benzene only ships. This VRU for Benzene loading ships are below the threshold of 1 million tonnes per year and as such BAT 52 does not apply to A18.

As the VRU at A18 does not related to the berths where the derogation is being applied, the emission limits will not change as a result of the variation.

Emission point A24 – The daily mean oxides of nitrogen emission limit for LCP652 cogeneration Plan Stack (emission point A24) has been amended to 55 mg/Nm<sup>3</sup>. It had been identified<sup>10</sup> that the previous permit versions had erroneously listed this as 50 mg/Nm<sup>3</sup>. IED Annex V part 4 states that the daily value should not exceed 110% of the monthly emission which is 50 mg/Nm<sup>3</sup>. As such we have correct the error and amended the daily value to 55 mg/Nm<sup>3</sup>.

### **14.3. Monitoring and reporting**

On the basis of granting the derogation, there are no changes to monitoring or reporting requirements.

### **14.4. Improvement conditions**

Based on the information on the application, we consider that we need to impose improvement conditions. Details of the improvement conditions used can be found at Annex 4.

This improvement condition, IC42, required the operator to supply a report with associated targets / timelines for reaching compliance with BAT 52 by 1<sup>st</sup> December 2034. This replaces an existing improvement condition IC39 (now marked as superseded) which was added in the previous derogation.

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<sup>10</sup> Compliance Assessment Report CAR\_NRW0043013 dated 23/11/2023

## 15. OPRA

The OPRA score has not been changed as a result of this variation and remains as 443. This will form the basis for ongoing subsistence fees.

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## ANNEX 1: Consultation Responses

### 1. Advertising and consultation on the Application

The application has been advertised and consulted upon in accordance with Natural Resources Wales Public Participation Statement. Responses to this consultation and how we have taken these into account in reaching our draft decision are summarised in this Annex.

#### Consultation Responses from Statutory and Non-Statutory Bodies

<b>Response Received from Public Health Wales</b>	
<b>Brief summary of issues raised:</b>	<b>Summary of action taken / how this has been covered</b>
Public Health Wales (PHW) have stated that if NRW are satisfied that the emission of NMVOC are below the threshold for adverse health and the cost benefit analysis demonstrates that alternative are not beneficial then there would be no concerns with Valero operating without BAT 52.	We have checked the background maps on Defra's website and these have shown no exceedances for benzene in the area during 2023. Granting the derogation is unlikely to lead to an increase in background as there is no change to site operations as a result. There had been four refineries in the area and Valero is now the only one, which has decreased the background emissions in the area over the last two decades. The majority of emissions usually occur towards the end of the loading and unloading process.

<b>Response Received from Pembrokeshire County Council</b>	
<b>Brief summary of issues raised:</b>	<b>Summary of action taken / how this has been covered</b>
On the basis of "do nothing" if derogation is granted then no objections. However if a derogation is not granted then the operator will need to apply for planning to install the abatement plant.	No action required for the determination of the derogation.

We also sent a consultation to the HSE during the initial consultation but received no response.

## Consultation Responses from Members of the Public and Community Organisations

No response was received from members of the public or community organisations during the initial consultation stage.

### 2. Advertising and consultation on the draft decision

**To be completed after Draft consultation**

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## ANNEX 2: BAT Assessment

The BAT Conclusions for the Refining of Mineral Oil and Gas were published in the Official Journal of the EU on 28 October 2014. There are 58 BAT Conclusions, however the only BAT conclusion being assessed for derogation is BAT 52. This annex should be read in conjunction with the permit. [COMMISSION IMPLEMENTING DECISION - of 9 October 2014 - establishing best available techniques \(BAT\) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, for the refining of mineral oil and gas - \(notified under document C\(2014\) 7155\) - \(2014/738/EU\) \(europa.eu\)](#)

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BATc number	Summary of BAT Conclusion requirement	Status/comment <b>One of the following:</b> Not Applicable, <b>Currently Compliant</b> , <b>Compliant in the future</b> , <b>Not Compliant</b>
BAT 52.	<b>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 %. Vapour recovery by:</b>	
	i Condensation	<b>Not Compliant -</b> Derogation As outlined elsewhere in the Decision document and annex 3
	ii Absorption	In the submitted information the operator has stated that if BAT 52. was to be used the method most suitable for the site would be a combination of (ii) absorption and (iii) adsorption which would fall under a hybrid method (v). All of the other techniques were ruled out as being not feasible due to high capital costs compare to absorption-adsorption.
	iii Adsorption	
	iv Membrane separation	
	v Hybrid systems	
	<b>BAT-associated emission levels for non-methane VOC and benzene emissions to air from loading and unloading operations of volatile liquid hydrocarbon compounds</b>	
NMVOC Benzene	0.15-10 g/Nm <sup>3</sup> < 1 mg/Nm <sup>3</sup>	<b>Not Compliant -</b> Derogation under Article 15(4)

Section 1.20.6 of BAT Conclusions for the Refining of Mineral Oil and Gas (Description of techniques for the prevention and control of emissions to air for vapour recover):

*Volatile organic compounds emissions from loading and unloading operations of most volatile products, especially crude oil and lighter products, can be abated by various techniques e.g.*

- *Absorption: the vapour molecules dissolve in a suitable absorption liquid (e.g. glycols or mineral oil fractions such as kerosene or reformate). The loaded scrubbing solution is desorbed by reheating in a further step. The desorbed gases must either be condensed, further processed, and incinerated or re-absorbed in an appropriate stream (e.g. of the product being recovered)*
- *Adsorption: the vapour molecules are retained by activate sites on the surface of adsorbent solid materials, e.g. activated carbon (AC) or zeolite. The adsorbent is periodically regenerated. The resulting desorbate is then absorbed in a circulating stream of the product being recovered in a downstream wash column. Residual gas from wash column is sent to further treatment —*
- *Membrane gas separation: the vapour molecules are processed through selective membranes to separate the vapour/air mixture into a hydrocarbon-enriched phase (permeate), which is subsequently condensed or absorbed, and a hydrocarbon-depleted phase (retentate).*
- *Two-stage refrigeration/condensation: by cooling of the vapour/gas mixture the vapour molecules condense and are separated as a liquid. As the humidity leads to the icing-up of the heat exchanger, a two-stage condensation process providing for alternate operation is required.*
- *Hybrid systems: combinations of available techniques*

## ANNEX 3: Derogations

Annex to conditions – Derogation under Industrial Emissions Directive  
 Derogation under Article 15(4) of **Industrial Emissions Directive DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions**

<p>Operating techniques</p>	<p>We have considered the Operator's proposed techniques and its comparison against other relevant techniques as described in the relevant BAT Reference note.</p> <p>Our full reasoning is given in our decision document that accompanies the permit variation determination.</p> <p>The proposed techniques will result in emissions for which the appropriate emission limits are less stringent than those associated with the best available techniques as described in BAT conclusions.</p> <p>We have considered the operator's justification for departure from the guidance and accept it in the following respects and for the following reasons;</p> <p>The installation of BAT techniques as listed in BAT 52 of the BAT conclusions on Refining of Mineral Oil and Gas and achievement of associated BAT-AELS would lead to disproportionately higher costs compared to the environmental benefits due to:</p> <ul style="list-style-type: none"> <li>• The use of the jetty to export the fuel products to ships. 83% of the fuel produced at the site is exported through the jetty rather than road or pipeline. The site does not have any connection to the rail network and has to primarily export its gas products via the berths.</li> <li>• Large volumes of both low Reid Vapour Pressure (RVP) and high RVP products are exported. Any vapour recovery unit using absorption-adsorption technique would concentrate NMVOCs absorbed from a high RVP and could risk cross-contaminating ship compartments for low RVP export. Such contamination would result in an entire ship load being rejected (breach of contract) even with segregation of compartments. Swapping absorbent after each run would add significant business cost and delays. The site would require multiple vapour recovery units (at least two) to achieve the BAT-AEL and avoid the high risk of cross-contamination. This would add significant additional business cost, more than what would normally be expected, which are made more significant by the scale of the jetty.</li> </ul> <p>For the majority of the loading period the NMVOC emissions are relatively low, with the peak emissions of NMVOCs only occurring towards the end of the loading. Ozone formation from local concentration of NMVOCs is also expected to be low.</p> <p>There is no indication that significant pollution would be caused. The background levels of these pollutants in the area do not exceed the environmental associated limits. Milford Haven now has one only oil refinery where once there were four. This has resulted in an overall reduction in the emissions from this sector in the area.</p> <p>The cost benefit analysis has shown that the use of vapour recovery units to achieve the BAT-AELs would lead to a disproportionately higher cost compared to the environmental benefits from achieving the BAT-AELs.</p>
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NRW are satisfied that the techniques to achieve the BAT-AEL would lead to 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.

Substance	ELV <sup>(1)</sup>	Derogation until	ELV during derogation period
NMVOG	0.15-10 g/Nm <sup>3</sup> <sup>(2)</sup> <sup>(3)</sup>	<b>1<sup>st</sup> December 2034 or next relevant sector BRef Review</b>	No Limit set
Benzene <sup>(3)</sup>	<1 mg/Nm <sup>3</sup>	<b>1<sup>st</sup> December 2034 or next relevant sector BRef Review</b>	No Limit set

(1) Hourly values in continuous operation expressed and measured according to European Parliament and Council Directive 94/63/EC (OJ L 365, 31.12.1994, p. 24).

(2) Lower value achievable with two-stage hybrid systems. Upper value achievable with single-stage adsorption or membrane system.

(3) Benzene monitoring may not be necessary where emissions of NMVOG are at the lower end of the range.

## ANNEX 4: Improvement conditions

**Table S1.3 Improvement programme requirements**

Reference	Requirement	Date
IC 42	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 2034. The first report due on the 1st December 2028, with a progress report every 2 yrs until completion. The report shall address the following BATc: 52	1 <sup>st</sup> December 2028 and every 2 years after until 1 <sup>st</sup> December 2034

End of Decision Document

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