Construction Permit
Source Analysis & Technical Review

Company	**Quail Run Carbon, LLC**	Permit Numbers	**173197, PSDTX1622, and HAP83**
City	**Odessa**	Project Number	**359380**
County	**Ector**	Regulated Entity Number	**RN111762076**
Project Type	**Initial**	Customer Reference Number	**CN606154052**
Project Reviewer	**Christopher Loughran, P.E.**	Received Date	**June 23, 2023**
Site Name	**QRC Carbon Capture Plant**		

Project Overview

Quail Run Carbon, LLC (QRC) submitted an expedited initial air permit application to authorize the construction and operation of a Carbon Capture Plant (CCP) to be located in Odessa, Ector County. The CCP will remove carbon dioxide (CO_2) from the flue gas produced by an existing natural gas combined cycle power plant (NGCC plant) operating as the Quail Run Energy Center (QREC). The recovered CO_2 is transported for geologic sequestration either via enhanced oil recovery (EOR) at an oil production facility or via underground injection at a storage facility. The proposed project includes three new natural gas fired auxiliary boilers, a cooling tower, an absorber, several storage tanks, a dehydration unit, and associated equipment leak fugitives. The project triggers PSD review for PM, PM_{10}, $PM_{2.5}$, VOC, NOx, and CO. Additionally, the applicant voluntarily submitted a case-by-case MACT initial permit application for HAP emissions pursuant to Section 112(g) of the Federal Clean Air Act (CAA), 40 CFR 63 Subpart B, and 30 TAC 116.400 out of an abundance of caution since the existing MACT standard that applies to turbines is not completely clear whether it exempts the CCP from §112(g) of the CAA for case-by-case MACT permitting.

Maintenance, startup and shutdown (MSS) activities are authorized in this permit.

Emission Summary

Air Contaminant	Current Allowable Emission Rates (tpy)	Proposed Allowable Emission Rates (tpy)	Change in Allowable Emission Rates (tpy)
PM	0	63.17	63.17
PM_{10}	0	46.91	46.91
$PM_{2.5}$	0	44.42	44.42
VOC	0	367.82	367.82
NO_X	0	69.67	69.67
CO	0	233.90	233.90
SO_2	0	3.67	3.67
HAPs	0	107.55	107.55

Compliance History Evaluation - 30 TAC Chapter 60 Rules

A compliance history report was reviewed on:	June 30, 2023
Site rating & classification:	N/A
Company rating & classification:	N/A
Has the permit changed on the basis of the compliance history or rating?	No
Did the Regional Office have any comments? If so, explain.	No

Public Notice Information

Requirement	Date
Legislator letters mailed	**6/28/2023**
Date 1st notice published	**7/29/2023**
Publication Name: **Odessa American**	
Pollutants: **Hazardous air pollutants, carbon monoxide, nitrogen oxides, organic compounds, particulate matter including particulate matter with diameters of 10 microns or less and 2.5 microns or less, and sulfur dioxide**	
Date 1st notice Alternate Language published	**8/3/2023**
Publication Name (Alternate Language): **El Editor Midland/Odessa**	
1st public notice tearsheet(s) received	**7/31/2023 (English); 8/8/2023 (Spanish)**
1st public notice affidavit(s) received	**7/31/2023 (English); 8/8/2023 (Spanish)**
1st public notice certification of sign posting/application availability received	**9/8/2023**
SB709 Notification mailed	**8/21/2023, 12/7/2023**
Date 2nd notice published	**12/20/2023**
Publication Name: **Odessa American**	
Pollutants: **Hazardous air pollutants, carbon monoxide, nitrogen oxides, organic compounds, particulate matter including particulate matter with diameters of 10 microns or less and 2.5 microns or less, and sulfur dioxide**	
Date 2nd notice published (Alternate Language)	**12/21/2023**
Publication Name (Alternate Language): **El Editor Midland/Odessa**	
2nd public notice tearsheet(s) received	**12/27/2023**
2nd public notice affidavit(s) received	**12/27/2023**
2nd public notice certification of sign posting/application availability received	**1/23/2024**

Public Interest

Number of comments received	3 logged into CID (1 timely, 2 untimely)[a]
Number of meeting requests received	0
Number of hearing requests received	0
Date meeting held	N/A
Date response to comments filed with OCC	N/A
Date of SOAH hearing	N/A

[a]Three positive comments were received, two of which were untimely since they were submitted via email and received after the end of the comment period associated with the second public notice. The one timely comment was submitted by a state House of Representative member, to which the interim Executive Director responded. Therefore, a formal response to comments (RTC) was not required.

Federal Rules Applicability

Requirement			
Subject to NSPS?			**Yes**
Subparts	**A**	& **Db**	
Subject to NESHAP?			**No**
Subparts		**N/A**	
Subject to NESHAP (MACT) for source categories?			**Yes**
Subparts	**A, B,** & **DDDDD**		

See the discussion below regarding the §112(g) case-by-case HAP MACT permitting review.

Nonattainment review applicability:

The site is located in Ector County, which is currently designated as either attainment or unclassifiable for all pollutants. Therefore, nonattainment new source review does not apply.

PSD review applicability:

The proposed plant, to be known as the QRC, will be constructed on property that is contiguous or adjacent to the existing natural gas combined cycle power plant that is permitted by Quail Run Energy Partners LP, operating as the Quail Run Energy Center or QREC, under existing TCEQ Permit Nos. 76990, PSDTX1059, and PSDTX1099. While QRC's SIC code will be 2813 (Industrial Gas Manufacturer) and the power plant's SIC code is 4911 (Electrical Services), the applicant referred to an EPA letter, referred to as the "Meadowbrook Letter" dated April 30, 2018 from the EPA, to represent that QRC and QREC currently have common ownership and plan to establish shared management of operations and environmental compliance responsibilities of the CCP and the existing combined cycle power plant. Therefore, the applicant acknowledged that a common control relationship exists between QRC and QREC, while reserving the right to change source designations if the planned business arrangements substantively change during the life of the source. Therefore, the application represented the QRC and QREC assets as one site for PSD and Title V major source applicability.

The site is an existing named PSD major source since the existing site allowable CO, NOx, PM, and PM_{10} emissions each exceed the major source threshold of 100 tpy (the named source is "chemical process plants, other than ethanol by fermentation"). The "step 1" project emissions increases are summarized in the table below, which were calculated based on the proposed potential-to-emit minus the baseline actual emissions of 0 tpy since all of the units are new. As shown in the table, the "step 1" project emissions increase for each pollutant is greater than its respective significant threshold except for SO_2 and greenhouse gasses (GHGs), and, therefore, contemporaneous netting is required for the PSD pollutants other than SO_2 and GHGs. The "step 2" net contemporaneous emission changes for PM, PM_{10}, $PM_{2.5}$, VOC, NOx, and CO each exceed their respective PSD significant threshold, and, therefore, PSD is triggered for these pollutants.

As a potential PSD "anyway" source, meaning PSD is triggered for a non-greenhouse gas pollutant, GHGs must be evaluated for PSD applicability. The applicant calculated GHG emissions for the proposed project, and the GHG annual emission rate as CO_2e is less than its respective PSD significant threshold. Therefore, PSD is not triggered for GHGs.

Also, the proposed installation and operation of the CCP by QRC will not affect the existing QREC combined cycle plant because the applicant stated that installation and operation of the CCP does not constitute a modification under the NSR permitting program. With the exception of CO_2 emissions which are not regulated under QREC's existing permits, all other QREC source pollutants are assumed to "pass through" the CCP process without any changes imparted by the flue gas quench or CO_2 amine absorber operations. Furthermore, the applicant stated that operation of the CCP is not expected to cause an emissions increase at the existing combined cycle power plant because no physical changes to emissions generating equipment at the combined cycle plant are being proposed. The applicant stated that any changes to operational characteristics at the existing QREC combined cycle power plant after the QRC's CCP commences initial operation would fall within the normal range of operating practices accommodated under the existing air permits and associated with meeting changes in power market demands. Therefore, the existing QREC power plant sources are not considered modified or debottlenecked affected sources for PSD applicability purposes.

Note that had the applicant treated QRC and QREC as separate sites for PSD applicability purposes, the PSD applicability analysis would have been the same since the VOC project emission increase alone exceeds the new major source threshold and the net contemporaneous emissions are equal to the step 1 project emission increases.

Air Contaminant	"Step 1" Project Emissions Increase (tpy)	PSD Significant and Netting Threshold (tpy)	Netting Triggered?	"Step 2" Net Contemporaneous Emissions Change (tpy)	PSD Triggered?
PM	63.17	25	Yes	63.17	**Yes**
PM_{10}	46.91	15	Yes	46.91	**Yes**
$PM_{2.5}$	44.42	10	Yes	44.42	**Yes**
VOC	367.82	40	Yes	367.82	**Yes**
NO_X	69.67	40	Yes	69.67	**Yes**
CO	233.90	100	Yes	233.90	**Yes**
SO_2	3.67	40	No	N/A	No
GHG, CO_2e	68,333.34	75,000	No	N/A	No

Title V Applicability - 30 TAC Chapter 122 Rules

Requirement

Title V applicability:

As discussed above under the PSD discussion, the proposed QRC carbon capture plant is considered one source with the existing natural gas combined cycle power plant known as QREC. The proposed CCP will trigger Title V permitting because the proposed CO and VOC emissions each exceed the Title V major source threshold of 100 tpy specified in 30 TAC 122.10(13)(C) and is therefore subject to 30 TAC § 122 permitting requirements. Proposed HAP emissions from the project also exceed the Title V major source threshold specified in 30 TAC 122.10(13)(A). While QREC has its own Title V permit, Permit No. O-2886, QRC plans to obtain a separate Title V permit.

Periodic Monitoring (PM) applicability:

The proposed CCP will be Title V major source because it emits more than 100 tpy of CO and VOC, more than 10 tpy of any single HAP, and more than 25 tpy of total HAPs and is therefore subject to 30 TAC § 122 requirements. The permit requires periodic monitoring as follows:

- Monthly tank service and liquid throughput records (Special Condition or SC No. 7.B).
- Monthly Auxiliary Boiler (FINs AUXB1, AUXB2, and AUXB3) natural gas fuel usage records (SC No. 10).
- Natural gas fuel total sulfur and net heating value sampling at least every 6 months or fuel supplier test records (SC No. 12).
- Recordkeeping and monthly emission records for planned MSS activities on the Auxiliary Boilers (SC No. 14).
- Total dissolved solids (TDS) and monthly $PM/PM_{10}/PM_{2.5}$ emission records for the Cooling Tower, EPN CT (SC No. 15). Cooling tower water VOC monthly monitoring and recordkeeping to ensure that no leaks of VOC into the cooling tower water occurs, which may be reduced to once every six months if there is no VOC detected for 12 consecutive months (SC No. 15.F).
- 28VHP leak detection and repair (LDAR) program for equipment leak fugitives (SC No. 16).
- Quarterly records assessing the physical and chemical properties of the CCP Absorber (EPN ABS) recirculating amine solvent (SC No. 18).
- Stack testing of the Auxiliary Boilers (FINs AUXB1, AUXB2, and AUXB3) and CCP Absorber (EPN ABS) (SC No. 24).
- NOx, CO, and O_2 CEMS for the Auxiliary Boilers (FINs AUXB1, AUXB2, and AUXB3) (SC No. 25).
- Continuous temperature monitoring of the liquid supply to the first water wash section of the CCP Absorber (EPN ABS) as parametric monitoring to promote continuous compliance with the VOC and HAP MAERT limits for EPN ABS (SC No. 26).
- Daily monitoring (at least once every 24 hours) of the KS-21™ (proprietary amine solvent mixture) concentration (wt.%) in the lean CO_2-absorbing solution supplied to the CO_2 recovery section of the CCP Absorber (EPN ABS) as parametric monitoring to promote continuous compliance with the VOC and HAP MAERT limits for EPN ABS (SC No. 27).
- Visible emission records (SC No. 30.H).

Compliance Assurance Monitoring (CAM) applicability:

CAM applies at Title V major sources to emission units that are subject to an emission limitation or standard for an air pollutant specified in an applicable requirement, the emission unit uses a control device to achieve compliance with the emission limitation or standard, and the emission unit has a pre-control PTE that exceeds the Title V major source threshold as specified in 30 TAC 122.604(b). None of the emission units meet the CAM applicability criteria.

Process Description

The proposed CCP will receive flue gas from the ductwork connection at the battery limits of the CCP process island, process the flue gas to cool, remove unwanted contaminants, strip CO_2 from the solvent, compress the CO_2 for delivery to the battery limits, regenerate, clean and filter solvent (trademark name "KS-21"), and remove heat stable salts from the solvent circulation system. This equipment will include, but not be limited to, ductwork, supports, quencher / absorber, regenerator, CO_2 compressor and supporting heat exchangers and all ancillary systems for a functioning facility. The CCP is designed to recover 7,546 short tons/day of CO_2 from the flue gas from four gas turbines and duct burners in the QREC and auxiliary boilers which generate steam required for the CCP.

Flue Gas Pretreatment

The flue gas will be sent to the flue gas quencher (FGQ) where the flue gas is cooled by direct contact saturation on the surface of structured packing. The cooling water is circulated within the FGQ via a pump, and heat is removed via heat exchangers (Flue Gas Cooling Water Coolers). Two 50% Flue Gas Blowers will be installed at the inlet of the FGQ to provide the draft required through the entire system.

CO_2 Recovery

The cooled flue gas from the FGQ moves upward through the packing, and CO_2 lean solvent is supplied at the top of the absorption section packing. The flue gas contacts with the solvent on the surface of the packing where at least 95% of the CO_2 in the flue gas is absorbed by the solvent. The flue gas then passes through a demister before continuing upward into the washing section. The CO_2 rich solvent is collected by a pair of chimney trays in series which are continuously drained to the Solution Storage Tank. From the Solution Storage Tank, the rich solvent is pumped through the Solution Heat Exchangers by two 50% Rich Solution Pumps to the Regenerator where CO_2 is removed from the solvent and CO_2 lean solvent is returned to the absorber. The washing sections are integrated with the Absorber to recover amine solvent vapor prior to exiting the vessel.

The lower (first) washing section is similar to the flue gas quench section in that cooled water comes into direct contact with the flue gas. The purpose of this section is to recover amine entrained in the flue gas and cool the flue gas in order to maintain water balance within the system. The first Wash Water Circulation Pump transfers water from the bottom of the chimney tray through the Wash Water Coolers before returning the cooled water to the top of the packing. As in the FGQ, condensate is generated when cooling the flue gas. To control the level of the first wash chimney tray, excess liquid is blown down to the lean solvent entering the CO_2 absorption section.

The upper (second) wash section also circulates water to recover amine vapor and mist. The second Wash Water Circulation Pump transfers water from the bottom of the chimney tray of the second washing section back to the top of the packing of the second washing section. To keep the amine concentration low, flue gas condensate from the FGQ is used as makeup for the second wash. To control the liquid level in the second wash chimney tray, excess liquid is blown down to the first wash. At the outlet of the flue gas washing section, the treated gas is exhausted to the atmosphere from the CO_2 Absorber top.

<u>Energy System</u>
The Quail Run power plant is designed to solely produce electric power. As a result, all steam produced from the power plant bottoming cycle is used for power generation, and exhaust steam from the steam turbines is routed to the condensers for recycle to the steam system. Therefore, no process steam is produced at the power plant, and there is no steam available for use by the CCP. Therefore, the steam required to drive the CO_2 compressors and to provide heat for solvent regeneration is produced from new, high efficiency natural gas fired auxiliary boilers. In order to increase the overall system efficiency, exhaust steam from the CO_2 compressors is attemperated with boiler feedwater to produce the steam necessary for solvent regeneration.

<u>Solvent Regeneration System</u>
The cylindrical regenerator pressure vessel is used to remove the CO_2 from the CO_2 rich solvent fluid by heating and stripping the CO_2 with steam. This is accomplished by using two regenerative reboilers to transfer heat from low pressure steam supplied by the auxiliary boilers to the solvent solution which will boil the solvent, and heat exchangers to transfer heat between the lean and rich fluid streams as they circulate between the Absorber and Regenerator and optimize heat usage within the system that transfer heat from the solvent and the steam condensate to the system. The CO_2 vapor will then be cooled down by direct contact saturation on the surface of packing in the Regenerator Reflux Drum.

<u>Solvent Filtration</u>
When particulates from flue gas accumulate in the system and become too concentrated, flooding, erosion, or fouling in the CO_2 capture system could occur. Therefore, the system must continuously remove particulates from the system to prevent them from accumulating. The system will utilize three process filters: the Precoat Filter Unit, the Precoat Afterguard Filter, and the Downstream Guard Filter. The Precoat Filter uses cellulose as the filter medium to treat 100% of the flue gas condensate sent to the flue gas washing section of the CO_2 Absorber. The Precoat Afterguard Filter is installed downstream of the Precoat Filter and uses cartridge type filters to remove any precoat material that may have passed through the Precoat Filter. The Downstream Guard Filter also uses cartridge type filters and is installed on a slipstream of the lean solvent.

<u>Solvent Reclaiming (Continuous Batch Operation)</u>
The solvent reclaiming system will remove soluble solvent degradation products such as heat stable salts, soluble metals, and suspended solid ("SS") from the lean solution. The Reclaimer will operate as a simple batch distiller. The unit includes systems to control usage of reflux water, demineralized water and a caustic soda solution of 50% by weight of NaOH to assist in evaporation of solvent and break down of heat stable salts to release pure solvent.

CO_2 Compression
The CO_2 Compressor(s) are steam driven with multiple stages of compression split into a low pressure (LP) side and a high pressure (HP) side. The O_2 Removal Reactor is located at the outlet of the LP section, and the Hydrogen Generation Unit uses demineralized water and electricity to produce high purity hydrogen that is fed to the O_2 Removal Reactor for oxygen removal. The O_2 Removal Reactor is followed by the Dehydration Unit where moisture in the CO_2 is removed. After the Dehydration Unit, CO_2 is returned to the compressor and compressed in the HP section up to 2,200 psig, above supercritical conditions. After compression, the CO_2 is cooled by the Final Stage Discharge Cooler before it is transported to the CO_2 pipeline.

Project Scope

QRC proposes to construct a carbon capture system that will process and treat flue gas from an existing natural gas combined cycle power plant that is permitted by Quail Run Energy Partners LP, also known as QREC, under existing TCEQ Permit Nos. 76990, PSDTX1059, and PSDTX1099. The proposed project includes three new natural gas fired auxiliary boilers (FINs AUXB1, AUXB2, and AUXB3 / EPN ABS), a cooling tower (EPN CT), an absorber (EPN ABS), several storage tanks, a dehydration unit (EPN DEHY), and associated equipment leak fugitives (EPNs KSFUG and CPKFUG). The flue gas from the QREC plant first flows to a flue gas quencher to reduce the flue gas temperature and is then directed to an absorber utilizing an anti-foam agent and an amine-based proprietary solvent mixture (KS-21™). The absorber off-gas is discharged to the atmosphere via a single stack located on top of the absorber column. The carbon rich liquid solvent flows to the regenerator, where it is combined with caustic soda to reclaim heat-stable salts produced during process operation, and CO_2 is separated from the solvent, which is returned to the absorber in a closed cycle system. The reclaimed salts are sent to a third party for treatment/disposal while the produced CO_2 flows to the compressor and dehydrator for transport and geologic sequestration of the CO_2 either via enhanced oil recovery (EOR) at an oil production facility or via underground injection at a storage facility which will be separately permitted under the Underground Injection Control (UIC) program. QRC will use triethylene glycol (TEG) to dehydrate the remaining gas, remove excess O_2, and produce CO_2.

CAA §112(g) Case-by-Case HAP MACT Permit Review Summary

Case-by-case MACT permits apply to affected sources that are not exempted from the requirements and do not have an applicable MACT standard and for which a major HAP source is constructed, meaning any individual HAP exceeds 10 tpy or total HAPs exceed 25 tpy, as specified in 30 TAC 116.400(a), 40 CFR 63.40(b), and Section 112(g) of the federal Clean Air Act, specifically, 42 U.S.C. 7412(g)(2)(B) of the CAA. The applicant represented that case-by-case MACT permitting requirements of Section 112(g) of the Federal Clean Air Act, 40 CFR 63 Subpart B, and 30 TAC 116.400 do not apply. Specifically, the application supplement noted that both 40 CFR 63.40(b) and 30 TAC 116.400(b) state that case-by-case MACT applies "unless the major source in question has been specifically regulated or exempted from regulation". Additionally, the application supplement noted that 40 CFR 63 Subpart YYYY, specifically §63.6085(a), exempts the control equipment, i.e., the proposed CCP, from the turbine MACT applicability and therefore case-by-case MACT since the proposed CCP project will control CO_2 emissions from combustion turbines at the existing QREC natural gas combined cycle power plant. However, out of an abundance of caution to allay any potential concerns that case-by-case MACT permitting does apply, the applicant voluntarily submitted an initial §112(g) case-by-case HAP MACT permit.

There are no applicable MACT standards for carbon capture/recovery processes. The proposed total HAP emissions from the CCP Absorber (EPN ABS) are 106.49 tpy, which exceeds the 25 tpy threshold for triggering a case-by-case MACT permit, conservatively assuming that the control equipment exemption noted above does not apply. Additionally, the acetaldehyde (HAP) annual emission rate from the CCP Absorber is proposed at 100.30 tpy, which exceeds the individual HAP threshold of 10 tpy. The HAP emissions from the proposed project are summarized in the table below.

HAP Air Contaminant	Proposed Allowable HAP Hourly Emission Rates (lb/hr)	Proposed Allowable HAP Annual Emission Rates (tpy)
CCP Absorber (EPN ABS)		
Acetaldehyde	22.90	100.30
Formaldehyde	0.98	4.29
Acetamide	0.38	1.66
N-Nitrosomorpholine	0.04	0.17
Ethylene imine	0.01	0.06
CCP Absorber Total HAPs:	24.31	106.49
Dehydration Unit (EPN DEHY)		
n-Hexane	0.03	0.12
Benzene	0.02	0.07
Toluene	0.03	0.13
Ethylbenzene	0.05	0.22
o-Xylene	0.07	0.31
m-Xylene	0.05	0.21
Dehydration Unit Total HAPs:	0.24	1.06
Project Total HAPs (CCP Absorber + Dehydration Unit)	**24.55**	**107.55**

The federal rule, 40 CFR 63.43(c), provides three options for obtaining a case-by-case MACT permit, which are the following:

1) Obtain a preconstruction Title V permit, either voluntarily or as required [40 CFR 63.43(c)(1)];
2) Apply for and obtain a Notice of MACT Approval (NOMA), and follow the procedures outlined in 40 CFR § 63.43(f) through (h) [40 CFR 63.43(c)(2)(i)]; or
3) Apply for a MACT determination "under any other administrative procedures for preconstruction review and approval established by the permitting authority for a State…" which adhere to the general principles of MACT determination specified in 40 CFR 63 Subpart B [40 CFR 63.43(c)(2)(ii)].

The applicant chose option 3 above to pursue a case-by-case permit pursuant to 40 CFR 63.43(c)(2)(ii). Regardless of the application avenue chosen, 40 CFR 63.43(c)(4) specifies that the MACT limitation and standards must be consistent with the principles specified in 40 CFR 63.43(d), which include:

1) The emission limitation may not be less stringent than the emission control which is achieved in practice by the best controlled similar source [40 CFR 63.43(d)(1)]; and
2) The emission limitation must achieve the maximum degree of reduction in emissions of HAP which can be achieved by utilizing those control technologies that can be identified from the available information, taking into consideration the costs of achieving such emission reduction and any non-air quality health and environmental impacts and energy requirements associated with the emission reduction [40 CFR 63.43(d)(2)].

The case-by-case MACT permit application requirements are specified in 40 CFR 63.43(e) and 30 TAC 116.404, the latter of which refers to 30 TAC 116.110 for the permit application requirements which the applicant is meeting by the application submittal including form PI-1. The case-by-case MACT determination principles including the MACT emission limitation and control technology evaluation are specified in 40 CFR 63.43(d), which the applicant demonstrated as follows.

The CCP Absorber control options identified for HAP emissions control include adsorption, thermal oxidizers, flares, catalytic oxidizers, absorption, condensation, and alternative raw materials. The feasibility of each control option is discussed in the BACT table below for the CCP Absorber (EPN ABS). As shown in the table below for total HAPs control, the most cost effective option evaluated is calculated by the applicant to have a cost effectiveness of $101,138 per ton of total HAPs removed for carbon adsorption. Supporting this as not being cost effective, the applicant cited Table 14 of the HON proposed rule preamble titled "Nationwide Emissions Reductions and Cost Impacts of Control Options Considered for Continuous Process Vents at HON Facilities" (Federal Register, April 25, 2023, Volume 88, No. 79, page 25130). Control Option 2 of Table 14 involving future closed vent system and control device installations on existing Group 2 continuous process vents with a total organic HAP emission rate greater than 0.10 lb/hr was considered "not cost effective" at an annualized cost of $19,400 per ton of HAP removed. EPA's determination that a candidate MACT control option for an analogous source can be deemed as not cost effective at annualized cost levels which are much lower than the calculated cost effectiveness values for the CCP Absorber vent summarized in the BACT summary table below for total HAPs further supports the applicant's position that no add-on VOC/organic HAP controls should be required to be installed as part of the case-by-case MACT determination for the CCP Absorber, EPN ABS. Lastly, the applicant derived a Total Resource Effectiveness (TRE) Index Value for the CCP Absorber of greater than 50, which they stated is an order of magnitude higher than the typical TRE range of 1.0 to 5.0 below which continuous process vents are required to be controlled under the various NSPS and NESHAP/MACT regulations.

Therefore, the applicant's argument that no further control is required to satisfy the §112(g) case-by-case MACT permitting requirements for the CCP Absorber was deemed valid. To minimize emissions from the CCP Absorber, the applicant proposed implementing good design and operating practices consistent with the underlying engineering basis used to quantify the proposed VOC BACT and case-by-case MACT limits. The applicant will also minimize degradation of the amine solution by using the solvent specified by the engineering design for the unit and by assessing the relevant physical and chemical properties of the recirculating amine solvent to ensure the quality and appropriate CO_2 removal characteristics.

SC No. 18 of the permit will require the applicant to operate and maintain the CCP Absorber as specified by the manufacturer or engineering design and to assess the relevant physical and chemical properties of the recirculating amine solvent mixture at least quarterly to ensure the quality and appropriate CO_2 removal characteristics. SC No. 24 will require initial stack testing for VOC and the HAP pollutants, acetaldehyde (CAS 75-07-0), formaldehyde (CAS 50-00-0), acetamide (CAS 60-35-5), N-nitrosomorpholine (CAS 59-89-2), and ethylene imine (CAS 151-56-4) from the CCP Absorber (EPN ABS). To promote continuous compliance with the proposed HAP emission rate limits from the CCP Absorber (EPN ABS), SC No. 26 will require continuous temperature monitoring of the liquid supply to the first water wash section of the CCP Absorber as parametric monitoring. Also, SC No. 27 will require daily (at least once every 24 hours) monitoring of the KS-21™ (proprietary amine solvent mixture) concentration (wt.%) in the lean CO_2-absorbing solution supplied to the CO_2 recovery section of the CCP Absorber (EPN ABS) as parametric monitoring to promote continuous compliance with the HAP emission rate limits.

The Dehydration Unit (EPN DEHY) is a source of HAP emissions, though the proposed total HAP emission rate of 1.06 tpy is less than the major HAP source trigger. The applicant considered flare and thermal oxidizer controls as potentially feasible control technologies for the dehydration unit vent, consistent with the technologies shown in the RACT/BACT/LAER Clearinghouse (RBLC) searches for dehydrators. The applicant estimated the cost effectiveness of flare control at $386,738 per ton of total HAPs removed and estimated the cost effectiveness of thermal oxidizer control at $191,515 per ton of total HAPs removed based on a pre-control dehydration unit total HAPs emission rate of 1.06 tpy and 98% control for a flare and 99% control for a thermal oxidizer. The applicant stated that routing the Dehydration Unit vent stream to add-on control is not cost effective, which was deemed valid. Therefore, good design and operating practices was proposed to meet BACT and §112(g) case-by-case MACT permitting requirements for the dehydration unit. SC No. 17 of the permit will require the applicant to operate and maintain the Dehydration Unit as specified by the manufacturer or engineering design and to utilize a triethylene glycol (TEG) solution as the contactor (absorber) solution.

Special Conditions and MAERT

The permit special conditions (SCs) and MAERT for this initial permit are summarized below.

New SC No.	Description
1	Standard TCEQ boilerplate permit language for the scope of the permit that specifies that the permit only authorizes the sources listed in the MAERT.
2	Standard TCEQ boilerplate permit language related to unauthorized non-fugitive emissions from relief valves, safety valves, or rupture discs of gases containing volatile organic compounds (VOC) at a concentration of greater than 1 percent.
3	Standard TCEQ boilerplate permit language related to federal applicability that includes 40 CFR 60 Subparts A and Db.
4	Standard TCEQ boilerplate permit language related to federal applicability that includes 40 CFR 63 Subparts A, B, and DDDDD.
5-7	Standard TCEQ boilerplate permit language related to emission standards and operating specifications for storage tanks.
8-10	Special conditions related to emission standards and operating specifications for the Auxiliary Boilers, FINs AUXB1, AUXB2, and AUXB3, and EPN ABS. These special conditions were developed based on a combination of standard TCEQ boilerplate permit language and other permits. SC No. 9 specifies the maximum hourly and 12-month rolling annual heat input rates on a HHV basis (MMBtu/hr and MMBtu/year). The applicant represented maximum firing rates for three different auxiliary boiler vendor options since the final vendor design has not been chosen at the time of the application submittal. Therefore, each vendor option is listed in the firing rate limit table provided in SC No. 9 by vendor option number (the applicant requested to not list the vendor names in the permit due to their agreement with the vendors). The condition requires the applicant to submit a permit alteration or amendment action to specify the maximum firing rate and corresponding MAERT limits once the vendor is chosen, with a deadline of as soon as practicable once the vendor is chosen, but not later than 30 days following the auxiliary boilers startup date.
11-12	Standard TCEQ boilerplate permit language related to the maximum sulfur content limit and sampling of the natural gas used as fuel for the Auxiliary Boilers, FINs AUXB1, AUXB2, and AUXB3, and EPN ABS. The natural gas fired in the Auxiliary Boilers specified in SC No. 11 is limited to 0.2 grains total sulfur per 100 dscf on a 1-hour average basis and 12-month rolling basis, which is being specified based on the permit application basis.
13-14	Special conditions related to emission standards and operating specifications for planned maintenance, startup, and shutdown (MSS) activities for the Auxiliary Boilers represented by FIN AUX1,2,3 and EPN AUXB-MSS. These special conditions were developed based on language used for other permits and the permit application representations for the planned MSS events.
15	Standard TCEQ boilerplate permit language related to emission standards and operating specifications for particulate matter ($PM/PM_{10}/PM_{2.5}$) from the Cooling Tower, EPN CT, with one exception – the applicant requested to reference the permit application for the $PM/PM_{10}/PM_{2.5}$ emissions methodology for clarity. The applicant represented that the cooling tower system does not have VOC emissions since plate and frame heat exchangers are used for all coolers applied to fluids that could contain VOC except for one vapor condenser, and this vapor condenser operates at a much lower pressure than the cooling water, thus preventing leakage of VOC into the cooling water. For plate type heat exchangers where the VOC-containing process fluid is at a higher pressure than the cooling water, there is a solid titanium plate between the two fluids and gaskets between the plates. Any leakage potential for this design of a plate and frame heat exchanger would likely to occur from the gasket. The gaskets are located between the plates, and if a gasket on the

	process fluid side of the plate were to leak, the leak would occur out of the heat exchanger and would not allow for cross contamination of the cooling water. Such a release would be considered an emissions event by the applicant who stated that they would comply with the emission event requirements of 30 TAC 101.201. Therefore, SC No. 15.F was adapted from TCEQ cooling tower boilerplate language for VOC cooling water monitoring and states that any detectable VOC in the cooling tower water is an indication of faulty heat exchange equipment. The specified cooling water VOC minimum sampling frequency is monthly, but may be reduced to once every six months if no detectable VOC is measured for 12 consecutive months. Any detectable VOC from the monitoring requires the monitoring to return to a minimum monthly frequency and may not return to a minimum six-month frequency until another 12 consecutive months of non-detectable VOC is measured.
16	Standard TCEQ boilerplate permit language related to emission standards and operating specifications for the 28VHP LDAR program for equipment leak fugitives, EPNs KSFUG and CPKFUG.
17	This condition for the Dehydration Unit (EPN DEHY) states that it must be operated and maintained as specified by the manufacturer or engineering design and that a triethylene glycol (TEG) solution is used as the contactor (absorber) solution. This condition was developed based on BACT representations in the permit application.
18	This condition for the CCP Absorber (EPN ABS) states that it must be operated and maintained as specified by the manufacturer or engineering design and that an amine solvent mixture will be used as the absorber solution. This condition also requires the permit holder to minimize degradation of the amine solution by using the solvent specified by the engineering design for the unit and by assessing the relevant physical and chemical properties of the recirculating amine solvent at least quarterly to ensure the quality and appropriate CO_2 removal characteristics. This condition was developed based on BACT representations in the permit application.
19	This condition specifies that the Auxiliary Boilers represented by FINs AUXB1, AUXB2, and AUXB3 must be routed to the CCP Absorber (EPN ABS) to be treated for CO_2 recovery except during planned MSS activities as represented in the permit application.
20	This condition specifies that existing Gas Turbine/Duct Burner units, EPNs CTDB1-A, CTDB1-B, CTDB2-A, and CTDB2-B, authorized under QREC's Permit Numbers 76990 and PSDTX1059 are authorized to be routed to the CCP Absorber to be treated for CO_2 recovery and emitted from EPN ABS. This condition also states that the emissions from EPN ABS and EPNs CTDB1-A, CTDB1-B, CTDB2-A, and CTDB2-B shall not exceed the combined maximum allowable emission rates for those EPNs authorized under QRC's Permit No. 173197 and QREC's Permit Numbers 76990 and PSDTX1059. This condition is necessary since QREC's gas turbine/duct burner units are being rerouted to the CCP Absorber for CO_2 recovery rather than being emitted as represented in QREC's permit. This condition was developed based on SC No. 11 of Petra Nova's Permit Nos. 98664, PSDTX1268, and N138. Petra Nova is carbon capture process.
21	This condition specifies that the CEMS specified in Permit Numbers 76990 and PSDTX1059 will measure and record the NO_x and CO emission rates of the streams from the gas turbine/duct burner units (EPNs CTDB1-A, CTDB1-B, CTDB2-A, and CTDB2-B) authorized in Permit Nos. 76990 and PSDTX1059 prior to being routed to the CCP Absorber (EPN ABS) to ensure compliance with the MAERT for Permit Nos. 76990 and PSDTX1059.
22	Continuous compliance for the CCP Absorber shall be conducted as specified in SC Nos. 26 and 27.
23	Standard TCEQ boilerplate permit language related to opacity/visible emissions. The opacity is limited to no more than five percent averaged over a six-minute period from each exhaust stack.
24	Standard TCEQ boilerplate permit language related to initial compliance via stack testing. The pollutants and sources to be measured are the following: 1) NOx, CO, PM, PM_{10}, $PM_{2.5}$, and VOC from each Auxiliary Boiler represented by FINs AUXB1, AUXB2, and AUXB3 to be sampled prior to the CCP Absorber; and

	2) VOC, acetaldehyde (CAS 75-07-0), formaldehyde (CAS 50-00-0), acetamide (CAS 60-35-5), N-nitrosomorpholine (CAS 59-89-2), and ethylene imine (CAS 151-56-4) from the CCP Absorber represented by EPN ABS. The sum of the emission rates of acetaldehyde, formaldehyde, acetamide, N-nitrosomorpholine, and ethylene imine represent the HAPs to be tested. Note that SO_2 stack testing is not required at the applicant's request since the boilers fire pipeline quality natural gas and therefore the fuel sulfur content records specified in SC No. 12 should be sufficient to demonstrate compliance with the SO_2 emission rate limits.
25	Standard TCEQ boilerplate permit language related to continuous compliance for continuous emission monitoring system (CEMS) that applies to NOx, CO, and O_2 from the Auxiliary Boilers (FINs AUXB1, AUXB2, and AUXB3). The NOx, CO, and O_2 concentrations from each Auxiliary Boiler are required by this condition to be measured prior to CCP Absorber so they can be attributed specifically to these sources since the CCP Absorber includes the emissions contributions from QREC's gas turbine/duct burner units that are being routed to the CCP Absorber for CO_2 recovery (the QREC CEMS are covered under Permit Numbers 76990 and PSDTX1059, which is addressed under SC No. 21 as explained above).
26	Continuous monitoring system requirements to measure and record the liquid supply temperature to the first water wash section of the CCP Absorber (EPN ABS). These temperature data are reduced to 3-hour rolling average temperatures that are not to exceed the maximum temperature specified by the manufacturer, with a provision to retest within 365 days if the maximum 3-hour average temperature value measured during the last satisfactory stack test is not within 20°F of the manufacturer's recommended maximum value and the measured VOC or HAP emission rate during the stack test is at or above 90% of the MAERT hourly emission rate limits to ensure the validity of the stack test measured temperature and emissions compliance. This temperature limit is being set since staying below the limit is a parametric monitoring approach to indicate VOC and HAP MAERT compliance. This condition was added to promote continuous compliance with the VOC and HAP emission rate limits in the MAERT from EPN ABS as parametric monitoring since the system is not amenable to a THC CEMs due to the inability of the THC CEMS to measure some of the species including oxidized carbon compounds such as formaldehyde.
27	Monitoring of the KS-21™ (proprietary amine solvent mixture) concentration (wt.%) in the lean CO_2-absorbing solution supplied to the CO_2 recovery section of the CCP Absorber (EPN ABS) at least once every 24-hours. The absolute value of the maximum KS-21™ concentration in the lean CO_2-absorbing solution is considered proprietary by the applicant and therefore the concentration data are normalized by dividing by the minimum of the following: 1) the maximum concentration value established by manufacturer's design and operation specifications for ensuring compliant VOC and HAP emissions rates, or 2) the maximum concentration value measured during the last satisfactory stack test. The relative concentration is specified to less than 1.0 since staying below this limit is a parametric monitoring approach to indicate VOC and HAP MAERT compliance. Like the previous condition, this condition was added to promote continuous compliance with the VOC and HAP emission rate limits in the MAERT from EPN ABS as parametric monitoring since the system is not amenable to a THC CEMs due to the inability of the THC CEMS to measure some of the species including oxidized carbon compounds such as formaldehyde.
28	This condition states that associated Permit Number HAP83 represents the requirements of Section 112(g) of the Federal Clean Air Act, 40 CFR 63 Subpart B, and 30 TAC 116.400 for case-by-case MACT permitting. Special Condition Nos. 4.B, 17, 18, 22, 24.B(2), 26, and 27 are referenced by this condition since they have been developed to demonstrate compliance with the case-by-case MACT permit.
29	Recordkeeping requirement that includes the records to be kept for the life of the permit including a copy of the permit, stack test reports, and manufacturer's design and operation

	specifications and all emission-related maintenance requirements. This condition was developed from other issued permits.
30	Recordkeeping requirement that includes the records specified in each special condition that are required to be kept for at least five years and are required to be made available upon request to representatives of the TCEQ, the EPA, or any local air pollution control program having jurisdiction. This condition was developed from other issued permits.
MAERT	New MAERT for the initial permit that specifies the maximum hourly and annual emission rate limits for each EPN authorized by the permit.

Best Available Control Technology

BACT for the proposed project is summarized in the table below. The applicant submitted RACT/BACT/LAER Clearinghouse (RBLC) database search summaries for the pollutants that triggered PSD, which are PM, PM_{10}, $PM_{2.5}$, VOC, NOx, and CO, and these RBLC search summary results are included in the table below. The EPA has agreed to accept the TCEQ three-tier BACT approach as equivalent to the EPA top-down BACT approach for PSD review when the following are considered: recently issued/approved permits within the state of Texas; recently issued/approved permits in other states; and control technologies contained within the EPA's RBLC. The applicant fulfilled these requirements.

Source Name	EPN	Best Available Control Technology Description
Cooling Tower	CT	VOC - The applicant represented that the cooling tower system does not have VOC emissions since plate and frame heat exchangers are used for all coolers applied to fluids that could contain VOC except for one vapor condenser, and this vapor condenser operates at a much lower pressure than the cooling water, thus preventing leakage of VOC into the cooling water. For plate type heat exchangers where the VOC-containing process fluid is at a higher pressure than the cooling water, there is a solid titanium plate between the two fluids and gaskets between the plates. Any leakage potential for this design of a plate and frame heat exchanger would likely to occur from the gasket. The gaskets are located between the plates, and if a gasket on the process fluid side of the plate were to leak, the leak would occur out of the heat exchanger and would not allow for cross contamination of the cooling water. Such a release would be considered an emissions event by the applicant who stated that they would comply with the emission event requirements of 30 TAC 101.201. Therefore, SC No. 15.F of the permit states VOC emissions from the cooling tower are not authorized and requires monthly VOC cooling water monitoring to indicate faulty heat exchange equipment. The monthly VOC sampling may be reduced to at least once every six months if the monitoring detects no VOC in the cooling tower water for 12 consecutive months, but can revert back to monthly sampling if VOC is measured by the sampling. The TCEQ Tier I BACT guidelines for VOC from cooling towers are non-contact design and monthly monitoring of VOC in the water according to Appendix P or approved equivalent (assume all VOC stripped out). Also, the guidelines include repairing identified leaks as soon as possible, but before the next scheduled shutdown, or shutdown triggered by 0.08 ppmw cooling water VOC concentration. Since the applicant is not authorized for VOC emissions from cooling towers, Tier I BACT is satisfied. PM – The particulate matter emissions were estimated assuming a maximum TDS content of 12,000 ppm, a maximum cooling water circulation rate of 142,700 gallons per minute, and drift loss rate of 0.0005% according to the equipment specification achieved by the use of drift eliminators. The PM_{10} and $PM_{2.5}$ emission rates were calculating following a paper by Joel Reisman and Gordon

		Frisbie, AWMA, Proceedings Florida Conference 2001, Abstract No. 216, Session No. AM-1b, consistent with TCEQ air permitting policies. The TCEQ Tier I BACT guideline for cooling towers is a drift loss of no more than 0.001% achieved by drift eliminators. Therefore, the cooling tower meets Tier I BACT. The applicant submitted RBLC searches for VOC from cooling towers which showed BACT as non-contact design, sampling of the cooling tower water for VOC, and proper operation and maintenance. The RBLC searches for $PM/PM_{10}/PM_{2.5}$ emissions from cooling towers showed that drift eliminators achieving 0.0001% - 0.005% drift loss as BACT. The proposed BACT for the cooling tower meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Aux Boiler 1 Aux Boiler 2 Aux Boiler 3	EPN ABS (FIN AUXB1) EPN ABS (FIN AUXB2) EPN ABS (FIN AUXB3)	The proposed project includes three equally sized natural gas fired auxiliary boilers. Three different vendor options were considered, with the proposed emission rates based on the maximum case from the three proposed options for each pollutant. The three proposed boiler vendor options are the following: 1) Clever Brooks, 436 MMBtu/hr per boiler; 2) Rentech, 438.7 MMBtu/hr per boiler; or 3) Nooter Erickson, 459 MMBtu/hr per boiler. The auxiliary boilers meet BACT during routine operations as summarized below. NOx – The proposed NOx exhaust concentration is 9 ppmvd at 3% oxygen on both an hourly and annual basis during routine operations, which converts to an emission factor of 0.01 lb/MMBtu, achieved through the use of low-NOx burners. The TCEQ Tier I guideline for natural gas fired boilers greater than 40 MMBtu/hour is a NOx emission factor of 0.01 lb/MMBtu. The applicant proposed CEMS that will ensure the NOx emission limits are met. CO - The CO emission basis is proposed as 50 ppmvd at 3% oxygen on both an hourly and annual basis during routine operations, which converts to an emission factor of 0.037 lb/MMBtu, achieved through the use of good combustion practices and proper maintenance. The TCEQ Tier I BACT guideline for natural gas fired boilers greater than 40 MMBtu/hour is 50 ppmvd at 3% oxygen. The applicant proposed CEMS that will ensure the CO emission limits are met. $PM/PM_{10}/PM_{2.5}$ – Less than 5% opacity and use of good combustion practices. The particulate matter emission factors were taken from Table 1.4-2 of AP-42 dated July 1998 for the Clever Brooks boiler option (0.0075 lb/MMBtu) and from the vendors for the Rentech (0.005 lb/MMBtu) and Nooter Erickson (0.005 lb/MMBtu) boiler options. The TCEQ Tier I BACT for particulate matter emissions from boilers greater than 40 MMBtu/hr is meeting opacity of less than 5% and good combustion practices. VOC - Good combustion practices was proposed as BACT for VOC, which meets the TCEQ Tier I BACT guidelines for boilers greater than 40 MMBtu/hr. This emission factors were provided by the auxiliary boiler vendors and are 0.012 lb/MMBtu for the Clever Brooks boiler option, 0.004 lb/MMBtu for the Rentech boiler option, and 0.016 lb/MMBtu for the Nooter Erickson boiler option. SO_2 – Good combustion practices and the SO_2 emission factor taken from Table 1.4-2 of AP-42 dated July 1998, which is based on a natural gas sulfur content

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of 0.2 grains sulfur/100 dscf gas fired. The meets the TCEQ Tier I BACT guideline of firing pipeline quality natural gas and good combustion practices.
The applicant submitted RACT/BACT/LAER Clearinghouse (RBLC) searches for natural gas fired boilers that showed that previous BACT determinations were the following:

NOx - SCR that achieves 5-7 ppmv NOx at 15% oxygen on a three-hour average or low-NOx or ultra-low NOx burners that achieve 0.01-0.2 lb/MMBtu.
CO – oxidation catalyst that achieves 0.0013-0.035 lb/MMBtu or good combustion practices at 50 ppmv at 15% oxygen and 0.02-0.465 lb/MMBtu.
$PM/PM_{10}/PM_{2.5}$ - good combustion practices and natural gas fuel firing.
VOC - good combustion practices and natural gas fuel firing.
SO_2 - good combustion practices, pipeline quality natural gas, fuel sulfur contents of 1.0-2 grains sulfur/100 dscf.

The proposed BACT for the auxiliary boilers meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
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<td>Auxiliary Boilers 1-3 (Start-up)</td>
<td>AUXB-MSS</td>
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The auxiliary boilers meet BACT during planned startup events by using good combustion practices and minimizing the duration of the startup sequence. The applicant represented a maximum of 120 startup events per year for all three auxiliary boilers combined, with a duration of 5 hours per startup event, such that the maximum number of hours per year for startup events is 600 hours/year for all three auxiliary boilers combined. These startup events include both “cold starts” and “warm starts”.
The represented emission factors during planned startup events are summarized in the following table:
<table>
<tr><th rowspan="2">Pollutant</th><th colspan="2">Represented Startup Emission Factors, lb/MMBtu</th></tr>
<tr><th>10-25% Steam Load</th><th>> 25% Steam Load</th></tr>
<tr><td>NOx</td><td>0.13</td><td>0.011</td></tr>
<tr><td>CO</td><td>0.3</td><td>0.037</td></tr>
<tr><td>$PM/PM_{10}/PM_{2.5}$</td><td>0.028</td><td>0.007</td></tr>
<tr><td>SO_2</td><td>0.000588</td><td>0.000588</td></tr>
<tr><td>VOC</td><td>0.033</td><td>0.016</td></tr>
</table>
The applicant submitted RBLC searches for natural gas fired boiler MSS operations, but the results did not indicate different determinations for MSS operations from the routine emissions summarized above.
The TCEQ Tier I BACT guidelines for planned MSS activities for boilers are minimizing the duration of the MSS activities and operating the facility in accordance with best management practices and good air pollution control practices. Tier I BACT is satisfied during planned MSS activities as summarized above.
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CCP Absorber	ABS	VOC and HAP emissions may be emitted from the absorber as a result of evaporative losses of the amine-based solvent used for CO_2 capture and physical losses of the amine solvent as "liquid carryover" in the form of mists and aerosols that are not removed by the mist elimination section of the absorber tower and are discharged from the CCP absorber stack. The applicant was unable to identify any PSD permits for comparable CCP facilities located in the United States that capture CO_2 from natural gas combined cycle turbine exhaust to identify comparable BACT limits or control technology determinations, which included a search of the RBLC database. The applicant submitted RBLC searches for absorbers which showed that thermal oxidizer control has been used to control CO and VOC emissions. However, these determinations are not directly comparable to the QRC project since the RBLC determinations were at chemical units rather than for carbon capture projects. Therefore, the applicant conducted a TCEQ Tier III, which is very similar to an EPA top-down BACT analysis. This Tier III analysis provided by the applicant follows the approaches outlined in Appendix E and Appendix G of the TCEQ's Air Pollution Control guidance document, APDG 6110v2 dated January 2011 and is summarized below. Step 1 - Identify all potential options to reduce the VOC emissions from the CCP Absorber, which are the following: • Adsorption • Thermal Oxidizers • Flares • Catalytic Oxidizers • Absorption • Condensation • Alternative Raw Materials Step 2 - Eliminate technically infeasible options, which are the following: • Thermal oxidizers – temperature infeasibility issues (100°F for the absorber stream vs. 1000°F or higher for thermal oxidizers). • Catalytic oxidizers – temperature infeasibility issues (100°F for the absorber stream vs. 600°F or higher for catalytic oxidizers). However, for completeness, the applicant included catalytic oxidation in the remaining steps of the BACT evaluation despite technical challenges of the temperature ranges. • Absorption - installing a secondary absorption process for VOC emissions removal downstream of the absorber is not a technically feasible control option because this secondary absorption process would not offer any further VOC emissions reduction. • Alternate raw materials - the specific properties of proprietary amine solvent are necessary to achieve the desired CO_2 removal capability for the specific application to the turbine's exhaust stream. Step 3 - Rank remaining control technologies by control effectiveness, as summarized in the table below. <table><tr><th>Rank</th><th>Control Option</th><th>Approximate</th></tr></table>

		Control Efficiency
1	Adsorption Regenerative Catalytic Oxidizer Flare	~98%
2	Condensation	~90%

Step 4 - Eliminate control options based on collateral impacts such as energy, environmental, and economic impacts. The estimated cost impacts for the remaining control options that were not eliminated in step 2 as summarized in the table below.

Control Option	Total Capital Investment	Total Annual Direct and Indirect Costs ($/year)	Pollutant Control Efficiency (%)	Annual VOC Controlled (tpy)	Annualized Control Cost[a] ($/ton VOC removed)
Carbon Adsorbers	$34,356,934	$10,554,453	98%	255.45	$41,317
Oxidation Catalysts	$111,587,715	$85,319,724	98%	255.45	$333,999
Refrigerated Condensers	$485,263,869	$155,713,657	90%	234.60	$663,752
Flares – Self Supported	$184,476,133	$3,424,324,077	98%	255.45	$13,405,102

[a] Based on dollar-year of 2022.

The dollars per ton of VOC removed for the four control options listed above were not considered cost effective ($41,317 per ton of VOC removed and higher).

A similar analysis was conducted for HAPs. The table below summarizes the applicant's cost effectiveness calculation for HAPs.

Control Option	Total Capital Investment	Total Annual Direct and Indirect Costs ($/year)	Pollutant Control Efficiency (%)	Annual HAPs Controlled (tpy)	Annualized Control Cost[a] ($/ton HAP removed)
Carbon Adsorbers	$34,356,934	$10,554,453	98%	104.36	$101,138
Oxidation Catalysts	$111,587,715	$85,319,724	98%	104.36	$817,577
Refrigerated Condensers	$485,263,869	$155,713,657	90%	95.84	$1,624,761
Flares – Self Supported	$184,476,133	$3,424,324,077	98%	104.36	$32,813,608

[a] Based on dollar-year of 2022.

Similar to VOC, the dollars per ton of total HAP removed for the four control options listed above were not considered cost effective ($101,138 per ton of total HAP removed and higher).

Step 5 - Select BACT. Since none of the control options were considered cost effective, the applicant represented BACT for the CCP Absorber as implementing good design and operating practices consistent with the underlying engineering basis used to quantify the proposed VOC BACT limit. The applicant will also minimize degradation of the amine solution by using the solvent specified by the engineering design for the unit and by assessing the relevant physical and chemical properties of the recirculating amine solvent to ensure the quality and appropriate CO_2 removal characteristics. The proposed allowable emissions from the CCP Absorber vent are 59.51 lb/hr and 260.66

		tpy of VOC and 24.31 lb/hr and 106.49 tpy of total HAPs. MSS – The applicant represented that the primary CCP Absorber stack does not have increased emissions during MSS events, so the hourly and annual potential emission calculations reflecting worst-case operation during normal, steady-state conditions would encompass any regulated air pollutant emissions from the CCP Absorber stack occurring during an MSS event. However, there are two locations where a CO_2-rich vent stream must be discharged into the CCP Absorber stack to facilitate start-ups and shutdowns of the CCP Regenerator and CO_2 Compressor sections. The applicant represented two vent streams during which CO_2-rich streams may be emitted for brief periods of less than 0.5 hours per event. However, these two MSS streams that are vented from the CCP Absorber stack do not contain any regulated pollutants other than CO_2. Since PSD was not triggered for GHGs, BACT is not required to be evaluated for these CCP MSS activities with CO_2 emissions, and the GHG emissions represented by the applicant are not being listed in the MAERT since the TCEQ does not authority to regulate GHG emissions unless a PSD action is triggered, i.e., the agency does not have a minor GHG program as specified in the Texas Health and Safety Code §382.05102(b) and 30 TAC 116.164(b).
Solution Sump Tank	TK-1	Horizontal fixed roof tank painted white with a nominal capacity of 1,860 gallons that is proposed to store KS-21™ solution (proprietary amine solvent mixture), with a maximum hourly fill rate of 10,800 gallons/hour, a maximum annual throughput of 301,780 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Solution Storage Tank	ABS (FIN TK-2)	Vertical fixed roof tank painted white with a nominal capacity of 321,703 gallons that is proposed to store KS-21™ solution (proprietary amine solvent mixture), with a maximum hourly fill rate of 71,146 gallons/hour, a maximum annual throughput of 6,618,176,740 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The tank vents to the CCP Absorber, EPN ABS, but the applicant did not apply any control due to the absorber. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines.

		The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Fresh Solution Storage Tank #1	TK-3	Vertical fixed roof tank painted white with a nominal capacity of 28,201 gallons that is proposed to store KS-21™ solution (proprietary amine solvent mixture), with a maximum hourly fill rate of 10,800 gallons/hour, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Fresh Solution Storage Tank #2	TK-4	Vertical fixed roof tank painted white with a nominal capacity of 28,201 gallons that is proposed to store KS-21™ solution (proprietary amine solvent mixture), with a maximum hourly fill rate of 10,800 gallons/hour, a maximum annual throughput of 154,000 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Reclaimed Waste Tank	TK-5	Vertical fixed roof tank painted white with a nominal capacity of 17,485 gallons that is proposed to store "Reclaimed Waste", with a maximum hourly fill rate of 2,400 gallons/hour, a maximum annual throughput of 175,151 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 150°F. The tank shell and tank roof for this tank are fully insulated.

		The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
TEG Storage Tank	TK-6	Vertical fixed roof tank painted white with a nominal capacity of 4,199 gallons that is proposed to store "Triethylene Glycol (TEG)", CAS 112-27-6, with a maximum hourly fill rate of 6,000 gallons/hour, a maximum annual throughput of 18,150 gallons/year, and a maximum liquid vapor pressure of 0.0000813 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
1st Wash Water Storage Tank	TK-7	Vertical fixed roof tank painted white with a nominal capacity of 154,653 gallons that is proposed to store "1st Wash Water" (4.3 wt. % KS-21™ / 95.7 wt. % water), with a maximum hourly fill rate of 10,800 gallons/hour, a maximum annual throughput of 216,554,227 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.

2nd Wash Water Storage Tank	TK-8	Vertical fixed roof tank painted white with a nominal capacity of 124,333 gallons that is proposed to store "2nd Wash Water" (0.116 wt. % KS-21™ / 99.9 wt. % water), with a maximum hourly fill rate of 27,000 gallons/hour, a maximum annual throughput of 174,098,380 gallons/year, and a maximum VOC partial pressure of less than 0.5 psia at 95°F. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Caustic Soda Tank	TK-9	Horizontal fixed roof tank painted white with a nominal capacity of 711 gallons that is proposed to store "Caustic Soda" (50 wt. % sodium hydroxide / 50 wt. % water), with a maximum hourly fill rate of 3,000 gallons/hour, a maximum annual throughput of 5,530 gallons/year, and a maximum liquid vapor pressure of 0.56 psia (NaOH and water mixture) at 95°F. Note that the partial pressure of the NaOH is 0.0000312 psia at 95°F in the NaOH/water mixture. The TCEQ's Tier I BACT guidelines for fixed roof storage tanks with a capacity less than 25,000 gal or a true vapor pressure less than 0.50 psia is submerged fill and uninsulated exterior surfaces exposed to the sun that are white or aluminum in color. The TCEQ's Tier I BACT guideline for planned MSS activities is to send the liquid to a covered vessel when draining the tank. The tank will meet the Tier I BACT guidelines. The applicant submitted RBLC searches that showed that previous BACT determinations were tanks with white shells, submerged filling, and good maintenance practices. The proposed BACT for tanks meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
Dehydration Vent	DEHY	The proposed emissions from the glycol (TEG) Dehydration Unit flash tank and overhead regenerator vent are 0.36 lb/hr and 1.59 tpy for VOC and 0.24 lb/hr and 1.06 tpy for HAPs. The TCEQ Tier I BACT guidelines for glycol dehydrators is to route the reboiler stills vent to a flare with 98% DRE or a firebox with 99+% DRE. The applicant submitted RBLC searches for VOC emissions from dehydrators which showed that thermal oxidizers or flares are used to meet BACT. However, the dehydrators are listed in the RBLC are all located at a refinery or a chemical manufacturing plant. The dehydration unit for the proposed CO_2 capture project is used for a different process than those listed in the RBLC

and therefore the applicant provided further justification for the proposed BACT.

The applicant stated that since the Dehydration Unit is being used to dehydrate a CO_2 rich stream with a relatively low VOC concentration compared to traditional glycol dehydrators that are commonly used to dehydrate wet natural gas streams, the potential VOC emissions from the dehydrator vent are less than 2 tpy. Therefore, due to lack of comparable installations and not being similar to dehydrators in the oil and gas industry, the applicant proceeded from TCEQ Tiers I and II to Tier III, similar to a traditional EPA top-down analysis.

The applicant considered flare and thermal oxidizer controls as potentially feasible control technologies for the dehydration unit vent, consistent with the technologies shown in the RBLC searches for dehydrators. The applicant estimated the cost effectiveness of flare and thermal oxidizer control of VOC as summarized in the following table:

Control Option	Total Capital Investment	Total Annual Direct and Indirect Costs ($/year)	Pollutant Control Efficiency (%)	Annual VOC Controlled (tpy)	Annualized Control Cost ($/ton VOC removed)
Flare – Self Supported	$117,241	$411,577	98%	1.558	$264,171
Thermal Oxidizer	$847,240	$200,707	99%	1.574	$127,523

The dollars per ton of VOC removed for the flare and thermal control options listed above were not considered cost effective ($264,151 per ton of VOC removed for flare control and $127,523 per ton of VOC removed for thermal oxidizer control).

A similar analysis was conducted for HAPs. The table below summarizes the applicant's cost effectiveness calculation for HAPs.

Control Option	Total Capital Investment	Total Annual Direct and Indirect Costs ($/year)	Pollutant Control Efficiency (%)	Annual HAPs Controlled (tpy)	Annualized Control Cost ($/ton HAP removed)
Flare – Self Supported	$117,241	$411,577	98%	1.037	$396,738
Thermal Oxidizer	$847,240	$200,707	99%	1.048	$191,516

Similar to VOC, the dollars per ton of total HAP removed for the flare and thermal oxidizer control options listed above were not considered cost effective ($396,738 per ton of total HAPs removed for flare control and $191,516 per ton of total HAPs removed for thermal oxidizer control)).

In summary, the applicant stated that routing the Dehydration Unit vent stream to add-on control is not cost effective, which was deemed valid based on the cost analysis provided by the applicant. Therefore, good design and good operating practices was proposed as BACT for the dehydration unit.

KS Fugitives	KSFUG	The total VOC emission rate from equipment leak fugitives from all fugitives associated with the proposed project combined (EPNs KSFUG and CPKFUG) before taking LDAR credits is less than 10 tpy. The TCEQ Tier I BACT guidelines for equipment leak fugitives is the following:
CPK Fugitives	CPKFUG	

<table>
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Uncontrolled VOC emissions < 10 tpy: no control.
10 tpy < uncontrolled VOC emissions < 25 tpy: 28M leak detection and repair program. 75% credit for 28M.
Uncontrolled VOC emissions > 25 tpy: 28VHP leak detection and repair program. 97% credit for valves, 85% for pumps and compressors.

The applicant represented that the 28VHP LDAR program will be used, which exceeds the Tier I BACT guidelines since the uncontrolled VOC emission rate is less than 10 tpy. Since the existing QREC Permit No. 76990 does not include fugitive emissions, the total annual VOC emission rate for the proposed project and the existing QREC plant is also less than 10 tpy.
The applicant submitted RBLC searches that showed that previous BACT determinations were leak detection and repair programs that meet 40 CFR 60 Subparts VVa or OOOO, audio, visual, olfactory (AVO) checks, or the TCEQ 28M, 28MID, or 28VHP LDAR programs.
The proposed BACT for fugitives meets the TCEQ Tier I guidelines and is consistent with the RBLC searches.
</td></tr>
<tr><td>Low Pressure CO_2 Fugitives</td><td>LPCO2FUG</td><td rowspan="2">The fugitive emissions assigned to EPNs LPCO2FUG and HPCO2FUG are associated with the piping used for the streams from the existing QREC natural gas combined cycle power plant that are directed to the CCP for CO_2 removal and are therefore primarily in CO_2 rich service (95 weight % CO_2) for the purposes of evaluating PSD applicability for GHGs. The applicant quantified the CO_2 emissions from these fugitive streams assuming the 28M LDAR program. However, PSD was not triggered for GHGs and therefore BACT does not apply to the fugitive emissions from these CO_2 rich streams. As noted earlier, BACT is not required to be evaluated for sources with CO_2 emissions, and the GHG emissions represented by the applicant are not being listed in the MAERT since the TCEQ does not authority to regulate GHG emissions unless a PSD action is triggered, i.e., the agency does not have a minor GHG program as specified in the Texas Health and Safety Code §382.05102(b) and 30 TAC 116.164(b).</td></tr>
<tr><td>High Pressure CO_2 Fugitives</td><td>HPCO2FUG</td></tr>
</table>

Permits Incorporation

Permit by Rule (PBR) / Standard Permit / Permit Nos.	Description (include affected EPNs)	Action (Reference / Consolidate / Void)
N/A	**N/A**	**N/A**

Impacts Evaluation

Was modeling conducted? **Yes** Type of Modeling: **AERMOD version 22112**

Is the site within 3,000 feet of any school? **No**

Additional site/land use information: **Applicant assumed rural dispersion option**

The applicant provided an air quality analysis, which was audited by the TCEQ ADMT. The air quality analysis is acceptable for all review types and pollutants. More detailed information regarding the air quality analysis may be found in the ADMT modeling memo, ADMT Project No. 8860, dated November 5, 2023. The modeling results are summarized below.

Modeling Results for PSD De Minimis Analysis in Micrograms Per Cubic Meter (µg/m^3)

Pollutant	Averaging Time	GLCmax (µg/m^3)	De Minimis (µg/m^3)
PM_{10}	24-hr	4.52	5
PM_{10}	Annual	0.87	1
$PM_{2.5}$ (NAAQS)	24-hr	0.43	1.2
$PM_{2.5}$ (NAAQS)	Annual	0.07	0.2
$PM_{2.5}$ (Increment)	24-hr	0.48	1.2
$PM_{2.5}$ (Increment)	Annual	0.08	0.2
NO_2	1-hr	7.02	7.5
NO_2	Annual	0.11	1
CO	1-hr	22	2000
CO	8-hr	14	500

Modeling Results for Ozone PSD De Minimis Analysis in Parts per Billion (ppb)

Pollutant	Averaging Time	GLCmax (ppb)	De Minimis (ppb)
O_3	8-hr	0.42	1

Modeling Results for PSD Monitoring Significance Levels

Pollutant	Averaging Time	GLCmax (µg/m^3)	Significance (µg/m^3)
PM_{10}	24-hr	4.52	10
NO_2	Annual	0.11	14
CO	8-hr	14	575

Project-Related Modeling Results for State Property Line

Pollutant	Averaging Time	GLCmax ($\mu g/m^3$)	De Minimis ($\mu g/m^3$)
SO_2	1-hr	0.21	20.42

Modeling Results for Minor NSR De Minimis

Pollutant	Averaging Time	GLCmax ($\mu g/m^3$)	De Minimis ($\mu g/m^3$)
SO_2	1-hr	0.21	7.8
SO_2	3-hr	0.18	25

Minor NSR Project (Increases Only) Modeling Results for Health Effects

Pollutant & CAS#	Averaging Time	GLCmax ($\mu g/m^3$)	10% ESL ($\mu g/m^3$)
formaldehyde 50-00-0	1-hr	0.11	1.5
acetamide 60-35-5	1-hr	0.04	32
acetaldehyde 75-07-0	1-hr	2.53	12
n-hexane 110-54-3	1-hr	0.003	560
n-hexane 110-54-3	Annual	1.56×10^{-4}	20
benzene 71-43-2	1-hr	0.002	17
benzene 71-43-2	Annual	8.95×10^{-5}	0.45
ethylbenzene 100-41-4	1-hr	0.01	2600
ethylbenzene 100-41-4	Annual	2.85×10^{-4}	57
o-xylene 95-47-6	1-hr	0.01	220
o-xylene 95-47-6	Annual	4.08×10^{-4}	18
m-xylene 108-38-3	1-hr	0.01	220
m-xylene 108-38-3	Annual	2.74×10^{-4}	18

Minor NSR Site-wide Modeling Results for Health Effects

Pollutant	CAS#	Averaging Time	GLCmax ($\mu g/m^3$)	GLCmax Location	GLCni ($\mu g/m^3$)	GLCni Location	ESL ($\mu g/m^3$)

KS-21 [proprietary amine solvent mixture]	NA	1-hr	31.90	E Property Line	13.17	S Property Line	16
KS-21 [proprietary amine solvent mixture]	NA	Annual	1.03	E Property Line	< 1.03	NA	1.5

The applicant provided a health effects review as specified in the TCEQ's Modeling and Effects Review Applicability (MERA) guidance (APDG 5874 dated March 2018) for project emission increases of non-criteria pollutants. The project emissions of non-criteria pollutants listed below satisfy the MERA and are protective of human health and the environment.

Health Effects Review - Minor NSR Project-Related Results

Pollutant & CAS#	Averaging Time	GLCmax µg/m³	ESL µg/m³	Modeling and Effects Review Applicability (MERA) Step in Which Pollutant Screened Out
Formaldehyde 50-00-0	1-hr	0.11	15	Step 3 - GLCmax < 10% ESL
	Annual	0.01	3.3	Step 3 - GLCmax < 10% ESL
n-Nitrosomorpholine 59-89-2	1-hr	N/A	140	Step 2 – long-term ESL ≥ 10% of short-term ESL, 2 µg/m³ ≤ short-term ESL < 500 µg/m³ and production emission increase < 0.04 lb/hr
	Annual	N/A	14	Step 0 – long-term ESL ≥ 10% of short-term ESL
Acetamide 60-35-5	1-hr	0.04	320	Step 3 - GLCmax < 10% ESL
	Annual	0.002	32	Step 3 - GLCmax < 10% ESL
Acetaldehyde 75-07-0	1-hr	2.53	120	Step 3 - GLCmax < 10% ESL
	Annual	0.13	45	Step 3 - GLCmax < 10% ESL
Proprietary Amine Based Solvent Mixture (KS-21™) No CAS specified	1-hr	Sitewide GLCmax = 31.90 GLCni = 13.17	16[a]	Step 7 – sitewide modeling deemed acceptable by ADMT; Tier III Toxicology review not triggered since GLCmax ≤ 2 x ESL and GLCni < ESL
	Annual	Sitewide GLCmax = 1.03	1.5[a]	Step 7 – sitewide modeling deemed acceptable by ADMT
Ethylene imine 151-56-4	1-hr	N/A	2	Step 2 – long-term ESL ≥ 10% of short-term ESL, 2 µg/m³ ≤ short-term ESL < 500 µg/m³ and production emission increase < 0.04 lb/hr

	Annual	N/A	0.2	Step 0 – long-term ESL ≥ 10% of short-term ESL
Propane 74-98-6	1-hr	-	-	Step 0 – simple asphyxiate
	Annual	-	-	Step 0 – simple asphyxiate
i-Butane 75-28-5	1-hr	N/A	23,000	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	7100	Step 0 – long-term ESL ≥ 10% of short-term ESL
n-Butane 106-97-8	1-hr	N/A	66,000	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	7100	Step 0 – long-term ESL ≥ 10% of short-term ESL
i-Pentane 78-78-4	1-hr	N/A	59,000	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	7100	Step 0 – long-term ESL ≥ 10% of short-term ESL
n-Pentane 109-66-0	1-hr	N/A	59,000	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	7100	Step 0 – long-term ESL ≥ 10% of short-term ESL
Cyclopentane 287-92-3	1-hr	N/A	17,000	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	1700	Step 0 – long-term ESL ≥ 10% of short-term ESL
n-Hexane 110-54-3	1-hr	0.003	5600	Step 3 - GLCmax < 10% ESL
	Annual	0.0002	200	Step 3 - GLCmax < 10% ESL
Benzene 71-43-2	1-hr	0.002	170	Step 3 - GLCmax < 10% ESL
	Annual	0.00009	4.5	Step 3 - GLCmax < 10% ESL
Toluene 108-88-3	1-hr	N/A	4500	Step 2 – long-term ESL ≥ 10% of short-term ESL, short-term ESL ≥ 3,500 µg/m^3 and production emissions increase ≤ 0.4 lb/hr
	Annual	N/A	1200	Step 0 – long-term ESL ≥ 10% of short-term ESL
Ethylbenzene 100-41-4	1-hr	0.01	26,000	Step 3 - GLCmax < 10% ESL
	Annual	0.0003	570	Step 3 - GLCmax < 10% ESL

o-Xylene 95-47-6	1-hr	0.01	2200	Step 3 - GLCmax < 10% ESL
	Annual	0.0004	180	Step 3 - GLCmax < 10% ESL
m-Xylene 108-38-3	1-hr	0.01	2200	Step 3 - GLCmax < 10% ESL
	Annual	0.0003	180	Step 3 - GLCmax < 10% ESL

[a] ESLs for the proprietary amine-based solvent solution (KS-21™) used in the carbon capture system was provided by the TCEQ in an email dated September 20, 2023 from Stanley Aniagu of the TCEQ Toxicology, Risk Assessment and Research Division to the applicant. Due to the proprietary nature of the solvent, the technology provider submitted a request under confidential cover to TCEQ's Toxicology division to derive short-term and long-term ESLs for the solvent solution.

As noted earlier, the proposed project will authorize rerouting of the existing Quail Run Energy Center (QREC) natural gas combined cycle power plant, specifically, turbine/duct burner EPNs CTDB1-A, CTDB1-B, CTDB2-A, and CTDB2-B authorized in QREC's existing Permit Nos. 76990, PSDTX1059, and PSDTX1099, to QRC's CCP Absorber (EPN ABS). Since the emissions are being rerouted from existing EPNs authorized in QREC's permit to the subject QRC permit, a request was submitted to the applicant to provide a demonstration that the proposed project would not affect previous modeling protectiveness reviews conducted for these existing QREC power plant sources and result in more adverse impacts as a result of rerouting the QREC existing turbine/duct burner sources to the CCP Absorber. The applicant submitted a memorandum dated August 21, 2023 and associated AERMOD (version 22112) dispersion modeling files that were reviewed by the ADMT. In summary, the modeling conducted by the applicant showed that the rerouting of the existing QREC turbine/duct burner sources to the CCP Absorber will not result in more adverse impacts, as illustrated in the table below that summarizes the applicant's modeling analysis provided in the August 21, 2023 summary memorandum that shows the unit impact multiplier (UIM) results are less for CCP Absorber stack compared to the existing QREC turbine/duct burner stacks.

Unit Impact Modeling Results Comparison for
Rerouting Existing QREC Turbine/Duct Burner Stacks to QRC CCP Absorber

Averaging Period	Absorber Stack[a] (μg/m^3 per lb/hr)	Combustion Turbines[b] (μg/m^3 per lb/hr)	Absorber Stack UIM < Combustion Turbines UIM?
1-hour	0.1105	0.3155	Yes
3-hour	0.0664	0.2730	Yes
8-hour	0.0548	0.2559	Yes
24-hour	0.0396	0.1602	Yes
Annual	0.0058	0.0267	Yes

[a]The proposed QRC absorber vent stack (EPN ABS) was modeled with a unit emission rate (1 lb/hr).
[b]The four existing QREC combustion turbines were modeled by dividing the unit emission rate (1 lb/hr) by four (4), i.e., 0.25 lb/hr for each turbine.

In summary, the applicant has demonstrated that the proposed project's emissions will not adversely affect public health and welfare, which includes NAAQS, additional impacts, minor new source review of regulated pollutants without a NAAQS, and air toxics review. The proposed increases in health effects pollutants will not cause or contribute to any federal or state exceedances. Therefore, emissions from the facility are not expected to have an adverse impact on public health or the environment.

Permit Concurrence and Related Authorization Actions

Is the applicant in agreement with special conditions?	**Yes**
Company representative(s):	**Mike Meister, consultant on behalf of the applicant who copied applicant on concurrence email**
Contacted Via:	**Email**
Date of contact:	**12/5/2023**
Other permit(s) or permits by rule affected by this action:	**QREC's Permit Nos. 76990, PSDTX1059, and PSDTX1099 – QREC's permit will be revised to allow for rerouting of the subject existing turbine units to the QRC carbon capture plant as discussed above.**
List permit and/or PBR number(s) and actions required or taken:	**N/A**

	1/25/2024		1/26/2024
Project Reviewer Christopher Loughran, P.E.	Date	Section Manager Kristyn Campbell	Date