FEDERAL OPERATING PERMIT - TECHNICAL REVIEW SUMMARY SITE OPERATING PERMIT (SOP) RENEWAL

Permit #:	O2309	Company:	Air Products LLC
Project #:	34298	Site:	Pasadena Steam Methane Reformer
Regulated Entity #:	RN100221324	Application Area:	Pasadena Steam Methane Reformer
Region:	12	Customer #:	CN602299257
NAICS Code:	325120	County:	Harris
Permit Reviewer:	Camilla Widenhofer	NAICS Name:	Industrial Gas Manufacturing

SITE INFORMATION

Physical Location:	1423 Highway 225
Nearest City:	Pasadena
Major Pollutants:	CO, NOX
Additional FOPs:	None

PROJECT SUMMARY

Air Products LLC, Pasadena Steam Methane Reformer is an Industrial Gas Manufacturing facility operating under Federal Operating Permit (FOP) O2309 which was last renewed on May 9, 2018. A timely renewal application was received on September 26, 2022.

PROCESS DESCRIPTION

At Air Product's Pasadena Plant, gaseous hydrogen (H_2) is produced by reacting natural gas with steam. The hydrogen production process consists of four basic process steps: (1) natural gas desulfurization, (2) reforming, (3) shift conversion, and (4) hydrogen purification.

Desulfurization

Natural gas is passed through a nickel-molybdenum (Ni-Mo) catalyst where sulfur compounds are reduced to hydrogen sulfide (H_2S). The H_2S is captured by zinc oxide (ZnO), where the H_2S is converted to zinc sulfide (ZnS) and water (H_2O).

Reforming

Desulfurized natural gas and steam are introduced into the steam methane reformer (SMR) where they pass through nickel catalyst-filled tubes located in the radiant section of the reformer. The natural gas and steam react to form H_2 and carbon oxides (CO and CO ₂) via the following reactions:

Steam-Hydrocarbon Reforming Reaction: $C H_4 + H_2O + heat \div CO + 3 H_2$

Water-Gas Shift Reaction:
$$CO + H_2O + heat \div CO_2 + H_2 + heat$$

The reforming reaction is endothermic, with heat supplied by carefully controlled combustion in the radiant section of the reformer. The high temperatures necessary for the natural gas and steam to react are achieved by combusting fuel gases in the reformer with combustion air.

Carbon Monoxide (CO) Shift Conversion

The syngas exiting the reformer's nickel-catalyst tubes is cooled by heat transfer to a boiler water/steam mixture which is recycled back to the steam drum. The process gas stream next enters the high temperature shift reactor, which contains an iron-chromium (Fe-Cr) catalyst. In the presence of the Fe-Cr catalyst, additional hydrogen is produced by a continuation of the exothermic water-gas shift reaction. After exiting the high temperature shift reactor, the hot process gas is cooled by heat exchange with the reformer feed gas and the boiler feedwater. The cooled process gas then goes to the low temperature shift reactor where additional CO is converted to H_2 and CO_2 . The process gas is then cooled and flows to the Hydrogen Purification System.

Hydrogen Purification

After condensate separation downstream of the low temperature shift reactor, the process gas contains hydrogen, carbon dioxide, and methane with some CO, nitrogen, and residual water vapor. To produce high purity H_2 , the process gas is sent to a pressure-swing adsorption (PSA) unit. The PSA unit comprises a series of vessels, each of which contains solid granular alumina, molecular sieve, and activated carbon. This adsorption process selectively adsorbs the impurities in the process gas, allowing the hydrogen to pass through. The H_2 product leaving the PSA unit is sent to two hydrogen pipelines.

Plant Flare

In addition to the reformer, the other combustion source at the Pasadena SMR Plant is a flare. The SMR flare system consists of stand-alone elevated ground flare and a network of piping and ancillary equipment connecting all relief devices and process vents in combustible gas service.

TECHNICAL REVIEW

Permit Content Summary	
1. Was Periodic Monitoring (PM) required and included in the permit?	Yes
2. Was Compliance Assurance Monitoring (CAM) required and included in the permit?	No
3. Was case-by-case PM or CAM included in the permit?	Yes
4. Was a permit shield requested?	Yes
5. If a permit shield was requested, was any permit shield request denied?	No
6. Identify if the following are applicable for this project:	
(a) Manually-built applicable requirements	No
(b) Customized Special Terms and Conditions	Yes
(c) Manual changes to the IMS-generated applicable requirements	No
(d) Alternate means of compliance for any emission unit/source at the site	No
7. Is the site subject to the requirements of 40 CFR Part 72 (Acid Rain Permit)?	No
8. Did the applicant's review/comments on the working draft permit result in changes	
to the permit content?	No
9. Will the draft permit be sent to public notice with unresolved issues	
(i.e., disagreements with applicant)?	No

Permit reviewer notes:

- Form OP-PBRSUP was included in the application. There are no registered PBRs associated with this facility and PBRs 106.261 and 106.262 were removed from the permit. The only remaining PBR is 106.511;
- The customized term and condition for MACT & Chapter 113 remains unchanged and the PBR term and condition
 was customized to include the date and project number for submittal of OP-PBRSUP;
- Periodic monitoring
 - For SMR REFORM see the historical notes below for the existing case-by-case monitoring for Chapter 117 NH3. PM-C-001 was added for Chapter 117 CO monitoring;
 - For SMR REFORM new case-by-case periodic monitoring was added for CO. This monitoring reflects the fuel flowrate monitoring from the NSR Permit
- Existing permit shields were reviewed and remain. No new permit shields were requested;
- Deleted unit OSC GEN;
- Renamed CSC GEN to CSC/OSC GEN and updated the description to CSC/OSC Emergency Generator;

Historical Notes for SMR REFORM:

Review of this application was stalled when the applicant requested 117.310(c)(2)(B) for measuring NH3 based on a rolling 24-hour averaging period for SMR REFORM rather than 117.310(c)(2)(A) based on a block one-hour averaging period for units not equipped with a CEMS for ammonia. The applicant indicated that they were using the NOx CEMS to calculate NH3, rather than a NH3 CEMS. However, Alfredo Mendoza contacted Javier Galvan and Vincent Meiller in the Air Quality Division, Air Quality Planning Section. They agreed with APD that using a dual NOx CEMS in conjunction with monitoring ammonia injection using a mass balance approach to calculate ammonia emissions, i.e. ammonia slip, does not equal an ammonia CEMS as described in 30 TAC 117.310(c)(2)(B). Therefore, the appropriate citation is § 117.310(c)(2)(A).

It was finally decided that in order to meet the one-hour block average of 117.310(c)(2)(A), they could add caseby-case periodic monitoring since the NOx CEMS is monitoring data at least four times per hour and averaged hourly, and the ammonia injection is being monitored hourly (per NSR permit 27773). Therefore, the hourly rate could be calculated. Alfredo Mendoza proposed the monitoring procedure which was approved by the applicant and added to the permit.

In the final review, the applicant still did not agree with keeping § 117.310(c)(2)(A) even though the case-by-case monitoring justifies how they meet that requirement.

Statement of Basis

A Statement of Basis sets forth the legal and factual basis for the applicable requirements that are included in the FOP. A Statement of Basis was prepared for this project and is included in the permit file. **Compliance History Review**

 In accordance with 30 TAC Chapter 60, the compliance history was reviewed on <u>October 17, 2022.</u> Site rating: <u>0.00 / High</u> Company rating: <u>1.68 / Satisfactory</u> 			
(High < 0.10 ; Satisfactory ≥ 0.10 and ≤ 55 ; Unsatisfactory > 55)			
2. Has the permit changed on the basis of the compliance history or site/company rating?	. No		
Site/Permit Area Compliance Status Review			
1. Were there any out-of-compliance units listed on Form OP-ACPS?	. No		
2. Is a compliance plan and schedule included in the permit?			
Delinquent Fee Check			
1. The delinquent fee check was performed on June 19, 2023			
2. Were there any delinquent fees owed?	No		
Public Notice Information			
 Were comments received from the applicant after the draft permit was mailed and 			
before Public Notice was published?			
Was a revised draft permit or public notice authorization package (PN-Errata) sent			
for any reason?	No		
3. Publication date: 07/19/2023 Newspaper name: Pasadena Citizen			
4. Was bilingual public notice published?	Yes		
Publication date: 07/26/2023 Newspaper name: La Voz			
5. Were comments received during Public Notice period?	Yes		
(a) Was a public hearing requested?	Yes		
(b) Was a public hearing held?	. NO		
(c) Was the public hearing request withdrawn?	. NO		
(a) was permit content changed as a result of any public comments?	. NO		
o. was re-publication necessary?	N0		

Permit reviewer notes:

A hearing request was received by TCEQ on August 7, 2023. Kim Strong indicated that TCEQ would send a response to comments instead of holding a public hearing.

EPA Review

1. Did EPA comment on the draft permit?	. No
2. Was a separate NOPP - Notice of Proposed Permit sent to the EPA?	Yes
If yes, did the EPA comment on the proposed permit?	. No
3. Were any changes made to the permit after the EPA Review Period?	. No
If ves, were these changes made within the 60 day Public Petition Period?	NA
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Permit reviewer notes:

EPA had no comments on TCEQ's response to comments and hearing request or to the proposed permit.

IMPORTANT MILESTONES

Milestone (Standard)	Start Date	End Date
Date Application Received by TCEQ	09/26/2022	
Date Project Received by Engineer	10/11/2022	
Technical Review Period	12/16/2022	03/06/2023
Working Draft Permit Reviewed by Applicant	01/19/2023	02/15/2023
Date PNAP/Draft Permit Mailed	06/22/2023	
Public Notice Comment Period	07/19/2023	08/18/2023
Date Comment on Draft Permit Received from Public	08/03/2023	
EPA Review Period	10/24/2023	12/01/2023
Date Sign Posting Certification Received	09/07/2023	

EFFECTIVE PERMIT ISSUANCE DATE: 12/15/2023

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12/11/2023

Camilla Widenhofer Permit Reviewer **Operating Permits Section** Air Permits Division

Date

12/11/2023 Date

Mark Meyer Acting Team Leader **Operating Permits Section** Air Permit Division

CONTACT INFORMATION

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