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TCEQ DOCKET NO. 2023-0649-AIR

IN THE MATTER OF APPLICATION BY EXXON MOBIL CORPORATION TO AMEND AIR QUALITY PERMIT NO. 102982 IN BAYTOWN, HARRIS COUNTY, TEXAS	§ § § § § § §	**BEFORE THE** **STATE OFFICE OF** **ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY

OF

ROBERT JACKSON

FOR

ENVIRONMENT TEXAS

NOVEMBER 3, 2023

DIRECT TESTIMONY OF ROBERT JACKSON

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Robert Jackson. My business address is 2078 West 130 South, Mapleton, Utah, 84664.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

I trained at the Advanced Combustion Engineering Research Centre ("ACERC") at Brigham Young University ("BYU") where I earned a Bachelor of Science and a Master's Degree in Mechanical Engineering. In my 5 years at ACERC I worked with utility boilers, process furnaces, and fuel combustion characteristics. I have completed seven continuing education courses over the course of my career, including: LECO S-144DR Determinator Training Course (2001); LECO TGA-601 Determinator Training Course (2001); HP 5890 GC Training Course (2002); NAFI's CFEI training (2004); NFPA training course for NFPA 921 (2004); NAFI's continuing CFEI training (2009); NAFI & NFPA Computer Fire Modeling (2009). I have acquired 23 years of experience in the process industry with expertise in fuels analysis, combustion, combustion modelling and emissions.

Q. DO YOU HAVE ANY PROFESSIONAL CERTIFICATIONS?

A. I received professional training from the Advanced Combustion Engineering Research Centre at BYU. I have been certified as a Cause and Origin Fire and Explosion Investigator. I received an Engineer-In-Training Certificate from the State of Utah, in April 1985.

Q. WHAT IS YOUR OCCUPATION AND HOW ARE YOU EMPLOYED?

A. I am currently employed as a High Performance Computational Engineer at Zeeco Incorporated.

Q. PLEASE DESCRIBE YOUR OCCUPATION.

A. At Zeeco, I primarily use computational fluid dynamics (CFD) codes to model combustion systems in process furnaces, industrial flares and thermal oxidizers (i.e., incinerators) to determine their efficiency, effectiveness and emissions. The work also includes research and development projects to improve burner designs being developed at Zeeco.

Q. PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.

A. I have over 25 years of experience in engineering and consulting in the utility and petrochemical industries at BYU (Research Assistant), Combustion Resources ("CR") (Analytical Laboratory Manager and Engineering Manager), Systems Analyses and Solutions Inc. ("SAS") (Senior Project Manager), Elevated Analytics Consulting ("EAC") (Chief Engineer), and Zeeco Inc. (High Performance Computational Engineer). While at Combustion Resources, I oversaw all engineering and laboratory activities. I performed extensive fuels analysis and research for clients and consulted on a variety of projects from explosion relief systems to projects related to lowering emissions in industrial applications.

The consulting work included numerous Expert Witness cases where I worked with Dr. L. Douglas Smoot for approximately half of the cases. During this time at CR I also consulted with the U.S. Department of Justice and the Department of Energy regarding flaring emissions and helped set new regulations related to flaring to more accurately predict flare performance. My consulting work continued at SAS where I worked mostly with clients from the energy and process industry sector.

I then partnered in a startup company, EAC, working to develop emission monitoring systems that could be deployed for flaring systems which would allow for direct monitoring of even difficult systems such as multi-point ground flares. During this time, I was part of the ASTM committee on air-quality monitoring sensor technology. At Zeeco, I use CFD codes and other high performance computing software to analyse and improve utility furnaces, burners, flares and thermal oxidizers.

I also have 8 years of experience in the Aerospace industry at General Dynamics (Propulsion Engineer) and Lockheed Martin (Advanced Propulsion systems Group).

Q. HAVE YOU PREPARED A TRUE AND CORRECT COPY OF YOUR CURRICULUM VITAE FOR USE IN THIS PROCEEDING?

A. Yes.

II. PURPOSE OF YOUR TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I was asked to look at parts of the Application materials and Draft Permit and offer my opinion on whether this project is utilizing the best available technologies to control or to measure certain emissions.

Q. WHAT HAS BEEN THE SCOPE OF YOUR WORK IN THE PRESENT PROCEEDING?

A. I have reviewed material supplied to me by counsel related to the proposed expansion of the Baytown Olefin plant. I have not looked at the entire record. For example, for this report, I have not received or reviewed information stamped as Confidential.

Q. HOW DID YOU CONDUCT THAT REVIEW?

A. To form my opinions, I have performed several tasks including:

1) Reviewed materials describing the current Application to the TCEQ for the expansion project.
2) Reviewed information on olefin production from the literature including the John Zink Combustion Handbook.
3) Reviewed previous literature related to flare performance testing including the TCEQ 2010 Flare Study, several papers from the American Flame Research Committee and several technical articles published in the peer reviewed open literature.

I received and reviewed the following materials and information provided to me for this case during my analysis to form my opinions:

1) ExxonMobil - Notice of Administrative Record Exhibits and Public Notice and Jurisdictional Exhibits (3293951).

2) ExxonMobil - Notice of Appearance (3293950).

3) ExxonMobil - Motion for Entry of Protective Order (3298312).

4) Applicant's Motion for Entry of Agreed Procedural Schedule (3299186).

5) Exxon-Mobil-corporation-TCEQ Notice of Hearing.

6) Air Permit 102982 Amendment Application.

7) Proofs of publication and original affidavit of publication for air permitting.

8) EXEC_SUMMARY_20220915_114919.

9) ATTACH_Permit No. 102982 PI-1 workbook_10-13-2022.

10) TCEQ's Air Permit Technical Guidance for Chemical Sources, Fugitive Guidance, APDG 6422.

11) Petrachem Live - BOP-2X Unit Exxon Baytown Refinery Ethylene Unit.

12) Particulate matter stack test reports for Exxon Bayton Olefins Plant.

13) Portions of TCEQ-issued permits.

I have also relied upon my education, training, knowledge, skills, and experience in the field of chemical engineering and my specific experience in combustion technology related to cracking furnaces and gas flare design and operation.

Q: BEFORE WE GET INTO YOUR SPECIFIC CONCLUSIONS, WOULD YOU PLEASE GIVE THE COMMISSION A BRIEF SUMMARY OF YOUR FINDINGS FOR CONTEXT?

A: Exxon Mobil (EXXON) has proposed expanding their Baytown Olefins plant by adding additional ethylene production capacity to support new plastic products manufacturing. EXXON submitted a minor New Source Review permit amendment, as opposed to a major New Source Review permit application and TCEQ is proposing to issue the permit.

I did not see that EXXON had included the expected air emissions produced by the additional flaring required to support their plant expansion. Standard practice in the process industry is that companies like EXXON estimate flare emissions based on the EPA regulations included in 40 CFR § 60.18 which assumes a 98% destruction efficiency for a properly designed and operated industrial flare. Previous industrial scale flare testing has shown flare destruction and removal efficiency ("DRE") may be lower than 98% under certain conditions (e.g., wind, rain) and when burning flare gas with heating values below 200 BTU/scf.

Currently the EPA has certified certain sensor technology that can be used to monitor flare performance by measuring the DRE for operating flares. Using this type of sensor technology represents the best available technology for quantifying flare emissions associated with the proposed expansion.

Therefore, my opinions include:

1) EXXON should document and include potential flare emissions from flaring required to support their proposed expansion in the total plant emissions. TCEQ should consider flare emissions in their estimated emissions.

2) Flare emissions monitoring technology exists that would allow EXXON to continuously monitor flare emissions during major flaring events using non-extractive technologies to demonstrate compliance with the limits in the Baytown Olefins Plant permit. EXXON should use available sensor technology to continuously monitor flare emissions from flares supporting the new olefins plant. In doing so, EXXON will not only meet the standard but also help set the standard for other olefin plant expansions.

Also, emission limits in the Draft Permit should be, in my opinion, similar to what are found in other TCEQ-issued permits for similar sources.

3) Particulate matter emission limits from the proposed cracking furnace should be the same as EXXON has demonstrated in practice at its other Baytown furnaces.

4) The permit should include lower ammonia emission limits, as TCEQ has required of other similar plants.

5) The permit should include more stringent fuel sulfur content limits, as TCEQ has required for other similar plants.

My opinions are based on my review of the materials provided including exhibits, expert reports, and the scientific literature. I reserve the right to modify my opinions if additional information becomes available.

Q. PLEASE PROVIDE A SUMMARY OF THE PROPOSED PROJECT.

A. The dispute concerns an application by Exxon Mobil Corporation (EXXON) to amend Air Quality Permit Number 102982 in Baytown, Harris County, Texas as part of their proposed increased production in the BOP-2X Ethylene Unit. EXXON has applied to the Texas Commission on Environmental Quality (TCEQ) for authorization to modify the Baytown Olefins Plant located at 3525 Decker Drive, Baytown, Harris County, Texas 77520 (see Figure 1).

Figure 1 - EXXON Baytown refinery located near Houston, Texas

The Baytown Olefins Plant is one of the largest ethylene plants in the world. The plant includes an ethylene cracker with eight furnaces (see Figure 2) which have a combined capacity of 1.5 million tons per year.

Figure 2 - Baytown ethylene cracker system at the EXXON Baytown refinery

The Exxon Baytown refinery also includes three crude distillation units, a sulfur plant, a hydrotreater, fluid catalytic cracking units, a delayed Coker unit, hydrofining units, hydro-desulphurization and de-asphalter units (see Figure 3). The EXXON Baytown refinery processes crude oil to generate petrol, diesel, jet fuel, heating oil, and carbon coke. The refinery also produces feedstock for the chemical and Olefins plants in the complex.

The Baytown chemical plant produces approximately 700,000 tons per year (TPY) polypropylene, 600,000 TPY paraxylene, 125,000 TPY butyl, 50,000 TPY synthetics, and other performance products including ethylene.

In May 2019, ExxonMobil proposed an expansion to the Baytown chemical plant. This expansion includes a new 400,000 TPY Vistamaxx performance polymer unit and a 350,000 TPY linear alpha olefins unit.

What is now known as the Baytown Olefins Plant produces approximately 3.8 million TPY (MTPY) ethylene plus additional propylene and butadiene. The existing Olefins plant consists of eight steam cracking furnaces and associated recovery and separation equipment, and began operation in 2018. Ethylene produced by the olefins plant is supplied to Exxon’s Mont Belvieu Plastics Plant.

The Baytown olefins plant emits several hazardous compounds from the cracking plant (Figure 4) which are identified in their permit application (Figure 5).

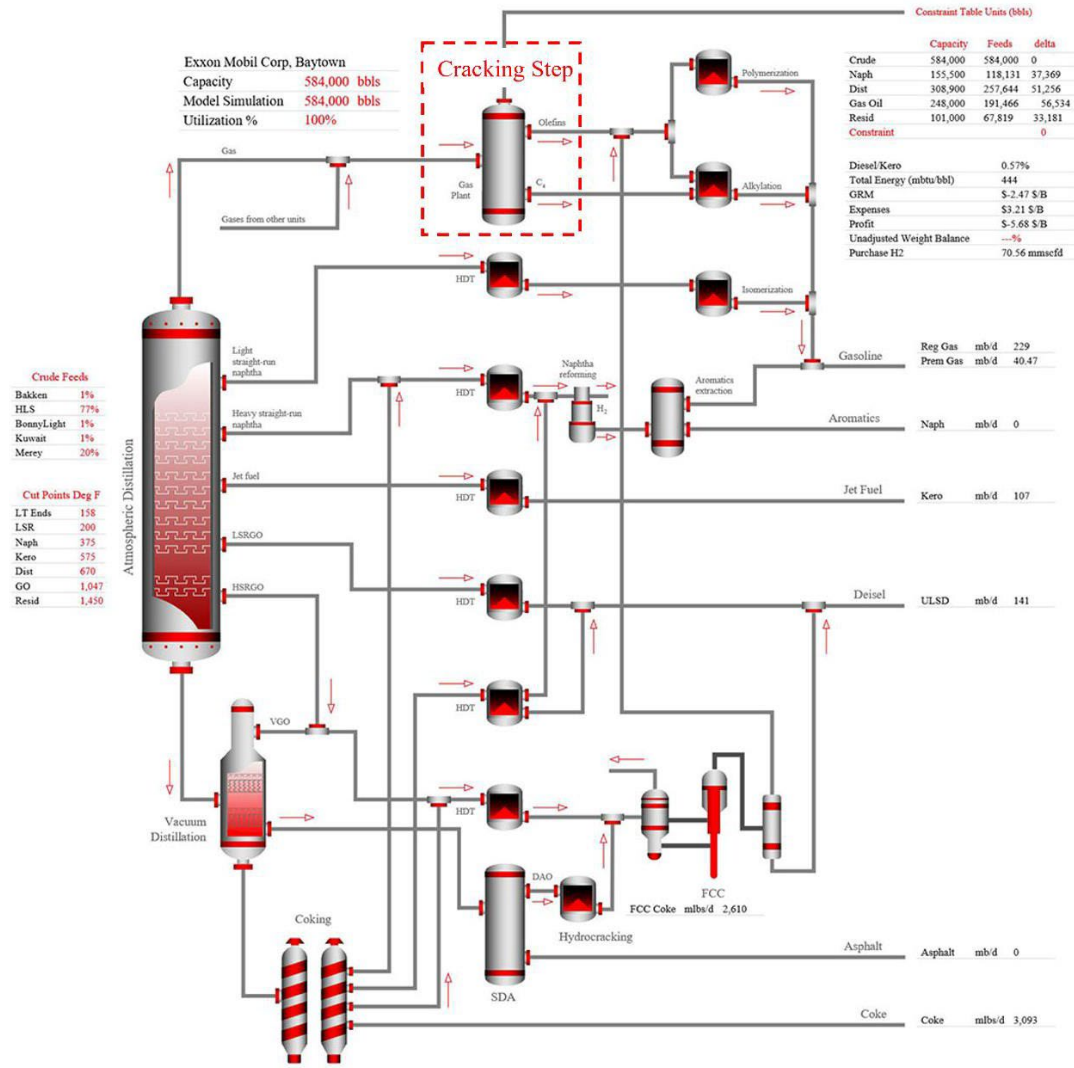

Figure 3 - EXXON Baytown refinery process showing cracking step for ethylene production

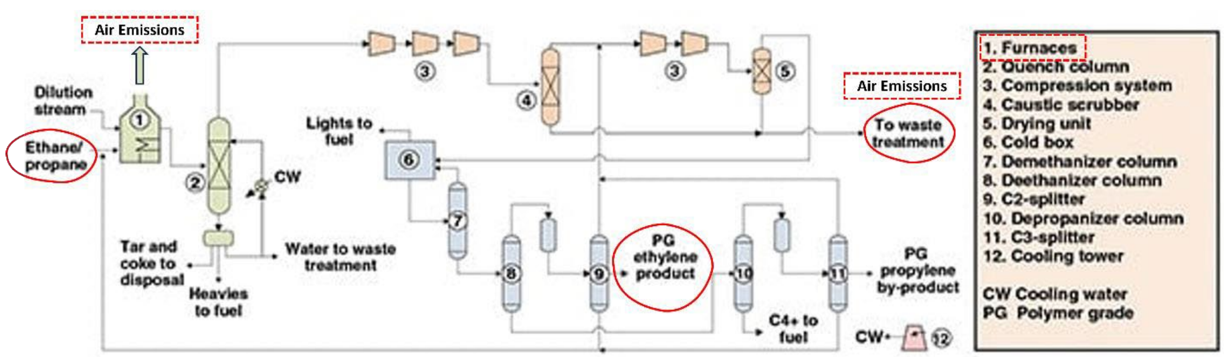

Figure 4 - Overall process to produce ethylene from ethane/propane feedstock

Air Contaminant	Current Allowable Emission Rates (tpy)	Allowable Emission Rated Authorized by Consolidated PBRs (tpy)	Proposed Allowable Emission Rates (tpy)	Change in Allowable Emission Rates (tpy)	Project Changes at Major Sources (Baseline Actual to Allowable)* (tpy)
PM	90.37	0	116.51	26.14	N/A
PM_{10}	78.41	0	102.21	23.80	N/A
$PM_{2.5}$	73.28	0	95.90	22.62	N/A
VOC	219.40	0.02	250.60	31.18	N/A
NO_x	232.27	0.58	264.19	31.34	N/A
CO	929.75	0	1082.24	152.49	N/A
SO_2	22.44	0	58.33	35.89	N/A
NH_3	82.79	0.01	94.43	11.63	N/A
H_2SO_4	0.39	0	3.69	3.30	N/A

* BOP has Plant-wide Applicability Limits (PALs) for NOx, CO, VOC, $PM/PM_{10}/PM_{2.5}$, SO_2, and sulfuric acid (H_2SO_4) in Permit No. PAL6 issued on August 24, 2005. BOP is not requesting an increase in a PAL for any of these criteria pollutants as a result of the proposed project. Therefore, a federal permitting applicability review is not required in accordance with 30 TAC 116.190.

Figure 5 - Emission summary with modified air permit

The BOP-2X Unit contains eight existing furnaces (Figure 2) and associated recovery equipment (Figure 3), plus a cooling tower, a flare system, and other utilities (not shown in the cracking process layout depicted in Figure 4). The BOP-2X Unit processes ethane fed to the cracking furnaces to produce ethylene and other products.

Cracking furnaces "crack" ethane (C2H6) into ethylene (C2H4) and hydrogen (H2) using thermal radiation (heat) produced by burning hydrocarbon fuels (e.g., fuel gas):

$$C_2H_6 \overset{heat}{\Longrightarrow} C_2H_4 + H_2 \qquad \text{eq. 1}$$

Thermal radiation generated from wall and floor burners located inside the cracking furnace heat the process tubes (see Figure 6a). Occasionally, flames from the floor burners "roll-over" and impinge on the process tubes which creates hot spots on the tubes and results in coke formation when the inner tube surface temperature is greater than about 850°C (Figure 6b).

The proposed expansion project will add a new furnace with a Selective Catalytic Reduction (SCR) system to control NOx emissions. Although ethylene cracking furnaces are equipped with "low-NOx" burners that limit NOx emissions, an SCR is still required to minimize NOx emissions.

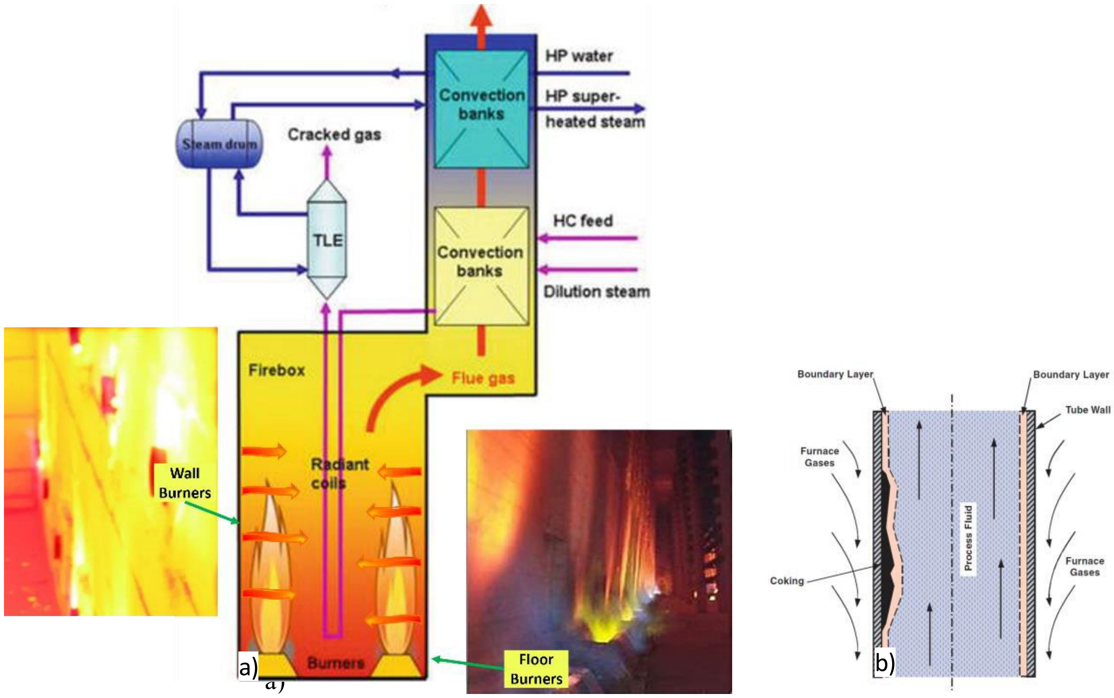

Figure 6 - Ethylene cracking furnace: a) floor and wall burners create thermal radiation to heat process tubes, b) coke formation inside process tubes when inner tube surface area > 850°C

The expansion includes a new cracking furnace which will include new continuous emissions monitoring equipment (CEMS) to measure NOx and CO from the furnaces. The new furnaces will use new SCR units to reduce NOx emitted from the furnaces. Additional stack monitoring for NH3 will also be included. Fugitive emissions from equipment and piping leaks in the new furnace will also be monitored. During routine operation, the cracking furnaces will be "de-coked" to remove coke build-up inside the process tubes. "De-coking" creates fine carbon particles which will be collected in cyclonic separators before the effluent gas is released to the atmosphere.

III. DOCUMENTATION OF POTENTIAL FLARE EMISSIONS

Q. LET'S TAKE THE FIRST ISSUE YOU IDENTFY, DOCUMENTATION OF POTENTIAL FLARE EMISSIONS. WHAT IS YOUR CRITICISM HERE?

A. Waste gas from the cracking furnace also includes heavier hydrocarbon gases including propane (C3H8), propylene (C3H6), butane (C4H10), butylene (C4H8), pentane (C5H12) and others which are sent to a De-propanizer to recover these products. Unfortunately, not all these waste products are recovered and must be flared.

The flare system associated with the olefin plant includes an elevated flare and a multi-point ground flare (see Figure 7). These flares are designed to safely burn waste gases from the ethylene cracking system described above. Based on extensive testing, well designed flares routinely operate with a combustion efficiency above 98%[1,2] The flare system monitors flare gas flow using a flow meter with an on-line analyzer to quantify flare gas composition.

Figure 7 - Cracking furnaces with elevated flare and multi-point flare that treat waste gases from cracking system.

According to the Application, emissions from the proposed expansion project result in:

- New allowable limits for a new furnace to be known as the XXI Furnace (EPNs XXIF01-ST, XXIF01-MSS);
- Increase to allowable limits for Decoke Pot XXI (EPN XXI-DEC / EPN: BOPXXDECOKE);
- Increase to allowable limits for Fugitives (EPN BOPXXFUG); and
- Increase to allowable limits for the Cooling Tower (EP BOPXXCT).

As shown, Exxon has estimated emissions from their proposed expansion for equipment and furnaces but seem to have ignored flare emissions to support the additional cracking furnaces proposed as part of the expansion project.

Q. WHAT IS YOUR CONCLUSION REGARDING FLARE EMISSIONS THAT WOULD RESULT FROM THE PROPOSED NEW FURNACE?

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[1] Pohl, J.H., R. Payne & J. Lee, "Evaluation of the Efficiency of Industrial Flares: Test Results", EPA-600/2-84-095, May (1984).

[2] Blackwood, T.R., "An Evaluation of Flare Combustion Efficiency Using Open-Path Fourier Transform Infrared Technology," *J. Air & Waste Manage. Assoc.*, 50, 1714-1722, October (2000).

A. The proposed expansion project will allow EXXON to significantly expand plant capacity by adding additional ethylene cracking capacity. This expansion will require additional flaring to support the new cracking system. According to the Draft Permit:

> 10. The elevated flare (EPN FLAREXX1) shall be designed and operated in accordance with the following requirements:
>
> A. The flare system shall be designed such that the combined assist gas and waste stream to each flare meets the 40 CFR § 60.18 specifications of minimum heating value and maximum tip velocity under normal, upset, and maintenance flow conditions.
>
> Flare testing per 40 CFR § 60.18(f) may be requested by the appropriate regional office to demonstrate compliance with these requirements.

EXXON does not appear to have included flare emissions in their application (see Figure 11 and Figure 12). Instead, it appears EXXON has assumed a destruction efficiency of 98% per 40 CFR § 60.18 of existing flows to the flare to estimate flare emissions. However, the increase in emissions that will result from the proposed furnace should be included in the application along with the other sources.

IV. MONITORING AND DOCUMENTING FLARE EMISSIONS

Q. CAN YOU DESCRIBE HOW REQUIRED FLARE DESTRUCTION EFFICIENCIES ARE ACHIEVED AND MONITORED?

A. Various technologies have been developed and used to quantify flare performance (Figure 8).

Extensive testing of industrial flare systems at large scale production plants has been conducted (Figure 9) with results reported as shown in Figure 10. This work illustrates the variability of destruction efficiency for well-designed and operated flares similar to what are currently used by Exxon in the Baytown Olefins Plant. Figure 7.

In addition, EPA has proposed new regulations governing flares at certain petrochemical sites such as EXXON to measure compliance with flare emission limits. This includes monitoring key performance parameters such as:

- Heating value
- Ensure steam/air assist at appropriate flow rates

Rank	Measurement Method	Additional Data Needed
1	Continuous composition monitoring (or manual sampling at least once every 3 hours during flaring events) and continuous flow rate monitoring of the gas sent to the flare	▪ Combustion efficiency (based on results of a direct measurement test, if available, or a default assumption)
2	Continuous flow rate monitoring and daily or weekly compositional analysis	▪ Representative sample (grab or integrated) ▪ Assumed combustion efficiency
3	Continuous flow rate and heating value monitoring	▪ Emission factors based on heating value
4	Engineering calculations	▪ Process knowledge of units connected to flare (e.g., volume, composition of process streams) ▪ Temperature and pressure monitoring data or other process operating data as needed ▪ Assumed combustion efficiency
5	Emission factors based on energy consumption	▪ Flow estimates (not continuous) ▪ Heat value estimates (not continuous)
6	Default emission factors based on refinery or process throughput	▪ Refinery or process throughput

Figure 8 – Estimation methods to determine flare emissions[3]

Study ID	Authors	Date	% H_2 in Vent Gas	Test Method
EPA-600/2-83-052	McDaniel [1]	July 1983	0	Extractive
EPA-600/2-85-106	Pohl and Soelberg [3]	Sept 1985	0	Extractive
MPC TX	Clean Air Engineering [12]	May 2010	3.1-24	PFTIR
INEOS	Clean Air Engineering [13]	July 2010	0	PFTIR
MPC Detroit	Clean Air Engineering [14]	Nov 2010	7.0-55	PFTIR
FHR (AU)	Clean Air Engineering [15]	June 2011	13-47	PFTIR
FHR (LOU)	Clean Air Engineering [15]	June 2011	20-30	PFTIR
SDP EPF	Shell Global Solutions [16]	Apr 2011	37-62	PFTIR
TCEQ	Allen and Torres [7]	Aug 2011	0	Extractive, AFTIR, PFTIR

Figure 9 - Industrial flare tests conducted using various technologies reported in the literature[4]

[3] Table 6-1. Summary of Flare Emissions Estimate Methodologies, from "Emission Estimation Protocol for Petroleum Refineries," version 3, RTI International (April 2015), submitted to the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27711.

[4] US EPA Office of Air Quality Planning and Standards, "Parameters for properly designed and operated flares," US EPA (2012).

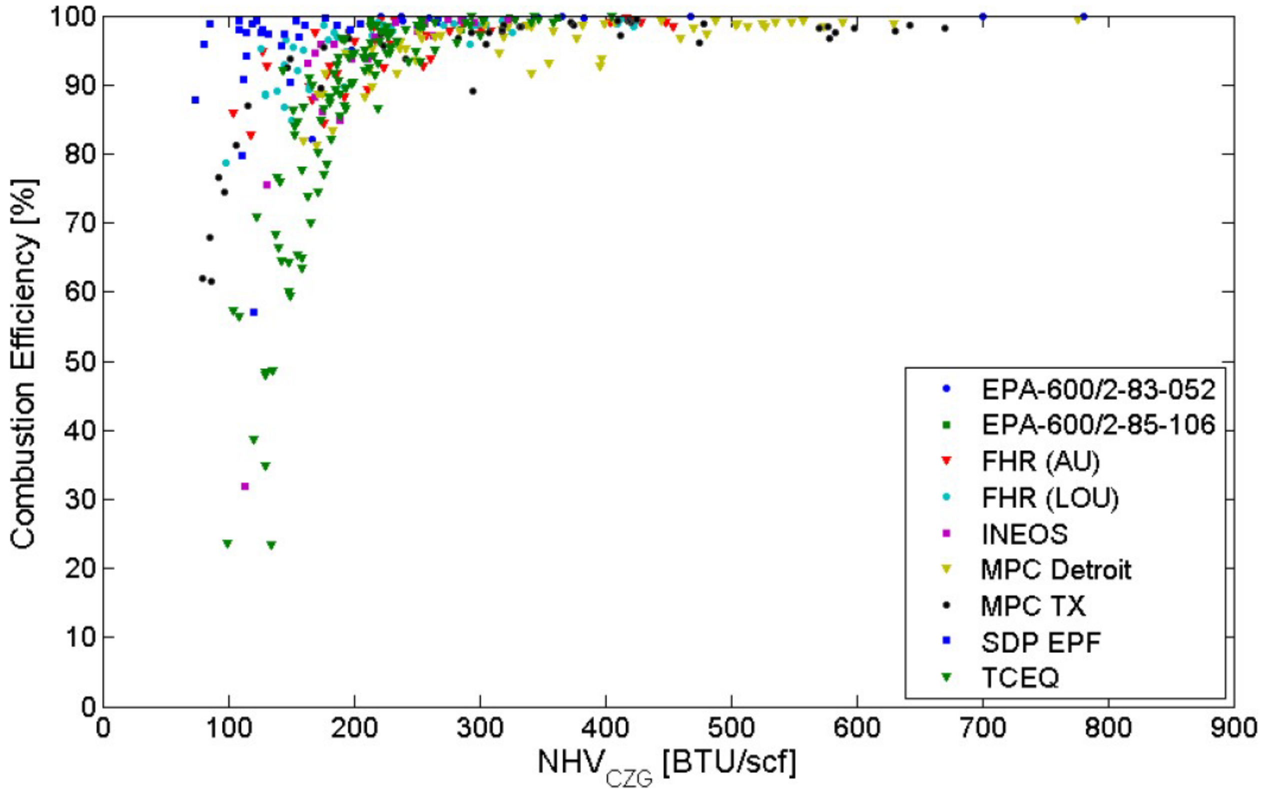

Figure 10 - Measured combustion efficiency of industrial scale flares[4]

Well designed and operated flares can reasonably be assumed to achieve a destruction efficiency equal to or greater than 98%. However, under certain conditions including high wind/rain conditions and when firing flare gas with a net heating value less than 200 Btu/scf, large industrial flares may have a destruction efficiency less than 98%.

Q. ARE THERE MONITORING TECHNOLOGIES THAT COULD REASONABLY BE USED TO MONITOR AND DOCUMENT THE DESTRUCTION EFFICIENCIES ACHIVED BY THE FLARES AT EXXONS OLEFINS PLANT?

A. As shown from previous plant testing results shown above, flare destruction efficiency can be measured using either extractive or open path FTIR techniques as demonstrated by the TCEQ[5] in 2010 during tests conducted at the John Zink Company flare test facility in Tulsa, Oklahoma. Although extractive techniques are not practical for full scale plant testing, the TCEQ confirmed that open path FTIR is a valid technique for full scale plant testing. This has subsequently been reconfirmed as evidenced by data collected at several large plants as reported (see Figure 10).

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[5] Allen, D.T. and V.M. Torres (2011) "TCEQ 2010 Flare Study Final Report," prepared for TCEQ. *PGA No. 582-8-862-45-FY09-04* with supplemental support from *TCEQ Grant No. 582-10-94300*. https://www.tceq.texas.gov/assets/public/implementation/air/rules/Flare/2010flarestudy/2010-flare-study-final-report.pdf (accessed October 23, 2023).

Q. WHAT IS YOUR CONCLUSION REGARDING FLARE MONITORING REQUIREMENTS?

A. Exxon currently monitors flows to the flare but estimates destruction efficiencies (Tier 2 in Figure 8). Direct measurement of emissions from the flare plume (Tier 1 in Figure 8) is tested and proven technology for monitoring flare performance that would ensure the design destruction efficiency of 98% is met and position EXXON as an industry leader for flare monitoring and performance.

Emission Sources - Maximum Allowable Emission Rates

Permit Number 102982

This table lists the maximum allowable emission rates and all sources of air contaminants on the applicant's property covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities, sources, and related activities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

Air Contaminants Data

Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates	
			lbs/hour	TPY (4)
BOPXXFURNACE	BOP-XX Furnace Vent Cap (6)	NO_x	45.20	155.58
		SO_2	2.47	5.16
		CO	2609.78	609.49
		PM	16.53	65.31
		PM_{10}	16.53	65.31
		$PM_{2.5}$	16.53	65.31
		NH_3	47.54	74.01
		H_2SO_4	0.19	0.39
		VOC	22.66	47.26
BOPXXDECOKE	BOP-XX Furnace Decoke Cap (7)	CO	630.76	183.95
		PM	53.12	15.49
		PM_{10}	45.84	13.37
		$PM_{2.5}$	39.68	11.57
		VOC	0.08	0.01
		NO_x	4.14	0.72
XXIF01-ST	XXI Furnace Combustion Vent	NO_x	18.00	29.27
		SO_2	8.19	35.89
		CO	21.62	94.69
		PM	4.36	18.98
		PM_{10}	4.36	18.98
		$PM_{2.5}$	4.36	18.98

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Figure 11 – Maximum allowable emissions for the Furance vent cap, Decoking vent, and Furnace Combustion vent

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Emission Sources - Maximum Allowable Emission Rates

Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates	
			lbs/hour	TPY (4)
BOPXXCT	BOP-XX Cooling Tower	PM	3.82	16.72
		PM_{10}	1.04	4.54
		$PM_{2.5}$	0.01	0.03
		VOC (5)	108.09	47.34
BOPXXFUG	BOP-XX Fugitives (5)	VOC	8.52	37.32
		NH_3	2.03	8.88
		CO	0.06	0.27
XXNH3SUMP	Ammonia Sump	NH_3	0.44	0.02
XXTOTES	Chemical Storage Totes	VOC	0.22	0.01
XXZLTK16	Emergency Generator Diesel Storage Tank 1	VOC	0.03	0.06
XXZLTK17	Emergency Generator Diesel Storage Tank 2	VOC	0.03	0.06
XXZLTK18	Emergency Generator Diesel Storage Tank 3	VOC	0.03	0.06
DIESELXX	Backup Generator Engines (9)	NO_x	23.06	1.15
		SO_2	0.03	<0.01
		CO	1.11	0.06
		PM	0.17	0.01
		PM_{10}	0.17	0.01
		$PM_{2.5}$	0.17	0.01
		VOC	1.50	0.07

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.
(2) Specific point source name. For fugitive sources, use area name or fugitive source name.
(3) VOC - volatile organic compounds as defined in Title 30 Texas Administrative Code § 101.1
NO_x - total oxides of nitrogen
SO_2 - sulfur dioxide
PM - total particulate matter, suspended in the atmosphere, including PM_{10} and $PM_{2.5}$, as represented
PM_{10} - total particulate matter equal to or less than 10 microns in diameter, including $PM_{2.5}$, as represented

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Figure 12 - Maximum allowable emissions rates for Cooling tower, fugitive emissions, Ammonia sump, Chemical storage totes, Emergency deisel generator1-3, and Backup Generator engines

V. PARTICULATE MATTER EMISSIONS

Q. CAN YOU DESCRIBE YOUR CONCERNS WITH THE ALLOWABLE LIMITS ON PARTICULATE MATTER EMISSIONS FROM THE CRACKING FURNACE?

A. On February 28, 2019, ExxonMobil submitted a request to waive further testing requirements for furnaces authorized by Permit No. 102982 based on the results of testing at four of its furnaces (Summarized in Table 1). Permit No. 102982 only requires a single stack test, which may be waived, to establish emission rate to demonstrate compliance with PM pound per hour and annual (Tons per year) limits.

The waiver incorporates the results of stack tests conducted in November and December of 2018 at EXXON. As detailed in the test reports, the tests were performed according to Sampling Protocol 18-351 following the procedures set forth in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Appendix A, Methods 1, 2, 3A, 4, 5, and 25A; Part 51, Appendix M, Method 202.

The PM emission limits that are being proposed in the Draft Permit for the new cracking furnace are based on EPA's published "AP-42" emissions factor(s), (see application at 5-2) (Summarized in Table 1 below).

Table 1: Estimated Particulate Emissions from Furnace XXI and 2018 Stack Test Results

PM (Total) Emission Factors from AP-42 Table 1.4-2 (July 1998)			Resulting Emissions for Furnace XXI		2018 Stack Test PM (Total) Emissions (lb/hr)[b]					
$lb/10^6$ scf	Rating	lb/MMBtu[a]	lb/hr	tpy	Furnace				Avg	Std Dev
					XXA	XXB	XXD	XXH		
7.6	D	0.0075	4.36	18.98	0.48	0.55	0.62	0.45	0.53	0.08

[a] Converted based on assumed HHV of 1,020 for natural gas.
[b] The Emission rate listed for each furnace is the average rate over four tests conducted at each furnace.

It is my opinion that a permit limit based on the AP-42 factor does not represent a valid reasonable emission limit. EXXON should be held to the same PM limits as they have demonstrated in their other furnaces at the Baytown refinery.

Q. WHAT IS YOUR CONCLUSION REGARDING THE BEST AVAILABLE CONTROL TECHNOLOGY FOR PARTICULATE MATTER EMISSIONS FROM THE NEW FURNACE?

A. EXXON's own stack test results, representative of actual emissions from the plant's existing furnaces, should be the basis of proposed new furnace allowable PM emission limits.

VI. AMMONIA EMISSION LIMITS

Q. CAN YOU DESCRIBE YOUR CONCERNS WITH THE AMMONIA EMISSION LIMITS INCLUDED IN THE DRAFT PERMIT?

A. Special condition 7D of the draft permit includes a short-term (1-hour) limit on ammonia emissions associated with the Selective Catalytic Reduction (SCR) of 15 ppmvd at 3% O_2 and an annual limit (12-month rolling average) of 10 ppmvd at 3% O_2.

However, there are multiple recently issued permits that limit short-term (1-hour) emissions of NH_3 to 10 ppmvd at 3% O_2 (See Table 2). The Draft Permit should require that EXXON also meet these emission limits, as other similar sources are required to do.

Table 2: Permits Limiting Short-term (1-hour) NH_3 emissions to 10 ppmvd at 3%O_2

Facility ID	Facility	Permit	Permit Condition
RN100825249	Chevron Phillips Chemical Sweeny Old Ocean Facilities	22690, PSDTX751M1 7/29/2022	7G
RN100225945	Dow Freeport	107153, PSDTX1332 4/5/2023	9
RN100542281 (Equistar); RN100633650 (Lyondell)	Equistar Channelview Complex	2933, PSDTX1270, N140M1 11/4/2022	10
RN100210319	Equistar La Porte Complex	18978, PSDTX752M5, N162M1 3/31/2023	6E
RN100211176	Occidental Chemical Ingleside	107530, PSDTX1338, GHGPDSTX40 9/2/2020	7C

VII. FUEL SULFUR CONTENT

Q. CAN YOU DESCRIBE YOUR CRITICISM OF THE LIMIT ON FUEL SULFUR CONTENT?

A. Special condition 7A limits the sulfur content of the fuel (gas) fired in the furnaces to no more than 5 grains of sulfur/100 dscf.

However, there are two recently issued permits at ethane cracking facilities that include lower limits on the fuel sulfur content on an annual basis (See Table 2). TCEQ should require that Exxon also meet a lower annual limit, as required at other similar sources.

Table 2: Permits Limiting Annual Fuel Sulfur Content to less than 5 gr S/100 dscf

Facility ID	Facility	Permit	Limit	Permit Condition
RN100225945	Dow Freeport	107153, PSDTX1333 (4/5/2023)	5 gr S/100 dscf (unspec. Period) 0.2 gr S/100 dscf (12-mo rolling)	7
RN109753731	GCGV Gregory	146425, PSDTX1518 (4/16/2023)	5 gr S/100 dscf (1-hr) 0.5 gr S/100 dscf (12-mo rolling)	20C

Q. DOES THIS CONCLUDE YOUR PREFILED TESTIMONY?

A: Yes.

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Associated Case Party: Executive Director

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Associated Case Party: TheresaBlackwood

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