Formosa Plastics

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April 29, 2013

Mr. David Garcia
Acting Director, Multimedia
Planning and Permitting Division
U.S. EPA Region 6, 6PD
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: EPA Request for Information
Greenhouse Gas Permit Application
Formosa Plastics Corporation, Texas
2012 Expansion Project: LDPE Plant
Point Comfort, Calhoun County, Texas

Dear Mr. Garcia:

This letter is in response to your letter dated April 9, 2013, requesting supplemental information related to FPC TX's Greenhouse Gas (GHG) permit application for the Low Density Polyethylene (LDPE) Plant. The attachment to this letter provides the supplemental information you have requested.

Also, as it relates to the Biological Assessment and Cultural Resources Reports, FPC TX has performed a preliminary biological assessment analysis. FPC TX continues to work on finalizing the reports as required for EPA to issue a final GHG permit. The Biological Assessment and Cultural Resources Reports will be forthcoming in a few weeks.

Should you have any questions regarding this application, please contact myself at tammyl@fdde.fpcusa.com, or 302-836-2241 or Ms. Karen Olson of Zephyr Environmental Corporation, at kolson@zephyrenv.com or 512-879-6618.

Sincerely,

Tammy G Lasater

Tammy G. Lasater

Enclosure

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Attachment

The following is provided in response to the information request in EPA letter dated April 9, 2013. Each request for information is repeated below in bold italics followed by FPC TX response and supplemental information. When responses are required for multiple sub-questions contained in an EPA question, those sub-questions have been organized into the bullets below and responded to individually.

1. ***It is not clear from the process description and the process flow diagram that has been provided whether the additive hoppers, recycle/master silo and pellet dryer are closed systems? Are all the vent emissions from these vessels directed to the regenerative thermal oxidizer (RTO)? If not, would these emission sources be GHG (CH4) emission sources? Are there GHG (CH4) emissions from the "wax load out", hopper car loading, bulk truck loading and boxing? Please clarify whether the extruder building vent is a GHG emission source? Is it routed to an emissions control device? If these sources are GHG (CH4) emitting sources, please provide supplemental information to the emission calculations along with assigning an emission point identification number.***

   FPC TX Response: In preparing the GHG application for the LDPE plant, FPC TX carefully reviewed each emission source for GHG emission potential. As such, FPC TX has represented all GHG emission sources in its GHG permit application. More detail is provided below.

   - ***It is not clear from the process description and the process flow diagram that has been provided whether the additive hoppers, recycle/master silo and pellet dryer are closed systems? Are all the vent emissions from these vessels directed to the regenerative thermal oxidizer (RTO)? If not, would these emission sources be GHG (CH4) emission sources?***

     FPC TX Response: The additive hoppers, recycle/masterbatch silo and pellet dryer are not closed systems. The vents from these vessels are directed to the atmosphere; however, these vents are not sources of GHG emissions.

   - ***Are there GHG (CH4) emissions from the "wax load out", hopper car loading, bulk truck loading and boxing?***

     FPC TX Response: GHG emissions are not expected from these material loading operations. Specifically, the wax material loaded is a low molecular weight polymer and the hopper cars, trucks and boxes are loaded/packages with LDPE product which does not contain GHGs.

- ***Please clarify whether the extruder building vent is a GHG emission source?***
  - ***Is it routed to an emissions control device?***
  - ***If these sources are GHG (CH4) emitting sources, please provide supplemental information to the emission calculations along with assigning an emission point identification number.***

FPC TX Response: The pelletizer water bath recirculates to a tank that is vented inside of the extruder building. This tank is a source of non-GHG emissions (non-methane hydrocarbons) and emissions would be emitted to the atmosphere via the extruder building vent. The pelletizer water bath tank is not a source of GHG emissions.

2. ***On page 18 of the application, it states that recycled ethylene (stream 19) is compressed by the low pressure booster compressor and is combined with the ethylene feed (stream 1) received from outside battery limits (OSBL) and then compressed by the primary compressor to approximately 4000 psig. The high pressure recovery gas (stream 25) is mixed with the feed stream after primary compressor discharge and this combined stream is fed to the secondary compressor. The process description does not depict this feed stream to the secondary compressor. Please supplement the process flow diagram to indicate this feed stream.***

   FPC TX Response: These streams are included on the process flow diagram that was submitted with the permit application. Specifically, stream nos. 1 and 19 (fresh and recycle ethylene, respectively) are shown entering the booster compressor with the outlet stream entering the primary compressor. Also, stream no. 25 (high pressure recovery gas) was shown being routed to the feed stream of the secondary compressor (located in between the primary and secondary compressors). The flow diagram has been revised to more clearly show the feed stream entering the secondary compressor.

3. ***Please provide supplemental information to further explain the operation of the RTO. On page 21 of the permit application, the process description states that the purge air and the stripped VOCs (stream 28) from the degassing silos are routed to one of two RTOs for control. The process flow diagram depicts four emission sources with the following EPNs: LD-022A, LD- 022B, LD-023A and LD-023B. Also, on page 23 of the process description it is stated that the RTOs are designed for redundant operation. Please clarify if there are four RTOs or two RTOs proposed for the project? What does redundant operation mean for this source? Will two RTOs operate in series? What will be the procedures when a RTO is taken out of service for maintenance? Will there be a spare RTO(s)?***

   - ***Please clarify if there are four RTOs or two RTOs proposed for the project?***

FPC TX Response: FPC TX is proposing two RTOs (LD-022 and LD-023). Each RTO has two stacks (A & B). Normally, the RTOs' emissions are routed to one stack and the second stack is used for startup, shutdown and combustion chamber temperature maintenance purposes.

- ***What does redundant operation mean for this source? Will two RTOs operate in series?***

FPC TX Response: During normal operation one RTO would receive waste gas while the other RTO is maintained in hot standby mode (natural gas firing).

- ***What will be the procedures when a RTO is taken out of service for maintenance? Will there be a spare RTO(s)?***

FPC TX Response: As explained above one RTO will serve as a spare when other RTO is not available for maintenance or any other reason.

4. ***On page 21 of the permit application, it states that GHG (methane and CO2) can be formed in the polymerization reaction as an unfavorable side reaction and in order to maximize production of saleable product, the LDPE process design and control system "inherently limits this side reaction". Please provide supplemental technical benchmark data that compares the design selections to be employed to a similar or existing source in the industry. Please provide supporting data that includes the technical resources used to evaluate the design decisions and to support the assertions made in this section.***

- ***Please provide supplemental technical benchmark data that compares the design selections to be employed to a similar or existing source in the industry.***

FPC TX Response: The proposed process technology (design type "A" shown on Table 1, attached) was chosen over other design options because it uses a multi ethylene side feed instead of the straight feed found in other process licenses. This multi side feed process provides higher ethylene conversion (the amount of ethylene converting to polymer) and therefore, with higher conversion, less reactants are available for side reactions.

Please note that GHGs resulting from side reactions are expected to be removed in the degassing silos and routed to the RTOs.

- ***Please provide supporting data that includes the technical resources used to evaluate the design decisions and to support the assertions made in this section.***

FPC TX Response: The attached table presents three commercially available LDPE process technologies and their associated production capacities, energy demands and feed conversion rates. FPC TX is selecting process technology design type "A" for the proposed LDPE plant which has the highest feed conversion rate and lowest energy (electricity and steam) demands of the available design options.

5. ***On page 22 of the permit application, it states the reaction conversion rate can vary depending on the type of LDPE process technology selected, which results in a significant amount of unreacted ethylene in the reactor effluent. FPC TX is proposing a process technology that will maximize the feed conversion rate. In comparison, another LDPE design rate with a lower conversion rate would require additional ethylene recovery capacity, resulting in additional electrical consumption.***

   - ***Were other design technologies evaluated for this project?***

     FPC TX Response: As previously mentioned, three potential process technologies were evaluated. The proposed process technology (design type "A") was chosen over others because it uses a multi ethylene side feed instead of the straight feed found in other process licenses. This multi side feed process provides higher ethylene conversion (the amount of ethylene converting to polymer).

   - ***Was an electrical consumption comparison performed between the technology chosen for this project and another technology?***

     FPC TX Response: A qualitative electrical consumption comparison was made based on the overall process feed conversion rate. The higher conversion efficiency, the less recycle material and therefore less electrical power consumption for re-compression. As shown in Table 1, the selected design technology requires less electricity and less steam energy than other available design technologies.

   - ***If possible, please provide the technical resources used to evaluate the design decisions to support the assertions made in this section.***

     FPC TX Response: The attached Table 1 provides a comparison of the available process design options and demonstrates that the proposed design type "A" requires the least amount of energy (both electrical and steam).

6. ***On page 23 of the permit application, it is stated that "normal" emission sources from the LDPE process upstream of and including the extruder are routed to the LDPE flare header. Also, there are several flare header connections in the compression and reaction systems. The LDPE plant's flare gas header is routed to the Olefins 3 elevated flare header where the waste gas from LDPE plant is combusted along with waste gas from the Olefins 3 process.***

Please supplement the process flow diagram to show the LDPE flare header and its path to the Olefins 3 elevated flare header.

FPC TX Response: All major equipment routed to the LDPE flare header are identified on a separate LDPE flare header flow diagram (attached). This flow diagram is intended to provide information about the types of equipment and connections that are designed to be vented to the flare. This simplified diagram does not show each discrete physical connection to the LDPE flare header that would be provided in final confidential engineering design drawings.

7. ***On page 34 of permit application, it states that FPC TX estimates as much as 50% reduction in fuel gas combustion or approximately 316,000 MMBtu/yr of energy savings is gained by selecting a RTO instead of a non-regenerative thermal oxidizer. Also, the "unique" natural gas conservation (NGS) system allows the RTO to maintain its combustion temperature without use of the primary burner. The primary burner may be switched off while natural gas is injected into one of the four corners of the system. The injected natural gas ignites as it rises up through the ceramic bed. This design feature results in the consumption of up to 20% less natural gas (approximately 79,000 MMBTU/yr for RTOs). Also, compared to a traditional thermal oxidizer, FPC TX expects 40 kWh less electrical consumption.***

- ***Was this comparison made to a traditional regenerative oxidizer?***

FPC TX Response: Yes, the NGS comparison was made to a similar RTO without a NGS.

- ***Please provide:***
  - ***supplemental supporting calculations, and***
  - ***design and technical data to support this assertion.***

FPC TX Response: Please find Table 2 attached that quantifies heat input and associated GHG emission for an RTO with and without a natural gas conservation system. The GHG emission between these two RTO design shows the emission reductions associated with selection of an RTO with a natural gas conservation system. Please note that the calculated annual heat input savings shown on Table 2 are slightly lower those previous provided because they are based on slightly refined information as shown on the table.

8. ***On page 38 of the permit application, it is stated that operating the LDPE plant to minimize the amount of hydrocarbon waste gas routed to the flare will minimize the quantity of GHG emissions resulting from flaring of LDPE plant waste gas. It is estimated that proper operation of the LDPE plant (with recycle and reuse) is expected, based on process design, to minimize waste gas routed to the flare by several orders of magnitude, which corresponds to a GHG emission reduction of approximately 4.3 million tons/yr C02e.***

Please provide a basis for the rationale that was used to calculate this reduction, and technical data to support the assertion.

FPC TX Response: Additional waste gas would be routed to the flare for plant designs that include less (minimum) ethylene recycle capability. The design proposed by FPC TX would minimize waste gas to the flare by maximizing the amount of ethylene recycle. Please find calculations attached (Table 3) that quantifies the GHG emission reductions from the flare by including the proposed ethylene recycle capacity . To clarify, based on these calculations an estimated 4.3 million metric tons/yr of mass GHG and 4.6 metric tons/year of COe emission reductions are achieved by minimizing waste gas flaring..

9. ***On page 41 of the permit application, it is stated that FPC TX is proposing to operate the upstream stripping silos and monitor the pellet blending silo exhaust stream heating value as BACT. Monitoring the heating value of the pellet blending silo exhaust will alert FPC TX operations in the case that insufficient stripping (upstream) is being achieved. The heating value measurement is a direct indicator of the presence of volatiles (including GHGs) in the blending silo exhaust stream. FPC TX is proposing an initial control point of 5 BTU/scf, based on a 3- hour average measurement. Exhaust stream heating value measurements at or above this value will trigger operations to increase the quantity of stripping air in the upstream stripping silos. Will this exhaust stream be continuously monitored? Will the increase in stripping air be added manually or will it be automated? Please provide the basis for the rationale, and technical data and calculations that support the control point selection of 5 BTU/scf.***

- ***Will this exhaust stream be continuously monitored? Will the increase in stripping air be added manually or will it be automated?***

  FPC TX Response: The heating value of the blending silo vent stream will be monitored continuously. The monitor signal will connect to the plant distributed control system (DCS). When the automated control system indicates a high heating value in the blending silo vent stream there will be an alarm and the field operator will be alerted to adjust air flow rate in the stripping silos so the heating value reading in the blending silo vent is maintained in an acceptable range.

- ***Please provide the basis for the rationale, and technical data and calculations that support the control point selection of 5 BTU/scf.***

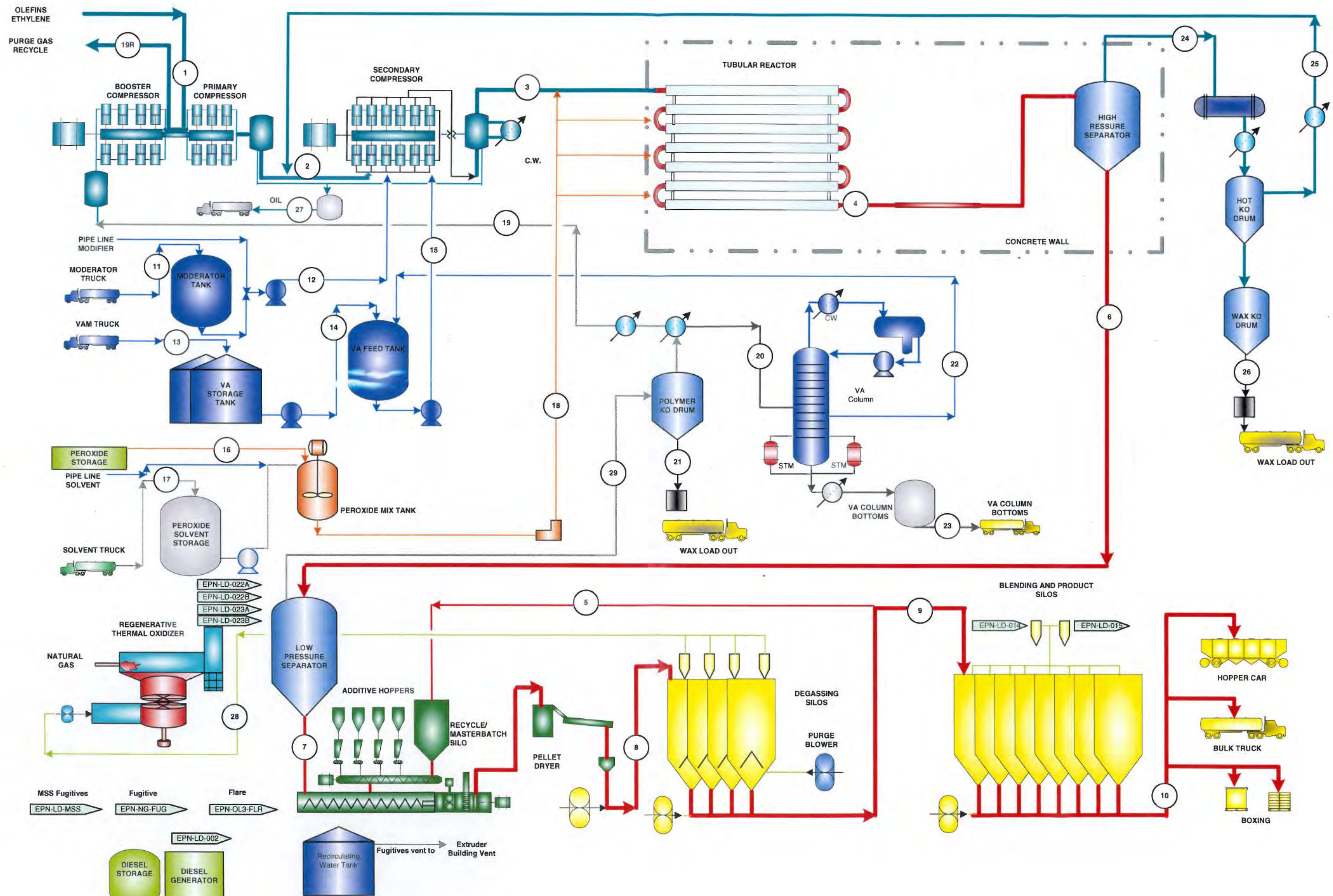
  FPC TX Response: The attached calculations in Table 4 show the basis and rationale for selection of the exhaust stream heating value control point.

10. ***On page 75 of the permit application, FPC TX proposes to use weekly AVO monitoring. Please provide supplemental data that discusses the details of what this***

program will involve. What is the proposed compliance strategy including recordkeeping, schedule, and the protocol for equipment repairs? Is there a TCEQ LDAR method that would be preferred to use? Please provide supplemental data that includes the basis for utilizing this preferred method versus other potential methods.

FPC TX Response: The GHG fugitive emission sources in this plant will be in natural gas service. FPC TX is proposing:

- To implement an Audio Visual and Olfactory (AVO) monitoring program for equipment in natural gas and fuel gas service.
  - To perform the AVO monitoring on a weekly basis
  - To maintains a written log of weekly inspections identifying the operating area inspected, the date inspected, the fuel gas and natural gas equipment inspected (valves, lines, flanges, etc), whether any leaks were identified by visual, audible or olfactory inspections, and corrective actions/repairs taken
- For leaks identified, immediately of detection of the leak, plant personnel will take the following action:
  - Tag the leaking equipment
  - Commence repair or replacement of the leaking component
- AVO is a more appropriate monitoring method for natural gas components in this plant as explained in the permit application and below:
  - Monitoring can be done more frequently so leaks can be detected more quickly than with the TCEQ 28 series of Method 21 based LDAR program
  - The total estimated GHG fugitive emissions from this plant are small (<0.03% of total mass and <0.5% of the total CO_2e)


OLEFINS ETHYLENE
PURGE GAS RECYCLE
BOOSTER COMPRESSOR
PRIMARY COMPRESSOR
SECONDARY COMPRESSOR
C.W.
OIL
TUBULAR REACTOR
CONCRETE WALL
HIGH RESSURE SEPARATOR
HOT KO DRUM
WAX KO DRUM
WAX LOAD OUT
PIPE LINE MODIFIER
MODERATOR TRUCK
MODERATOR TANK
VAM TRUCK
VA STORAGE TANK
VA FEED TANK
POLYMER KO DRUM
WAX LOAD OUT
VA Column
CW
STM
STM
VA COLUMN BOTTOMS
VA COLUMN BOTTOMS
PEROXIDE STORAGE
PIPE LINE SOLVENT
PEROXIDE SOLVENT STORAGE
PEROXIDE MIX TANK
SOLVENT TRUCK
EPN-LD-022A
EPN-LD-022B
EPN-LD-023A
EPN-LD-023B
REGENERATIVE THERMAL OXIDIZER
NATURAL GAS
LOW PRESSURE SEPARATOR
ADDITIVE HOPPERS
RECYCLE/ MASTERBATCH SILO
PELLET DRYER
DEGASSING SILOS
PURGE BLOWER
BLENDING AND PRODUCT SILOS
EPN-LD-014
EPN-LD-015
HOPPER CAR
BULK TRUCK
BOXING
MSS Fugitives
EPN-LD-MSS
Fugitive
EPN-NG-FUG
Flare
EPN-OL3-FLR
EPN-LD-002
DIESEL STORAGE
DIESEL GENERATOR
Recirculating Water Tank
Fugitives vent to
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LDPE Flare Header - Simplified Flow Diagram
Formosa Plastics Corporation, Texas
LDPE Plant
April 2013

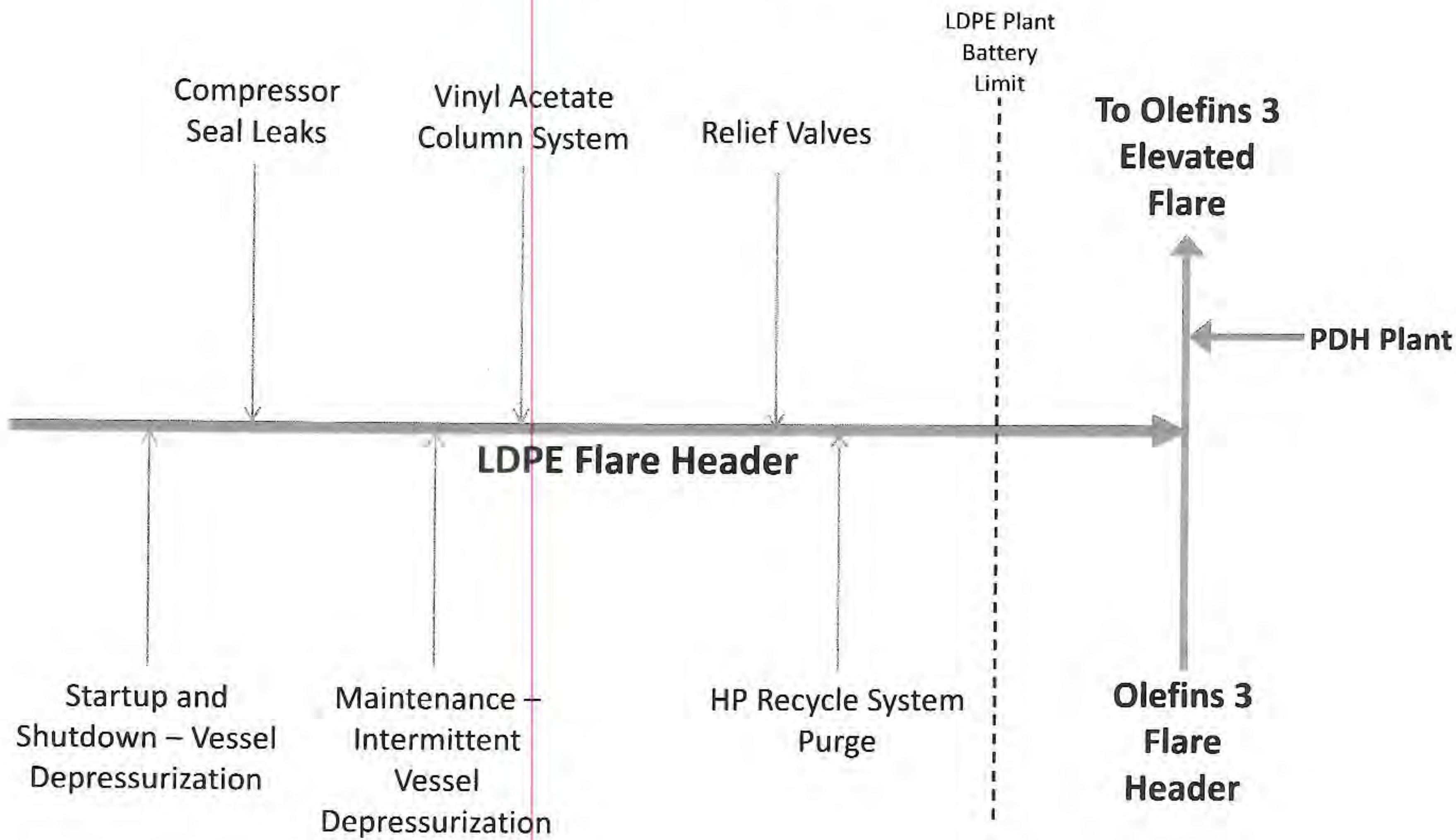

Table 1 - Response to Question 4
LDPE Process Design Technology Comparison
Formosa Plastic Corporation, Texas
LDPE Plant
April 2013

	LDPE Process Design Type		
	A	B	C
Production Rate Capacity (metric ton/hr)	53.9	52.5	50.83
Electricity Demand (Kwh)	730	750	866
Steam Demand (kg)	75	100	462
On stream rate	~98%	~98%	~97%
Ethylene (feed) conversion rate	~38%	~37%	~36%
Ethylene Feed Points	1 Main + 4 Sides	1 Main	1 Main
Peroxide Feed Points	6	4	4

Table 2 - Response to Question 7
GHG Emission Reductions - RTO Natural Gas Conservation System
Formosa Plastic Corporation, Texas
LDPE Plant
April 2013

GHG Emissions Reduction From Natural Gas Conservation System:

							Emission Reduction, All RTOs					
Source Type	Average Heat Input/unit - RTO **without** NG Conservation system (MMBtu/hr)	Average Heat Input/unit - **with** NG Conservation system (MMBtu/hr)	Heat Input/unit savings (MMBtu/hr)	Number of units	Annual Operation hrs/yr	Annual Avg Heat input savings, both units (MMBtu/yr)	Pollutant	Emission Factor (kg/MMBtu)[1]	GHG Mass Emissions[2] (metric ton/yr)	Global Warming Potential[3]	CO_2e (metric ton/yr)	CO_2e (tpy)
RTOs	22	18	4	2	8,760	70,080	CO_2	53.02	3,716	1	3,716	4,096
							CH_4	1.0E-03	0.07	21	1.47	1.62
							N_2O	1.0E-04	0.007	310	2.17	2.40
								Totals	**3,716**		**3,719**	**4,101**

Notes:

1. CH_4 and N_2O GHG factors based on Table C-2 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.
2. CO_2 emissions based on 40 CFR Part 98, Subpart C Equation C-1
CH_4 and N_2O Emissions from 40 CFR Part 98, Subpart C Equation C-8.
3. Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.

Sample Calculations, CO_2:

GHG Mass Emissions = 0.001 x 70080 (MMBtu/yr) x 53.02 (kg/MMBtu) = 3716 (metric ton/yr)

CO2e Emissions (from CO2) = 3715.6 (metric ton/yr) x 1 (GWP factor) = 3716 (metric ton/yr)

Table 3 - Response to Question 8

GHG Emission Calculations - Elevated Flare Contributions (Olefins 3 Elevated Flare)

Formosa Plastic Corporation, Texas

LDPE Plant

April 2013

Flare Gas Data:

Variable	Value	Units	Reference
Carbon content (annual avg)	0.80	kg C/kg	Formosa design data
Molecular Weight (annual avg)	31.9	kg/kmol	Formosa design data

GHG Emissions from Flares:

Source Type	Annual Flare gas flow rate - Maximum Design Case (minimal ethylene recycle) (scf/yr)	Annual Flare gas flow rate - Minimized design case (maximum ethylene recycle) (scf/yr)	Annual Flare gas flow rate **Reductions** (scf/yr)	Pollutant	GHG Mass Emissions Reductions[2] (metric ton/yr)	Global Warming Potential[3]	CO_2e (metric ton/yr)	CO_2e (tpy)
Elevated Flare	4.00E+10	2.63E+07	3.997E+10	CO_2	4.30E+06	1	4.30E+06	4.74E+06
				CH_4	1.30E+04	21	2.73E+05	3.00E+05
				N_2O	4.30E+01	310	1.33E+04	1.47E+04
				Totals	**4.31E+06**		**4.59E+06**	**5.06E+06**

Notes:

1. *CH_4 and N_2O GHG factors based on Table C-2 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*
2. *CO_2 emissions based on 40 CFR Part 98, Subpart Y Equation Y-1a*

CH_4 emissions based on 40 CFR Part 98, Subpart Y Equation Y-4

3. *Global Warming Potential factors based on Table A-1 of 40 CFR 98 Mandatory Greenhouse Gas Reporting.*

Sample Calculations, CO_2:

GHG Mass Emissions = (44/12) x 3.997E+10 (scf/yr) x 0.8 (kg C/kg) x
(31.91 (kg/mol) / 849.5 (scf/kg-mole @ std cond.)) x 0.001 x 0.98
= 4.30E+06 (metric ton/yr)

CO2e Emissions (from CO2) = 4.30E+06 (metric ton/yr) x 1 = 4.30E+06 (metric ton/yr)

Table 4 - Response to Question 9

Pellet Blending Silos, heating value calculation

Formosa Plastic Corporation, Texas

LDPE Plant

April 2013

Compound in Silo Exhaust stream [1]	Silo exhaust stream concentration [2] (ppmv)	Silo exhaust stream concentration (mol frac)	Compound Lower Heating Value (Btu/scf)	Component Lower Heating Value in Exhaust Stream (Btu/scf) [3]
VOC (as ethylene)	22	0.000022	1,477.25	0.0325
methane	3000	0.003	910.77	2.73
		Total silo exhaust stream LHV (Btu/scf) =		**2.76**
		Control point value (Btu/scf) [4] =		**5.0**

Notes:

[1] Other compounds in exhaust stream are considered to have little or no heating value (e.g., air).

[2] Estimated 3-hour average VOC concentration is representative and may vary; used for emission calculation purposes only.

[3] 3-hour average value calculated as follows: LHV in exhaust (Btu/scf) = compound LHV (Btu/scf) x mol fraction

[4] 3-hour average control point value = calculated silo exhaust LHV rounded to nearest 5 Btu/scf (to account for calorimeter instrumentation measurement accuracy).