REDACTED VERSION

ARKEMA

November 26, 2018

Mr. Jason Holloman
Air Program Investigator
TCEQ Region 12-Houston
5425 Polk Street, Suite H
Houston, Texas 77023-1452

Re: Emissions Event Final Report – Revised Event Emissions and Air Impact Analysis
Arkema Crosby Plant, 18000 Crosby Eastgate Road, Crosby, Texas 77532
CN600124044, RN100210301
Incident Nos: 267578, 267679,266756,266771, 266778

Dear Mr. Holloman:

Arkema Inc. (Arkema) owns and operates the Arkema Crosby Plant (Crosby Plant), located in Harris County, Texas. Arkema is registered under Texas Commission on Environmental Quality (TCEQ) Customer Number (CN) 600124044. The Crosby Plant is registered under TCEQ Regulated Entity Number (RN) 100210301. The Crosby Plant operates under New Source Review (NSR) Permit No. 6271, Federal Operating Permit (Title V) No. 1554, and several registered and unregistered Permit by Rules (PBRs).
Arkema reported five air emissions events that occurred at the Crosby Plant between August 29, 2017 and September 3, 2017 that were directly attributable to the record precipitation amounts associated with Hurricane Harvey. Arkema filed separate initial and final incident reports online using the State of Texas Environmental Electronic Reporting System (STEERS) for each of the five emissions event incidents, which described the causes, actions, and reported release quantities. Arkema also submitted a modeling analysis in response to the TCEQ's September 26, 2017 request to provide air quality dispersion modeling of emissions associated with reportable emissions events (TCEQ Incident Nos. 266756, 266771, 266778, 267578, and 267679; Investigation No. 1438846) to evaluate the off-property air quality impacts due to the event releases.
Arkema has recently determined that several minor corrections are required to the emissions associated with the product storage trailer fires identified in TCEQ Incident Nos. 266756, 266778, and 267679; therefore Arkema is submitting revised emission summaries and calculations. Arkema also requests that these revised emissions estimates be entered into STEERS.

Specifically, for Incident Nos. 266756, 266778 and 267679 related to the product storage trailer fires, a revision was made in order to more accurately represent emissions of hydrofluoric acid (HF) produced by the fires. The impact of combustion of the HFC refrigerant in each trailer's cooling system has been corrected to account for the molar conversion of the HFC refrigerant to HF. The calculations have been corrected in the Trailer 1, Trailers 2-3, and Trailers 4-9 emission estimates found in Attachment 1 to multiply the number of moles of the original compound by the number of moles of fluorine (F) in the compound resulting in approximately 3.75 times higher emissions of HF than in the originally reported.

One additional update was made to the calculations for Incident No. 266756, related to the product Trailers 2-3 fire. There was an equation error in the "Summary of Speciated Emissions" table of Trailers 2-3 calculations. The table did not sum the total acetophenone, OMS, nonene, 2-ethyl hexanol, 2-ethyl hexanal emissions from the "Emissions from Decomposition Products – Burned" table correctly. The updated calculations for this event are found in Attachment 1.

These calculation changes also impact the results of the modeling analysis Arkema submitted in response to the TCEQ's September 26, 2017 request to provide air quality dispersion modeling of emissions associated with reportable emissions events (TCEQ Incident Nos. 266756, 266771, 266778, 267578, and 267679) to evaluate the off-property air quality impacts due to the event releases. A revised modeling analysis was submitted to TCEQ in January 2018. The corrections made to the emission event calculations impact the modeled emission rates of HF from Incident Nos. 266756, 266778 and 267679 and the modeled emissions rates of acetophenone, OMS, nonene, 2-ethyl hexanol, 2-ethyl hexanal from Incident No. 266756.

As described in detail in the air quality analysis and modeling study performed by Trinity Consultants on behalf of Arkema[1], a unit emission rate modeling approach was used to predict the maximum concentrations of each constituent released during each emission event. Because the concentrations are directly proportional to the emissions in dispersion modeling, a unit emission rate of 1.0 g/s was used in all modeling. Thereafter, the calculated emissions were assigned on a constituent by constituent basis using a spreadsheet to pro-rate the contributions and make the final concentration estimates per event and per chemical constituent. Since the corrections referenced in this letter are limited to emission rates only, a new modeling analysis is not required. The revised emission rates are multiplied by the modeled impact corresponding unit emission rate for each event. The revised modeling results tables are provided in Attachment 2. The resulting modeled concentrations for HF from each of trailer fire event is higher than originally reported, but the impacts remain significantly below the corresponding effects screening levels (ESL). In addition, the revised modeled concentrations of acetophenone, OMS, nonene, 2-ethyl hexanol, 2-ethyl hexanal from Incident No. 266756 increase as a result of the corrections, but these increases do not result in any exceedances of a corresponding ESL.

If you have any questions concerning this response, please do not hesitate to contact me at (610) 878-6632.

Sincerely,

Jean-Marie Cencetti
Director of Environment and Sustainable Development

[1] *Emissions Events Modeling Analysis Arkema, Inc. > Arkema Crosby Plant, Hurricane Harvey Vapor and Fire Events August 29 – September 3, 2017*, Trinity Consultants, Covington, KY and Austin, TX, October 2017 and January 2018.

900 First Avenue, King of Prussia, PA 19438

Attachments

cc: all with attachments

Mr. Roberto Bernier, EPA Region 6
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Attachment 1

Arkema Inc. - Crosby
Trailer No. 1 Emissions
August 31, 2017

Emissions Summary

Emission Source	Emissions (lb/event)								
	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	VOC	HF	Lead
Products in Trailer No. 1 Consumed in Fire	511.17	59.62	176.71	176.71	176.71	--	4,751.74	--	--
Trailer Consumed in Fire	484.38	15.50	387.50	387.50	387.50	--	124.00	--	--
Pallets Consumed in Fire	133.50	4.27	106.80	106.80	106.80	--	34.16	--	--
Containers Consumed in Fire	342.90	10.97	274.32	274.32	274.32	--	87.78	--	--
Refrigeration Unit Consumed in Fire	61.72	1.98	49.38	49.38	49.38	--	15.80	--	--
Refrigerant Consumed in Fire	--	--	--	--	--	--	--	12.31	--
Battery Consumed in Fire	--	--	5.37	5.37	5.37	9.79	--	--	1.82
Diesel Fuel Consumed in Fire	0.13	0.60	0.08	0.08	0.08	1.78	0.01	--	--
Total Emissions	**1,533.79**	**92.94**	**1,000.16**	**1,000.16**	**1,000.16**	**11.56**	**5,013.50**	**12.31**	**1.82**

Summary of Speciated Emissions

Compound	CAS#	Contaminant Code	Total
			lb/event
Nonane	111-84-2	56703	**1,297.43**
Nonene	124-11-8	56704	**427.13**
OMS	68551-17-7	59275	**1,069.31**
Acetophenone	98-86-2	59861	**805.93**
2-Ethyl hexanol	104-76-7	51521	**869.00**
2-Ethyl hexanal	123-05-7	51601	**282.94**
Acetone	67-64-1	54020	**393.76**
Ethane	74-84-0	56550	**38.32**
Hydrofluoric Acid	7664-39-3	11162	**12.31**
Lead	7439-92-1	14319	**1.82**
CO	630-08-0	90300	**1,533.79**
NO_X	10102-44-0	70402	**92.94**
PM	--	10000	**1,000.16**
PM_{10}	--	20000	**1,000.16**
$PM_{2.5}$	--	39999	**1,000.16**
SO_2	7446-09-5	70510	**11.56**
Unclassified VOC [1]	--	500001	**261.76**

Note:
[1] Unclassified VOC includes VOC emissions from combustion products.

Arkema Inc. - Crosby
Trailer No. 1 Emissions
August 31, 2017

Summary of Emissions from Trailer 1

Emission Source	Emissions (lb/event)					
	VOC	CO	SO_2	PM	PM_{10}	$PM_{2.5}$
Decomposition to Vapor - Unburned	1,008.37	--	--	--	--	--
Decomposition Products - Burned	2,783.37	311.17	59.62	176.71	176.71	176.71
Total	3,791.74	311.17	59.62	176.71	176.71	176.71

1. Emissions from Decomposition to Vapor - Unburned

Product	Decomp Composition [1]	Vapor wt% [2]	Decomp to Vapor, Unburned - Total lbs	Decomp to Vapor, Unburned - Speciated lbs	Speciated VOC Emissions to Air lbs
Lup 188M75	Nonane	23.48%	1,181.25	276.93	276.93
	Nonene	7.74%		91.48	91.48
	Carbon Dioxide	10.73%		126.70	
	OMS	24.89%		294.06	294.06
	Acetophenone	29.28%		345.89	345.89
	Methane	3.92%		46.19	
			Total VOC from Vapor (Unburned) to Air		1,008.37

2. Emissions from Decomposition Products - Burned

VOC Emissions

Destruction Efficiency 99% [3]

Product	Original Composition [4]	Original wt% [4]	Decomposed Composition [1]	Decomposed wt% [2]	Product Unburned - Total [5] lbs	Speciated Emissions to Air lbs	Product Burned - Total [5] lbs	Product Burned - speciated lbs	Heating Value [6] btu/lb	Heat Input MMbtu	Speciated VOC Emissions to Air lbs
Lup 10	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	>=95%	Nonane	57%	951	205.62	[redacted]	2,731.81	19,000	51.96	205.62
	Hydroperoxide, 1,1-dimethylethyl	<1%	Nonene	12%		67.46		896.29	18,800	16.85	67.46
			Carbon Dioxide	22%		119.73		1,590.73	0	0.00	
			OMS	0%		0.00		0.00	15,000	0.00	0.00
			Acetone	23%		124.14		1,649.32	12,281	20.25	
			Methane	6%		34.29		455.60	21,500	9.80	
Lup 188M75	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	>= 74- <=76%	Nonane	29%	1,103	323.98		4,304.26	19,000	81.78	323.98
	Naphtha (petroleum), hydrotreated heavy	<26%	Nonene	10%		106.29		1,412.39	18,800	26.55	106.29
	Naphtha (petroleum), heavy alkylate	<26%	Carbon Dioxide	13%		148.22		1,969.25	0	0.00	
	Hydroperoxide, 1,1-dimethylethyl	<0.2%	OMS	25%		274.37		3,645.26	15,000	54.68	274.37
			Acetone	18%		195.60		2,598.68	12,281	31.91	
			Methane	5%		54.63		725.55	21,500	15.44	
Lup 188M75	Neodecanoperoxoic acid, 1-methyl-1-phenylethyl ester	>=74- <75%	Nonane	23%	1,571	368.32		4,893.34	19,000	92.97	368.32
	Benzenemethanol, alpha, alpha-dimethyl-	>=5- <=13 %	Nonene	8%		121.67		1,616.46	18,800	30.39	121.67
	Benzene, (1-methylethyl)-	>=5 -<=7%	Carbon Dioxide	11%		168.93		2,238.75	0	0.00	
	Ethanone, 1-phenyl-	>=5%	OMS	25%		391.10		5,196.58	15,000	77.94	391.10
	Naphtha (petroleum), hydrotreated	>= 1 - <25%	Acetophenone	29%		460.04		6,111.95	14,297	87.14	460.04
	Naphtha (petroleum), heavy alkylate	>= 1 - <25%	Methane	4%		61.43		816.10	21,500	17.55	
Lup 223M75	Peroxydicarbonic acid, bis(2-ethylhexyl)	>= 74 - <= 77 %	2-Ethyl hexanol	56%	1,544	889.00		11,345.23	15,000	173.18	889.00
	Naphtha (petroleum), hydrotreated heavy	<25%	2-Ethyl hexanol	18%		262.94		3,359.95	15,000	50.39	262.94
	Naphtha (petroleum), heavy alkylate	<25%	Carbon Dioxide	25%		391.56		5,202.22	0	0.00	
	Proprietary component	<0.2%									
Lup 546M75	Neodecanoperoxoic acid, 1,1-dimethylpropyl ester	>= 74 - <= 75 %	Nonane	29%	441	122.59		1628.69	15,000	30.95	122.59
	Naphtha (petroleum), hydrotreated heavy	>= 0 - <= 25 %	Nonene	9%		40.22		534.36	18,800	10.05	40.22
	Naphtha (petroleum), heavy alkylate	>= 0 - <= 25 %	Carbon Dioxide	13%		56.09		745.15	0	0.00	
	Hydroperoxide, 1,1-dimethylpropyl	<= 0.1 %	OMS	25%		106.77		1418.36	15,000	21.08	106.77
			Acetone	17%		74.03		983.32	12,281	12.08	
			Ethane	9%		38.32		508.91	20,626	10.40	
Totals:										936.87	2,783.37

SO_2, CO, and PM Emissions

Pollutants	Emission Factors	Emissions
	lb/MMbtu	lbs/event
SO_2 [7]	0.0643	59.62
CO [7]	0.3356	311.17
PM [8]	0.19	176.71

Notes

[1] Decomposition ("Decomp") products provided by Arkema in the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx". "OMS" stands for

[2] Calculated based on 1000 pounds of Lup 188M75 product decomposed, provided by Arkema in the file "In the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx".

[3] Per *TCEQ publication RG-360A/11, Revised February 2012, TECHNICAL SUPPLEMENT & FLARES*, based on EPA test data, for combustions that do not satisfy 40 CFR 60.18, a 98 percent destruction efficiency (DRE) is assumed

[4] Product composition provided by Arkema via email on 8/16/2017 in the file "Crosby Inventory 082817 Trailers Stg Bldg.xlsx".

[5] According to Arkema, 98% of Lup 188M75 was emitted as vapor prior to combustion. The remaining product decomposed except diluent (e.g., OMS) and burned with a 99% DRE (i.e., 1% of decomposition products and diluent emitted to atmosphere and the remainder converted to combustion products).

[6] Value: Handbook of Thermodynamic and Physical Properties of Chemical Compounds/Enthalpy of Combustion

[7] *TCEQ publication RG-360A/11, Revised January 2012, TECHNICAL SUPPLEMENT & FLARES, Table A 7, air or assisted flare, low Btu*

[8] Based on AP 42 Table 13.5-1, heavily smoking flares 274 µg/L in exhaust, calculated from concentration using F-factor method on a dry basis, assuming 3% O_2 in exhaust gas stream (*Emission Estimation Protocol for Petroleum Refineries*, STI International, May 2011, Table 6-4).

ARK_TCEQ_0015780

ED_004042_00000022-00006

Arkema Inc. - Crosby
Trailer No. 1 Emissions
August 31, 2017

Summary of Emissions from Trailer Components Combustion

Emission Source	Emissions (lb/event)					
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$
Combustion Emissions	261.76	1,022.49	32.72	818.00	818.00	818.00

Trailers		
Weight of Trailer [1]	15,500	pounds
Burned [2]	50%	
Weight of Trailer Burned	7,750	pounds
Pallets		
Weight of Each Pallet [3]	44.5	pounds
# of Pallets in a Trailer [4]	48	
Burned	100%	
Weight of Pallets Burned	2,136	pounds
Containers		
Weight of a 5 Gal Container [5]	1,153	grams
Weight of a 5 Gal Container	2.54	pounds
Trailer Capacity	3,500	ft^3
Number of 5 Gal Containers Impacted [5]	2,160	
Burned	100%	
Weight of Containers in a Trailer	5,486	pounds
Refrigeration Unit		
Weight of Refrigeration Unit [8]	1,975	pounds
Burned	50%	
Weight of Refrigeration Unit Burned	988	pounds
Total Weight of Solid Combustibles Per Trailer	**8.18**	**tons**

Refrigerant

Weight of Refrigerant [6] 16 pounds

Compositions [7]	CAS #	M. Wt. lb/lb-mol	Wt%	Emissions lbs
1,1,1-Trifluoroethane [7]	420-46-2	84.04	52%	8.32
Pentafluoroethane [7]	354-33-6	120.02	44%	7.04
1,1,1,2-Tetrafluoroethane [7]	811-97-2	102.03	4%	0.64
Emissions as Hydrofluoric Acid (HF)	7664-39-3	20.01		**12.31**

Battery

Weight of Battery [8] 50 pounds

Compositions [9]	CAS #	M. Wt. lb/lb-mol	Wt%	Weight lbs
Lead	7439-92-1	207.2	70%	35
Sulfuric acid	7664-93-9	98.08	30%	15

Emissions from Battery Burned

Pollutant	Emission Factor [10] lb of pollutant/ton of metal produced	Emissions from Lead Burned lbs	Emissions from Sulfuric Acid Burned [11] lbs
PM	307	5.37	--
Lead	104	1.82	--
SO_2	--	--	9.79

NOx, CO, and PM Emissions from Trailer Components Combustion

Pollutants	Emission Factors [12] lb/ton	Emissions From Trailer Burning lbs	Emissions From Pallets Burning lbs	Emissions From Containers Burning lbs	Emissions From Refrigeration Unit Burning lbs	Total Emissions From Solids Burning lbs
VOC	32	124.00	34.18	87.78	15.80	**261.76**
NOx	4	15.50	4.27	10.97	1.98	**32.72**
CO	125	484.38	133.50	342.90	61.72	**1,022.49**
PM	100	387.50	106.80	274.32	49.38	**818.00**

Notes:
[1] Per information provided by Arkema, the trailer is a 53' refrigerated trailer, based on vendor information, typical weight of refrigerated trailer is 15,500 lb.
[2] Based on phone communication between Arkema and Trinity Consultants on September 6, 2017, 50% of weight of trailer estimated to be combusted.
[3] According to dimensions of trailer provided by Arkema, typical pallet used in this type of trailer is 46"x 48" and weight is 44.5 lb.
[4] Provided by Arkema based on trailer inventory and products information.
[5] Provided by Arkema based on trailer inventory and products information, typical 35 lbs products per container. Typical empty container weight based on vendor information.
[6] Weight of refrigeration unit and refrigerant based on vendor information for typical unit.
[7] Per R-404A Refrigerant safety data sheet (SDS)
[8] Per KLLM Trailer Specifications
[9] Per Lead-acid Battery SDS normalized to total weight of battery for conservatism.
[10] The battery in engine of trailer burned in the fire and is represented as second lead processing in blast furnaces. Particulate and lead emission factors are selected based on AP-42 Chapter 12.11.2, Table 12.11-2, Emission Factors for Secondary Lead Processing.
[11] Sulfur dioxide (SO_2) emissions estimated assuming all sulfur from sulfuric acid converted to SO_2.
[12] Emission factors from AP-42 Chapter 2.5, Table 2.5-1 "Emission Factors for Open Burning of Municipal Refuse," factors for Automobile Components

Products in Trailer No. 1

Product Name	Composition [1]	CAS#	wt% [1]	Quantity in 1st Trailer [2] lbs
Lup 10	Neodecaneperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	>=95%	(D) (3) (A), (b) (4)
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<1%	
Lup 10M75	Neodecaneperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	>= 74- <=76%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<0.2%	
Lup 11M45	Propaneoperoxoic acid, 2,2-dimethyl-, 1,1- dimethlethyl ester	927-07-1	>=44- <46%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<56%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<56%	
Lup 11M75	Propaneoperoxoic acid, 2,2-dimethyl-, 1,1- dimethlethyl ester	927-07-1	>=74- <75%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
Lup 188M75	Neodecaneperoxoic acid, 1-methyl-1-phenylethyl ester	26748-47-0	>=74- <75%	
	Benzenemethanol, -alpha-,alpha-dimethyl-	617-94-7	>=5- <=11%	
	Benzene, (1-methylethyl)-	98-82-8	>=5 -<=7%	
	Styrene, 1-phenyl-	98-86-2	<=5%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>=1 - <25%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>=1 - <25%	
Lup 221	Peroxydicarbonic acid, dipropyl ester	16066-38-9	>= 99 %	
Lup 223M75S	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 75 - <= 77 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<25%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<25%	
	Proprietary component	NJTSN# 03365400	<0.2%	
Lup 223S	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 97 - <= 100 %	
	Proprietary component	NJTSN# 03365400	<0.3%	
Lup 223V75	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	75%	
	Proprietary component	NJTSN# 03365400	25%	
Lup 225M60	Peroxydicarbonic acid, bis(1-methylpropyl) ester	19910-65-7	>= 59 - <= 61 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<41%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<41%	
Lup 546M75	Neodecaneperoxoic acid, 1,1- dimethylpropyl ester	68299-16-1	>= 74 - <= 75 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>= 0 - <= 25 %	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>= 0 - <= 25 %	
	Hydroperoxide, 1,1-dimethylpropyl	3425-61-4	<= 0.1 %	
			Total (lbs)	75,600

Arkema Inc. - Crosby
Trailer No. 1 Emissions
August 31, 2017

Estimate Pounds of Material Lost in Fire

Destruction Efficiency [4] 93%

Products in Trailers	Quantity [1]	% Fast Decomp - to Vapor [3]	% Decomp to Fire - Unburned [4]	% Decomp to Fire - Burned [4]	% Burned from Original Product [5]	lb Decomp to Vapor	lb Decomp to Fire, Unburned	lb Decomp to Fire, Burned
	lbs					lbs	lbs	lbs
Lup 10	(b) (3) (A), (b) (4)	--	7%	93%	0%	--	551	7,323.75
Lup 10M75	[redacted]	--	7%	93%	0%	--	1,102.50	14,647.50
Lup 11M45	[redacted]	--	7%	93%	0%	--	--	--
Lup 11M75	[redacted]	--	7%	93%	0%	--	--	--
Lup 188M75	[redacted]	5%	6.65%	88.35%	0%	1,181.25	1,571.06	20,872.69
Lup 221	[redacted]	--	7%	93%	0%	--	--	--
Lup 223M75S	[redacted]	--	7%	93%	0%	--	1,543.50	20,506.50
Lup 223S	[redacted]	--	7%	93%	0%	--	--	--
Lup 223V75	[redacted]	--	7%	93%	0%	--	--	--
Lup 225M60	[redacted]	--	7%	93%	0%	--	--	--
Lup 546M75	[redacted]	--	7%	93%	0%	--	441.00	5,859.00
Total	**75,600**					**1,181.25**	**5,209.31**	**69,209.44**

Notes:
[1] Product composition provided by Arkema via email on 9/5/2017 in the file "Crosby Inventory 082817 Trailers Stg Bldg.xlsx".
[2] Provided by Arkema via email on 9/8/2017 in the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx".
[3] Based on the information provided by Arkema, 5% of Lup 188M75 is used to represent the decomposition products to vapor phase
[4] Per *TCEQ publication RG-360A/11, Revised February 2012, TECHNICAL SUPPLEMENT 4: FLARES,* based on EPA test data, for combustions that do not satisfy 40 CFR 60.18, a 93 percent destruction efficiency is assumed. Therefore, for decomposed product Lup 188M75 remaining after vapor release, 7% unburned, and 93% of decomposed part is burned.
[5] Value excludes diluent (e.g., naphtha).

Arkema Inc. - Crosby
Trailer No. 1 Emissions
August 31, 2017

Input

Parameter	Value	Units
Diesel Oil Burned [1]	25	gal/event

[1] Volume combusted based on email from Arkema. September 7, 2017.

Emission Factors and Emissions of Criteria Pollutants

Pollutant	Emission Factor [1] [2] (lb/Mgal)	Emissions (lb/event)	Emissions (short tons/event)
CO	5	0.13	6.3E-05
NO_X	24	0.60	3.0E-04
PM	3.3	0.08	4.1E-05
PM_{10}	3.3	0.08	4.1E-05
$PM_{2.5}$	3.3	0.08	4.1E-05
SO_2	71	1.78	8.9E-04
VOC	0.2	0.01	2.5E-06

Note:

[1] U.S. EPA AP-42, Section 1.3 - Fuel Oil Combustion, May 2010, Tables 1.3-1 and 1.3-2 - No. 2 oil fired (1-01-005-01), (1-02-005-01), (1-03-005-01) for CO, NO_X, PM, PM_{10}, $PM_{2.5}$, and SO_2.

[2] U.S. EPA AP-42, Section 1.3 - Fuel Oil Combustion, May 2010, Table 1.3-3 - Industrial boilers, Distillate oil fired (1-02-005-01/02/03) for VOC.

Arkema Inc. - Crosby
Trailer Nos. 2 and 3 Emissions
September 1, 2017

Emissions Summary

Emission Source	Emissions (lb/event)								
	CO	NO_x	PM	PM_{10}	$PM_{2.5}$	SO_2	VOC	HF	Lead
Products in Trailer No. 2 and 3 Consumed in Fire	479.95	55.98	165.92	165.92	165.92	--	3,977.20	--	--
Trailer Consumed in Fire	968.75	31.00	775.00	775.00	775.00	--	248.00	--	--
Pallets Consumed in Fire	122.38	3.92	97.90	97.90	97.90	--	31.33	--	--
Containers Consumed in Fire	314.33	10.06	251.46	251.46	251.46	--	80.47	--	--
Refrigeration Unit in Fire	123.44	3.95	98.75	98.75	98.75	--	31.60	--	--
Refrigerant Consumed in Fire	--	--	--	--	--	--	--	24.62	--
Battery Consumed in Fire	--	--	10.75	10.75	10.75	19.58	--	--	3.64
Diesel Fuel Combusted in Fire	0.25	1.20	0.17	0.17	0.17	3.55	0.01	--	--
Total Emissions	**2,009.09**	**106.10**	**1,399.94**	**1,399.94**	**1,399.94**	**23.13**	**4,368.61**	**24.62**	**3.64**

Summary of Speciated Emissions

Compound	CAS#	Contaminant Code	Total
			lb/event
Nonane	111-84-2	56703	**1,424.49**
Nonene	124-11-8	56704	**468.14**
OMS	68551-17-7	59275	**996.50**
Acetophenone	98-86-2	59861	**429.83**
2-Ethyl hexanol	104-76-7	51521	**496.57**
2-Ethyl hexanal	123-05-7	51601	**161.68**
Acetone	67-64-1	54020	**652.26**
Ethane	74-84-0	56550	**38.32**
Hydrofluoric Acid	7664-39-3	11162	**24.62**
Lead	7439-92-1	14319	**3.64**
CO	630-08-0	90300	**2,009.09**
NO_x	10102-44-0	70402	**106.10**
PM	--	10000	**1,399.94**
PM_{10}	--	20000	**1,399.94**
$PM_{2.5}$	--	39999	**1,399.94**
SO_2	7446-09-5	70510	**23.13**
Unclassified VOC [1]	--	500001	**391.41**

Note:
[1] Unclassified VOC includes VOC emissions from combustion products.

Arkema Inc. - Crosby
Trailer Nos. 2 and 3 Emissions
September 1, 2017

Summary of Emissions from Trailer 2 and Trailer 3

Emission Source	Emissions (lb/year)					
	VOC	CO	SO_2	PM	PM_{10}	$PM_{2.5}$
Decomposition to Vapor - Unburned	732.85	--	--	--	--	--
Decomposition Products - Burned	3,844.35	439.93	25.98	165.92	165.92	165.92
Total	4,577.20	439.93	25.98	165.92	165.92	165.92

1. Emissions from Decomposition to Vapor - Unburned

Product	Decomp Composition [1]	Vapor wt% [2]	Decomp to Vapor, Unburned - Total lbs	Decomp to Vapor, Unburned - Speciated lbs	Speciated VOC Emissions to Air lbs
Lup 10	Nonane	37.36%	395.75	148.97	148.97
	Nonene	12.24%		48.19	48.19
	Carbon Dioxide	21.72%		85.52	
	OMS	0.00%		0	0
	Acetone	22.52%		88.67	
	Methane	6.32%		24.89	
Lup 188M75	Nonane	29.49%	638.00	187.70	187.70
	Nonene	2.74%		48.79	48.79
	Carbon Dioxide	10.73%		67.37	
	OMS	24.89%		156.83	156.83
	Acetophenone	29.28%		184.48	184.48
	Methane	3.81%		24.53	
			Total VOC from Vapor (Unburned) to Air		732.85

2. Emissions from Decomposition Products - Burned

VOC Emissions

Destruction Efficiency 93% 131

Product	Original Composition [4]	Original wt% [4]	Decomposed Composition [1]	Decomposed wt% [2]	Product Unburned - Total [5] lbs	Speciated Emissions to Air lbs	Product Burned - Total [5] lbs	Product Burned - speciated lbs	Heating Value [6] btu/lb	Heat Input MMbtu	Speciated VOC Emissions to Air lbs
							(b) (3) (A), (b) (4)				
Lup 10	Neodecanoperoxoic acid, 1,1-Dimethylethyl ester	>=95%	Nonane	37%	524	195.94	[redacted]	2,595.22	19,000	49.31	195.94
	Hydroperoxide, 1,1-dimethylethyl	<1%	Nonene	12%		64.69		851.47	18,800	16.01	64.69
			Carbon Dioxide	22%		113.75		1,511.20	0	0.00	
			OMS	0%		0.00		0.00	15,000	0.00	0.00
			Acetone	23%		117.94		1,566.85	17,281	19.24	
			Methane	6%		32.58		432.62	21,500	9.33	
Lup 188M75	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	>= 74 - <=76%	Nonane	24%	2,095	615.55	[redacted]	8,178.09	19,000	155.39	615.55
	Naphtha (petroleum), hydrotreated heavy	<26%	Nonene	10%		201.96		2,683.18	18,800	50.44	201.96
	Naphtha (petroleum), heavy alkylate	<26%	Carbon Dioxide	13%		281.52		3,741.57	0	0.00	
	Hydroperoxide, 1,1-dimethylethyl	<0.2%	OMS	25%		521.31		6,926.00	15,000	103.89	521.31
			Acetone	18%		371.64		4,937.50	17,281	60.64	
			Methane	5%		102.86		1,365.87	21,500	25.34	
Lup 188M75	Neodecanoperoxoic acid, 1-methyl-1-phenylethyl ester	>=74 - <75%	Nonane	23%	838	196.44	[redacted]	2,608.70	19,000	49.59	196.44
	Benzenemethanol, alpha, alpha-dimethyl-	>=5 -<=11%	Nonene	8%		64.89		862.13	18,800	16.21	64.89
	Benzene, (1-methylethyl)-	>=5 -<=7%	Carbon Dioxide	11%		89.67		1,194.00	0	0.00	
	Ethanone, 1-phenyl-	<=5%	OMS	25%		208.59		2,771.24	15,000	41.57	208.59
	Naphtha (petroleum), hydrotreated	>=1 - <25%	Acetophenone	29%		245.35		3,259.71	14,217	46.37	245.35
	Naphtha (petroleum), heavy alkylate	>=1 - <25%	Methane	4%		32.78		435.25	21,500	9.36	
Lup 223M75S	Peroxydicarbonic acid, bis(2-ethylhexyl)	>= 75 - <= 77 %	2-Ethyl hexanol	56%	988	496.57	[redacted]	6,597.22	15,000	98.96	496.57
	Naphtha (petroleum), hydrotreated heavy	<25%	2-Ethyl hexanol	18%		161.68		2,148.03	15,000	32.22	161.68
	Naphtha (petroleum), heavy alkylate	<25%	Carbon Dioxide	25%		272.75		2,372.70	0	0.00	
	Proprietary component	<0.2%									
Lup 546M75	Neodecanoperoxoic acid, 1,1-dimethylpropyl ester	>= 74 - <= 75 %	Nonane	28%	441	122.59	[redacted]	1628.69	19,000	30.95	122.59
	Naphtha (petroleum), hydrotreated heavy	>= 0 - <= 25 %	Nonene	9%		40.22		534.36	18,800	10.05	40.22
	Naphtha (petroleum), heavy alkylate	>= 0 - <= 25 %	Carbon Dioxide	13%		56.09		745.15	0	0.00	
	Hydroperoxide, 1,1-dimethylpropyl	<= 0.1 %	OMS	25%		109.77		1458.36	15,000	21.88	109.77
			Acetone	17%		74.01		983.22	17,281	12.00	
			Ethane	3%		28.32		509.12	20,426	10.40	
				Totals						873.28	3,844.35

NOx, CO, and PM Emissions

Pollutants	Emission Factors lb/MMbtu	Emissions lbs/year
NOx [7]	0.0631	25.98
CO [7]	0.1068	439.93
PM [8]	0.13	165.92

Notes
[1] Decomposition ("Decomp") products provided by Arkema in the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx". "OMS" stands for
[2] Calculated based on 1000 pounds of Lup 188M75 product decomposed, provided by Arkema in the file "in the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx".
[3] Per *TCEQ publication RG-360A/11, Revised February 2012, TECHNICAL SUPPLEMENT & FLARES*, based on EPA test data, for combustions that do not satisfy 40 CFR 60.18, a 93 percent destruction efficiency (DRE) is assumed
[4] Product composition provided by Arkema via email on 9/5/2017 in the file " Crosby inventory 082817 Trailers Stg Bldg.xlsx".
[5] According to Arkema, 5% of Lup 10 and Lup 188M75 was emitted as vapor prior to combustion. The remaining product decomposed except diluent (e.g., OMS) and burned with a 93% DRE (i.e., 7% of decomposition products and diluent emitted to atmosphere and the remainder converted to combustion products).
[6] Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds/Enthalpy of Combustion
[7] *TCEQ publication RG-360A/11, Revised January 2012, TECHNICAL SUPPLEMENT & FLARES, Table A-2, air or assisted flare, low btu.*
[8] Based on AP 42 Table 13.5-1, heavily smoking flares 274 mg/L in exhaust, calculated from concentration using F-factor method on a dry basis, assuming 3% O_2 in exhaust gas stream (*Emission Estimation Protocol for Petroleum Refineries*, RTI International, May 2011, Table 5-4)

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Summary of Emissions from Trailer No. 2 and No.3 Components Combustion

Emission Source	Emissions (lb/event)					
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$
Combustion Emissions	391.40	1,528.89	48.92	1,223.11	1,223.11	1,223.11

Trailers		
Weight of a Trailer [1]	15,500	pounds
Number of Trailers Burned	2	
Burned [2]	50%	
Weight of Trailer Burned	15,500	pounds
Pallets		
Weight of Each Pallet [3]	44.5	pounds
# of Pallets in a Trailer [4]	22	
Burned	100%	
Weight of Pallets Burned	1,958	pounds
Containers		
Weight of a 5 Gal Container [5]	1,153	grams
Weight of a 5 Gal Container	2.54	pounds
Trailer Capacity	3,500	ft^3
Number of 5 Gal Containers Impacted [5]	1,980	
Burned	100%	
Weight of Containers in a Trailer	5,029	pounds
Refrigeration Unit		
Weight of a Refrigeration Unit [6]	1,975	pounds
Burned	50%	
Weight of Refrigeration Unit Burned	1,975	pounds
Total Weight of Solid Combustibles Per Trailer	**12.23**	**tons**

Refrigerant

Weight of Refrigerant [8] 16 pounds/trailer

Compositions [7]	CAS #	M. Wt lb/lb-mol	Wt%	Emissions lbs
1,1,1-Trifluoroethane [7]	420-46-2	84.04	52%	16.64
Pentafluoroethane [7]	354-33-6	120.02	44%	14.08
1,1,1,2-Tetrafluoroethane [7]	811-97-2	102.03	4%	1.28
Emissions as Hydrogen Fluoride	7664-39-3	20.01		**24.62**

Battery

Weight of Battery [8] 50 pounds/trailer

Compositions [9]	CAS #	M. Wt lb/lb-mol	Wt%	Weight lbs
Lead	7439-92-1	207.2	70%	70
Sulfuric acid	7664-93-9	98.08	30%	30

Emissions from Battery Burned

Pollutant	Emission Factor [10] lb of pollutant/ton of metal produced	Emissions from Lead Burned lbs	Emissions from Sulfuric Acid Burned [11] lbs
PM	307	18.75	--
Lead	104	3.64	--
SO_2	--	--	19.58

NOx, CO, and PM Emissions from Trailer Components Combustion

Pollutants	Emission Factors [12] lb/ton	Emissions From Trailer Burning lbs	Emissions From Pallets Burning lbs	Emissions From Containers Burning lbs	Emissions From Refrigeration Unit Burning lbs	Total Emissions From Solids Burning lbs
VOC	32	248.00	31.33	80.47	31.60	**391.40**
NOx	4	31.00	3.92	10.06	3.95	**48.92**
CO	125	968.75	122.38	314.33	123.44	**1,528.89**
PM	100	775.00	97.90	251.46	98.75	**1,223.11**

Notes:
[1] Per information provided by Arkema, the trailer is a 53' refrigerated trailer, based on vendor information, typical weight of refrigerated trailer is 15,500 lb.
[2] Based on phone communication between Arkema and Trinity Consultants on September 6, 2017, 50% of weight of trailer estimated to be combusted.
[3] According to dimensions of trailer provided by Arkema, typical pallet used in this type of trailer is 40"x 48" and weight is 44.5 lb.
[4] Provided by Arkema based on trailer inventory and products information.[8
[5] Provided by Arkema based on trailer inventory and products information, typical 35 lbs products per container. Typical empty container weight based on vendor information.
[6] Weight of refrigeration unit and refrigerant based on vendor information for typical unit.
[7] Per R-404A Refrigerant safety data sheet (SDS)
[8] Per KLLM Trailer Specifications
[9] Per Lead-acid Battery SDS normalized to total weight of battery for conservatism.
[10] The battery in engine of trailer burned in the fire and is represented as second lead processing in blast furnaces. Particulate and lead emission factors are selected based on AP-42 Chapter 12.11.2, Table 12.11-2, Emission Factors for Secondary Lead Processing.
[11] Sulfur dioxide (SO_2) emissions estimated assuming all sulfur from sulfuric acid converted to SO_2.
[12] Emission factors from AP-42 Chapter 2.5, Table 2.5-1 "Emission Factors for Open Burning of Municipal Refuse," factors for Automobile Components

Products in Trailer No. 2 and No.3

Product Name	Composition [1]	CAS#	wt% [1]	Quantity in Trailers [2] lbs
Lup 10	Neodecaneperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	>=95%	(b) (3) (A), (b) (4) [redacted]
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<1%	
Lup 10M75	Neodecaneperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	>= 74- <=76%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<0.2%	
Lup 11M45	Propaneoperoxoic acid, 2,2-dimethyl-, 1,1- dimethlethyl ester	927-07-1	>=44- <46%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<56%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<56%	
Lup 11M75	Propaneoperoxoic acid, 2,2-dimethyl-, 1,1- dimethlethyl ester	927-07-1	>=74- <76%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
Lup 188M75	Nedodecaneperoxoic acid, 1-methyl-1-phenylethyl ester	26748-47-0	>=74- <75%	
	Benzenemethanol, .alpha.,.alpha.-dimethyl-	617-94-7	>=5- <=11%	
	Benzene, (1-methylethyl)-	98-82-8	>=5 -<=7%	
	Ethanone, 1-phenyl-	98-86-2	<=5%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>=1 - <25%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>=1 - <25%	
Lup 221	Peroxydicarbonic acid, dipropyl ester	16066-38-9	>= 99 %	
Lup 223M75S	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 75 - <= 77 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<25%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<25%	
	Proprietary component	NJTSN# 03365400	<0.2%	
Lup 223S	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 97 - <= 100 %	
	Proprietary component	NJTSN# 03365400	<0.3%	
Lup 223V75	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	75%	
	Proprietary component	NJTSN# 03365400	25%	
Lup 225M60	Peroxydicarbonic acid, bis(1-methylpropyl) ester	19910-65-7	>= 59 - <= 61 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<41%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<41%	
Lup 546M75	Neodecaneperoxoic acid, 1,1- dimethylpropyl ester	68299-16-1	>= 74 - <= 75 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>= 0 - <= 25 %	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>= 0 - <= 25 %	
	Hydroperoxide, 1,1-dimethylpropyl	3425-61-4	<= 0.1 %	
			Total (lbs)	**69,300**

Estimate Pounds of Material Lost in Fire

Destruction Efficiency [4] 93%

Products in Trailers	Quantity [1]	% Fast Decomp - to Vapor [3]	% Decomp to Fire - Unburned [4]	% Decomp to Fire - Burned [4]	% Burned from Original Product [5]	lb Decomp to Vapor	lb Decomp to Fire, Unburned	lb Decomp to Fire, Burned
	lbs					lbs	lbs	lbs
Lup 10	(b) (3) (A), (b) (4)	5%	6.65%	88.35%	0%	393.75	524	6,957.56
Lup 10M75	[redacted]	--	7%	93%	0%	--	2,094.75	27,830.25
Lup 11M45	[redacted]	--	7%	93%	0%	--	--	--
Lup 11M75	[redacted]	--	7%	93%	0%	--	--	--
Lup 188M75	[redacted]	5%	6.65%	88.35%	0%	630.00	837.90	11,132.10
Lup 221	[redacted]	--	7%	93%	0%	--	--	--
Lup 223M75S	[redacted]	--	7%	93%	0%	--	882.00	11,718.00
Lup 223S	[redacted]	--	7%	93%	0%	--	--	--
Lup 223V75	[redacted]	--	7%	93%	0%	--	--	--
Lup 225M60	[redacted]	--	7%	93%	0%	--	--	--
Lup 546M75	[redacted]	--	7%	93%	0%	--	441.00	5,859.00
Total	**69,300**					**1,023.75**	**4,779.34**	**63,496.91**

Notes:
[1] Product composition provided by Arkema via email on 9/5/2017 in the file "Crosby Inventory 082817 Trailers Stg Bldg.xlsx".
[2] Provided by Arkema via email on 9/8/2017 in the file "Crosby Inv 082817 Trailers Stg Bldg.xlsx".

[3] According to Arkema, 5% as Lup 10 and LUP 188M75 was emitted as vapor prior to combustion. The remaining product decomposed except diluent (e.g., OMS) and burned with a 93% DRE (i.e., 7% of decomposition products and diluent emitted to atmosphere and the remainder converted to combustion products).
[4] Per *TCEQ publication RG-360A/11, Revised February 2012, TECHNICAL SUPPLEMENT 4: FLARES,* based on EPA test data, for combustions that do not satisfy 40 CFR 60.18, a 93 percent destruction efficiency is assumed. Therefore, for decomposed product Lup 188M75 remaining after vapor release, 7% unburned, and 93% of decomposed part is burned.
[5] Value excludes diluent (e.g., naphtha).

Arkema Inc. - Crosby
Trailer Nos. 2 and 3 Emissions
September 1, 2017

Input

Parameter	Value	Units
Diesel Oil Burned [1]	50	gal/event

[1] Total volume combusted (25 gallons from each trailer) based on email from Arkema, September 7, 2017.

Emission Factors and Emissions of Criteria Pollutants

Pollutant	Emission Factor [1] [2] (lb/Mgal)	Emissions (lb/event)	Emissions (short tons/event)
CO	5	0.25	1.3E-04
NO_X	24	1.20	6.0E-04
PM	3.3	0.17	8.3E-05
PM_{10}	3.3	0.17	8.3E-05
$PM_{2.5}$	3.3	0.17	8.3E-05
SO_2	71	3.55	1.8E-03
VOC	0.2	0.01	5.0E-06

Notes:

[1] U.S. EPA AP-42, Section 1.3 - Fuel Oil Combustion, May 2010, Tables 1.3-1 and 1.3-2 - No. 2 oil fired (1-01-005-01), (1-02-005-01), (1-03-005-01) for CO, NO_X, PM, PM_{10}, $PM_{2.5}$, and SO_2.

[2] U.S. EPA AP-42, Section 1.3 - Fuel Oil Combustion, May 2010, Table 1.3-3 - Industrial boilers, Distillate oil fired (1-02-005-01/02/03) for VOC.

Arkema Inc. - Crosby
Trailer No. 4-9 Combustion Emissions
September 3, 2017

Emissions Summary

Emission Source	Emissions (lb/event)								
	CO	NO_X	PM	PM_{10}	$PM_{2.5}$	SO_2	VOC	HF	Lead
Products in Trailer Nos 4-9 Consumed in Fire	1,458.11	170.06	504.08	504.08	504.08	--	10,368.95	--	--
Trailer Consumed in Fire	2,906.25	93.00	2,325.00	2,325.00	2,325.00	--	744.00	--	--
Pallets Consumed in Fire	367.13	11.75	293.70	293.70	293.70	--	93.98	--	--
Containers Consumed in Fire	1,005.64	32.18	804.51	804.51	804.51	--	257.44	--	--
Refrigeration Unit in Fire	370.31	11.85	296.25	296.25	296.25	--	94.80	--	--
Refrigerant Consumed in Fire	--	--	--	--	--	--	--	73.87	--
Battery Consumed in Fire	--	--	32.24	32.24	32.24	58.73	--	--	10.92
Total Emissions	**6,107.44**	**318.84**	**4,255.77**	**4,255.77**	**4,255.77**	**58.73**	**11,559.17**	**73.87**	**10.92**

Summary of Speciated Emissions

Compound	CAS#	Contaminant Code	Total
			lb/event
Nonane	111-84-2	56703	**2,268.66**
Nonene	124-11-8	56704	**746.08**
Isobutane	75-28-5	55178	**501.32**
Isobutene	115-11-7	90100	**161.31**
n-propanol	71-23-8	51570	**64.32**
n-propanal	123-38-6	51721	**20.72**
sec-butanol	78-92-2	51580	**219.22**
sec-butanone	78-93-3	54065	**71.09**
OMS	68551-17-7	59275	**2,608.73**
Acetophenone	98-86-2	59861	**969.34**
2-Ethyl hexanol	104-76-7	51521	**2,065.61**
2-Ethyl hexanal	123-05-7	51601	**672.55**
Acetone	67-64-1	54020	**1,569.03**
Ethane	74-84-0	56550	**24.48**
Hydrofluoric Acid	7664-39-3	11162	**73.87**
Lead	7439-92-1	14319	**10.92**
CO	630-08-0	90300	**6,107.44**
NO_X	10102-44-0	70402	**318.84**
PM	--	10000	**4,255.77**
PM_{10}	--	20000	**4,255.77**
$PM_{2.5}$	--	39999	**4,255.77**
Unclassified VOC [1]	--	500001	**1,190.23**

Note:
[1] Unclassified VOC includes VOC emissions from combustion products.

Summary of Emissions from Trailer No. 4 - No. 9

Emission Source	Emissions (lb/event)					
	VOC	CO	NOx	PM	PM_{10}	$PM_{2.5}$
Decomposition Products - Burned	10,368.92	1,038.11	138.06	504.08	504.08	504.08
Total	10,368.92	1,038.11	138.06	504.08	504.08	504.08

2. Emissions from Decomposition Products - Burned
VOC Emissions

Decomp Non Emissions 98% 2%

Products	Original Composition [1]	Original wt% [2]	Decomposed Composition [3]	Decomposed wt% [3]	Decomp Products Released to Air 7/5/08 [3] lbs	Speciated Emissions to Air lbs	Product Burned - Total [5] lbs	Product Burned - Speciated lbs	Heating Value [6] btu/lb	Heat Input mmbtu	Speciated VOC Emissions to Air lbs
Lup 10	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	>=95%	Nonane	37%	2,809	1,058.78	[redacted]	14,866.63	19,000	282.27	1,058.78
	Hydroperoxide, 1,1-dimethylethyl	<5%	Nonane	12%		347.38		4,815.48	19,000	68.27	347.38
			Carbon Dioxide	22%		616.53		8,195.31	0	0.00	
			OMS	0%		0.00		0.00	15,000	0.00	0.00
			Acetone	23%		630.23		8,882.69	12,901	104.59	
			Methane	5%		136.58		5,882.97	21,502	59.68	
Lup 108875	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	>= 74 - <= 76%	Nonane	29%	1,210	355.49		4,722.93	19,000	89.74	355.49
	Naphtha (petroleum), hydrotreated heavy	<26%	Isobutane	10%		116.63		1,548.56	18,905	29.13	116.63
	Naphtha (petroleum), heavy alkylate	<26%	Carbon Dioxide	13%		152.64		2,168.80	0	0.00	
	Hydroperoxide, 1,1-dimethylethyl	<0.2%	OMS	25%		301.86		3,999.86	15,000	59.99	301.86
			Acetone	10%		214.63		2,853.46	12,281	35.04	
			Methane	5%		58.89		2,407.88	21,502	25.84	
Lup 115445	Peroxyneopentanoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester	>=86 - <=90%	Isobutane	12%	1,319	164.21		2,257.99	19,507	44.05	164.21
	Naphtha (petroleum), hydrotreated heavy	<5.6%	Isobutane	4%		52.85		739.94	19,351	14.30	52.85
	Naphtha (petroleum), heavy alkylate	<5.6%	Carbon Dioxide	13%		165.63		2,319.09	0	0.00	
			OMS	50%		656.49		9,186.93	15,000	137.71	656.49
			Acetone	17%		218.83		3,060.31	12,281	37.58	
			Methane	5%		60.97		2,535.39	21,502	26.38	
Lup 118675	Peroxyneopentanoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester	59%	Isobutane	19%	1,885	337.97		4,973.18	19,507	97.03	337.97
	Naphtha (petroleum), hydrotreated heavy	29%	Isobutane	4%		108.46		1,596.68	19,351	29.35	108.46
	Naphtha (petroleum), heavy alkylate	29%	Carbon Dioxide	14%		346.79		5,102.14	0	0.00	
			OMS	25%		449.86		6,620.52	15,000	99.30	449.86
			Acetone	10%		147.04		2,164.52	12,281	26.58	
			Methane	7%		124.85		5,499.60	21,502	52.24	
Lup 108875	Neodecanoperoxoic acid, 1-methyl-1-phenylethyl ester	>=74 - <=76%	Nonane	23%	5,519	776.87		10,319.76	19,000	195.99	776.87
	Benzenemethanol, alpha,-alpha,-dimethyl-	>=5 - <=13%	Nonane	8%		258.37		3,466.03	19,000	65.85	258.37
	Benzene, (1-methylethyl)	>=5 - <=7%	Carbon Dioxide	11%		353.06		4,737.17	0	0.00	
	Silicone, 1-phenyl-	<=0.5%	OMS	25%		824.09		10,148.63	15,000	154.23	824.09
	Naphtha (petroleum), hydrotreated	>=3 - <=25%	Methylcyclohexane	28%		965.94		12,879.43	14,357	185.03	965.94
	Naphtha (petroleum), heavy alkylate	>=3 - <=25%	Isobutane	4%		128.42		1,719.59	19,507	33.55	
Lup 121	Peroxydicarbonic acid, dipropyl ester	100%	n-propanol	44%	168	64.32		858.49	13,243	11.37	64.32
			n-propanol	14%		20.72		276.27	13,243	3.65	20.72
			Carbon Dioxide	42%		62.08		828.22	0	0.00	
Lup 223867PS	Peroxydicarbonic acid, bis(2-ethylhexyl)	>= 95 - <= 97 %	2-Ethyl hexanol	56%	2,733	1,068.94		20,200.54	18,900	381.90	1,068.94
	Naphtha (petroleum), hydrotreated heavy	<25%	2-Ethyl hexanol	10%		502.55		6,674.79	15,000	100.15	502.55
	Naphtha (petroleum), heavy alkylate	<25%	Carbon Dioxide	25%		695.49		9,236.13	0	0.00	
	Proprietary component	<0.5%									
Lup 7230	Peroxydicarbonic acid, bis(3-ethylhexyl) ester	>= 98 - <= 100 %	2-Ethyl hexanol	56%	645	362.20		4,025.14	15,000	72.38	362.20
	Proprietary component	<0.9%	2-Ethyl hexanol	19%		118.76		1,575.53	15,000	23.67	118.76
			Carbon Dioxide	25%		156.66		2,176.35	0	0.00	
Lup 223PS	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	75.0%	2-Ethyl hexanol	56%	2867	458.50		2,113.13	15,000	31.67	458.50
	Proprietary component	25.0%	2-Ethyl hexanol	18%		51.74		689.39	15,000	10.34	51.74
			Carbon Dioxide	25%		72.60		963.26	0	0.00	
Lup 225PD60	Peroxydicarbonic acid, bis(1-methylpropyl) ester	>= 59 - <= 61 %	sec-Butanol	28%	771	218.22		2,932.64	14,206	41.67	218.22
	Naphtha (petroleum), hydrotreated heavy	<41%	sec-Butanol	9%		71.89		944.67	15,663	14.79	71.89
	Naphtha (petroleum), heavy alkylate	<41%	Carbon Dioxide	22%		173.54		2,305.67	0	0.00	
			OMS	40%		307.86		4,088.73	15,000	61.38	307.86
Lup 546MPS	Neodecanoperoxoic acid, 1,1-dimethylpropyl ester	>= 74 - <= 75 %	Nonane	28%	262	70.32		1,040.55	19,000	19.77	70.32
	Naphtha (petroleum), hydrotreated heavy	>= 0 - <= 25 %	Nonane	9%		25.70		343.49	19,000	6.42	25.70
	Naphtha (petroleum), heavy alkylate	>= 0 - <= 25 %	Carbon Dioxide	13%		35.83		476.07	0	0.00	
	Hydroperoxide, 1,1-dimethylpropyl	<= 0.1 %	OMS	25%		76.13		933.73	15,000	15.68	76.13
			Acetone	17%		47.29		628.23	12,281	7.72	
			Ethane	5%		14.60		325.77	20,425	6.66	
					Totals					2,553.04	10,368.92

NOx, CO, and PM Emissions

Pollutants	Emission Factors	Emissions
	lb/MMBtu	lbs/event
NOx [7]	0.0681	138.06
CO [7]	0.0512	1,038.11
PM [8]	0.25	504.08

Notes
[1] Decomposition ("Decomp") products provided by Arkema in the file "Crosby 2017 Trailers Sig Ship.xlsx". "OMS" stands for Organic
[2] Calculated based on Lup 118445 and 118675 product decomposed, provided by Arkema in the file "In the file "Crosby Inc 083817 Trailers Sig Ship.xlsx".
[3] Per TCEQ publication RG-360/01, Revised February 2012, TECHNICAL SUPPLEMENT 4-FLARES, based on EPA test data, for combustions that do not satisfy 40 CFR 60.18, a 97 percent destruction efficiency (DRE) is assumed.
[4] Product composition provided by Arkema via email on 9/5/2017 in the file "Crosby inventory 082717 Trailers Sig Ship.xlsx".
[5] Based on information provided by Arkema, 75% of Lup 118445 and 118675 vapor is atmospheric in the September 5, 2017 emission event
combustion of the September 6, 2017 event. For the September 6, 2017 combustion, the remaining product decomposed except diluent (e.g., OMS) and burned with a 98% DRE. 5% of the decomposition products and diluent condensed in atmosphere and the remainder
combustible combustion products.
[6] Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds/Enthalpy of Combustion
[7] TCEQ publication RG-360/01, Revised January 2012, TECHNICAL SUPPLEMENT 4-FLARES, Table 4-2, as an uncontrolled flare, low btu.
[8] Based on AP 42 Table 13.5-1, heavily smoking flare 274 µg/L in exhaust, calculated from concentration using F factor converted on a dry basis, assuming 3% O2, in exhaust gas stream (Emissions Estimation Protocol for Petroleum Refineries , RTI International, May 2011, Table 4-4).

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Summary of Emissions from Trailer Components Combustion

Emission Source	Emissions (lb/event)					
	VOC	CO	NO_x	PM	PM_{10}	$PM_{2.5}$
Combustion Emissions	1,190.23	4,649.33	148.78	3,719.46	3,719.46	3,719.46

Trailers		
Weight of Trailer [1]	15,500	pounds
# of Trailers	6	
Burned [2]	50%	
Weight of Trailer Burned	46,500	pounds
Pallets		
Weight of Each Pallet [3]	44.5	pounds
# of Pallets in a Trailer [4]	22	
Burned	100%	
Weight of Pallets Burned	6,674	pounds
Containers		
Weight of a 5 Gal Container [5]	1,153	grams
Weight of a 5 Gal Container	2.54	pounds
Capacity of a Trailer	3,500	ft^3
Number of 5 Gal Containers Impacted [5]	6,335	
Burned	100%	
Weight of Containers in a Trailer	16,090	pounds
Refrigeration Unit		
Weight of a Refrigeration Unit [6]	1,975	pounds
Burned	50%	
Weight of Refrigeration Unit Burned	5,925	pounds
Total Weight of Solid Combustibles	**37.19**	**tons**

Refrigerant

Weight of Refrigerant [6] 16 pounds/trailer

Compositions [7]	CAS #	M. Wt.	Wt%	Emissions
		lb/lb-mol		lbs
1,1,1-Trifluoroethane [7]	420-46-2	84.04	52%	49.92
Pentafluoroethane [7]	354-33-6	120.02	44%	42.24
1,1,1,2-Tetrafluoroethane [7]	811-97-2	102.03	4%	3.84
Emissions as Hydrogen Fluoride	7664-39-3	20.01		**73.87**

Battery

Weight of Battery [8] 50 pounds/trailer

Compositions [9]	CAS #	M. Wt.	Wt%	Weight
		lb/lb-mol		lbs
Lead	7439-92-1	207.2	70%	210
Sulfuric acid	7664-93-9	98.09	30%	90

Emissions from Battery Burned

Pollutant	Emission Factor [10]	Emissions from Lead Burned	Emissions from Sulfuric Acid Burned [11]
	lb of pollutant/ton of metal produced	lbs	lbs
PM	307	32.24	--
Lead	104	10.92	--
SO_2	--	--	58.73

NOx, CO, and PM Emissions from Trailer Components Combustion

Pollutants	Emission Factors [12]	Emissions From Trailer Burning	Emissions From Pallets Burning	Emissions From Containers Burning	Emissions From Refrigeration Unit Burning	Total Emissions From Solids Burning
	lb/ton	lbs	lbs	lbs	lbs	lbs
VOC	32	744.00	93.98	257.44	94.80	**1,190.23**
NOx	4	93.00	11.75	32.18	11.85	**148.78**
CO	125	2,906.25	367.13	1,005.64	370.31	**4,649.33**
PM	100	2,325.00	293.70	804.51	296.25	**3,719.46**

Notes:
[1] Per information provided by Arkema, the trailer is a 53' refrigerated trailer, based on vendor information, typical weight of refrigerated trailer is 15,500 lb.
[2] Based on phone communication between Arkema and Trinity Consultants on September 6, 2017, 50% of weight of trailer estimated to be combusted.
[3] According to dimensions of trailer provided by Arkema, typical pallet used in this type of trailer is 40"x 48" and weight is 44.5 lb.
[4] Provided by Arkema based on trailer inventory and products information.[5]
[5] Provided by Arkema based on trailer inventory and products information, typical 35 lbs products per container. Typical empty container weight based on vendor information.
[6] Weight of refrigeration unit and refrigerant based on vendor information for typical unit.
[7] Per R-404A Refrigerant safety data sheet (SDS)
[8] Per KLLM Trailer Specifications
[9] Per Lead-acid Battery SDS normalized to total weight of battery for conservatism.
[10] The battery in engine of trailer burned in the fire and is represented as second lead processing in blast furnaces. Particulate and lead emission factors are selected based on AP-42 Chapter 12.11.2, Table 12.11-2, Emission Factors for Secondary Lead Processing.
[11] Sulfur dioxide (SO_2) emissions estimated assuming all sulfur from sulfuric acid converted to SO_2.
[12] Emission factors from AP-42 Chapter 2.5, Table 2.5-1 "Emission Factors for Open Burning of Municipal Refuse," factors for Automobile Components

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Products in Trailer No. 4 to No. 9

Product Name	Composition [1]	CASS	wt% [1]	Quantity in Trailers 4-9 [2] lbs
Lsp 10	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	<=95%	(b) (3) (A), (b) (4)
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<1%	
Lsp 108075	Neodecanoperoxoic acid, 1,1-dimethylethyl ester	26748-41-4	>= 74 - <=76%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
	Hydroperoxide, 1,1-dimethylethyl	75-91-2	<0.2%	
Lsp 113449	Propanoperoxoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester	927-07-1	>=68 - <86%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<56%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<56%	
Lsp 113075	Propanoperoxoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester	927-07-1	>=74 - <76%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<26%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<26%	
Lsp 188075	Neodecanoperoxoic acid, 1-methyl-1-phenylethyl ester	26748-47-0	>=74 - <75%	
	Benzenemethanol, alpha, alpha-dimethyl-	617-94-7	>=5- <=13%	
	Benzene, (1-methylethyl)-	98-82-8	>=5 - <=7%	
	Ethanone, 1-phenyl-	98-86-2	<=5%	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>=1 - <25%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>=1 - <25%	
Lsp 221	Peroxydicarbonic acid, dipropyl ester	16066-38-9	>= 99 %	
Lsp 275075	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 75 - <= 77 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<20%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<25%	
	Proprietary component	NJTS#9 03365400	<0.2%	
Lsp 3235	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	>= 97 - <= 100 %	
	Proprietary component	NJTS#9 03365400	<=3%	
Lsp 275075	Peroxydicarbonic acid, bis(2-ethylhexyl) ester	16111-62-9	75%	
	Proprietary component	NJTS#9 03365400	25%	
Lsp 725060	Peroxydicarbonic acid, bis(1-methylpropyl) ester	19910-65-7	>= 59 - <= 61 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	<=1%	
	Naphtha (petroleum), heavy alkylate	64741-65-7	<=1%	
Lsp 540M75	Neodecanoperoxoic acid, 1,1-dimethylpropyl ester	68299-16-1	>= 74 - <= 75 %	
	Naphtha (petroleum), hydrotreated heavy	64742-48-9	>= 0 - <= 25 %	
	Naphtha (petroleum), heavy alkylate	64741-65-7	>= 0 - <= 25 %	
	Hydroperoxide, 1,1-dimethylpropyl	3425-61-4	<= 0.1 %	
			Total (lbs)	221,716

Composition [1]
Neodecanoperoxoic acid, 1,1-dimethylethyl ester (>=95%, CASS 26748-41-4); Hydroperoxide, 1,1-dimethylethyl (<1%, CASS 75-91-2)
Neodecanoperoxoic acid, 1,1-dimethylethyl ester (>= 74 - <=76%, CASS 26748-41-4); Naphtha (petroleum), hydrotreated heavy (<26%, CASS 64742-48-9); Naphtha (petroleum), heavy alkylate (<26%, CASS 64741-65-7); Hydroperoxide, 1,1-dimethylethyl (<0.2%, CASS 75-91-2)
Propanoperoxoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester (>=68 - <86%, CASS 927-07-1); Naphtha (petroleum), hydrotreated heavy (<56%, CASS 64742-48-9); Naphtha (petroleum), heavy alkylate (<56%, CASS 64741-65-7)
Propanoperoxoic acid, 2,2-dimethyl-, 1,1-dimethylethyl ester (>=74 - <76%, CASS 927-07-1); Naphtha (petroleum), hydrotreated heavy (<26%, CASS 64742-48-9); Naphtha (petroleum), heavy alkylate (<26%, CASS 64741-65-7)
Neodecanoperoxoic acid, 1-methyl-1-phenylethyl ester (>=74- <=75%, CASS 26748-47-0); Benzenemethanol, alpha, alpha-dimethyl- (>=5- <=13%, CASS 617-94-7); Benzene, (1-methylethyl)- (>=5 - <=7%, CASS 98-82-8); Ethanone, 1-phenyl- (<=5%, CASS 98-86-2); Naphtha (petroleum), hydrotreated heavy (>=1 - <25%, CASS 64742-48-9); Naphtha (petroleum), heavy alkylate (>=1 - <25%, CASS 64741-65-7)
Peroxydicarbonic acid, dipropyl ester (>= 99 %, CASS 16066-38-9)
Peroxydicarbonic acid, bis(2-ethylhexyl) ester (CASS 16111-62-9, >= 75 - <= 77 %); Naphtha (petroleum), hydrotreated heavy (CASS 64742-48-9, < 20 %); Naphtha (petroleum), heavy alkylate (CASS 64741-65-7, < 25 %); Proprietary component NJTS#9 03365400- 50949* (< 0.2 %)
Peroxydicarbonic acid, bis(2-ethylhexyl) ester (CASS 16111-62-9, >= 97 - <= 100 %); Proprietary component NJTS#9 03365400- 50949* (< 0.3 %)
Peroxydicarbonic acid, bis(2-ethylhexyl) ester (CASS 16111-62-9, 75 %); Proprietary diluent (25 %)
Peroxydicarbonic acid, bis(1-methylpropyl) ester (CASS 19910-65-7, >= 59 - <= 61 %); Naphtha (petroleum), hydrotreated heavy (CASS 64742-48-9, < 1 %); Naphtha (petroleum), heavy alkylate (CASS 64741-65-7, < 1 %)
Neodecanoperoxoic acid, 1,1-dimethylpropyl ester (CASS 68299-16-1, >= 74 - <= 75 %); Naphtha (petroleum), heavy alkylate (CASS 64741-65-7, >= 0 - <= 25 %); Naphtha (petroleum), hydrotreated heavy (CASS 64742-48-9, >= 0 - <= 25 %); Hydroperoxide, 1,1-dimethylpropyl (CASS 3425-61-4, <= 0.1 %)

Estimate Fraction of Material Lost to Fire

Destruction Efficiency [1] 99%

Products in Trailers	Quantity [1]	% Fast Decomp - to Vapor [3]	% Decomp to Fire - Unburned [4]	% Decomp to Fire - Burned [4]	% Burned from Original Product [5]	lb Decomp to Vapor	lb Decomp to Fire, Unburned	lb Decomp to Fire, Burned
	lbs					lbs	lbs	lbs
Lsp 10	35,574	--	7%	93%	0%	--	2,489	33,213
Lsp 108075	37,382	--	7%	93%	0%	--	2,617	34,892
Lsp 113449	19,810	5.00%	6.65%	88.35%	0%	991.50	1,318.78	17,520
Lsp 113075	37,186	5.00%	6.65%	88.35%	0%	1,859.28	1,867.98	24,828
Lsp 188075	4,721	--	7%	93%	0%	--	330.47	4,391
Lsp 221	2,112	--	7%	93%	0%	--	147.80	1,964
Lsp 275075	39,165	--	7%	93%	0%	--	2,741.55	36,423
Lsp 3235	9,315	--	7%	93%	0%	--	652.17	8,663
Lsp 275075	3,832	--	7%	93%	0%	--	268.24	3,563
Lsp 725060	13,985	--	7%	93%	0%	--	979.05	13,006
Lsp 540M75	4,025	--	7%	93%	0%	--	281.75	3,743
Total	221,716					2,850.89	15,396.54	203,969

Notes:
[1] Product composition provided by Arkema via email on 9/5/2017 in the file "Crosby Inventory 082817 Trailers 5&6 Bldg.xlsx".
[2] Provided by Arkema via email on 9/5/2017 in the file "Crosby Inv 082817 Trailers 5&6 Bldg.xlsx".
[3] Based on information provided by Arkema, 5% of Lsp 113449 and 113075 vapor to atmosphere in the September 3, 2017 emissions event
contribution of the September 3, 2017 event. For the September 3, 2017 combustion, the remaining product decomposed except diluent (e.g., DMF) and burned with a 93% DRE (i.e. 7% of decomposition products and diluent emitted to atmosphere and the remainder
composed of incomplete products).
[4] Per TCEQ publication RG-106(R)/11, Revised February 2012, "TECHNICAL SUPPLEMENT 2: FLARES", based on EPA test data, for compounds that do not satisfy 40 CFR 60.18, a 93 percent
destruction efficiency is assumed. Therefore, for decomposed product, 1 Lsp 113449 producing other vapor release, 7% unburned, and 93% of decomposed parts burned.
[5] Value excludes diluent (e.g. naphtha).

Attachment 2

Table 5 1. Event One Maximum 1-Hour Modeled Concentrations: Health Effects Analysis

Constituent	CAS No.	AMCV?	AMCV or ESL ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < AMCV or ESL?
T-Amyl Alcohol	75-85-4	N	320	24.1	Yes
T-Butyl Alcohol	75-65-0	N	620	5.0	Yes
Di-T-Butyl Peroxide	110-05-4	N	100	21.0	Yes
Di-T-Amyl Peroxide	10508-09-5	N	100	12.7	Yes
2,5 Dimethyl-2,5 Di (T-Butyl Peroxy) Hexane	78-63-7	N	100	1.2	Yes
Ethyl Benzene	100-41-4	Y	86,000	20.2	Yes
Naphthalene (Crude Or Refined)	91-20-3	Y	500	17.6	Yes
1, 2, 4 - Trimethylbenzene	95-63-6	Y	15,000	93.0	Yes
Hydrotreated Heavy Naphtha	64742-48-9	N	3000	17.6	Yes
Odorless Mineral Spirits (OMS)	68551-17-7	N	3,500	130.4	Yes
Naphtha, light aromatic	64742-95-6	N	4,400	289.6	Yes
Xylene, mixed isomers	1330-20-7	N	2,200	21.1	Yes

Table 5 2. Event Two Modeled Impacts: NAAQS Analysis

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < NAAQS?
CO	1-hour	40,000	29.4	Yes
	8-hour	10,000	5.5	Yes
NOX	1-hour	188	1.8	Yes
SO_2	1-hour	196	0.22	Yes
	3-hour	1,300	0.11	Yes
	24-hour	365	0.01	Yes
PM_{10}	24-hour	50	1.2	Yes
$PM_{2.5}$	24-hour	35	1.2	Yes
Lead	3-month	0.15	0.000024	Yes

Table 5-4. Event Two Maximum 1-Hour Modeled Concentrations: Health Effects Analysis

Constituent	CAS No.	AMCV?	AMCV or ESL ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < AMCV or ESL?
Nonane	111-84-2	Y	16,000	15,759	Yes
Nonene	124-11-8	N	5,800	5,206	Yes
OMS	68551-17-7	N	3,500	16,734	No
Acetone	67-64-1	Y	26,000	7.5	Yes
Acetophenone	98-86-2	N	490	19,684	No
2-Ethyl hexanol	104-76-7	N	540	16.6	Yes
2-Ethyl hexanal	123-05-7	N	1,400	5.4	Yes
Hydrofluoric Acid	7664-39-3	N	3	0.2	Yes

Table 5-5. Event Three Modeled Impacts: NAAQS Analysis

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < NAAQS?
CO	1-hour	40,000	3.65	Yes
	8-hour	10,000	0.68	Yes
NOX	1-hour	188	0.19	Yes
SO_2	1-hour	196	0.04	Yes
	3-hour	1,300	0.02	Yes
	24-hour	365	0.003	Yes
PM_{10}	24-hour	50	0.16	Yes
$PM_{2.5}$	24-hour	35	0.16	Yes
Lead	3-month	0.15	0.0000045	Yes

Table 5-7. Event Three Maximum 1-Hour Modeled Concentrations: Health Effects Analysis

Constituent	CAS No.	AMCV?	AMCV or ESL ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < AMCV or ESL?
Nonane	111-84-2	Y	16,000	451	Yes
Nonene	124-11-8	N	5,800	148	Yes
OMS	68551-17-7	N	3,500	240	Yes
Acetone	67-64-1	Y	26,000	1.18	Yes
Acetophenone	98-86-2	N	490	282	Yes
2-Ethyl hexanol	104-76-7	N	540	0.90	Yes
2-Ethyl hexanal	123-05-7	N	1,400	0.29	Yes
Hydrofluoric Acid	7664-39-3	N	3	0.04	Yes

Table 5-8. Event Four Maximum 1-Hour Modeled Concentrations: Health Effects Analysis

Constituent	CAS No.	AMCV?	AMCV or ESL ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < AMCV or ESL?
Isobutane	75-28-5	Yes	23,000	89.4	Yes
Isobutene	115-11-7	Yes	180,000	28.8	Yes
Organic Mineral Solvent (OMS)	68551-17-7	Yes	3,500	197.2	Yes
Acetone	67-64-1	Yes	26,000	119.1	Yes

Table 5-9. Event Five Modeled Impacts: NAAQS Analysis

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < NAAQS?
CO	1-hour	40,000	9.2	Yes
	8-hour	10,000	2.3	Yes
NOX	1-hour	188	0.48	Yes
SO_2	1-hour	196	0.09	Yes
	3-hour	1,300	0.06	Yes
	24-hour	365	0.007	Yes
PM_{10}	24-hour	50	0.54	Yes
$PM_{2.5}$	24-hour	35	0.54	Yes
Lead	3-month	0.15	0.000015	Yes

Table 5-11. Event Five Maximum 1-Hour Modeled Concentrations: Health Effects Analysis

Constituent	CAS No.	AMCV?	AMCV or ESL ($\mu g/m^3$)	Maximum Modeled Impact ($\mu g/m^3$)	Modeled Impacts < AMCV or ESL?
Nonane	111-84-2	Y	16,000	3.4	Yes
Nonene	124-11-8	N	5,800	1.1	Yes
Isobutane	75-28-5	Y	78,000	0.76	Yes
Isobutene	115-11-7	Y	620,000	0.24	Yes
n-propanol	71-23-8	N	2,460	0.10	Yes
n-propanal	123-38-6	Y	1,800	0.03	Yes
sec-butanol	78-92-2	N	3,000	0.33	Yes
sec-butanone	78-93-3	Y	59,000	0.11	Yes
OMS	68551-17-7	N	3,500	3.9	Yes
Acetone	67-64-1	Y	26,000	2.4	Yes
Acetophenone	98-86-2	N	490	1.5	Yes
2-Ethyl hexanol	104-76-7	N	540	3.1	Yes
2-Ethyl hexanal	123-05-7	N	1,400	1.0	Yes
Hydrofluoric Acid	7664-39-3	N	3	0.11	Yes