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February 5, 2014

Honorable Bernice Johnson
Ranking Minority Member
House Committee on Science, Space, and Technology
Minority Office
394 Ford Office Building
Washington, D.C. 20515

Dear Ms. Bernice Johnson,

We understand that the House Committee on Science, Space, and Technology is holding a hearing on, "Examining the Science of EPA Overreach: A Case Study in Texas." We respectfully request that the Committee address some real scientific issues that directly affect the health and quality of life of communities downwind from chemical plants and refineries in Texas and other states. More specifically, an accumulation of research and data collected within the last ten years shows that the petrochemical industry releases far more pollution than is reported to the U.S. Environmental Protection Agency (USEPA), or to the Texas Commission on Environmental Quality (TCEQ) and other state agencies.

For example, the USEPA's review of emissions data from 138 refineries estimated that the industry released more than 40 million pounds of hazardous air pollutants (HAPS) in 2010 – nearly three times the 14 million pounds reported to the Toxics Release Inventory the same year.[1] According to EPA's evaluation, Texas refineries alone emitted almost 9.7 million pounds of HAPs, more than twice the amount reported to either the Toxics Release Inventory or to the state's annual emission inventory in 2010.[2] (See tables A and B). Hazardous air pollutants include benzene, a known carcinogen, and hydrogen cyanide, which the Centers for Disease Control has identified as an asphyxiant sometimes used in chemical warfare.

The EPA data was developed through an Information Collection Request to help the Agency determine whether to require additional emission controls under Section 112 of the Clean Air Act. The ICR required emissions testing for certain pollutants — like hydrogen cyanide — that are almost never actually monitored at refineries, and invited (but did not require) refineries to use enhanced protocols

[1] We compared all Hazardous Air Pollutants reported to the Refinery ICR against all Hazardous Air Pollutants reported to EPA's Toxic Release Inventory. This comparison excludes a few Clean Air Act Hazardous Air Pollutants that were included in the ICR data, but which are not listed as reportable pollutants to the Toxic Release Inventory.
[2] We compared all Hazardous Air Pollutants reported to the Refinery ICR against all Hazardous Air Pollutants reported to Texas' emission inventory database.

to estimate equipment leaks and other emission sources that are often overlooked when refineries report their emissions to the Toxics Release Inventory or to state agencies.

The discrepancy confirms results obtained in other studies that compare reported emissions to the amounts actually measured in the field. For example, a 2010 study at the Shell Deer Park refinery in Houston measured benzene and volatile organic compounds from tanks at levels ten times higher than amounts based on the "emission factors" that many refineries rely upon to report such releases. [3]Similar results were obtained at an evaluation of the BP Texas City refinery in 2009 performed by the National Physical Laboratory. Both the Texas City and the Shell Deer Park studies utilized differential absorption "Light Detection and Ranging" (LIDAR) technology that measures the concentration of various pollutants based on their light absorption capacity. We have attached an appendix that includes citations to these and other studies that the Committee might find to be of interest.

Why do these investigations find so much more pollution than refineries report? Because so many industry reports assume that operating conditions are ideal and pollution controls are working perfectly, which is far from the day to day reality at any manufacturing operation. The emission factors that are supposed to reflect leak rates for carcinogens like benzene or butadiene are rated "D" or "F," which make them useless for estimating and reporting emissions. Testing of many hazardous air pollutants (like hydrogen cyanide, in the example above) is so infrequent as to be virtually nonexistent, or is conducted under conditions designed to minimize emissions.

The existing network of air quality monitors maintained by TCEQ does not provide reliable information about the toxins that may accumulate in neighborhoods next to petrochemical plants. More accurate emissions reporting can help fill that gap, by providing information that can be used to identify and estimate the potential exposure to communities that live downwind. Better data can also help uncover cost-effective opportunities to reduce such pollution, e.g., by improving combustion efficiency and plugging leaks.

Hundreds of thousands of Americans in Texas and other states live, work, or go to school in neighborhoods right next to refineries and chemical plants, and deserve to know what they are breathing and how these chemicals may affect their health. We hope the Science Committee can help find answers to these important questions.

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[3] Emission factors are a mathematical constant (e.g. pounds per unit of fuel combusted or throughput), derived from source testing or engineering calculations, that define the relationship between emissions of a given contaminant and the amount of raw material processed, the amount of fuel burned for heat or steam and its heat value and other factors. The factors are used to estimate emissions by multiplying the emission factor constant with the process conditions it is related to.

Sincerely,

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Enclosures

cc: The Honorable Lamar Smith
Chairman on Science, Space, and Technology

Remote Sensing Studies Demonstrate that Refinery Emissions are Underestimated.

Emissions from tanks, wastewater treatment plants, and flares cannot be measured using traditional methods because the releases are not vented through a discreet point or because the conditions, like at a flare tip, make it impossible to use traditional measurement techniques. Historically, facilities have used emission factors to calculate and report these emissions. But well established remote sensing technology, including Differential Absorption LIDAR (DIAL) and Passive Fourier Transform Infrared (PFTIR), has consistently shown that these emission factors can underestimate emission factors by several orders of magnitude or more. Both DIAL and PFTIR utilize the unique spectral signature of pollutants to measure its concentration in a plume of air. The main difference between the two is that PFTIR measures the infrared light emitted by the pollution and DIAL measures how the pollution absorbs light from an external source. Emission factors are a mathematical constant (e.g. pounds per unit of fuel combusted or throughput), derived from source testing or engineering calculations, that define the relationship between emissions of a given contaminant and the amount of raw material processed, the amount of fuel burned for heat or steam and its heat value and other factors. The factors are used to estimate emissions by multiplying the emission factor constant with the process conditions it is related to.

DIAL: Three separate DIAL studies at refineries in North America have shown that emission factors for tanks, wastewater plants, flares, and several other processes significantly underestimate emissions. DIAL measures pollution by emitting a pulsed laser beam through a column of air, and measuring the light that is reflected back to a sensor. Because different compounds like benzene, ethylene, and toluene each absorb and reflect light in different amounts and at different wavelengths, the sensor is able to determine the concentration and ultimately the mass of a specific compound.

1. DIAL Measurement of Emissions at BP Texas City (EPA 2010) – available at http://www.epa.gov/ttn/atw/bp_dial_review_report_12-3-10.pdf

The National Physical Laboratory conducted a DIAL test at the BP Texas City Petroleum Refinery in 2008. EPA issued a review of the data and found emissions from several units exceeded estimated emissions calculated using emission factors:

Table 1: Comparison of DIAL Results and Estimated Emissions[1]

Source	Source Description	Compound	Average Emissions Measured Using DIAL[2] (lb/hr)	Estimated Emissions Using Standard Estimating Procedures with Actual Conditions at the Time of the DIAL Test (lb/hr)
Tanks 1020, 1021, 1024, and 1025	External Floating Roof tanks storing crude oil	VOC	6.4	1.3 - 1.9
Tanks 1052, 1053, and 1055	External Floating Roof tanks storing crude oil	VOC	16.3	1.8 - 2.3

[1] EPA, CRITICAL REVIEW OF DIAL EMISSIONS TEST DATA FOR BP PETROLEUM REFINERY IN TEXAS CITY, TEXAS, EPA 453/R-10-002, ES-2, Table 1 (Nov. 2010).

[2] *Id.* (the DIAL results are related as "Average DIAL flux lb/hr," the flux is the average emissions over a given period of time).

Source	Source Description	Compound	Average Emissions Measured Using DIAL[2] (lb/hr)	Estimated Emissions Using Standard Estimating Procedures with Actual Conditions at the Time of the DIAL Test (lb/hr)
Tanks 501, 502, 503, and 504	External Floating Roof tanks storing light distillates	VOC	8.6	3.0 - 3.9
Tank 43	Vertical Fixed Roof tank storing fuel oil #6	VOC	2	1.3
			9.3	1.3
Tanks 60, 63, 11, 12, 18, 42, 61, and 65	Vertical Fixed Roof and External Floating Roof tanks storing various products	VOC	9	0.6 - 9.1
Tanks 54, 55, 56, and 98	Vertical Fixed Roof and External Floating Roof tanks storing various products	VOC	3.1	0.3 - 9.7
Tanks 53 and 55	Vertical Fixed Roof tanks storing diesel fuel	VOC	23.8	4.8 - 5.2
F-8 EBU	Activated sludge unit	VOC	30	22 - 55
API separator	API separator	VOC	7	ND[i]
Wastewater vents	Vents from collection system	VOC	9	ND
Flare #6	Ground flare	VOC	13	17
Temporary flare	Temporary flare	VOC	6	100 – 300
ULC flare	Ultracracker flare	VOC	192	3 - 25
Coker Unit C	Coker	VOC	18	ND
Coker Unit C	Coker while cutting coke	Benzene	1.8	ND

Based on these measurements EPA concluded that:

- "For storage tanks, the average DIAL results generally are higher than [emission estimates calculated from emission factors and emission inventory reports."[3]
- "On average, the DIAL results for external floating roof tanks storing crude oil were at least 3 to 7 times higher than estimates that used conditions at the time of the DIAL testing."[4]
- "The average emissions from DIAL testing of the ultracracker flare were 6 times higher than the average hourly emission rate in the 2007 emission inventory report (192 lb/hr versus 31 lb/hr). Estimated emissions are even lower (3 lb/hr to 25 lb/hr) when using the actual flow and composition data during the DIAL test period and assuming a control efficiency of 98 percent."[5]
- "Over the three days of DIAL testing it appears the ultracracker flare efficiency was highly variable between 50 and 90 percent."[6]

[3] *Id.* at ES-1
[4] *Id.* at ES-4
[5] *Id.* at ES-5
[6] *Id*. at ES-5

2. DIAL Measurement of Emissions at Houston Ship Channel Refinery (City of Houston 2011) – available at http://www.greenhoustontx.gov/dial20110720.pdf

The City Houston conducted a comprehensive survey project regarding emissions from a combined refinery and chemical plant complex in the Houston Ship Channel area using DIAL and found:

Table 2: Comparison of DIAL measurements with estimated emissions[7]

Source	Compound	Average Emissions Measured Using DIAL (lb/hr)[8]	Estimated Emissions Using Standard Estimating Procedures with Actual Conditions at the Time of the DIAL Test (lb/hr)
Southwest Tanks A-333, A-330, A-332	VOC	20.18	2.15
Southwest Tanks A-325, A-326	VOC	13.15	0.56
South West Tanks AP-17	VOC	42.6	0.46
Southwest Tanks AP-17, AP-16	VOC	51.53	0.39
West Tanks A-310, U-324-R1	VOC	15.8	0.43
CR-3	VOC	27.37	20.67
East Tanks J-327; J-328, J-331, J-332	VOC	37.05	9.52
East Tanks J-327; J-328	VOC	18.07	0.27
East Tanks J-327, J-328, J-331, J-332	VOC	35.98	9.53
Northwest Wastewater	VOC	1192	11
Northwest Wastewater	Benzene	7.3	0.11
East Wastewater	VOC	43.35	5.88
Tanks T-OL913 and T-OL920	Benzene	19.76	2.00
ACU BEU	Benzene	16.77	3.41
ACU BEU	VOC	77.48	2.49
Tanks South of ACU BEU D-350, D-351, D-381, D-352	Benzene	41.13	0.44

Based on these findings the City of Houston Bureau of Pollution Control and Prevention concluded:

- "The survey indicates that measured emissions from process areas and tanks exceed the emission factor estimates for benzene and VOCs. . . Emission factors used to estimate emissions from the Southwest Tanks VOCs produced the most potential underestimated emissions compared to the DIAL measured emissions, off by a factor of 132. The comparison of benzene emission factor estimates to the DIAL measured emissions produced potential underestimated emissions ranging from a factor of 5 at the Aromatics Concentration Unit/Benzene Extraction Unit area, to a factor of 93 for the tanks located south of the ACU/BEU area."[9]

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[7] LOREN RAUN AND DAN W. HOYT, CITY OF HOUSTON, BUREAU OF POLLUTION CONTROL AND PREVENTION, MEASUREMENT AND ANALYSIS OF BENZENE AND VOC EMISSIONS IN THE HOUSTON SHIP CHANNEL AREA AND SELECTED SURROUNDING MAJOR STATIONARY SOURCES USING DIAL (DIFFERENTIAL ABSORPTION LIGHT DETECTION AND RANGING) TECHNOLOGY TO SUPPORT AMBIENT HAP CONCENTRATIONS REDUCTIONS IN THE COMMUNITY (DIAL PROJECT), 92-93, Table 4.4(a) (Jul. 2011) [Hereinafter Shell Deer Park DIAL Study].

[8] *See supra note* 2.

[9] Shell Deer Park DIAL Study, at 1.

- "If DIAL costs could be reduced, perhaps by having a unit built for dedicated North American service (reducing transportation and travel costs), the potential for significant savings from emissions reductions suggest that the feasibility of conducting comprehensive DIAL surveys at similar sites would significantly improve."[10]
- "Dial emissions were verified by the [open path Fourier transform infrared (FTIR) measurement] concentrations"[11]
- "DIAL was shown to be an effective technology for the measurement of mass flux from fugitive, non-point emission sources."[12]

3. DIAL Measurement of Emissions at Alberta, Canada Refinery (Alberta Research Council 2006) – on file with EIP

The Ontario Ministry of Environment and Alberta Environment contracted the Alberta Research Council to take DIAL measurements of emissions from a refinery in Alberta Canada.

Table 3: Comparison of VOC estimates and DIAL measurements[13]

	Canadian National Pollution Release Inventory 2004 (metric ton/year)	DIAL VOC Measurements (metric ton/year)
Stack or point release	98.69	Not measured
Storage or handling	153.00	5,090
Fugitive releases	407.10	4,880
Spills	11.50	Not measured
Total	670.40	9,970

Table 4: Comparison of Estimated and Measured Benzene Emissions[14]

	Canadian National Pollution Release Inventory 2004 (metric tons/y)	DIAL Measurements (metric tons/y)
Stack or point release	0.039	Not measured
Storage or Handling	0.265	25.4
Fugitive releases	1.850	14.7
Spills	0.061	Not measured
Total	2.215	40.1

[10] *Id*. at 99.
[11] *Id.* at 98.
[12] *Id.* at 1.
[13] ALLAN CHAMBERS AND MEL STROSHER, REFINERY DEMONSTRATION OF OPTICAL TECHNOLOGIES FOR MEASUREMENT OF FUGITIVE EMISSIONS AND FOR LEAK DETECTION, 17, Table. 8 (2006).
[14] *Id*. at 18, Table 9.

Based on these measurements, the report concluded:

- Emissions from storage tanks accounted for over 50% of the total site fugitive emissions of both C2+ hydrocarbons and benzene.[15]
- The coker area was responsible for over 40 % of the total site emissions of methane and was also a significant source of both C2+ hydrocarbons and benzene emissions.[16]
- The cooling towers accounted for about 13% of the sites emissions of C2+ hydrocarbons.[17]
- Based on the DIAL measurements, fugitive emissions losses of methane, C2+ hydrocarbons from the refinery surveyed represent lost revenue in the order of $3.2 million per year (assuming product value of $40/bbl)[18]

PFTIR Flaring Studies: EPA has directed several refining facilities to measure flare combustion efficiency using PFTIR. PFTIR analyzes the infrared light emitted by the gases released at the flare. Each compound emits a unique pattern of infrared light. Based on this, the analyzer can determine the concentration of carbon dioxide at the flare tip.

These tests found that adding too much steam, a common practice at refineries, reduces combustion efficiency and can even extinguish the flare. Furthermore, the steam threshold varied based on the hydrogen content, heat value, volume, and nitrogen content of the waste gas.

Table 5: Combustion Efficiency Measured at Several Flares Using PFTIR During Performance Testing.

Test Location	PFTIR Measured Combustion Efficiency	Actual Steam to Vent Gas Ratio (lb/lb)	Pages
Marathon Texas City Refinery[19]	62%	6.01	6-24 – 6-27
	62%	5.76	
	68%	5.51	
	89%	1.80	
	78%	2.00	
	82%	0.70	
Marathon Detroit Refinery[20]	81%	4.0	33
	95%	2.1	37
	91%	2.2	41
Flint Hills Resources[21]	83%	5.0	Appendix pg. 39
	89%	3.3	Appendix pg. 42
	84%	4.0	Appendix pg. 48
	79%	8.5	Appendix pg. 52

[15] *Id*. at 27
[16] *Id*.
[17] *Id*.
[18] *Id*.
[19] MARATHON PETROLEUM COMPANY, LLC, PERFORMANCE TEST OF A STEAM-ASSISTED ELEVATED FLARE WITH PASSIVE FTIR (May 2010).
[20] MARATHON PETROLEUM COMPANY, LLC, PERFORMANCE TEST OF A STEAM-ASSISTED ELEVATED FLARE WITH PASSIVE FTIR – DETROIT (Nov. 2010).
[21] FLINT HILLS RESOURCES PORT ARTHUR, LLC, PFTIR TEST OF STEAM-ASSISTED ELEVATED FLARES – PORT ARTHUR (June 2011).

Test Location	PFTIR Measured Combustion Efficiency	Actual Steam to Vent Gas Ratio (lb/lb)	Pages
	88%	6.4	Appendix pg. 57
	85%	5.2	Appendix pg. 59
Shell Deer Park[22]	57.1%	4.61	14
	79.8%	5.15	14
	87.9%	6.92	17
John Zink Test Flares[23]	75%	0.80	10
	60%	1.8	15
	87%	1.4	16

[22] SHELL GLOBAL SOLUTIONS (US) INC., SHELL DEER PARK REFINING LP DEER PARK REFINERY EAST PROPERTY FLARE TEST REPORT (Apr 2011).
[23] DAVID T. ALLEN AND VINCENT M. TORRES, TCEQ 2010 FLARE STUDY FINAL REPORT (Aug. 2011).

Table A

Refinery Emissions of Hazardous Air Pollutants, 2010 EPA Information Collection Request (ICR) Data v. Amounts Reported to Toxics Release Inventory (TRI)				
STATE	COUNTY	FACILITY NAME	ICR (lbs.)	TRI (lbs.)
AK	Fairbanks North Star Borough	Flint Hills Resources Alaska LLC.	30,840	28,126
AK	Kenai Peninsula Borough	Tesoro Alaska Petroleum Company Kenai Refinery	50,193	42,967
AL	Mobile	Shell Chemical Company	102,032	25,884
AL	Tuscaloosa	Hunt Refining Co A Corporation	44,186	42,577
AR	Union	Lion Oil Company	230,628	125,847
CA	Contra Costa	Chevron Products Co. Richmond Refinery	481,650	88,409
CA	Contra Costa	ConocoPhillips San Francisco Area Refinery At Rodeo	119,083	35,895
CA	Contra Costa	Shell Oil Products Us - Martinez Refinery	300,165	123,106
CA	Contra Costa	Tesoro Refining And Marketing	87,067	33,305
CA	Kern	Big West Oil LLC (Prev. Shell Oil Products Us)	1,604	1,350
CA	Kern	Kern Oil & Refining Company	22,286	1,640
CA	Kern	San Joaquin Refining Company Incorporated	15,428	24
CA	Los Angeles	BP Carson Refinery	231,318	72,822
CA	Los Angeles	Chevron USA Products Co.	135,412	58,365
CA	Los Angeles	ConocoPhillips Carson Plant	56,681	27,590
CA	Los Angeles	Edgington Oil Company	1,129	1,791
CA	Los Angeles	Lunday-Thagard Oil Co	1,337	1,762
CA	Los Angeles	Mobil Oil Corp	222,247	119,024
CA	Los Angeles	Paramount Petroleum Corp	4,951	2,673
CA	Los Angeles	Shell Oil Products US - Wilmington	84,190	45,568
CA	Los Angeles	Union Oil Co Los Angeles Refinery	229,957	37,224
CA	Los Angeles	Valero Refining Co. - Wilmington (Prev. Ultramar Inc.)	92,016	13,126
CA	Los Angeles	Valero Wilmington Asphalt Plant	3,426	779
CA	San Luis Obispo	ConocoPhillips Santa Maria Facility- Refinery	6,700	5,770
CA	Solano	Valero Refining Co California Benicia Refinery	243,439	180,632
CO	Adams	Suncor Denver Refinery	290,281	29,739
DE	New Castle	Valero Refining Co. (Prev. Motiva Enterprises LLC)	10,492	13,369
GA	Chatham	Citgo Asphalt Refining Company	20,878	7,196
HI	Honolulu	Chevron Products Co - Hawaii Refinery	165,094	55,113
HI	Honolulu	Tesoro Hawaii Corporation Refinery-Kapolei	54,421	62,902
IL	Crawford	Marathon Petroleum Co LLC	469,771	161,418
IL	Madison	ConocoPhillips Co Wood River Refinery	636,428	229,667
IL	Will	Citgo Petroleum Corp	230,624	39,583
IL	Will	ExxonMobil-Joliet Refinery	618,689	88,063
IN	Lake	BP Products North America Inc, Whiting Refinery	2,498,287	367,359
KS	Butler	Frontier El Dorado Refining Company	380,340	154,779
KS	McPherson	National Cooperative Refinery	142,310	226,922
KS	Montgomery	Coffeyville Resources Refining & Marketing	462,783	55,420
KY	Boyd	Marathon Ashland Petroleum/Catlettsburg	516,145	171,967
KY	Pulaski	Somerset Refinery	381	3,723

Refinery Emissions of Hazardous Air Pollutants, 2010 EPA Information Collection Request (ICR) Data v. Amounts Reported to Toxics Release Inventory (TRI)				
STATE	COUNTY	FACILITY NAME	ICR (lbs.)	TRI (lbs.)
LA	Bossier Parish	Calumet Lubricants Co. LP - Princeton	11,690	7
LA	Caddo Parish	Calumet Shreveport Lubricants And Waxes LLC/Shreveport Refinery	182,792	112,546
LA	Calcasieu Parish	Calcasieu Refining Co	28,846	28,678
LA	Calcasieu Parish	Citgo Petroleum Corporation	1,477,331	363,026
LA	Calcasieu Parish	ConocoPhillips Co - Lake Charles Refinery	356,412	141,923
LA	Calcasieu Parish	Pelican Refining Company	1,964	1,695
LA	East Baton Rouge Parish	ExxonMobil Baton Rouge	799,473	581,193
LA	Plaquemines Parish	BP Oil Company Alliance Refinery	397,561	144,673
LA	St. Bernard Parish	ExxonMobil Refinery Complex	550,364	267,754
LA	St. Bernard Parish	Murphy Oil USA Inc Meraux Terminal	293,774	67,038
LA	St. Charles Parish	Motiva Enterprises LLC - Norco Refinery	449,819	188,452
LA	St. Charles Parish	Valero Saint Charles Refinery	136,380	39,934
LA	St. James Parish	Motiva Enterprises LLC/Convent Refinery	80,054	93,046
LA	St. John the Baptist Parish	Marathon Ashland Petroleum LLC	232,304	251,351
LA	St. Landry Parish	Valero Refining Co/Krotz Springs Refinery	300,631	50,317
LA	Webster Parish	Calumet Lubricants Co - Cotton Valley Refinery	31,597	34,913
LA	West Baton Rouge Parish	Placid Refining Co LLC/Port Allen Refinery	407,261	28,523
MI	Wayne	Marathon Ashland Petroleum	279,723	129,753
MN	Dakota	Flint Hills Resources LP	497,738	147,934
MN	Washington	Marathon Petroleum Co LLC Saint Paul Park Refiner	129,694	105,947
MS	Jackson	Chevron Texaco Products Company, Pascago	2,262,522	544,790
MS	Jones	Hunt Southland Refining Company	12,749	26,692
MS	Warren	Ergon Refining Inc	26,193	39
MT	Cascade	Montana Refining Company	25,217	114,125
MT	Yellowstone	Cenex Inc Laurel Refinery	1,717,732	93,779
MT	Yellowstone	Conoco Incorporated Refinery	846,343	58,903
MT	Yellowstone	Exxon Billings Refinery	370,464	64,532
ND	Morton	Tesoro - Mandan	641,176	376,658
NJ	Gloucester	Citgo Asphalt Refining Company	47,495	41
NJ	Gloucester	Valero Refining Co	515,157	194,795
NJ	Middlesex	Amerada Hess Corp Packaging	60,006	34,890
NJ	Middlesex	Chevron Products Company	2,944	103

Refinery Emissions of Hazardous Air Pollutants, 2010 EPA Information Collection Request (ICR) Data v. Amounts Reported to Toxics Release Inventory (TRI)				
STATE	COUNTY	FACILITY NAME	ICR (lbs.)	TRI (lbs.)
NJ	Union	Bayway Chemical Plant Of Infineum USA	231,184	53,921
NM	Eddy	Navajo Refining Co. - Artesia	280,759	263,026
NM	Lea	Navajo Refining Co. - Lovington	5,830	20,802
NM	McKinley	Giant Refining Co. - Ciniza Refinery	62,146	114,162
NV	Nye	Eagle Springs Refinery	12,027	2,762
OH	Allen	Valero Refining Co. (Prev. Premcor Refining Group)	80,916	96,904
OH	Lucas	BP Oil Company Toledo Refinnery	423,846	128,529
OH	Lucas	Sunoco Inc. Toledo Refinery	147,690	37,294
OH	Stark	Marathon Petroleum Company LLC, Canton Refinery	148,366	44,795
OK	Carter	Valero Refinery Co/Ardmore Refinery	102,846	49,611
OK	Garvin	Wynnewood Refining Co	151,817	70,300
OK	Kay	ConocoPhillips Co Ponca City Refinery	278,755	266,613
OK	Tulsa	Sinclair Oil Tulsa Refining Tulsa Trucking	99,467	106,575
OK	Tulsa	Sunoco Pipeline LP - Sunoco Ballinger - Coleman County TX	58,949	59,509
PA	Delaware	ConocoPhillips Co. Trainer Refinery	128,488	29,896
PA	Delaware	Sunoco Marcus Hook Refinery	468,009	92,270
PA	McKean	American Refining Group Inc	308,623	184,971
PA	Philadelphia	Sunoco Girard Point Refinery	806,551	216,691
PA	Warren	United Refining Co/Warren Plant	108,134	35,911
TN	Shelby	Valero Refining Co. (Prev. Premcor Refining, Prev. Williams Refining LLC)	165,377	39,218
TX	Bexar	AGE Refining & Manufacturing	26,591	22,278
TX	Brazoria	Phillips 66 Company Sweeny Complex	309,991	187,676
TX	El Paso	El Paso Refinery	339,448	78,297
TX	Galveston	BP Texas City Refinery	2,015,283	464,888
TX	Galveston	Marathon Ashland Petroleum Co LLC	78,478	77,590
TX	Galveston	Valero Refining Co. Texas	124,613	71,086
TX	Harris	Channel Energy Energy	130,543	140,449
TX	Harris	ExxonMobil Ref & Supply	1,261,229	929,150
TX	Harris	Pasadena Refining System PRSI West Demolition Project	213,320	211,468
TX	Harris	Shell Oil Deer Park	176,583	145,800
TX	Harris	Valero Refining Houston Refinery	98,051	32,480
TX	Howard	Fina Oil & Chemical	117,854	90,334
TX	Hutchinson	ConocoPhillips Co. - Borger (Prev. Phillips 66 Co.)	427,432	355,881
TX	Jefferson	ExxonMobil Oil Beaumont Refinery	802,966	422,979
TX	Jefferson	Port Arthur Refinery	200,413	28,719
TX	Jefferson	Total Petrochemicals USA Inc. - Port Arthur Refinery	394,259	75,011
TX	Jefferson	Valero Refining Co. - Port Arthur (Prev. Premcor Refining Group Inc.)	576,442	54,649
TX	Live Oak	Valero Three Rivers Refinery	128,891	78,408

Refinery Emissions of Hazardous Air Pollutants, 2010 EPA Information Collection Request (ICR) Data v. Amounts Reported to Toxics Release Inventory (TRI)				
STATE	**COUNTY**	**FACILITY NAME**	**ICR (lbs.)**	**TRI (lbs.)**
TX	Moore	Valero Energy Corp. - Mckee (Prev. Diamond Shamrock Refining)	119,069	45,825
TX	Nueces	Citgo East Plant Refinery	310,309	68,617
TX	Nueces	Citgo Refining & Chemicals Co LP	5,189	8,066
TX	Nueces	Flint Hills Resources LP - West Plant	723,633	239,000
TX	Nueces	Koch Refining Company	194,625	38,064
TX	Nueces	Trigeant Ltd	604	12
TX	Nueces	Valero Refining - Texas L.P.	226,591	81,831
TX	Nueces	Valero Refining Texas LP Corpus Christi East Plant	192,420	135,348
TX	Smith	Delek Tyler Refinery	53,474	50,182
UT	Davis	Big West Oil Co. (Flying J)	91,046	35,497
UT	Davis	Holly Refining & Marketing, Fka Phillips 66 Company	35,175	38,510
UT	Davis	Silver Eagle Refining	146,764	5,126
UT	Salt Lake	Chevron USA Products Company	154,632	64,480
UT	Salt Lake	Tesoro - Salt Lake City	251,408	57,172
VA	York	Giant Yorktown Refinery	66,997	71,267
VI	St. Croix	Hovensa LLC	1,877,381	274,369
WA	Pierce	U.S. Oil & Refining Co.	179,159	31,798
WA	Skagit	Anacortes Refinery Tesoro Northwest Company	265,146	80,028
WA	Skagit	Shell Oil Anacortes Refinery	59,814	19,945
WA	Whatcom	BP West Coast Products - Cherry Point	365,646	88,475
WA	Whatcom	ConocoPhillips Co Ferndale Refinery	169,066	66,284
WI	Douglas	Murphy Oil USA, Inc., Superior Refinery	99,609	16,973
WV	Hancock	Ergon - West Virginia, Inc.	80,821	4,973
WY	Carbon	Sinclair Oil Corporation	299,902	139,586
WY	Laramie	Frontier Refining Inc.	52,952	64,569
WY	Natrona	Little America Refining Co. (Sinclair)	155,030	35,565
WY	Uinta	Silver Eagle Refining-Evanston	33,538	4,832
WY	Weston	Wyoming Refining Company	7,820	11,401
TOTAL		**Number of Facilities: 138**	**40,178,281**	**14,230,225**

Source: EPA Petroleum Refinery ICR, Emission Inventory Data. http://www.epa.gov/ttn/atw/petref/petrefpg.html;
EPA Toxics Release Inventory 2010. http://www2.epa.gov/toxics-release-inventory-tri-program/tri-basic-data-files-calendar-years-1987-2012

Table B

Refinery Emissions of Hazardous Air Pollutants, 2010 EPA Information Collection Request (ICR) Data v. Amounts Reported to TCEQ's Point Source Emissions Inventory (TX EI)				
STATE	**COUNTY**	**FACILITY NAME**	**ICR (lbs.)**	**TX EI (lbs.)**
TX	Bexar	AGE Refining & Manufacturing	26,692	4,739
TX	Brazoria	Phillips 66 Company Sweeny Complex	310,381	59,307
TX	El Paso	El Paso Refinery	343,099	87,494
TX	Galveston	Bp Texas City Refinery	2,192,037	541,377
TX	Galveston	Marathon Ashland Petroleum Co LLC	79,531	67,598
TX	Galveston	Valero Refining Co. Texas	127,536	78,657
TX	Harris	Channel Energy Energy	130,504	117,233
TX	Harris	ExxonMobil Ref & Supply	1,277,989	1,006,101
TX	Harris	Pasadena Refining System PRSI West Demolition Project	219,140	206,894
TX	Harris	Shell Oil Deer Park	178,453	468,796
TX	Harris	Valero Refining Houston Refinery	99,329	35,744
TX	Howard	Fina Oil & Chemical	117,895	112,872
TX	Hutchinson	ConocoPhillips Co. - Borger (Prev. Phillips 66 Co.)	438,963	376,036
TX	Jefferson	ExxonMobil Oil Beaumont Refinery	900,637	372,842
TX	Jefferson	Port Arthur Refinery	205,725	59,604
TX	Jefferson	Total Petrochemicals USA Inc. - Port Arthur Refinery	396,892	30,089
TX	Jefferson	Valero Refining Co. - Port Arthur (Prev. Premcor Refining Group Inc.)	580,304	61,413
TX	Live Oak	Valero Three Rivers Refinery	134,033	81,101
TX	Moore	Valero Energy Corp. - Mckee (Prev. Diamond Shamrock Refining)	123,815	49,380
TX	Nueces	Citgo East Plant Refinery	310,309	104,045
TX	Nueces	Citgo Refining & Chemicals Co LP	5,189	5,309
TX	Nueces	Flint Hills Resources LP - West Plant	800,167	264,288
TX	Nueces	Koch Refining Company	205,939	46,222
TX	Nueces	Trigeant Ltd	604	2,494
TX	Nueces	Valero Refining - Texas L.P.	235,709	168,486
TX	Nueces	Valero Refining Texas LP Corpus Christi East Plant	193,234	134,329
TX	Smith	Delek Tyler Refinery	54,476	48,673
TOTAL		**Number of Facilities: 27**	**9,688,583**	**4,591,123**

Source: EPA Petroleum Refinery ICR, Emission Inventory Data. http://www.epa.gov/ttn/atw/petref/petrefpg.html;
Texas State Emission Inventory 2010, on file with EIP, available upon request.