CITY OF PHILADELPHIA
Department of Public Health
Environmental Protection Division
Air Management Services

InterOffice Memo

To: File

From: Laura Nikkel-Dumyahn

Date: August 10, 2015

Subject: 1997 8-Hour RACT Analysis for Plains Products Terminals LLC

Introduction:

The Clean Air Act (CAA) requires that moderate (or worse) ozone nonattainment areas implement reasonably available control technology (RACT) controls on all major sources of Volatile Organic Compounds (VOC) and Nitrogen Oxides (NOx). Philadelphia County is part of the Philadelphia-Wilmington-Atlantic City moderate ozone nonattainment area for the 1997 8-hour ozone NAAQS. This document presents the findings of a RACT evaluation for the 1997 8-hour ozone standard for this facility.

Company Description:

The two adjacent bulk liquid storage and distribution terminals formerly known as Maritank and Exxon Mobil are now under one owner, Plains Products Terminals LLC (PPT). The terminals are now operated as one facility because they are contiguous and under a common owner.

Applicability for NOx and VOC RACT:

Plains Products Terminals LLC is not a major source of NOx having potential NOx emissions less than 100 tons per year, the major source threshold in Philadelphia County that is applicable to NOx RACT for the 1997 8-hour ozone NAAQS.

Plains Products Terminals LLC is a major source of VOC having potential VOC emissions greater than 50 tons per year, the major source threshold in Philadelphia County that is applicable to VOC RACT for the 1997 8-hour ozone NAAQS.

Plains Products Terminals LLC is subject to the 1-hour RACT for VOC, per the 1-hour RACT Plan Approvals approved under the facility's previous names: "Maritank Philadelphia, Inc." Permit # PA-51-5013 (presently, the North Terminal) effective on December 28, 1995 and "Exxon Company" Permit # PA-51-5008 (presently, the South Terminal) effective May 29, 1995, both approved by EPA into the Pennsylvania State Implementation Plan (SIP) on October 31, 2001 (66 FR 54947 and 66 FR 54936, respectively).

Process Descriptions:

The facility's air emissions sources contributing to VOC emissions include the following:
North Terminal

- One (1) 20 MMBTU/hr thermal fluid heater;
- One (1) 4.74 MMBtu/Hr boiler;
- 3 petroleum/organic products storage tanks, each with a capacity greater than or equal to 40,000 gallons;
- 7 petroleum/organic products storage tanks each with a capacity less than or equal to 40,000 gallons;
- Truck loading process at North Terminal Rack;
- Two (2) recovery tanks, each with a capacity of 8,814 gallons, that store #2 oil and #6 oil recovered from a water remediation process. Materials are loaded from the tanks into trucks a few times per year.
- Non-gasoline marine loading of petroleum/organic products with a Reid Vapor Pressure (RVP) of less than 4.0;

South Terminal

- Six (6) 0.25 MMBTU/hr space heating units (listed as "insignificant sources" on Title V Operating Permit V10-025);
- 10 petroleum/organic products storage tanks each with a capacity greater than or equal to 10,566 gallons;
- Fugitive emissions from light liquids and gasoline from pumps, valves, & flanges;

- 23 storage tanks each with a capacity each less than 4,725,000 gallons (listed as "insignificant sources" on Title V Operating Permit V10-025);
- Tank cleaning and repair (listed as "insignificant sources" on Title V Operating Permit V10-025);
- Lubricity additive systems, one at the North Terminal and one at the South Terminal (both listed as "insignificant sources" on Title V Operating Permit V10-025);
- Truck loading process at South Terminal Rack.

The facility's control devices, which are used for emissions from truck loading, include the following:

- One (1) Vapor Incinerator (at North Terminal loading rack)
- One (1) Carbon Absorption Vapor Recovery Unit equipped with two (2) carbon beds (at South Terminal loading rack)

RACT Evaluation

At the time of the 1-hour ozone RACT determination, the following sources were existing and evaluated in Maritank: Shore tank cleaning; fugitive emission from valves, flanges, and pumps; marine vessel loading; barge cleaning plant; washwater treatment system; two #2 fuel oil fired boilers as part of heating system, Boiler A (30 MMBTU/hr) and Boiler B (7 MMBTU/hr); truck loading operations connected to five recovery tanks.

There were five recovery tanks identified in the 1999 RACT plan. These tanks stored material from the barge cleaning plant. The material was loaded from the tanks into trucks and hauled away a few times per year. This material had a RVP above 4, according to the 1-hour RACT proposal, as required by 25 Pa Code Section 129.60(c).

Since then, three of the tanks have been removed. The remaining two tanks are currently storing recovered #2 and #6 oil from historic groundwater remediation. The recovered oil is loaded into trucks a few times per year. Since both materials have a RVP < 4.0 vapor recovery is no longer required by regulation and the PTE from both storage and loading are well below 1 tpy VOC without vapor recovery. As a result, AMS has determined the source de minimis, maintaining vapor recovery technically and economically unreasonable, and is removing the requirement from the RACT plan approval.

Case-by-case VOC RACT was approved into the RACT Permit # PA-51-5013 for Maritank issued 12/28/95 for the fugitive emissions, dock transfer station (where currently marine loading operations take place), the two #2 fuel oil fired boilers, and the truck loading operations.

At the time of the 1-hour ozone RACT determination for Exxon, RACT for fugitive emissions from pumps, valves, and flanges was evaluated and approved into the RACT Permit # PA-51-5008 issued on 5/29/95.

The following 1-hour RACT sources have been shut down:

- Barge cleaning activity
- Water treatment plant
- Shore tank cleaning

Additionally, Boilers A and B (30 MMBTU/hr and 7 MMBTU/hr, respectively) addressed under 1-hour RACT were replaced in 2009 by two new boilers of 20 MMBtu/Hr and 4.74 MMBtu/Hr, respectively.

Presumptive RACT:

The following sources are covered by presumptive RACT provisions of 25 PA Code 129.93, as specified in the "Regulation" column of the tables below.

Boilers

Unit	Heat Input (BTU/hr.)	Fuel Burned	Regulation
CU-2 Thermal Fluid Heater B	20,000,000	No. 6 oil, No. 4 oil, No. 2 oil & Natural Gas	25 PA Code 129.93(b)(2)
CU-3 Boiler (IP No. 12145)	4,740,000	No. 2 & Natural Gas	25 PA Code 129.93(c)(1)

These boilers replaced Boilers A and B (30 MMBTU/hr and 7 MMBTU/hr, respectively), which were addressed in the 1-hour RACT Plan Approval. Both replacement boilers are applicable to Presumptive RACT regulations.

For the one (1) 20 MMBtu/Hr boiler, the presumptive RACT requirement is the performance of annual adjustments or tune-ups of the boiler, and keeping corresponding records. For the one (1) 4.74 MMBtu/Hr boiler, the presumptive RACT requirement is the installation, operation, and maintenance of the boiler as per the manufacturer's specifications.

Space Heating Units

Unit	Heat Input (BTU/hr.)	Regulation
6 Space Heating Units	Each < 250,000	25 PA Code 129.93(c)(1)

For the six (6) < 250,000 Btu/Hr boiler, the presumptive RACT requirement is the installation, operation, and maintenance of the boiler as per the manufacturer's specifications.

Fugitive Emissions (both North and South terminals)

Unit	Description	Regulation
Fugitive Emissions	From pumps, valves & flanges: Light liquids, Gasoline	AMR V, Section XIII

Fugitive process emission leaks are covered by the regulation, AMR V, Section XIII. As per AMR V Section XIII(1), no person shall cause, suffer, allow or permit volatile organic compounds (VOC) to be emitted from leaking flanges, gaskets, seals, connections, joints, fittings or other process equipment components not involving moving parts, nor shall any person cause, suffer, allow or permit VOC to be emitted from leaking valves, pumps, compressors, safety pressure relief devices or other process equipment components involving moving parts such that:

- The VOC emission from any leaking process equipment component results in a VOC in air concentration of 10,000 parts per million by volume (ppmv), or greater, when measured by test methods approved by the Department.

Additionally, under the SIP-approved 1-hr RACT plan approval, the facility is required to monitor, detect, and repair leaks from all valves, pumps, and flanges processing all liquids, including non-VOC liquids. The SIP-approved 1-hr RACT plan approval includes the following conditions:

- *Condition 2A:*
    - "The facility will implement quarterly visible leak detection and repair (LDAR) program for all pumps, valves, and flanges in VOC service."

Since AMR V, Section XIII has specific leak thresholds, AMS finds it is more stringent than the LDAR requirement approved as 1-hour RACT. Thus, the requirements in AMRV Section XIII will supersede the LDAR requirements, specified in the SIP. Consequently, AMS proposes to revise the existing requirements in the SIP for fugitive emissions to "shall comply with AMR V Section XIII."

CTG RACT [i.e. Applicable to EPA Control Technique Guideline (CTG)]:

The following sources are covered by regulations approved in the SIP to address RACT consistent with EPA's Control Technique Guidelines (CTGs), or CTG RACT regulations, as specified in the "CTG RACT Regulation" column of the table below:

13 Storage Tanks with capacities ≥ 40,000 gallons and containing VOCs with vapor pressure > 1.5 psi

Unit	Description	Capacity (Gallons)	CTG RACT Regulation
T-7	Tank #15006 *(≥ 10,566 gallons)*	4,725,000	25 PA Code 129.56
T-8	Tank #4007 *(≥ 10,566 gallons)*	1,260,000	25 PA Code 129.56
T-12	Tank #4511 *(≥ 10,566 gallons)*	1,417,500	25 PA Code 129.56
P60(S)	Storage Tank #5460 *(≥ 10,566 gallons)*	2,279,802	25 PA Code 129.56
P65(S)	Storage Tank #1965 *(≥ 10,566 gallons)*	817,572	25 PA Code 129.56
P68(S)	Storage Tank #6768 *(≥ 10,566 gallons)*	2,752,218	25 PA Code 129.56
P69(S)	Storage Tank #4069 *(≥ 10,566 gallons)*	1,664,082	25 PA Code 129.56
P70(S)	Storage Tank #6070 *(≥ 10,566 gallons)*	2,482,788	25 PA Code 129.56
P71(S)	Storage Tank #9771 *(≥ 10,566 gallons)*	3,975,132	25 PA Code 129.56
P72(S)	Storage Tank #6072 *(≥ 10,566 gallons)*	2,588,334	25 PA Code 129.56
P73(S)	Storage Tank #6073 *(≥ 10,566 gallons)*	2,516,724	25 PA Code 129.56
P7(S)	Storage Tank #6073 *(≥ 10,566 gallons)*	2,253,132	25 PA Code 129.56
P8(S)	Storage Tank #5407 *(≥ 10,566 gallons)*	2,256,224	25 PA Code 129.56

For the thirteen (13) storage tanks with capacities greater than 40,000 gallons, since each unit stores petroleum/organic products with a vapor pressure ≤ 11 psi, the RACT requirement is the installation of an external or an internal floating roof, in accordance with 25 PA Code 129.56(a)(1).

Case-by-Case RACT Analysis:

Marine Loading (North Terminal)
Marine loading was referred to as the dock transfer station in the 1-hour RACT plan approval. For the marine loading process, the facility was required to cease loading of gasoline after September 28, 1994, per the 1-hour RACT plan approval for Maritank. By definition, under 25 PA Code 121.1, gasoline is any petroleum distillate having a Reid vapor pressure (RVP) of 4 pounds per square inch (psi) (28 kilopascals) or greater and which is a liquid at standard temperature and pressure. Thus, AMS interprets this requirement to restrict marine loading of any organic liquids with RVP ≥ 4.0 psi.

Number 2 Fuel Oil is the highest VOC emitting material that is loaded at the marine loading station, so emissions calculations are based on the AP-42 loading loss factor of 2.6 lb/1000 gal for No. 2 Oil, calculated using the saturation factor table and loading loss equation in Chapter 5 of AP-42 Manual. The maximum number of hours per year experienced for marine loading operations is 4,380 hours due to the process of ships entering, exiting, and connecting to the loading dock. Therefore, the potential emissions from marine loading are 6.6 tpy. To determine RACT, AMS evaluated the feasibility of adding each of the following available VOC controls on the marine loading operations: thermal oxidation, carbon adsorption, bioreactor, wet scrubbers, and condensation via refrigeration.

<u>Technical Feasibility:</u>

Thermal Oxidation- Technically Feasible
Thermal Oxidation is a process in which the hydrocarbons in a gas stream are combusted to form carbon dioxide and water at an elevated temperature. Thermal Oxidation efficiency is governed by temperature, time, and turbulence. To achieve effective combustion, the organic must be raised 100°F or more above its ignition temperature and held at that temperature for 0.3 to 1.0 seconds. In addition, the stream must be sufficiently mixed for good oxidation to occur. An auxiliary fuel is required to ensure the temperature is maintained for proper combustion. There are essentially two types of incinerators: thermal and catalytic. Each type is considered <u>*technically feasible*</u> for the marine loading operation. However, for cost analysis purposes, only thermal incineration is considered since the relative loss of the two are similar.

Carbon Adsorption- Technically Feasible
Adsorption is an emission control technology in which the contaminant gas stream passes though a bed of solid particles and then diffuses from the gas to the bed and is held onto the media by attractive forces. The adsorptive capacity of the solid for the gas tends to increase with the gas phase concentration, molecular weight, diffusivity, polarity, and boiling point. Typical adsorbent media in use include activated carbon, silica gel, activated alumina, synthetic zeolites, fuller's earth, and other clays. Of these choices, this RACT analysis considers only the use of activated carbon because it is a commonly used adsorbent for VOCs. Carbon adsorption is considered *technically feasible* for the marine loading operation.

Bioreactor- Technically Infeasible
There are several different types of bioreactors from soil beds or bio-filters to bio-trickling filters and bio-scrubbers. Typically used for odor control, bioreactors can be used to oxidize VOCs. For a bioreactor to be effective, the contaminant stream needs to be consistent in composition and maintained above 60°F. The marine vessel operation at Plains is not continuous and the site average annual temperature is below 60°F (i.e. 54-56°F), so this control option is considered *technically infeasible* based on the batch nature of the loading process and the site average temperature.

Wet Scrubbers- Technically Infeasible
Wet scrubbers use absorption to remove pollutants from a gas stream into a liquid stream. In the absorption process, the organics in the gas stream are dissolved into a liquid solvent. The limiting factors as a primary control technique involve the availability of a suitable solvent and the solubility of the organic. To control emissions from marine loading, the terminal would require a nonvolatile organic solvent. In addition, the sizing of the scrubber and footprint for support equipment (circulation pumps, blowers, and scrubbing liquid storage and blowdown system for refresh of the scrubber liquid) and the possible need for redundancy would be a major design consideration for the limited space of the dock area. Based on these considerations, this control option is considered *technically infeasible*.

Condensation- Technically Infeasible
Refrigeration units are basically "heat pumps," absorbing heat on the "cold side" of the system and releasing heat on the "hot side" of the system.
A refrigerated condenser is a viable control option if:

- the air stream is saturated with the organic compound
- the organic vapor containment system limits air flow
- required air flow does not overload a refrigeration system with heat
- only one organic compound is emitted

In addition to the fact that the marine vessel loading operation may handle multiple compounds and the air stream is only considered to be 50 percent saturated, refrigerated units have extensive energy requirements, are unreliable, and may require additional controls due to low efficiencies. Based on these considerations, refrigerated condensation is considered *technically infeasible*.

In conclusion, AMS only found thermal oxidation and carbon adsorption to be technically feasible options for controlling VOC emissions of marine loading at Plains Product Terminal.

Cost Feasibility:

The following table summarizes the estimated control effectiveness for the technically feasible controls:

Control	VOC Emissions (tpy)	Estimated Control Effectiveness	VOC Reduction (tpy)	Total Annualized Cost (per year)	Cost Effectiveness (per ton)
Thermal Oxidation	6.6	98%	6.5	$727,094.44	$110,165.82
Carbon Adsorption	6.6	95%	6.3	$132,774.58	$20,117.36

A breakdown of the costs for these two options can be found in Appendix A.

AMS therefore determines that no available controls are technically or economically reasonable as RACT for marine vessel loading. In addition to the existing RACT requirements, including the prohibition of loading gasoline, AMS is proposing an emissions limit of 6 tpy VOC from marine vessel loading of liquids with RVP greater of equal to 4 psi to represent VOC RACT under the 1997 8-hour ozone standard for the marine vessel loading operations in Plains Products Terminals.

Tank Cleaning and Repair
The tanks are degassed approximately every 10 years and the degassing occurs for about 24 hours for out of service inspections. Only a few of the tanks are degassed at the same time. Using a methodology from the San Diego Air Pollution Control District to calculate emissions from this process, the highest annual VOC emissions from degassing are 9.27 tons per year. For Plain Products, degassing of three of its tanks is schedule to occur in 2021.

Tank cleaning PTE calculations for Year 2021:

Tank #	Capacity (bbls)	Product Stored	Tank Diameter	Degassing Emissions (tons)
15003	150000	gas going to Asphalt	48x150	5.25
5460	54000	ethanol	48x90	1.90
6072	60000	gasoline	48x95	2.12
				SUM: 9.27

Thermal oxidation could be used to control emissions to 90% effectiveness. The cost to control these emissions is $30,000 per tank per event based on a vendor quote. The cost to control these degassing events during a particular year is $90,000 (as three tanks will be scheduled for cleaning). The cost effectiveness to control these emissions is $9,700 per ton. Thus it is not cost effective to control the degassing emissions under RACT.

De Minimis Sources:

23 Storage Tanks (each with a capacity each less than 4,725,000 gallons)
Each of the tanks has a PTE of less than 1.0 tpy of VOC. Based on AMS permitting and engineering knowledge, AMS determines that installing any control technology on such small sources is both technically and economically unreasonable.

Truck Loading (both North and South terminals, formerly only Maritank)
Truck loading now occurs at both the North and South Terminals. Truck loading had previously only occurred at the North Terminal, but now there are truck loading operations at the South Terminal as well since Plains' acquisition of the property. Truck loading occurs at the racks, but no longer occurs at the recovery tanks.

The South Terminal has a 200 million gallons per rolling 12-month limit on distillate loading, which results in a PTE of less than 2.1 tpy VOC emissions. The North Terminal truck loading has a 101 million gallons per rolling 12-month limit on distillate loading, which results in a PTE of less than 1.1 tpy VOC emissions. Based on AMS permitting and engineering knowledge, AMS determines that installing any control technology on such small sources is both technically and economically unreasonable.

Lubricity Additive System North Terminal Rack and Lubricity Additive System South Terminal Rack
The lubricity additive systems each have a PTE less than 1.0 tpy of VOC. Based on AMS permitting and engineering knowledge, AMS determines that installing any control technology on such small sources is both technically and economically unreasonable.

Storage Tanks with capacities ≤ 40,000 gallons and containing VOCs with vapor pressure > 1.5 psi
For the two (2) storage tanks with capacities of 8,814 gallons storing recovered #2 and #6 oil from historic groundwater remediation, the PTE from both storage and loading are well below 1 tpy VOC. Based on AMS permitting and engineering knowledge, AMS determines that installing any control technology on such small sources is both technically and economically unreasonable.

Conclusions and Recommendations:

The two RACT permits for the former Maritank (Permit # PA-51-5013) and Exxon (Permit # PA-51-5008) will be replaced with one permit for Plains Products Terminals, the current owner. Air Management Services proposes that compliance with AMR V, Section XIII represent VOC RACT under the 1997 8-hour ozone standard for the fugitive emissions in Plains Products Terminals LLC. The quarterly LDAR program is removed. The marine loading will continue to be limited to less than 4 RVP organic liquids loading and is now subject to a limitation of 6.6 tpy VOC emissions. All other significant VOC emitting sources are either covered by presumptive RACT, are applicable to CTG regulations, or are determined to be de minimis. The vapor recovery requirement from the recovery tanks is being removed. All shut down sources are being removed.

8/10/15

Edward Wiener, Chief of Source Registration **Date**

Appendix A

The following are the cost analyses for the two feasible control options for marine vessel loading emissions, thermal oxidation and carbon adsorption:

Thermal Oxidation – Total Capital Investment

Direct Cost	
Purchased Equipment	$710,510.00
Instrumentation	-
Sales Tax	$42,630.60
Freight	$35,525.50
Purchased Equipment Cost	**$788,666.10**
Direct Installation Cost	
Foundations & supports	$63,093.29
Handling & erection	$110,413.25
Electrical	$31,546.64
Piping	$15,773.32
Insulation for ductwork	$7,886.66
Painting	0
Direct installatoin costs	**$228,713.16**
Site Preparation	$7,886.66
Total Direct Cost	$1,025,265.92

Thermal Oxidation – Total Annual Cost

Hours of operation		4380	
Direct Annual Costs			
Operating Labor	0.5 hrs/shift @ $18/hr	$	4,927.50
Supervisor 15% of operator		$	739.13
Operating Materials -			
Maintenance			
Labor 0.5 hr/shift $25/hr		$	6,843.75
Materials 100% of maintenance labor		$	6,843.75
Natural Gas	1.16 per therm	$	480,135.60
Electrcity	0.162/kwh	$	387.97
Total		**$**	**499,877.70**
Indirect Annual Cost			
Overhead 60% of sum of operating supervisor, & maintenance labor & maintenance materials		$	11,612.48
Administrative Charges 2% TCI - 9,650 17,800			$24,914.12
Property Taxes 1% TCI - 4,830 8,900			$12,457.06
Insurance 1% TCI - 4,830 122,700			$12,457.06
Capital recovery (7% over 10 years)			$177,388.50
Total IAC			**$227,216.74**
Total Annual Cost			**$727,094.44**

Thermal Oxidation – Cost Summary

Control Device	Total Capital Investment	Annual Operating Cost
Thermal Oxidation	$ 1,245,705.77	$ 727,094.44

Based on a vendor quote for another project, the capital cost for the incinerator is estimated to be $1,245,705.77 and the annual operating costs are $727,094.44 per year. Thermal oxidation would cost $110,165.82 per ton of VOC.

Carbon Adsorption – Total Capital Investment

Direct Cost			
Purchased Equipment	$29,000.00	(Two 2,000 lb units)	EPA Cost Control Manual
Instrumentation	$2,900.00		
Sales Tax	$1,740.00		
Freight	$1,450.00		
Purchased Equipment Cost	**$32,190.00**		
Direct Installation Cost			
Foundations & supports	$2,575.20		
Handling & erection	$4,506.60		
Electrical	$1,287.60		
Piping	$643.80		
Insulation for ductwork	$321.90		
Direct installation costs	**$9,335.10**		
Site Preparation	**$3,219.00**		
Total Direct Cost	**$44,744.10**		
Indirect Cost			
Engineering	$3,219.00		
Construction and field expenses	$1,609.50		
Contractor fees	$3,219.00		
Start-up	$643.80		
Contingency	$8,047.50		
Performance test	$7,500.00		
Total Indirect Cost	**$24,238.80**		
Total Capital Investment, TCI	**$68,982.90**		

Carbon Adsorption – Total Annual Cost

Hours of operation	4380		
Direct Annual Costs			
Operating Labor	0.5 hrs/shift @ $18/hr	$	4,927.50
Supervisor 15% of operator		$	739.13
Operating Materials -			
Maintenance			
Labor 0.5 hr/shift $25/hr		$	6,843.75
Materials 100% of maintenance labor		$	6,843.75
Carbon Replacment/Disposal		$	100,450.00
Electricity	0.162/kwh	$	387.97
Total		**$**	**120,192.10**
Indirect Annual Cost			
Overhead 60% of sum of operating supervisor, &		$	11,612.48
Administrative Charges 2% TCI - 9,650 17,800			$1,379.66
Property Taxes 1% TCI - 4,830 8,900			$689.83
Insurance 1% TCI - 4,830 122,700			$689.83
Capital recovery (7% over 10 years)			$9,823.16
Total IAC			**$12,582.48**
Total Annual Cost			**$132,774.58**

Carbon Adsorption – Cost Summary

Control Device	Total Capital Investment	Annual Operating Cost
Carbon Adsorption	$ 68,982.90	$ 132,774.58

Based on the EPA Cost Control Manual, the capital cost for purchased carbon is estimated to be $68,982.90 and the annual operating costs are $132,774.58 per year. The cost per ton or VOC is $20,117.36/ton.

Based on the current permitted values, the technically feasible controls for marine loading are not cost effective and thus no control device is required.