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

InterOffice Memo

To: File

From: Noelle Helmstetter and Maryjoy Ulatowski

Date: August 10, 2015

Subject: 1997 8-Hour RACT Analysis for Kinder Morgan Liquids Terminals, LLC - Philadelphia Terminal

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Table of Contents

I. 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.

II. Company Description:

Kinder Morgan Liquids Terminals (KMLT), LLC owns and operates as a bulk liquid terminal that warehouses a variety of products/chemicals/materials based on customer's demand. The materials/chemicals are in-bounded via ship/barge, rail car, and tank trucks and then the materials/chemicals are stored in fixed roof and internal floating roof tanks. The material/chemicals in the tanks are shipped out by ship/barge (marine), rail tank car, and tank truck. Kinder Morgan Liquids Terminals, LLC (Philadelphia Terminal) was previously named "GATX Terminals Corporation." Sources at the facility include tank/truck loading, marine loadings, storage tanks, compressors, emergency engine, fugitive emissions and insignificant sources. Examples of some chemicals or products that have been stored at the facility during the 2014 calendar year is listed in Attachment E.

III. Applicability for NOx and VOC RACT:

Kinder Morgan Liquids Terminals, LLC - Philadelphia Terminal 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 National Ambient Air Quality Standard (NAAQS).

Kinder Morgan Liquids 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.

IV. 1997 1-hour VOC RACT Sources:

Kinder Morgan Liquids Terminals, LLC is subject to the 1-hour RACT. As a result of a case-by-case RACT determination, the facility is subject to the 1-hour RACT Plan Approval listed under the facility's previous name, "GATX Terminals Corporation", effective on May 29, 1995, and approved by the United States Environmental Protection Agency (EPA) on October 31, 2001 in 66 FR 54936.

Table IV.1 below lists the VOC sources included in the 1-hr RACT Permit with the status of the source as of July 2015. Further discussion on the applicable 1-hour RACT requirements is provided in Section VI of this document for each source evaluated.

Table IV-1: VOC Sources subject to 1-hour RACT

1-hr RACT Sources	July 2015 Status:
(Controlled Tank-Truck Loading Operations) Tank car/truck loading racks connected to the NOA Thermal Oxidation Unit -A, B. E, F, M &, V	Controlled tank car-truck loading positions are now in Racks A, E, F, M, and D. See permit modification section under each group for details on specific permits.
(Uncontrolled Tank-Truck Loading Operations) All uncontrolled tank car/truck positions: (Racks-C,D,G,H,N,O,P,R,R-I,T & X)	Uncontrolled tank car -truck loading positions are now in the Racks listed on page 8 of this memo. See permit modification section under each group for details on specific permits
13.4 MMBtu/hr boiler;	Active. In 2010, the boiler was modified to allow it to burn natural gas and was fitted with a low NOx Burner.
6.7 MMBTU/hr boiler	Removed and replaced with a new 12.6 MMBtu/hr boiler with low NOx burner in 2005.
Thermal Oxidation Unit	Active
Oil/water separator	Active, under insignificant sources

14 volatile organic tanks, volume less than 40,000 gallons	Active, all presumptive/CTG RACT sources.
81 volatile organic tanks, volume greater than 40,000 gallons	Active, all presumptive/CTG RACT sources.
Fugitive Emissions from Process Equipment Components	Active, CTG RACT Source
Marine vessel loading operation, two berths.	Active
NOA - Control Equipment	Active

V. Sources Evaluated for 1997 8-hour VOC RACT :

The facility's significant air emissions sources contributing to VOC emissions are listed in the Table V-1. The facility's control devices for these emissions units are listed in Table V-2. The facility's De minimis air emissions sources (less than 1 tpy of VOC) contributing to VOC emissions are provided in Table V-3.

Table V-1: Sources subject to 8-hour RACT

VOC Sources:	**RACT Category**
Tank car/truck loading- organic liquids with RVP ≥ 4.0 psi (controlled) Tank car/truck loading- organic liquids with RVP < 4.0 psi (uncontrolled)	CTG RACT and Case-by-case RACT Case-by-case RACT
Marine vessel loading operations	Case-by-case RACT
Fugitive emissions from process piping pumps, valves, & flanges.	CTG RACT
108 storage tanks (81 storage tanks with capacities greater than or equal to 40,000 gallons; 27 storage tanks with capacities less than 40,000 gallons);	CTG RACT and Presumptive RACT
***490 hp emergency generator (Emergency Generator #1)	Presumptive RACT
12.6 MMBtu/hr boiler (Boiler #1); and ***13.4 MMBtu/hr boiler (Boiler #2)	Presumptive RACT

***Indicate sources that were installed/constructed after the 1-hr RACT Permit.

Table V-2: VOC Control Devices

Control Devices:	**Comments**
A. One NAO Thermal Oxidation Unit (aka Thermal Incinerator)	This unit captures VOC emissions from controlled tank car/truck loading operations.
B. *** One (1) Marine Vapor Combustion Unit (MVCU). Used for controlled marine vessel loading of cumene.	This unit was installed after the SIP-approved 1-hr RACT plan approval was issued, and it is only used during marine loading cumene operations. This unit was installed when there was an increased marine loading cumene. It was installed to ensure the facility stay below the facility-wide HAP Synthetic Minor limits and single HAP limits of AMS Plan Approval 06021 dated 2/2/2007.

***Indicate sources that were installed/constructed after the 1-hr RACT Determination.

Table V-3: De Minimis VOC Sources

Tank cleaning and degassing operations
*** Soil Vapor Extraction System with CatOx
***Two (2) 48 hp air compressors;
Painting of tanks;
Sump tank; (listed as "insignificant source)
Catch basins (listed as "insignificant sources" on Title V Operating Permit V95-044);
Two oil water separator (Receives <200 gallons of organic materials per day, listed as "insignificant sources" on Title V Operating Permit V95-044);
Drumming operations (listed as "insignificant sources" on Title V Operating Permit V95-044);
Steam cleaning of equipment (listed as "insignificant sources" on Title V Operating Permit V95-044);
Chemical dryers (listed as "insignificant sources" on Title V Operating Permit V95-044);
Pipe cleaning (listed as "insignificant sources" on Title V Operating Permit V95-044);
Flushing of tanks with incoming products (listed as "insignificant sources" on Title V Operating Permit V95-044);
Fire equipment (listed as "insignificant sources" on Title V Operating Permit V95-044);
Mobile tanks (500 gallons each, listed as "insignificant sources" on Title V Operating Permit V95-044);
Tanks 1 (Emergency containment tank, listed as "insignificant sources" on Title V Operating Permit V95-044);
Tanks 2 and 3 (Emergency containment tank, listed as "insignificant sources" on Title V Operating Permit V95-044);
Tank no471 (#2 oil for the vapor incinerator, listed as "insignificant sources" on Title V Operating Permit V95-044);
Tank no. 420 (#2 oil for the boilers, listed as "insignificant sources" on Title V Operating Permit V95-044);

***Indicate sources that were installed/constructed after the 1-hr RACT Determination.

VI. VOC RACT Evaluation:

A. Tank Car/Truck Loading Operations

Kinder Morgan Liquid Terminals, LLC owns and operates various tank car/truck loading racks. A loading rack consists of multiple loading positions, each loading position of a rack connects to a specific storage tank, and are used to transfer liquids between a tank car or trucks and the storage tank. Tank car / truck loading racks have various loading positions that can either be "controlled" or "uncontrolled". Controlled loading positions are permanently configured to vent to a NAO Thermal Oxidation Unit to control VOC emissions. Gasoline or organic liquids with a RVP equal to or greater than 4.0 psi are required to be controlled, per the presumptive RACT requirements of 25 PA Code 129.59. Uncontrolled loading positions at a loading rack are not vented to the Thermal Oxidizer, but are limited to loading liquids with RVP less than 4.0 psi. Therefore, uncontrolled loading is only expected to occur at any uncontrolled loading positions.

1. Tank Car/Truck Loading Operations - 1 Hour RACT Requirements

Under the 1-hour RACT permit, each rack was identified rack as "controlled" or "uncontrolled." Loading racks with some controlled loading positions were called controlled loading racks, even though they could also have uncontrolled loading positions. The case-by-case requirements for the tank car/truck loading racks included in the SIP-approved 1-hr RACT plan approval are provided in Table VI.A-1 below.

Table VI.A-1: 1-hour RACT Case-by-Case Requirements for Tank Car/Truck Loading

Condition 2B	The operation of the following equipment in accordance with the presumptive RACT requirements of 25 PA Code 129.93(c)(4)
Condition 2C	Tank car/truck loading racks – A, B, E, F, M, & V shall comply with 25 PA Code 129.59
Condition 2D	Tank car/truck loading racks – C, D, G, H, N, O, P, R, R-1, T, & X which are uncontrolled shall be limited to processing organic liquid with vapor pressure lower than 4 RVP
Condition 3A	Tank car/truck loading racks – C, D, G, H, N, O, P, R, R-1, T, & X which are uncontrolled shall be limited to 129 tons of VOC per year.
Condition 5B	GATX [Kinder Morgan] shall monitor throughput of material processed and vapor pressures for all tanks, marine loading, and tank car/truck loading racks on a daily basis."

Under the 1-hour RACT, controlled loading racks are subject to 25 PA Code 129.59. As per 25 PA Code 129.59 (a), a person may not cause or permit the loading of gasoline (defined in 25 PA Code 121.1, as petroleum distillate with a Reid Vapor Pressure (RVP) $\geq$ 4.0 psi and which is a liquid at standard temperature and pressure) into a vehicular tank from a bulk gasoline terminal unless the gasoline loading racks are equipped with a vapor collection and disposal system capable of processing volatile organic vapors and gases so that no more than 0.0668 pounds (30.3 grams) of gasoline (measured as propane) are emitted to the atmosphere for every 100 gallons (380 liters) of gasoline loaded. In other words, loading of organic liquids with RVP $\geq$ 4.0 psi was required to be controlled by operation of a vapor collection and control system. As a result, the facility operates a NAO Thermal Oxidizer. Operation of uncontrolled racks was limited to loading of liquids with RVP < 4.0 psi and subject to a combined emission limit of 129 tons of VOC per year.

The 1-hour RACT permit did not specify that there were certain loading positions in the "controlled racks" (i.e., racks A, B, E, F, M & V) that were not connected to the control. However, Kinder Morgan has operated these positions for loading of liquids with RVP $\leq$ 4.0 psi to be able to comply with 25 PA Code 129.59. Further, the facility and AMS have interpreted any uncontrolled loading at any of the racks to be subject to the 129 tpy VOC limit in the 1-hour RACT plan approval.

2. Tank Car/Truck Loading Operations- Permit Modifications

Table VI.A-2 lists the permit modifications for the controlled and uncontrolled tank car/ truck loading operations that AMS has approved since the 1-hr RACT Permit.

Table VI.A-2: Permit Modifications

Permit Modifications
Controlled and uncontrolled tank car /truck loading positions and racks have changed since the 1-hr RACT permit because certain racks are connected to certain storage tanks. Storage tanks usage depends on the clients' storage needs and the materials stored in the tanks. **TV No 095-44 dated 9/9/2001** • DSP Loading Rack is listed and permitted in the facility's Title V Operating Permit No. 95-044 under uncontrolled loading rack. **TV No. 095-44 dated 9/9/2001 and AMS Permit No. 02139 dated 12/10/2007.** • Uncontrolled Rail Siding 1, Rail Siding 2, and Rail 3 Siding loading positions were present during the 1-hr RACT, but not addressed. These were not racks (physical structures), but these were positions where the rail/tank cars would be set up for loading. With the exception of Rail Siding 1, Spot 1, these rail loading positions are listed and permitted in the facility's Title V No. 095-44 permit as uncontrolled loading positions. • Rail Siding 1, Spot 1 is a controlled loading position associated with Rack D which was modified to a controlled rack under AMS Permit No. 02139 below. **AMS Permit No. 02139 dated 12/10/2007 allowed for the following modifications:** • Rack X (450 gpm pump capacity) was modified to add a new bottom loading position which is controlled and vented to the control device. The permit limits loading from the Rack X new bottom position (controlled loading) to 49.25 million gallons per 12 month rolling period and a

VOC emissions of 2 tons per rolling 12 month period. The VOC potential increase from controlled emission from Rack X is the 2 tpy based on the throughput limit. With this permit modification, Rack X is now considered a controlled rack with the ability to also load materials with RVP < 4 at its existing uncontrolled loading position.

- The permit also allowed for disconnecting the existing vapor recovery line from Rack V and rerouting to Loading Rack D. The vapor line from Rack V was rerouted to Rack D so products with RVP of 4 or greater may be loaded on one side by truck and by rail on the other side (Rail Siding 1, Spot 1). Rack D is now considered a controlled rack and Rack V is now considered an uncontrolled rack. The pump capacity for Racks D and V is 450 gallons per minute.
- This permit did not change the total VOC PTE for uncontrolled tank car and truck loading operations because the 129 tons per rolling 12 month period is still in effect.

AMS Permit No. 08211 dated 12/11/2008 allowed for the following modifications:

- All controlled loading positions were removed from Racks X and B (one controlled loading position from each rack for a total of two controlled loading positions). One controlled loading position was moved to Rack F and the other controlled loading position was moved to Rack M. Racks F and M to be controlled racks, remaining capable of loading both uncontrolled and controlled products.
- As a result of the modifications above, Rack F increased loading capacity from 450 gpm to 1200 gpm for controlled products. Rack M loading capacity remains at 450 gallons per minute, but the number of controlled loading positions at Rack M increased to two.
- The permit also limits Racks B and X to loading of only organic liquids with a RVP of less than 4.0 psi. With the addition of Racks B and X to the uncontrolled Racks, there is no potential increase in the facility's emissions from uncontrolled tank car truck loading operations since the 129 tons of VOC per year RACT limit is still in effect.
- The permit also limits tank truck loading of ethanol at facility to 150,000,000 gallons per rolling 12 month which equates to about 3 tpy. (See Attachment A - AMS Permit 08211/14350 Memo for the detailed calculation.) Overall there is no VOC emission increase for the facility since uncontrolled loading is still limited to 129 tons per year.

AMS Permit No. 14351 dated 12/11/2014 allowed for the following modifications:

- Increase ethanol throughput through the facility to 200,000,000 gallons per year which corresponds to an emissions limit of 3.99 tons per rolling 12 month period for tank truck loading of ethanol. This is a potential increase of about 1 tpy of VOC emission from the increase in ethanol throughput. (See Attachment A - AMS Permit 08211/14351 Memo for detailed calculations) Overall there is no VOC emission increase for the facility since uncontrolled loading is still limited to 129 tons per year.

AMS Permit No 09105 dated 1/19/2010

- This permit intended to clarify the terms uncontrolled and controlled racks and uncontrolled and controlled loading positions at the facility and applicable requirements of the racks and loading positions to the 1-hr RACT permit. The 1-hr RACT permit listed specific racks as “controlled racks” and needed to comply with the requirements of 25 PA Code 129.59, requiring VOC control through operation of a vapor collection and disposal system (the NAO Thermal oxidizer). The 1-hr RACT Permit listed specific racks as “uncontrolled racks” which needed to comply with a 129 tons per year VOC limit. The 1-hr RACT Permit did not list or clarify that the controlled racks may also have uncontrolled loading positions which were not vented to a control device. When reading the 1-hr RACT permit, one might interpret that controlled racks have all controlled loading positions, but as explained earlier this is not the case. The permit clarified the applicable requirements for the positions rather than racks, based on the connection of loading positions to the control. The permit also removed the identification of specific racks and provided the applicable requirements in terms of loading positions rather than loading racks, per the facility’s request.
- Another intent of the permit was to provide consistency with the Philadelphia Air Management Services regulations, and construction permits approved by AMS after the 1-hr RACT permit. As

listed in the AMS permits above, some of the controlled racks and uncontrolled racks no longer had the same status as under the 1-hr RACT permit. The permit proposed a language that provided consistency with previous permits issued by AMS.

- There were no changes to any emission limits from the original 1-hr RACT Plan Approval. There were no physical changes proposed with the permit modification. The proposed clarification to the RACT conditions approved in this permit has not been approved into the SIP to date, but is proposed to be approved into the SIP as part of this 8-hour RACT determination. See Attachment B - AMS Permit 09105 Memo, for a comparison of conditions between the AMS Permit No. 09105 and the 1-hr RACT permit.
- The permit also clarified the applicability of the RACT requirements based on loading positions instead of racks.

After the approved permits, the racks at Kinder Morgan have been modified to the following:

Table VI.A-3: Summary of Modifications to Tank Car / Truck Loading Racks

Rack ID	Previous Rack Category (1-Hr RACT Permit)	Summary of Modifications	Controlled vs. Uncontrolled
A	Controlled	None	Remains with controlled and uncontrolled positions.
E	Controlled	None	Remains with controlled and uncontrolled positions.
F	Controlled	Increased pump capacity from 450 gpm to 1200 gpm for controlled loading. Additional control position added. The pump capacity for uncontrolled loading is at 450 gpm.	Remains with controlled and uncontrolled positions.
M	Controlled	Additional controlled loading position added. No increase in rack pump capacity.	Remains with controlled and uncontrolled positions.
D	Uncontrolled	Uncontrolled positions connected to control.	Currently has controlled and uncontrolled positions.
B	Controlled	Controlled positions no longer connected to control.	Currently with uncontrolled positions.
V	Controlled	Controlled positions no longer connected to control.	Currently with uncontrolled positions.
C	Uncontrolled	None	All positions remain uncontrolled.
G	Uncontrolled	None	All positions remain uncontrolled.
H	Uncontrolled	None	All positions remain uncontrolled.
N	Uncontrolled	None	All positions remain uncontrolled.
O	Uncontrolled	None	All positions remain uncontrolled.
P	Uncontrolled	None	All positions remain uncontrolled.
R	Uncontrolled	None	All positions remain uncontrolled.
R-1	Uncontrolled	None	All positions remain uncontrolled.
T	Uncontrolled	None	All positions remain uncontrolled.
X	Uncontrolled	Added controlled positions, but then removed from rack.	All positions remain uncontrolled.
DSP	N/A	New	All positions are uncontrolled.
Rail Siding 1	N/A	New	All positions are uncontrolled, expect for Rail Siding 1, Spot 1 (controlled under Rack D).
Rail Siding 2	N/A	New	All positions are uncontrolled.
Rail Siding 3	N/A	New	All positions are uncontrolled.

3. Tank Car /Truck Loading Operations- Applicable Requirements

Loading of VOC materials with a RVP greater than or equal to 4.0 psi continues to be subject to the CTG RACT regulation of 25 PA Code 129.59(a), as specified in the 1-hour RACT plan approval. Additionally, the loading of VOC materials with a RVP greater than or equal to 4.0 psi is subject to AMR V, Section V(a). As per AMR V, Section V(a), no person shall load any organic material having a Reid vapor pressure of 4.0 pounds or greater into any tank truck, tank car, or trailer from any loading facility from which 20,000 gallons or more of such organic material are loaded in any one day from this facility unless this facility is equipped with a vapor recovery system properly installed, well maintained, in operation, and approved by the Department. Such a vapor recovery system shall be capable of collecting the organic materials emitted from the filling operation and disposing of these emissions so as to prevent their release to the atmosphere.

As per the above CTG conditions, AMS finds that 25 PA Code 129.59(a) is more stringent than AMR V, Section V(a) for VOC emissions due to the emission limit from loading. Therefore, controlled loading must be connected to the NAO Thermal Oxidation unit which is capable of processing volatile organic vapors and gases so that the above emission rate is met (i.e. 0.0668 pounds /100 gallons of gasoline). See the table below for a "Tank Car/Truck Loading Operations 1-hr RACT Summary" of applicable regulations. Additionally, it is important to note that the NAO Thermal Oxidation Unit has a maximum throughput capacity of 85,260 gallons per hour.

Loading of VOC materials with a RVP below 4.0 psi is applicable to case-by-case RACT. As per the above case-by-case SIP-approved 1-hour RACT plan approval conditions, the uncontrolled tank car/truck loading racks can only process organic liquid with a vapor pressure lower than 4.0 RVP and have a combined emission limit of 129 tons of VOC per year. Although not specified in the SIP-approved 1-hour RACT plan approval, AMS considers the loading of materials with a vapor pressure lower than 4.0 RVP at the "controlled racks" (as identified in the SIP-approved 1-hour RACT plan approval) is subject to the 129 tons of VOC per year limit.

4. Tank Car/Truck Loading Operations - 8 Hour RACT Evaluation

a. Controlled Loading Positions

Table VI.A-4 below provides the PTE of controlled loading positions based on a possible actual operating scenario of 1000 hours of operation per controlled rack per year, which is the most a loading position can operate due to the time it takes to move trucks in and out of the position, connecting and disconnecting the loading arm, etc.

Table VI.A-4: Potential VOC Emissions from Controlled Tank Car/Truck Loading Operations

Location	Position*	Pumping Rate (gpm)	Emission Factor** (lb/100 gal)	Emissions (lb/hr)	Operating Hours*** (Hours/year)	Total Controlled Loading Emissions (tons/year)
A Rack	1 -Truck 2 - Truck	450	0.0668	18.036	1000	9.018
E Rack	1 - Truck	450	0.0668	18.036	1000	9.018
F Rack	1 - Truck 2 - Truck	1200	0.0668	48.096	1000	24.048
M Rack	1 - Truck 2 - Truck	450	0.0668	18.036	1000	9.018
D Rack	1 - Truck	450	0.0668	18.036	1000	9.018
Spot 1-1	2 - Rail	450	0.0668	18.036	1000	9.018
TOTAL	-	**3,450**	**-**	**138.28**	**6000**	**69.14**

*A, F, and M racks have two (2) loading positions that cannot load simultaneously due to space issues (a truck can only fit on one side of the rack);
**Emission factor from 25 PA Code 129.59(a);

***Operation is physically limited to 1,000 hours per controlled rack per year due to the time it takes to connect and disconnect trucks, move in and out of position, etc.

As seen above, all controlled loading has the potential to emit a total of 69.14 tons of VOC per year. Based on compliance with the 25 PA Code 129.59, all controlled positions loading organic liquids greater than or equal to 4.0 RVP are connected to the NAO Thermal Oxidation Unit, which is capable of processing volatile organic vapors and gases so that emissions are no more than 0.0668 pounds of VOC /100 gallons of gasoline. Stack testing of the NAO Thermal Oxidation Unit is necessary in order to ensure compliance the control device emission rate limitation.

b. Uncontrolled Loading Positions

Table VI.A-6 lists the uncontrolled tank car truck loading positions at the facility. Each uncontrolled loading rack pump has a maximum capacity of 450 gallons per minute. The PTE for each uncontrolled loading position is based on AP-42 Section 5.2 and fuel grade ethanol. Fuel grade ethanol is the facility's highest emitting product that can be loaded without controls. Table VI.A-5 below provides the fuel grade ethanol properties and loading operations characteristic that were used to calculate the loading loss emission factor (L_L).

Table VI.A-5: Loading Loss Emissions Factor for Fuel Grade Ethanol

Chemical Vapor Pressure (psia)	M; Molecular Weight	CE%**	S; Saturation Factor	T; Annual Avg. Temp. (deg. F)	L_L; Emission Factor (lb/1,000 gal)
1.21	46	0	0.5	60	0.67

**CE=0% because there is no control

Table VI.A-6 in the following page provides a more detailed PTE estimate per uncontrolled loading position, assuming ethanol loading. As shown in Table VI.A-6, uncontrolled loading positions at the facility are subject to the 129 tpy and that the PTE calculations per position to continue to be the most stringent and enforceable limit of the PTE.

Uncontrolled Loading Positions

Table VI.A-6: Potential VOC Emissions from Uncontrolled Tank Car/Truck Loading Operations

Rack Name	No. of Uncontrolled Loading Positions	Pumping Rate (gpm)	L_L; Emission Factor (lb/1,000 gal)	Emissions (lb/hr)	Operating Hours (Hours/year)	Emissions**** (tons)	Simultaneous Loading? ****	Number of Positions Loaded Simultaneously	Total Uncontrolled Loading Emissions (tons/year)	Total Uncontrolled Loading Emissions Limitation (tons/year)
A Rack*	2	450	0.67	18.0	1,000	9.0	No	1	9.05	129
		450	0.67	18.0	1,000	9.0				
E Rack*	6	450	0.67	18.0	1,000	9.0	Yes	2	18.10	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
F Rack*	1	450	0.67	18.0	1,000	9.0	No	1	9.05	
M Rack*	4	450	0.67	18.0	1,000	9.0	No		9.05	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
D Rack*	3	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
B Rack	2	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
V Rack	1	450	0.67	18.0	1,000	9.0	No	1	9.05	
C Rack	2	450	0.67	18.0	1,000	9.0	Yes	2	18.10	
		450	0.67	18.0	1,000	9.0				
G Rack	4	450	0.67	18.0	1,000	9.0	Yes	2	18.10	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
H Rack		450	0.67	18.0	1,000	9.0	Yes	2	18.10	

	2	450	0.67	18.0	1,000	9.0				
N Rack	2	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
O Rack	4	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
P Rack	2	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
R Rack	4	450	0.67	18.0	1,000	9.0	Yes	2	18.10	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
R-1 Rack	2	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
X Rack	2	450	0.67	18.0	1,000	9.0	No	1	9.05	
		450	0.67	18.0	1,000	9.0				
DSP Rack	1	450	0.67	18.0	1,000	9.0	No	1	9.05	
Rail Siding 1	5	450	0.67	18.0	1,000	9.0	Yes	5	45.25	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
Rail Siding 2	12	450	0.67	18.0	1,000	9.0	Yes	12	108.60	
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
Rail Siding	1	450	0.67	18.0	1,000	9.0	Yes	7	63.35	
	2	450	0.67	18.0	1,000	9.0				

3	3	450	0.67	18.0	1,000	9.0				
	7	450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
		450	0.67	18.0	1,000	9.0				
TOTAL									**415.58**	**129**

* Each rack has additional positions connected to the control, whose PTE has been considered for RACT under controlled loading.

** Operation is limited to 1,000 hours per year due to the time it takes to connect and disconnect trucks, move in and out of position, etc. Emissions based on AP-42, Section 5.2 using fuel grade ethanol. This is not an enforceable emissions limitation, but reflects actual and projected operations.

*** Some loading racks are able to load simultaneously, that is, they can have two trucks loading at the same time, one on each side of the rack. On the other hand most loading racks cannot load simultaneously, that is, they can only load one truck at a time because one side of the rack is blocked by an obstruction such as a wall or piping; there is not enough space to load more than one truck per side at any given time. Rail sidings at the facility have enough space to simultaneously load a rail car at each loading position.

In order to determine RACT 1997 8-hour ozone NAAQS for "uncontrolled" tank/rail car and truck loading operations, AMS has evaluated the feasibility of adding a control device to control VOC emissions from loading VOC liquid materials with an RVP < 4.0 psi. The following provides the associated analysis:

Table VI.A-7: Possible Control Rankings for Uncontrolled Loading Operations

Control	Estimated Effectiveness*
Thermal Oxidation	95-98 %
Carbon Adsorption	85-95%
Bioreactor	60-99%
Scrubbers	50-98%
Condensation	50-90%

Technically Feasibility Evaluation:

(1) Connection to the Existing Thermal Oxidation Unit - *Technically Infeasible*

a. Kinder Morgan Liquid Terminals, LLC cannot connect any additional loading positions to the NAO Thermal Oxidation Unit following the following reasons:

i. The existing thermal oxidizer is currently operated at capacity;

ii. The existing control system is not set up to handle such varying streams from very lean to very rich;

iii. It is not technically feasible to connect additional loading positions located at the "Controlled Loading Racks" (as defined in the 1-hor SIP-approved plan approval) since the racks have physical space limitations that would prevent the installation of equipment such as metered loading equipment, top/bottom loading arms, overflow sensors, steel support structures, etc.;

iv. Additionally, it is important to note that control of the low vapor pressure chemicals would require the control device to burn excessive quantities of natural gas in order to achieve and maintain the required operating temperature. As a result, the oxidizer would be generating significant nitrogen oxide and carbon monoxide emissions to achieve insignificant VOC reductions from the low vapor pressure products. This would be counterproductive with respect to protecting the environment. ;

(2) Additional Thermal Oxidation Unit - *Technically Feasible*

a. As is described above, 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 is governed by temperature, time, and turbulence. In order to achieve effective combustion the organic must be raised 100 degree Fahrenheit or more above its ignition temperature and held at that for good oxidation to occur. An auxiliary fuel is required to ensure the temperature is maintained for proper combustion.

b. There are essentially two (2) types of incinerators: thermal and catalytic. Each type is considered technically feasible for the marine loading operation. However, for costs analysis purposes, thermal incineration is being considered since the relative cost of the two are similar.

(3) Carbon Adsorption – *Technically Infeasible*

a. Adsorption is where gas molecules are passed through a bed or solid particles, then diffuses from the gas stream to the bed, and held on the media by attractive forces. Adsorptive capacity of the solid for the gas tends to increase with the gas phase concentration, molecular weight, diffusivity, polarity, and boiling point.

b. Typical adsorbents media in use include activated carbon, silica gel, activated alumina, synthetic zeolites, fuller's earth, and other clays. This RACT analysis is oriented toward the use of activate carbon, a commonly used adsorbent for VOCs. Carbon adsorption is effective when materials have a molecular weight of 50 or greater.

c. Carbon adsorption is considered technically infeasible for the operation since it would not be effective on all materials handled at the dock. Ethanol is loaded into vessels in addition to other materials. The molecular weight of ethanol is 46, thus making carbon adsorption infeasible.

(4) Bioreactor – *Technically Infeasible*

a. 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, one needs a consistent stream and maintain temperature above 60 degrees Fahrenheit. The marine vessel operation at Kinder Morgan is intermittent and the climates average annual temperature is below 60 degrees Fahrenheit. While there are other factors to consider, this control option is considered technically infeasible due to the intermittent nature of the operation and the climate of the area.

(5) Scrubbers – *Technically Infeasible*

a. Scrubbers use a process called absorption to remove pollutants from an air stream to a liquid stream. The absorption processes the organics in the air stream are dissolved in a liquid solvent. The limiting factors as a primary control technique deal with the availability of a suitable solvent and the solubility of the organic. In this case, the terminal would require different solvents to handle the varying material handled. Based on the organics in the air stream requiring different absorption media this control option is considered technically infeasible.

(6) Condensation – *Technically Infeasible*

a. 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.

b. A refrigerated condenser is a viable option if:

i. The air stream is saturated with the organic compound

ii. The organic vapor containment system limits air flow

iii. Required air flow does no overload a refrigeration system with heat

iv. Only one organic compound is emitted

c. Since the marine vessel loading operation is only considered to be 50 percent saturated and there are multiple organic compounds, this control option is considered infeasible.

- *Thermal Oxidizer Technical Feasibility Cost Analysis: “Uncontrolled Loading at All Positions”*

The goal of this cost analysis is to determine the feasibility of connecting all uncontrolled loading positions located at either the “Controlled Loading Racks” or at the “Uncontrolled Loading Racks” to a second thermal oxidation unit. (As is explained above, connection to the existing NAO Thermal Oxidation Unit is technically infeasible.)

To determine the cost effectiveness of the technically feasible control option, connection to a thermal oxidation unit, a cost analysis was conducted and is presented below. The capital cost for the thermal oxidizer is based on a vendor quote for another project (see “Attachment F”) and is presented in the following tables. Below is a cost analysis for the control of all uncontrolled loading positions at any Rack.

The cost analysis is based on 8760 hours annual of operation of a thermal oxidizer. All uncontrolled positions will need to be vented to the thermal oxidizer and as seen in Table IV-6, the total of uncontrolled operation hours for all uncontrolled position is more than 8760 hours.

Uncontrolled Loading at All Positions – Total Capital Investment

Kinder Morgan RACT Analysis	All Tank Truck and Rail Car Loading Positions Incinerator Cost Limited @ 129 tons		7/24/2015
Direct Cost			
Purchased Equipment	$1,706,542.07	Vendor Quote Attached	
Instrumentation	-		
Sales Tax	$102,392.52		
Freight	$85,327.10		
Purchased Equipment Cost	**$1,894,261.69**		
Direct Installation Cost			
Foundations & supports	$151,540.94		
Handling & erection	$265,196.64		
Electrical	$75,770.47		
Piping	$94,713.08		
Insulation for ductwork	$18,942.62		
Painting	0		
Direct installatoin costs	**$606,163.75**		
Site Preparation	$18,942.62		
Total Direct Cost	$2,519,368.06		
Indirect Cost			
Engineering	$189,426.17		
Construction and field expense:	$94,713.08		
Contractor fees	$189,426.17		
Start-up	$37,885.23		
Performance test	$7,500.00		
Total Indirect Cost	$518,950.65		
Total Capital Investment	**$3,038,318.71**		

**See Attachment F for vendor quote*

All Uncontrolled Loading Positions – Total Annual Cost

Kinder Morgan	All Tank Truck and Rail Car Loading Positions	7/24/2015
RACT Analysis	Incinerator Cost	
	Limited @ 129 tons	

Annual Costs			
Hours of operation	8,760		
	-		
Direct Annual Costs			
Operating Labor	0.5 hrs/shift @ $18/hr	$	9,855.00
Supervisor 15% of operator		$	1,478.25
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	$	1,298,448.62
Electrcity	0.162/kwh	$	7,759.46
Total		**$**	**1,331,228.83**
Indirect Annual Cost			
Overhead 60% of sum of operating supervisor, & maintenance labor & maintenance materials		$	15,012.45
Administrative Charges 2% TCI - 9,650 17,800			$60,766.37
Property Taxes 1% TCI - 4,830 8,900			$30,383.19
Insurance 1% TCI - 4,830 122,700			$30,383.19
Capital recovery (7% over 10 years)			$432,656.58
Total IAC			**$569,201.78**
Total Annual Cost			**$1,900,430.61**
Precontrol Emissions			**129**
Controlled Emissions			**107.5**
Cost Effectiveness			**$17,678.42**

Table IV.A-8: All Uncontrolled Loading Positions – Cost Summary

Source	Total Capital Investment	Total Annual Operating Cost (8760 hours)
All Uncontrolled Loading Rack Positions	$3,038,318.71	$ 1,900,430.61

Based on a vendor quote for another project, the capital cost for the thermal oxidizer is estimated to be $3,038,318.71 and the annual operating costs are $ 1,900,430.61per year. The costs estimates are consistent with the EPA Air Pollution Control Costs Manual, Version 6. The annual costs include operating and maintenance labor, fuel and electrical costs, and a capital depreciation of 7 percent over 10 years. The costs of the technically feasible controls are based on vendor quotes and readily available literature. The cost of this control unit is scaled from the original contractor proposal using the "Sixth-Tenth Factor Rule." The equation, referenced from Peters and Timmerhaus, Plant Design and Economics for Chemical Engineers, Fourth Edition, 1191 Page 169, is as follows:

Cost of Equipment A = Cost of Equipment B * (Capacity of Equipment A / Capacity of Equipment B)^0.6

As is discussed above, the potential to emit for total uncontrolled loading position is 129 tons of VOC per year. Using the 129 tons of VOC per year as the baseline emissions, and given the total capital investment and annual operating costs, the implementation and use of a thermal oxidation unit at each uncontrolled loading position does not prove to be cost effective in nature in that it yields a cost effectiveness of $17,678.42/ton.

In light of the aforementioned, given that the only technically feasible control option is not cost effective, no requirement to connect all uncontrolled loading positions to a thermal oxidation unit can be made.

All Uncontrolled Loading Positions – Technical/Cost Feasibility

Table VI.A-9: All Uncontrolled Loading Positions –Cost Feasibility

Rank 1	Control Technology	Baseline NOx Emissions (tpy)	NOx Reduction (%)	NOx Reduction (tpy)	Total Annualized Cost	Cost Effectiveness ($/Ton)
1	Thermal Oxidation	129	83.3	107.5	$1,900, 430.61	$17,678.42

The above cost analysis shows that based on the current permitted values/PTEs, the only technically feasible control, (the thermal oxidation unit) for all uncontrolled loading positions is not cost effective and thus no control device is determined as RACT. AMS; therefore, determines that the new case-by-case conditions presented above for uncontrolled loading positions represents VOC RACT under the 1997 8-hour ozone standard for the tank car/truck loading operations in Kinder Morgan. Additionally, in order to further ensure compliance with the 129 tons of VOC per year limitation, the facility is accepting the following limits: VOC emissions shall be limited to 9.0 tons of VOC per year and 18.1 pounds per hour per uncontrolled position at each tank car/truck loading rack.

5. Tank Car/Truck Loading Operations – Proposed 8 Hour RACT Requirements

a. Loading of Liquids Organic Liquids with RVP > 4.0 psi

For the tank car and truck loading of organic liquids with RVP of or greater than 4.0 psi, AMS proposes RACT should continue to be compliance with the CTG RACT regulation 25 PA Code 129.59.
Kinder Morgan is also taking a 57.0 pounds of VOC per hour limit for all controlled rail tank car/truck loading positions at the facility. The 57.0 lb/hr corresponds to the maximum capacity of the oxidizer at 1421 gallons per minute or 82,600 gallons per hour and the 0.0668 lb/100 gallon limit from 25 Pa Code 129.59(a). AMS has determined the following conditions in Table VI.A-10 below for controlled loading as RACT and as conditions in the revised RACT plan approval.

Table VI.A-10: Controlled Loading - 8 hr RACT

Condition 2A [The requirements of 25 Pa Code Section 129.59 are being written out for clarity]	Volatile Organic Compounds (VOC) liquids with a Reid Vapor Pressure (RVP) greater than or equal to 4.0 psi shall only be loaded at loading positions connected to the NAO Thermal Oxidation Unit complying with 0.0668 pounds (30.3 grams) of organic liquids (measured as propane) are emitted to the atmosphere for every 100 gallons (380 liters) of liquids loaded.
Condition 3A.1 [NEW- in the RACT Plan Approval]	The total combined VOC emissions from all controlled tank car/truck loading positions/operations at the facility shall be less than 57.0 pounds per hour.
Condition 4A and	Kinder Morgan shall conduct stack testing per AMS approved protocol on the NAO

Condition 5A [Both Conditions new in the RACT Plan Approval]	Thermal Oxidation Unit at least every five (5) years. Initial testing must commence no later than 18 months following the effective date of this plan approval.
AMS has added the following additional monitoring and recordkeeping requirements to the RACT plan approval:	
Condition 5A	Kinder Morgan shall monitor throughput of material processed and vapor pressures for all tanks, marine loading, and tank car/truck loading racks on a daily basis.
Condition 7A [NEW- in the RACT Plan Approval]	For controlled and uncontrolled loading tank car/truck operations, Kinder Morgan Liquid Terminals, LLC shall keep records of the following: 1. Which rack is being used for loading; 2. Which position at each rack is being used for loading; 3. Whether the position being used for loading is controlled or uncontrolled; 4. The name of material loaded per position; 5. Throughputs of each material loaded per position; 6. The corresponding vapor pressures of the material loaded per position; 7. Emissions calculations from all controlled loading rack positions to demonstrate compliance with the lb/hour limit of Condition 3.A.1

b. Loading of Liquids Organic Liquids with RVP < 4.0 psi

AMS has determined the following new case-by-case conditions for uncontrolled loading as 8-hr RACT:

Table VI.A-11: Uncontrolled Loading - 8 hr RACT

Condition 2B [New in 8hr- RACT Plan Approval]	Loading operations at any tank car/truck loading position not connected to the NAO Thermal Oxidizer, or "uncontrolled tank car/truck loading position", shall be limited to processing organic liquid with a Reid Vapor Pressure (RVP) less than 4.0 pounds per square inch (psi).
Condition 3B.1 thru B.3 [NEW- in the RACT 8hr - Plan Approval]	Loading operations at "uncontrolled tank car/truck loading positions" shall comply with the following: 1. Total combined emissions from all "uncontrolled tank car/truck loading positions" at the facility combined shall be limited to 129 tons of VOC per 12 month rolling period; 2. Emissions from each " uncontrolled tank car/truck loading position" shall not exceed 9.0 tons of VOC per 12 month rolling period; 3. Emissions from each "uncontrolled tank car/truck loading position" emission shall not exceed 18.1 pounds of VOC per hour.
AMS has added the following additional monitoring and recordkeeping requirements to the RACT plan approval:	
Condition 5A	Kinder Morgan shall monitor throughput of material processed and vapor pressures for all tanks, marine loading, and tank car/truck loading racks on a daily basis.
Condition 7A [NEW- in the RACT Plan Approval]	For controlled and uncontrolled loading tank car/truck operations, Kinder Morgan Liquid Terminals, LLC shall keep records of the following: 1. Which rack is being used for loading; 2. Which position at each rack is being used for loading; 3. Whether the position being used for loading is controlled or uncontrolled; 4. The name of material loaded per position; 5. Throughputs of each material loaded per position; 6. The corresponding vapor pressures of the material loaded per position; 7. Emissions calculations from all controlled loading rack positions to demonstrate compliance with the lb/hour limit of Condition 3.A.1 8. Emissions calculations from all uncontrolled loading rack positions on a monthly

	and rolling 12 month period to demonstrate compliance with Condition 3.B.1 9. Emissions calculations per uncontrolled loading rack position on an hourly, monthly, and rolling 12-month period to demonstrate compliance with Conditions 3.B.2 and 3.B.3.

B. Marine Vessel Loading Operations:

1. Marine Vessel Loading Operations: 1-Hour RACT

Under the 1-hour RACT permit, marine vessel loading operations of VOCs is limited to commodities with a RVP of less than 4 psia and limited to 59 tons of VOC per year. Table VI.B-1 below list the 1-hr RACT requirements associated with marine loading operations.

Table VI.B-1: Marine Vessel Loading - 1 hr RACT

The SIP-approved 1-hr RACT plan approval includes the following case-by-case requirements for marine vessel loading:	
Condition 2F	The marine vessel loading shall not process petroleum distillate with vapor pressures greater than 4 RVP.
Condition 3A(2)C	The operation of the marine vessel loading shall be limited to 59 tons of VOC per year
Condition 5B	GATX [Kinder Morgan] shall monitor throughput of material processed and vapor pressures for all tanks, marine loading, and tank car/truck loading racks on a daily basis.”

2. Marine Vessel Loading Operations: PTE

The PTE for each marine loading operations is based on AP-42 Section 5.2 and marine loading of fuel grade ethanol. Fuel grade ethanol emissions contributes to the majority of facility’s VOC emissions from marine loading. Below are the fuel grade ethanol properties and marine loading operations characteristic that were used to calculate the loading loss emission factor (L_L).

Table VI.B-2: Fuel Grade Ethanol Properties and Marine Loading Loss Emission Factor

Chemical Vapor Pressure (psia)	M; Molecular Weight	CE%**	S; Saturation Factor (Submerged loading of barges)	T; Annual Avg. Temp. (deg. F)	L_L; Emission Factor (lb/1,000 gal)
1.57	46	0	0.5	60	0.87

**CE=0% because there is no control

The VOC PTE for marine loading is 59 tons per year which is based on the following assumptions:

1) The outbound average pumping rate is 2100 gallons per minute or 126,000 gallons per hour;
2) Based on the permit limit of 59 tons per year , average pumping rate of 2100 gallons, the hours of operation are estimate to be a 1,076 hours per year. See Attachment C for the detailed calculation.

The total PTE for marine loading is based on the federally enforceable 1-hr RACT per limit of 59 tons per year for all marine loading operations at the facility. Since the total emissions from marine loading operations are still limited to the 59 tons of VOC per year as designated in the SIP-approved 1-Hour RACT plan approval, there is no change/increase in emissions.

c. Marine Vessel Loading Operations - Permit Modifications

In 2012, Kinder Morgan increased cumene storage and barge loading operations. In order to maintain the facility’s Synthetic Minor status for Hazardous Air Pollutants at the terminal, a Marine Vapor Combustor Unit was installed to control VOC emissions from cumene barge loading.

Below lists the permit modifications to marine vessel loading operations that AMS has approved since the 1hr RACT Permit.

Table VI.B-3: Summary of Permit Modifications

Marine vessel loading operation, two berths.	The 1-hr RACT permit limited marine loading to products less than RVP of 4.0. In 2012, AMS Plan Approval No. 11184 was approved by AMS for installation of a Marine Vapor Combustion Unit (MVCU) to control emissions from cumene loading. The facility anticipated a future increase in cumene loading operations and the MVCU was installed to assure comply with the HAP limits of AMS Plan Approval No. 06021. Cumene has a RVP of less than 4 and is not required to be controlled. The permit limits cumene loading to 457,889,148 gallons per 12 month rolling period which equates to about 1 tpy of cumene emissions from marine loading assuming a control efficiency of 98% for the MVCU. See Attachment D for detailed calculations and background information on the permit. The permit did not results in any significant changes to the 1-hr RACT permit since the facility is still subject to the 59 tpy limit for marine loading and the RVP of cumene is well below 4 psi.

d. Marine Vessel Loading Operations: 8-Hour Case-by-Case RACT Analysis

Currently there is a Marine Vapor Combustion Unit (MVCU) installed at the facility to control cumene emissions from marine loading operations. As the MVCU was paid for by a client of Kinder Morgan, the Permittee is contractually obligated to have the control unit available for this customer.

In order to further justify the AMS 8-Hour RACT determination, an economic evaluation has also been performed to evaluate the feasibility of adding a control device for marine vessel loading operations. The following provides the associated analysis:

Table VI.B-4: Possible Control Rankings for Marine Vessel Loading:

Control	Estimated Effectiveness*
Thermal Oxidation	95-98 %
Carbon Adsorption	85-95%
Bioreactor	60-99%
Scrubbers	50-98%
Condensation	50-90%

Does not include capture efficiency, therefore the actual control efficiencies used in the calculations below **may vary as they will integrate capture efficiency (i.e. **90%** is included in the analysis for an additional Thermal Oxidation Unit at the tank car/truck loading racks)t*

Currently there is a MVCU installed at the facility to control cumene emissions from marine loading operations. As discussed in the previous section, in 2012, Kinder Morgan increased cumene storage and barge loading operations. In order to maintain the facility's Synthetic Minor status for Hazardous Air Pollutants at the terminal, a Marine Vapor Combustor Unit was installed to control VOC emissions from cumene barge loading. As the Marine Vapor Combustion Unit was paid for by a client of Kinder Morgan, the Permittee is contractually obligated to have the Marine Vapor Combustion Unit available for the customer who paid for it.

In order to further justify the AMS 8-Hour RACT determination, an economic evaluation has also been performed to evaluate the feasibility of adding a control device for marine vessel loading operations. The following provides the associated analysis:

Technically Feasibility Evaluation:

(1) Thermal Oxidation

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 is governed by temperature, time, and turbulence. In order to achieve effective combustion the organic must be raised 100 degree Fahrenheit or more above its ignition temperature and held at that for good oxidation to occur. An auxiliary fuel is required to ensure the temperature is maintained for proper combustion. There are essentially two (2) types of incinerators: thermal and catalytic. Each type is considered technically feasible for the marine loading operation. However, for costs analysis purposes, thermal incineration is being considered since the relative cost of the two are similar.

(a) *Existing MVCU to control organics with vapor pressures above 0.4psia –technically infeasible*. The existing Marine Vapor Combustor was specifically designed for loading of cumene and the maximum design vapor pressure is set at 0.4 psia. This means that some commodities other than cumene (with max vapor pressure 0.4 psia), may be able to be controlled but the actual emission rates of these commodities are very low. Table VI.B-5 lists marine vessel emission loadings from the facility for the 2012-2013 calendar years. As the table indicate, the majority of marine loading emissions are from ethanol. Since the vapor pressure of ethanol is much greater than 0.4 psia, using the MVCU to control ethanol emissions is technically infeasible.

Table VI.B-5: Actual VOC Emissions Reported in 2012 and 2013 for Marine Vessel Loading

Kinder Morgan Philadelphia Terminal — 2012 Emission Statement

Primary	TRUE

Facility_Identifier	Chemical	Data Sum of Emissions	Sum of Emissions (tons)
Group 11 - Marine Vessel Loading (BG)	Cumene	6808.92	3.40
	FUEL GRADE ETHANOL	41561.28	20.78
	Phenol	222.70	0.11
Group 11 - Marine Vessel Loading (SS)	Phenol	118.90	0.06
Group 11 - MVR Marine Vessel Loading (BG)	Cumene	49.48	0.02
	FUEL GRADE ETHANOL	976.83	0.49
Grand Total		49738.11	24.87

Kinder Morgan Bulk Liquid Terminals
Philadelphia Terminal

2013 Emissions Inventory
Background Information
VOC Loading Emissions Summary

Row Labels	Values Sum of Emissions	Sum of Emissions (tons)
Group 11 - MVR Marine Vessel Loading	168.51	0.084
Cumene	168.51	0.084
Group 11 - Marine Vessel Loading	42,452.76	21.226
FUEL GRADE ETHANOL	41,939.18	20.970
Phenol	513.58	0.257
Group 11 - UNC Marine Vessel Loading	57.61	0.029
Cumene	57.61	0.029
Grand Total	42,678.87	21.34

(b) *Use Existing MVCU to control cumene and other commodities with vapor pressures less than 0.4psia –technically feasible but not economically feasible.*
The existing MVCU is capable of controlling VOC emissions from commodities with vapor pressure less than 0.4 psia. However, this equipment is owned by a client of the facility and the facility is contractly obligated to use the MVCU for cumene loading only. Therefore, an addition thermal oxidation unit would have to be purchased by the facility. As seen from the 2012 and 2013

emission inventories, aside from cumene, marine loading VOC emissions are from phenol loading and ethanol loading. Phenol has a RVP of less than 0.4 psia and can be controlled but the average emissions during 2012 and 2014 is less 0.3 tons. There are than no other commodities with vapor pressures less than 0.4 psia have been significantly loaded via marine vessel in 2012 and 2013.

(c) *Install a new Thermal Oxidation Unit or MVCU to control non-cumene loading operations - technically feasible.* Installing a new thermal oxidation unit to control non-cumene loading (commodities with pressures greater than 0.4 psia) is technically feasible.

(2) Carbon Adsorption – *Technically Infeasible*

a. Adsorption is where gas molecules are passed through a bed or solid particles, then diffuses from the gas stream to the bed, and held on the media by attractive forces. Adsorptive capacity of the solid for the gas tends to increase with the gas phase concentration, molecular weight, diffusivity, polarity, and boiling point.

b. Typical adsorbents media in use include activated carbon, silica gel, activated alumina, synthetic zeolites, fuller's earth, and other clays. This RACT analysis is oriented toward the use of activate carbon, a commonly used adsorbent for VOCs. Carbon adsorption is effective when materials have a molecular weight of 50 or greater.

c. Carbon adsorption is considered technically infeasible for the operation since it would not be effective on all materials handled at the dock. Ethanol is loaded into vessels in addition to other materials. The molecular weight of ethanol is 46, thus making carbon adsorption infeasible.

(3) Bioreactor – *Technically Infeasible*

a. 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, one needs a consistent stream and maintain temperature above 60 degrees Fahrenheit. The marine vessel operation at Kinder Morgan is intermittent and the climates average annual temperature is below 60 degrees Fahrenheit. While there are other factors to consider, this control option is considered technically infeasible due to the intermittent nature of the operation and the climate of the area.

(4) Scrubbers – *Technically Infeasible*

a. Scrubbers use a process called absorption to remove pollutants from an air stream to a liquid stream. The absorption processes the organics in the air stream are dissolved in a liquid solvent. The limiting factors as a primary control technique deal with the availability of a suitable solvent and the solubility of the organic. In this case, the terminal would require different solvents to handle the varying material handled. Based on the organics in the air stream requiring different absorption media this control option is considered technically infeasible.

(5) Condensation – *Technically Infeasible*

a. 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.

b. A refrigerated condenser is a viable option if:

i. The air stream is saturated with the organic compound
ii. The organic vapor containment system limits air flow
iii. Required air flow does no overload a refrigeration system with heat
iv. Only one organic compound is emitted

c. Since the marine vessel loading operation is only considered to be 50 percent saturated and there are multiple organic compounds, this control option is considered infeasible.

- *Thermal Oxidation Technical Feasible Cost Analysis:*
  "Marine Vessel Loading"

To determine the cost effectiveness of the technically feasible control option, a thermal oxidation unit, a cost analysis was conducted and is presented below for the following options:

<u>Install a new Thermal Oxidation Unit or MVCU to control non-cumene loading operations:</u>

- *Install a new Thermal Oxidation Unit or MVCU to control non cumene commodities with RVP of less than 0.4.*
- *Install a new Thermal Oxidation Unit or MVCU to control commodities (non-cumene) with RVP of greater than 0.4.*

The option above involve installation of new equipment. The capital cost for the thermal oxidizer is based on a vendor quote for another project (see Attachment F), and is presented in the tables below.

Marine Vessel Loading – Total Capital Investment

Direct Cost		
Purchsed Equipment*	$	522,950.94
Instrumentation		-
Sales Tax	$	31,377.06
Freight	$	26,147.55
Purchased Equipment Cost	**$**	**580,475.55**
Direct Installation Costs		
Foundations & Supports	$	46,438.04
Handling & Erection	$	81,266.58
Electrical	$	23,219.02
Piping	$	11,609.51
Insulation for ductwork	$	5,804.76
Painting	$	-
Direct Installation Costs	**$**	**168,337.91**
Site Preparation	$	5,804.76
Total Direct Cost	**$**	**754,618.22**
Indirect Cost		
Engineering	$	58,047.56
Construction and field expenses	$	29,023.78
Contractor fees	$	58,047.56
Start-up	$	11,609.51
Performance test	$	7,500.00
Total Indirect Cost	**$**	**164,228.41**
Total Capital Investment	**$**	**918,846.63**

**See Attachment F for vendor quote.*

Marine Loading Operations – Total Annual Cost

Annual Hours of Operation			1,076
Direct Annual Costs			
Operating Labor (0.5 hr/shift @ $18/hr)		$	1,210.50
Supervisor (15% of operator)		$	181.58
Operating Materials	-		
Maintenance			
Labor (0.5 hr/shift $25/hr)		$	6,843.75
Materials (100% of maint. Labor)		$	6,843.75
Natural Gas (1.16 per therm)		$	117,973.07
Electricity (0.162/kwh)		$	953.10
Total		**$**	**134,005.75**
Indirect Annual Cost			
Overhead (60% of sum of operating supervisor, maint. Labor, & maint. Materials)		$	9,047.75
Administrative Charges (2% TCI - 9,650 17,800)		$	18,376.93
Property Taxes (1% TCI - 4,830 8,900)		$	9,188.47
Insurance (1% TCI - 4,830 122,700)		$	9,188.47
Capital Recovery (7% over 10 years)		$	130,843.76
Total Indirect Annual Cost		**$**	**176,645.38**
Total Annual Cost		**$**	**310,651.13**

Table VI.B-5: Marine Loading Operations – Cost Summary

Source	Total Capital Investment	Annual Operating Cost
Marine Vessel Loading	$ 918,846.63	$ 310,651.13

Based on a vendor quote for another project, the capital cost for the thermal oxidizer is estimated to be $918,846.63 and the annual operating costs are $310,651.13 per year. The costs estimates are consistent with the EPA Air Pollution Control Costs Manual, Version 6. The annual costs include operating and maintenance labor, fuel and electrical costs, and a capital depreciation of 7 percent over 10 years. The costs of the technically feasible controls are based on vendor quotes and readily available literature. The cost of this control unit is scaled from the original contractor proposal using the “Sixth-Tenth Factor Rule.” The equation, referenced from Peters and Timmerhaus, Plant Design and Economics for Chemical Engineers, Fourth Edition, 1191 Page 169, is as follows:

Cost of Equipment A = Cost of Equipment B * (Capacity of Equipment A / Capacity of Equipment B)^0.6

Table VI.B-5: Marine Loading Operations – Cost Effectiveness

Rank 1	Control Technology	Baseline VOC Emissions (tpy)	VOC Reduction (%)	VOC Reduction (tpy)	Total Annualized Cost	Cost Effectiveness ($/Ton)
1	Thermal Oxidation	59	83.3	48.3	$310,651.13	6343.70

**Includes 85% capture efficiency based on Emission Estimation Protocol for Petroleum Refineries, Section 9, Table 9-5, 2011, Pag-9-7*

Based on the current permitted values, the technically feasible controls for marine loading are not cost effective and thus no control device is required. The 59 tons per year limit was proposed in the 1 hr RACT. Even though actual VOC emissions from marine loading at the facility on an annual basis is much less, this limit is being kept because of the wide myriad of products that may be handled at the terminal and the widely disparate vapor pressures of the products.

AMS therefore determines that the new case-by-case conditions presented in the following section for marine vessel loading represents VOC RACT under the 1997 8-hour ozone standard for the marine vessel loading operations in Kinder Morgan.

4. Marine Vessel Loading Operations: Proposed 8-Hour RACT Requirements

For the 2012-2013 calendar year, marine loading emissions from the facility are about 23-25 tons per year. This 59 tpy limit for marine loading is being kept because there is potential that the facility can load a different chemical with higher vapor pressures but still below 4 RVP; therefore, the 59 tpy limit is still an adequate limit for the 8-hr RACT Stack testing of the Marine Vapor Combustion Unit is necessary in order to ensure compliance the control device destruction efficiency.

Note: Under 40 CFR 63 Subpart Y there are presumptive RACT requirements for marine loading operations that process 10 million gallons of gasoline per year or 200 million barrels of crude per year. Kinder Morgan's Marine Vessel Loading has not been able to load either gasoline or crude since accepting the RVP limit in 1-hour RACT.

Table VI.B-6: Marine Loading Operations – 8 hr RACT

AMS has determined the following case-by-case conditions for marine vessel loading as 8-hr RACT:	
Condition 2C *[Keeping 1hr- RACT Plan Approval Language in the 8hr RACT Plan Approval]*	Marine vessel loading operations shall not process petroleum distillate with a vapor pressure of 4.0 RVP or greater.
Condition 3.C *[Modifying 1hr- RACT Plan Approval Language in the 8hr RACT Plan Approval to a 12 month rolling period instead of per year]*	Marine vessel loading operations shall be limited to less than 59 tons of VOC per 12 month rolling period;
Condition 5B *[NEW- in the 8-hr RACT Plan Approval]*	The Permittee shall conduct stack testing per AMS approved protocol on the Marine Vapor Combustion Unit at least every five (5) years." Testing shall be conducted on the Marine Vapor Combustion Unit within 5 years of the last test date conducted.
AMS has added the following additional monitoring and recordkeeping requirements to the RACT plan approval:	
Condition 5A[NEW- in the 8-hr RACT Plan Approval]	Kinder Morgan shall monitor throughput of material processed and vapor pressures for all tanks, marine loading, and tank car/truck loading racks on a daily basis.
Condition 7B [NEW- in the 8-hr RACT Plan Approval]	For marine vessel loading operations, Kinder Morgan Liquid Terminals, LLC shall keep records of the following: 1. The name of material loaded; 2. Whether the loading is controlled or uncontrolled; 3. Throughputs of each material loaded; 4. The corresponding vapor pressures of the material loaded; 5. Emission calculations on a monthly and rolling 12-month period to demonstrate compliance with Condition 3.C.1.

C. Fugitive Emissions

1. Fugitive Emissions: 1-Hour RACT

The following sources of VOC fugitive emissions from flanges, valves, and pumps leaks are subject to case-by-case 1-hour RACT requirements, per the SIP-approved RACT plan approval (under its former name "GATX Terminals Corporation"), effective on May 29, 1995, and approved by EPA on October 31, 2001 in 66 FR 54936:

- P01 – Process Piping Flanges
  - Fuel/Material: Organic/Inorganic Compounds
- P02 – Process Piping Valves
  - Fuel/Material: Organic/Inorganic Compounds
- P03 – Process Piping Pumps
  - Fuel/Material: Organic/Inorganic Compounds

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 2E:*
  - "The implementation of a quarterly leak detection and repair program on all pumps, valves, and flanges containing VOC;"
- *Condition 5A:*
  - "GATX [Kinder Morgan] shall monitor all valves, pumps, and flanges quarterly for visual leaks. GATX shall also monitor valves, pumps, and flanges which process organic liquid greater than or equal to 4 RVP for leaks of greater than 10,000 ppmv."

2. Fugitive Emissions: Applicable Requirements & Permit Modifications

Fugitive process emission leaks are covered by the CTG 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:

1. 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.

AMS issued Plan Approval No. 09105 dated January 19, 2010 which changed Condition 5A to be consistent with AMR V Section XIII the following: "The Permittee shall monitor all valves, pumps, flanges in Volatile Organic (VOC) service quarterly for visual leaks or for leaks greater than 10,000 ppmv."

<u>AMS Permit No 09105 dated 1/19/2010</u>

- The permit also intended to clarify fugitive emission requirements. The permit proposed to modify Condition 5.A of the 1-hr RACT permit from "GATX shall monitor all valves, pumps, and flanges quarterly for visual leaks. GATX shall also monitor valves, pumps, and flanges which process organic liquid greater or equal to 4 RVP for leaks greater than 10,000 ppmv" to "The Permittee shall monitor all valves, pumps, and flanges in Volatile Organic (VOC) Service quarterly for visual leaks or for leaks greater than 10,000 ppmv." The reasons for the requested change was that the RACT program was intended to reduce VOC emissions from major facilities. The wording of the 1-hr RACT Permit, required that the facility monitor all organics including organics that are not VOC. The RACT regulation applies to VOCs. The change will provide consistency with Air Management Regulation (AMR) Section XIII.

3. Fugitive Emissions: 8hr RACT Determination

Since AMR V, Section XIII has specific leak thresholds, it is more stringent than the LDAR requirement from the 1-hr RACT, and this will supersede the LDAR requirements. Consistently, AMS requests that the LDAR requirements be removed from the RACT plan approval. AMS determines that compliance with AMR V, Section XIII and the revisions to the SIP-approved 1-hr RACT plan approval represents VOC RACT under the 1997 8-hour ozone standard for the fugitive emissions in Kinder Morgan Liquid Terminals, LLC.

D. Storage Tanks

The storage tanks are covered by Control Technique Guideline RACT regulations or under the Presumptive RACT requirements of 25 PA Code 129.57 or 25 Pa Code 129.56 as specified in the "CTG RACT Regulation" column of the following table listed below. For informational purposes, the table also includes any applicable operational requirements (possible materials stored in the tank) or VOC limits per various AMS construction permits issued.

For storage tanks with capacities greater than 40,000 gallons, since each unit stores petroleum/organic products with a vapor pressure ≥ 1.5 psi and ≤ 11 psi, the RACT requirement is the installation of an external or an internal floating roof, as per the CTG rule 25 PA Code 129.56. The installation of an external or internal floating roof for storage tanks with capacities greater than 40,000 gallons storing petroleum/organic products with a vapor pressure ≥ 1.5 psi and ≤ 11 psi also satisfies the requirements of AMR V, Section II which similarly stipulates the implementation of a properly installed and well maintained organic material vapor control device such as a floating roof.

For storage tanks with capacities greater than or equal to 2,000 gallons but less than or equal to 40,000 gallons, since each unit stores petroleum/organic products with a vapor pressure > 1.5 psi, the RACT requirement is the existence of pressure relief valves which are maintained in good operating condition and which are set to release at various pressures, as per the CTG rule 25 PA Code 129.57.

The Description Codes are as follows:
IFR – Internal Floating Roof
FR – Fixed Roof
VFR DSP- Vertical Fixed Roof, Distilled Spirits
DS IFR – Double seal, Internal Floating Roof
HFR -Horizontal Fixed Roof
VFR – Vertical Fixed Roof)
IP - Installation Permit
GP- General Permit
PA - Plan Approval

Table V1.D-1: Storage Tanks

Source ID	Description*	CTG RACT Regulation	Materials Stored	VOC Emission Limit	From Permit No.
P051	VFR DSP	25 PA Code 129.57			
P052	VFR DSP	25 PA Code 129.57			
P053	VFR DSP	25 PA Code 129.57			
P054	VFR DSP	25 PA Code 129.57			
P055	VFR DSP	25 PA Code 129.57			
P056	VFR DSP	25 PA Code 129.57			

P057	VFR DSP	25 PA Code 129.57			
P058	VFR DSP	25 PA Code 129.57			
P104	VFR	25 PA Code 129.56 & AMR V, Section II			
P105	VFR	25 PA Code 129.56 &AMR V, Section II			
P106	VFR	25 PA Code 129.56 & AMR V, Section II	Slack Wax or equivalent with a vapor pressure of 0.0019 psia or less at 70 degrees Fahrenheit.	0.04 tons per rolling 12 month period.	IP 12239 dated 10/ 24 2012. GP 14378 - dated 12/10/2014 Reactivation of Tank
P107	DS IFR	25 PA Code 129.56 &AMR V, Section II			
P108	VFR	25 PA Code 129.56 & AMR V, Section II			
P121	VFR	25 PA Code 129.56 & AMR V, Section II			
P122	VFR	25 PA Code 129.56 & AMR V, Section II			
P123	VFR	25 PA Code 129.56 & AMR V, Section II			
P124	DS IFR	25 PA Code 129.56 & AMR V, Section II			
P125	IFR	25 PA Code 129.56 & AMR V, Section II			
P126	VFR	25 PA Code 129.56 & AMR V, Section II			
P127	VFR	25 PA Code 129.56 &AMR V, Section II			
P128	VFR	25 PA Code 129.56 & AMR V, Section II			GP 14378 - dated 12/10/2014 Reactivation of Tank
P129	VFR	25 PA Code 129.56 &AMR V, Section II			GP 14372 - dated 11/28/2014 Reactivation of Tank
P130	VFR	25 PA Code 129.56 & AMR V, Section II			
P131	VFR	25 PA Code 129.56 & AMR V, Section II			
P133	VFR	25 PA Code 129.56 & AMR V, Section II			
P134	VFR	25 PA Code 129.56 & AMR V, Section II			
P135	VFR	25 PA Code 129.56 & AMR V, Section II			

P137	VFR	25 PA Code 129.56 & AMR V, Section II			
P140	VFR	25 PA Code 129.56 & AMR V, Section II			
P141	VFR	25 PA Code 129.56 &AMR V, Section II			
P142	VFR	25 PA Code 129.56 & AMR V, Section II	Fural or equivalent with vapor pressure of 0.0225 psia or less at 70 degrees Fahrenheit.	0.10 tons per rolling 12 month period.	IP 12239 dated 10/ 24 2012.
P143	IFR	25 PA Code 129.56 &AMR V, Section II			
P144	VFR	25 PA Code 129.56 & AMR V, Section II			
P145	VFR	25 PA Code 129.56 & AMR V, Section II			
P146	VFR	25 PA Code 129.56 & AMR V, Section II			
P147	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.0 psia or less at 78 degrees Fahrenheit.	0.22 tons per rolling 12 month period.	PA No. 11184 dated 4/13/2012
P148	IFR	25 PA Code 129.56 & AMR V, Section II			
P149	IFR	25 PA Code 129.56 & AMR V, Section II	Cumene or equivalent with vapor pressure of 0.0606 psia or less at 70 degrees Fahrenheit.	0.06 tons per rolling 12 month period.	IP 12239 dated 10/ 24 2012.
P150	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.79 psia or less at 70 degrees Fahrenheit.	0.62 tons per rolling 12 month period.	IP 12239 dated 10/ 24 2012
P151	IFR	25 PA Code 129.56 &AMR V, Section II			
P152	IFR	25 PA Code 129.56 & AMR V, Section II			
P153	IFR	25 PA Code 129.56 &AMR V, Section II			
P154	VFR	25 PA Code 129.56 & AMR V, Section II			
P155	VFR	25 PA Code 129.56 & AMR V, Section II			

P156	VFR	25 PA Code 129.56 & AMR V, Section II			
P157	VFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.0 psia or less at 78 degrees Fahrenheit.	0.22 tons per rolling 12 month period.	PA No. 11184 dated 4/13/2012
P158	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.0 psia or less at 78 degrees Fahrenheit.	0.22 tons per rolling 12 month period.	PA No. 11184 dated 4/13/2012
P159	IFR	25 PA Code 129.56 & AMR V, Section II			
P160	IFR	25 PA Code 129.56 & AMR V, Section II			
P161	IFR	25 PA Code 129.56 &AMR V, Section II			
P162	IFR	25 PA Code 129.56 & AMR V, Section II			
P163	IFR	25 PA Code 129.56 &AMR V, Section II			
P164	IFR	25 PA Code 129.56 & AMR V, Section II			
P198	VFR	25 PA Code 129.56 & AMR V, Section II			
P199	VFR	25 PA Code 129.56 & AMR V, Section II			
P200	VFR	25 PA Code 129.56 & AMR V, Section II			
P201	VFR	25 PA Code 129.56 & AMR V, Section II			
P202	VFR	25 PA Code 129.56 & AMR V, Section II			
P203	VFR	25 PA Code 129.56 & AMR V, Section II			
P204	IFR	25 PA Code 129.56 &AMR V, Section II			
P205	IFR	25 PA Code 129.56 & AMR V, Section II			
P206	IFR	25 PA Code 129.56 &AMR V, Section II			
P207	IFR	25 PA Code 129.56 & AMR V, Section II			
P208	IFR	25 PA Code 129.56 & AMR V, Section II			
P209	IFR	25 PA Code 129.56 & AMR V, Section II			
P210	IFR	25 PA Code 129.56 &			

		AMR V, Section II			
P211	IFR	25 PA Code 129.56 & AMR V, Section II			
P212	VFR	25 PA Code 129.56 & AMR V, Section II			
P213	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.79 psia or less at 70 degrees Fahrenheit.	0.47 tons per rolling 12 month period.	IP 12228 dated 10/172012.
P214	VFR	25 PA Code 129.56 &AMR V, Section II			
P215	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.79 psia or less at 70 degrees Fahrenheit.	0.42 tons per rolling 12 month period.	IP 12228 dated October 17, 2012; 14226 dated 8/28/2014
P216	IFR	25 PA Code 129.56 &AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.79 psia or less at 70 degrees Fahrenheit.	0.47 tons per rolling 12 month period.	12228 dated October 17, 2012; 14226 dated 8/28/2014
P217	VFR	25 PA Code 129.56 & AMR V, Section II			
P218	VFR	25 PA Code 129.56 & AMR V, Section II			
P219	VFR	25 PA Code 129.56 & AMR V, Section II			
P220	VFR	25 PA Code 129.56 & AMR V, Section II			
P221	IFR	25 PA Code 129.56 & AMR V, Section II			
P222	IFR	25 PA Code 129.56 & AMR V, Section II			
P223	IFR	25 PA Code 129.56 & AMR V, Section II	Cumene or equivalent with vapor pressure of 0.21 psia or less at 78 degrees Fahrenheit.	0.22 tons per rolling 12 month period.	PA No. 11184 dated 4/13/2012
P224	IFR	25 PA Code 129.56 & AMR V, Section II			
P225	IFR	25 PA Code 129.56 & AMR V, Section II	Cumene or equivalent with vapor pressure of 0.21 psia or	0.22 tons per rolling 12 month period.	PA No. 11184 dated 4/13/2012

			less at 78 degrees Fahrenheit.		
P226	IFR	25 PA Code 129.56 & AMR V, Section II			
P227	IFR	25 PA Code 129.56 & AMR V, Section II			
P228	IFR	25 PA Code 129.56 & AMR V, Section II	Fuel Grade Ethanol or equivalent with vapor pressure of 2.79 psia or less at 70 degrees Fahrenheit.	0.0.10 tons per rolling 12 month period.	IP 12239 dated 10/24/ 2012.
P301	DS IFR	25 PA Code 129.56 & AMR V, Section II			
P302	DS IFR	25 PA Code 129.56 & AMR V, Section II			
P303	DS IFR	25 PA Code 129.56 & AMR V, Section II			
P304	DS IFR	25 PA Code 129.56 & AMR V, Section II			
P305	VFR	25 PA Code 129.56 & AMR V, Section II			
P420	HFR	25 PA Code 129.57			
P421	HFR	25 PA Code 129.57			
P422	HFR	25 PA Code 129.57			
P440	VFR	25 PA Code 129.57			
P450	VFR	25 PA Code 129.57			
P451	VFR	25 PA Code 129.57			
P460	HFR	25 PA Code 129.57			
P470	HFR	25 PA Code 129.57			
P471	HFR	25 PA Code 129.57			
P481	HFR	25 PA Code 129.57			
P482	HFR	25 PA Code 129.57			
P483	HFR	25 PA Code 129.57			
P484	HFR	25 PA Code 129.57			
P485	HFR	25 PA Code 129.57			
P486	HFR	25 PA Code 129.57			
P487	HFR	25 PA Code 129.57			
P488	HFR	25 PA Code 129.57			
P489	HFR	25 PA Code 129.57			
P490	HFR	25 PA Code 129.57			
FT00		25 PA Code 129.57			
FT01		25 PA Code 129.57			
FT02		25 PA Code 129.57			
FT03		25 PA Code 129.57			

The following sources are covered by Presumptive RACT regulations, as is specified in the “Presumptive RACT Regulation” column of the table below:

E. Emergency Generator

Source	Description	Capacity (hp)	Fuel Burned	Presumptive RACT Regulation
EG01	Emergency Generator 1	490	Diesel	25 PA Code 129.93(c)(5)

For the one (1) 490 hp emergency generator, the presumptive RACT requirement is the installation, operation, and maintenance of the unit as per the manufacturer's specifications. and a 500 hour per rolling 12 month period operation limit from AMS Installation Permit No. 09052 dated July 16, 2009.

F. Boilers

Source	Description	Capacity (MMBtu/Hr)	Fuel Burned	Presumptive RACT Regulation
CU01	Boiler #1, Hurst Boiler	12.6	No. 2, Natural Gas	25 Pa Code 129.93(c)(1)
CU01A 01	Boiler #2, York Boiler	13.4	No. 2, Natural Gas	25 Pa Code 129.93(c)(1)

For the one (1) 13.4 MMBtu/Hr boiler and the one (1) 12.6 MMBtu/Hr, the presumptive RACT requirement is the installation, operation, and maintenance of the boiler as per the manufacturer's specifications. These RACT requirements for Boiler #2, are part of the 1-hour RACT Plan Approval for the facility (under its former name "GATX Terminals Corporation"), effective on May 29, 1995, and approved by EPA on October 31, 2001 in 66 FR 54936.

D. De Minimis Sources:

VOC emissions from the Soil Vapor Extraction System and Cleaning and Degassing Operations are each is below 2.7 tons per year VOC). AMS determines that installing any control technology on such small source is both technically and economically unreasonable.

1. Soil Vapor Extraction (SVE) Remediation System (206 Process)

This equipment consists of an air sparge and soil vapor extraction system to remediate dissolved and adsorbed phase hydrocarbons on the Philadelphia Regional Port Property across from Kinder Morgan. The soil vapor extraction system consists of a holding tank, vapor/liquid separator, soil vapor extraction regenerative blower, and an electric catalytic oxidizer. AMS Installation Permit No. 10017 dated March 19, 2010 limits emissions to less than 2.7 tons per 12 month rolling period. The actual VOC emissions from this unit in 2014 was less than 1tpy (0.02 tpy).

2. Cleaning & Degassing Operations (204 Process)

AMS Installation Permit No. 03047 dated May 21, 2004 limits tank degassing and cleaning operations to 1.8 tons of VOC per 12 months. The actual VOC emissions from this unit in 2014 was less than 1 tpy (0.287 tpy).

Since the actual baseline emission of both sources are well below 1 tpy, based on AMS's engineering knowledge and experience, installing control devices on both sources is technically and economically unreasonable.

3. Other Smaller Sources Listed as Insignificant

VOC emissions from each the following sources is below 1.0 tons per year VOC. Based on AMS permitting and engineering knowledge, AMS determines that installing any control technology on such small source i s both technically and economically unreasonable.

- Painting of tanks,
- Sump tank,
- Catch basins,
- Two oil water separator (Receives <200 gallons of organic materials per day,
- Drumming, Steam cleaning of equipment,
- Chemical dryers, pipe cleaning,
- Flushing of tanks with incoming products,
- Fire equipment, Mobile tanks (500 gallons each),

- Tanks 1 (Emergency containment tank),
- Tanks 2 and 3 (Emergency containment tank),
- Tank no. 471 (#2 oil for the vapor incinerator),
- Tank no. 420 (#2 oil for the boilers),
- Two 48 HP Diesel Air Compressors

G. Control Devices

Source	Presumptive RACT Regulation
NAO Thermal Oxidizer	25 PA Code 129.93(c)(4)
Vapor Combustor	25 PA Code 129.93(c)(4)

For the NAO Thermal Oxidization Unit and the Marine Vapor Combustion Unit, the presumptive RACT requirement due to combustion is the installation, operation, and maintenance of the unit as per the manufacturer's specifications.

These RACT requirements for the NAO Thermal Oxidation Unit are part of the SIP-approved 1-hour RACT Plan Approval for the facility (under its former name "GATX Terminals Corporation"), effective on May 29, 1995, and approved by EPA on October 31, 2001 in 66 FR 54936.

VII. Conclusions and Recommendations:

AMS has determined or recommends the following RACT requirements for 1997 8-hour ozone NAAQS.

- The attached revised RACT Permit dated ___ is submitted for SIP approval and includes case-by-case RACT requirements per 25 PA Code 129.91-92 for tank car-truck loading operations and marine loading operations.
- Fugitive emissions will comply with the CTG RACT Requirements of AMR V, Section XIII. A RACT determination for fugitive emissions is not submitted for SIP approval.
- Each storage tanks will comply with a CTG RACT or the presumptive RACT requirements of 25 PA Code 129.56 or 129.57. A RACT determination for the storage tanks is not submitted for SIP approval.
- Each boiler will comply with the presumptive RACT of 25 PA Code 129.93(c)(1).
- The emergency generator will comply with the presumptive RACT requirements of 25 PA Code 129.93(c)(5). A RACT determination for the emergency generator is not submitted for SIP approval.
- The NAO Thermal Oxidation Unit and the Vapor Combustor shall comply with the presumptive RACT requirements of 25 PA Code SS129.93(c)(4). A RACT determination for the NAO Thermal Oxidation Unit and Vapor Combustor is not submitted for SIP Approval.

8/10/15

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

Attachment A - AMS Permit 08211/14350 Background Memo

DATE: 11/26/2014

TO: FILE

FROM: Maryjoy Ulatowski; Environmental Engineer

SUBJECT: Installation Permit 08211/14350

Owner: Kinder Morgan Liquid Terminals

Address: 3300 N. Delaware Ave., Philadelphia, PA 19134

RE: Loading Tank Modification

Kinder Morgan submitted an Installation Permit to increase the facility's tank truck loading throughput from 150,000,000 to 200,000,000 gallons per rolling 12 month.

The original 150,000,000 throughput limit was from Plan Approval 08211 dated December

The potential VOC emission increase from the modification is about 1 ton per year.

CMI Calculations from Permit Application No. 14350

Loading losses from ethanol will be before fuel throughput increase: (Using S= 0.6, submerged loading: normal service)

*Loading Losses (mg/l or lb/1000 gal) = 12.46 x (SPM/T) *(1-eff/100), where

*EPA's AP-42, equation pg 5.2-7

S=saturation factor 0.6	0.6		
P=true vapor pressure	2.1		
M = molecular weight of vapors	46.07		
T = temperature	80	F	540
Capture Efficiency	0.99		
Control Device Efficiency	0.98		
Overall reduction Efficiency	0.9702		

Loading losses = 0.039914372 lbs ethanol /1000 gallon of ethanol loading loaded

Ethanol emissions from loading = (throughput * ethanol emission factor)

throughput limit 150,000,000.00 gal/year

Ethanol emissions from loading = 5987.16 lbs/year

2.99 tons/year

Loading losses from ethanol will be after ethanol throughput increase: (Using S= 0.6, submerged loading: dedicated vapor balance)

*Loading Losses (mg/l or lb/1000 gal) = 12.46 x (SPM/T) *(1-eff/100), where
*EPA's AP-42, equation pg 5.2-7

S=saturation factor 0.6	0.6		
P=true vapor pressure	2.1		
M = molecular weight of vapors	46.07		
T = temperature	80	F	540
Capture Efficiency	0.99		
Control Device Efficiency	0.98		
Eff= Overall Reduction Efficiency	0.9702		

Loading losses = 0.039914372 lbs ethanol /1000 gallon of ethanol loading loaded

Ethanol emissions from loading = (throughput * ethanol emission factor)

throughput limit 200,000,000.00 gal/year
Ethanol emissions from loading = 7982.87 lbs/year
3.99 tons/year

Increase in VOC emissions from modification: 1.00 tons/year

Attachment B - AMS Permit 09105 Background Memo

- Kinder Morgan Liquid Terminals has submitted a Plan Approval Application to modify Conditions 2.C, 2.D, 3.A.(1), and 5.A of the facility's RACT Plan Approval for VOC. The original Plan Approval was issued to GATX Terminal Corporation. Modification of the conditions will clarify and provide consistency with the facility's operating scenarios, Philadelphia Air Management Services regulations, and construction permits previously issued. There are no changes to any emission limits from the original RACT Plan Approval. The modifications are listed below:

Condition No.	1-hr RACT Requirement:	2010 RACT Modification Permit Modify RACT Requirement to:
2.C	Tank Car/Truck Loading Racks A,B,E,F,M & V shall comply with 25 PA Code 129.59.	Volatile Organic Compounds (VOC) that require control by vapor incinerator per applicable regulations or permit conditions will be loaded at controlled tank car positions located at racks A,E,F,M, or D.
2.D	Tank Car/truck loading racks – C,D,G,H,N,O,P,R,R-1, T, & X which are uncontrolled shall be limited to processing organic liquid with vapor pressures lower than 4 RVP.	All volatile organic liquids loaded at uncontrolled rack positions at the facility must have a Reid Vapor Pressure (RVP) less than 4.0.
3.A.(1)	Tank Car/Truck loading Rack C,D,G,H,N,O,P,R,R-1, T,X which are uncontrolled shall be limited to 129 tons of VOC per year	All uncontrolled tank car/truck loading positions at the facility shall be limited to 129 tons of VOC per year.
5.A	GATX shall monitor all valves, pumps, and flanges quarterly for visual leaks. GATX shall also monitor valves, pumps, and flanges which process organic liquid greater or equal to 4 RVP for leaks greater than 10,000 ppmv	The Permittee shall monitor all valves, pumps, and flanges in Volatile Organic (VOC) Service quarterly for visual leaks or for leaks greater than 10,000 ppmv.

- Modify Condition 2.C from "Tank Car/Truck Loading Racks A,B,E,F,M & V shall comply with 25 PA Code 129.59." to "Volatile Organic Compounds (VOC) that require control by vapor incinerator per applicable regulations or permit conditions will be loaded at controlled tank car positions located at racks A,E,F,M, or D."

  <u>Reasons for the requested change</u>
  The change creates consistency with operations at Kinder Morgan. The Draft Renewal Title V Operating Permit, which is currently under review, will provide a list of uncontrolled and controlled loading rack positions at the facility.

- Modify Condition 2.D from "Tank Car/truck loading racks – C,D,G,H,N,O,P,R,R-1, T, & X which are uncontrolled shall be limited to processing organic liquid with vapor pressures lower than 4 RVP" to "All volatile organic liquids loaded at uncontrolled rack positions at the facility must have a Reid Vapor Pressure (RVP) less than 4.0."

  <u>Reasons for the requested change</u>
  The change creates consistency with operations at Kinder Morgan. The Draft Renewal Title V Operating Permit, which is currently under review, will provide a list of uncontrolled and controlled loading rack positions at the facility.

- Modify Condition 3.A.(1) from “Tank Car/Truck loading Rack C,D,G,H,N,O,P,R,R-1, T,X which are uncontrolled shall be limited to 129 tons of VOC per year” to “All uncontrolled tank car/truck loading positions at the facility shall be limited to 129 tons of VOC per year”.

  Reasons for the requested change
  The change creates consistency with construction permits issued and with operations at Kinder Morgan. The Draft Renewal Title V Operating Permit, which is currently under review, will provide a list of uncontrolled and controlled loading rack positions at the facility.

- Modify Condition 5.A from “GATX shall monitor all valves, pumps, and flanges quarterly for visual leaks. GATX shall also monitor valves, pumps, and flanges which process organic liquid greater or equal to 4 RVP for leaks greater than 10,000 ppmv” to “The Permittee shall monitor all valves, pumps, and flanges in Volatile Organic (VOC) Service quarterly for visual leaks or for leaks greater than 10,000 ppmv.”

  Reasons for the requested change
  The RACT program was intended to reduce VOC and NOx emissions from major facilities. The current wording of Condition 5.A requires that the facility monitor all organics including organics that are not VOC. The RACT regulation applies to VOCs. The change will clarify that monitoring will only apply to VOCs. The change will also provide consistency with Air Management Regulation (AMR) Section XIII.

Attachment C - Marine Loading PTE

Kinder Morgan - Philadelphia

LOADING EMISSION CALCUALTIONS

Product	Thoughput (Gallons/hour)	Hours	Thoughput (Gallons/Year)	Mode and Direction	Year	Rack ID	Chemical Vapor Pressure psia	M, Molecular Weight	Capture Efficiency %	CE %	S, Saturation Factor	T, Annual Average Temp (deg F)	L_L, Emission Factor (lb/1000 gals)	Emissions (tons)
FGE	126,000	1,076	135,632,184	Barge			1.57	46	0	0	0.5	60	0.87	59

Based on EPA's AP-42 Section 5.2 Transportation and Marketing of Petroleum Liquids

$$L_L = 12.46 \frac{SPM}{T}$$

L_L = loading loss, pounds per 1000 gallons (lb/10^3 gal) of liquid loaded
S = a saturation factor (see table below)
P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia)
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole)
T = temperature of bulk liquid loaded, °R (°F + 460)

Table 5.2-1. SATURATION (S) FACTORS FOR CALCULATING PETROLEUM LIQUID LOADING LOSSES

Cargo Carrier	Mode Of Operation	S Factor
Tank trucks and rail tank cars	Submerged loading of a clean cargo tank	0.50
	Submerged loading: dedicated normal service	0.60
	Submerged loading: dedicated vapor balance service	1.00
	Splash loading of a clean cargo tank	1.45
	Splash loading: dedicated normal service	1.45
	Splash loading: dedicated vapor balance service	1.00
Marine vessels[a]	Submerged loading: ships	0.2
	Submerged loading: barges	0.5

[a] For products other than gasoline and crude oil. For marine loading of gasoline, use factors from Table 5.2-2. For marine loading of crude oil, use Equations 2 and 3 and Table 5.2-3.

Attachment D - AMS Permit No. 11184 Background Memo

KMLT has submitted a Plan Approval Application to increase cumene loading, unloading, and storage volumes. The majority of cumene will be loaded out to marine vessels. Since the future volume of cumene is significantly greater and the facility has a Synthetic Minor HAP emissions limit, Kinder Morgan is proposing to control all cumene emissions over the dock with a Marine Vapor Combustion Unit. There will be two cumene vapor controlled loading positions, but the system will be designed such that one can be operated at a time. In addition, cumene will be stored in internal floating roof tanks.

In order for Kinder Morgan to handle cumene, Kinder Morgan will need to replace the internal floating roofs on Tank 223 and Tank 225. In addition Kinder Morgan will install internal floating roof into the fixed roof Tanks Nos. 147, 157 and 158 to be able to store ethanol and other materials of the same vapor pressure or lower.

Emission Calculations (From Attachment 2 of the Plan Approval Application)
Below are the potential emissions from each source or piece of equipment.

Source	**Pollutant Emissions (tpy)**				
	VOC/HAP	**NOx**	**CO**	**PM**	**SO2**
Cumene Loading Positions	1.05				
Tank 147	0.22				
Tank 155	0.22				
Tank 158	0.22				
Tank 223	0.05				
Tank 225	0.05				
Oxidizer	0.2	6.2	9.4	0.2	--
Additional Fugitives	0.09				

The loading loses from the cumene loading position were calculated using EPA's AP-42 Section 5.2.

L_L = 12.46 SPM / T

L_L =loading loss, pounds per 1000 gallons (lb/1000 gal) of liquid load loaded
S = saturation factor, 0.5 for submerged loading of marine barges.
P =true vapor pressure of liquid loaded, psia (Cumene =0.1644 psia)
M = Molecular Weight, lb/lb-mol (Cumene 120.2)
T = Temperature of Liquid Loaded, degrees R(F+460)
(Assuming average annual temp 70F)

L_L ➔ 12.46(0.5)(0.1644)(120.2)/(530) = 0.0046 (lb/1000 gallons)
Annual Emissions = L_L x Annual throughput in gallons
= (0.0046 lb/1000 gallons) x (457,889,148 gallons)
= 1.05 tons per year

Storage Tanks emissions were estimated using EPA's Tanks 4.0 Program.

Attachment E - Example Chemicals

The following are examples of some chemicals, products, or liquids that have been stored at the facility during the 2014 calendar year.

Products/chemicals/ material	Molecular Weight	Vapor Pressure (VP) Actual (psi)	VP Max (psi)	VP at 68 F (psi)	Reid Vapor Pressure (RVP) [a] or True Vapor Pressure [b] @100 F (psi)
Formic Acid	46	0.28546	1.05541	0.65173	< 4
Acetic Anhydride	102.09	0.02279	0.014146	0.07297	< 4
Aviation Gasoline	72.25	1.82318	5.4981	3.76235	> 4 [d]
Fuel Grade Ethanol	46.07	0.67	2.48443	1.53	2.3[c]
Slack Wax	420.00	0.00148	0.00042	0.0002	< 4
Farnesene	204.36	0.00717	0.02848	0.01707	< 4
Phenol	94.12	0.07478	0.0101	0.00418	0.019 [c]
Area 6 CO Product	150.50	0.06069	0.02783	0.01447	< 4
Plasticizer	390.57	2.99 E-05	0.0101	0.01707	< 4
Furfural	96.09	0.00407	0.04426	0.02014	0.076[c]
Xylene	106.17	0.03763	0.21434	0.1193	< 4
Toluene	92.13	0.15206	0.71005	0.4217	1.026[c]
Cumene	120.20	0.0188	0.12054	0.06456	0.187[c]
Alpha-Methylstyrene	118.20	0.01888	0.12054	0.06456	< 4
Nonene	120.00	0.06156	0.26933	0.15575	< 4
Valeric Acid	102.13	0.00403	0.00645	0.00294	< 4
Cyclohexanone	98.20	0.02412	0.12226	0.07007	< 4
Motor Oil	190.00	2.00E-5	0.00011	5.60E-5	< 4

[a] Reid Vapor Pressure (RVP) is a common measure of volatility of petroleum liquids defined as the absolute vapor pressure exerted by a liquid at 100°F. Under PA Code 121.1 is defined as the measure of pressure exerted on the interior of a special container as determined by the appropriate methodologies in 40 Coder of Federal Regulations (CFR) Part 80, Appendix E. 40 CFR Part 80 Appendix E method s **determine** the absolute pressure **of a sample**, measured against a vacuum of a gasoline or gasoline-oxygenate blend sample saturated with air at 32–40 °F (0–4.5 °C). The absolute (measured) pressure is observed with a system volume ratio of 1 part sample and 4 parts evacuated space at 100 °F (37.8 °C)**.**

[b] True vapor pressure is defined as the equilibrium partial pressure exerted by a volatile organic liquid as a function of temperature. For a pure component at 100°F, the true vapor pressure is equivalent to the RVP. [Source Section 9.4.1.1, Emission Estimation Protocol for Petroleum Refineries, RTI International April 2015]

[c] Obtained by using Antoine's equation and EPA AP42 Emission Factor, Section 7.1, Eq. 1-25 and Table 7.1-5 and a assuming a T_{LA} of 100 °F (37.8 °C)**.**

The true vapor pressure of organic liquids at the stored liquid temperature can be estimated by Antoine's equation:

$$\log P_{VA} = A - \left(\frac{B}{T_{LA} + C}\right) \tag{1-25}$$

where:

A = constant in vapor pressure equation
B = constant in vapor pressure equation
C = constant in vapor pressure equation
T_{LA} = daily average liquid surface temperature, °C
P_{VA} = vapor pressure at average liquid surface temperature, mm Hg

For organic liquids, the values for the constants A, B, and C are listed in Table 7.1-5. Note that in Equation 1-25, T_{LA} is determined in degrees Celsius instead of degrees Rankine. Also, in Equation 1-25, P_{VA} is determined in mm of Hg rather than psia (760 mm Hg = 14.7 psia).

[d] The RVP of Aviation Gasoline is assumed to be > 4 psi since gasoline is defined as a material with a RVP of 4 psi or greater.

Attachment F - Vendor Quote

(The vendor quote is attached in the following pages)