

## Executive Summary

This document reports measurements of speciated volatile organic compound (VOC) emissions from oil and condensate storage tanks at wellhead and gathering site tank batteries in East Texas. The measurements were made by directly monitoring the flow rates of gases escaping from storage tank vents and sampling the vent gases for chemical composition. An emission factor reflecting tank working, breathing, and flashing losses for each tank was calculated by dividing the measured emission rate by the amount of oil or condensate produced during the sampling period. The emission factors are expressed in units of pounds of VOC per barrel of liquid hydrocarbon produced (lb/bbl). Average emission factors for oil and condensate storage tanks were multiplied, respectively, by oil and condensate production totals for East Texas counties, including the Dallas-Fort Worth (DFW), Houston-Galveston-Brazoria (HGB), and Beaumont-Port Arthur (BPA) ozone nonattainment areas, to estimate regional emissions. Options for controlling tank battery vent gas emissions are also presented and discussed.

Emission measurements were made at 11 oil and 22 condensate tank battery sites in the BPA, DFW, and HGB areas during May-July, 2006. The average VOC emission factors for oil and condensate storage tanks were  $1.6 \pm 99\%$  lb/bbl and  $33.3 \pm 73\%$  lb/bbl, respectively, where the uncertainties are represented by the 95% confidence intervals of the means (Table ES-1). Variable site characteristics such as separator temperature, separator pressure, and the physicochemical properties of the liquid hydrocarbons, in addition to very low condensate production rates at well sites in Denton and Parker counties are probable leading causes of the uncertainty.

**Table ES-1. Average, Standard Deviation, and Range of VOC Vent Gas Emission Factors Measured for Oil and Condensate Storage Tank Batteries**

	Emission Factor (lb/bbl)	
	Oil Tanks Number Sampled =11	Condensate Tanks <sup>a</sup> Number Sampled = 22
Arithmetic Mean	1.6	33.3
Standard Deviation	2.3	53.3
95% Confidence Interval for Mean	0.0 – 3.1	9.1 – 57.7
Minimum	0.0	0.7
Maximum	6.8	215.1
Median	0.8	12.0

<sup>a</sup> Excludes data from one well site that was not representative of normal operating conditions

Table ES-2 gives the total *uncontrolled* VOC emissions estimated for wellhead and gathering site storage tanks in the HGB, DFW, and BPA based on the arithmetic mean emission

factors given in Table ES-1 and 2005 daily average oil and condensate production<sup>1</sup>. These estimates assume no vent gas controls at any source; although, it is evident based on screening of candidate host sites that vent gas is recovered at some undetermined number of tank batteries in East Texas. Additional uncertainties in the regional emissions estimates stem from the average emission factor uncertainties, which as noted above are close to a factor of 2, and the small number of test sites relative to the entire population of storage tank batteries in East Texas.

The number and selection of tank batteries that were sampled in this study were limited by budget and schedule constraints in addition to the finite pool of host sites that provided voluntary access. Future studies can reduce average emission factor uncertainty and broaden their applicability by sampling a larger number of tank batteries and by conducting the tests during a wider variety of weather conditions, respectively.

**Table ES-2. Estimated VOC Emissions from Oil and Condensate Wellhead and Gathering Site Storage Tanks**

<b>Nonattainment Area</b>	<b>Oil (bbl/Year)</b>	<b>Condensate (bbl/Year)</b>	<b>Estimated VOC (Tons per Day)</b>
<b>BPA</b>	2,419,201	3,065,105	145
<b>DFW</b>	102,558	816,724	38
<b>HGB</b>	9,875,858	5,858,404	289
<b>East Texas Attainment Counties<sup>a</sup></b>	49,939,437	16,171,858	846
<b>East Texas Region Total<sup>a</sup></b>	62,337,054	25,912,091	1,317

<sup>a</sup> The East Texas Region is defined by all the Texas counties that are traversed by or east of Interstate-35 or Interstate-37, plus Montague, Wise, Parker, Hood, Somervell, and Bosque counties

<sup>1</sup> The 2005 oil and condensate production levels were downloaded during July 2006 from the Texas Railroad Commission Production Data Query System, which is located on the Internet at [http://www.rrc.state.tx.us/interactive\\_data.html](http://www.rrc.state.tx.us/interactive_data.html).