



ETHYLENE, PROPYLENE, AND 1,3-BUTADIENE PIPELINE EMISSIONS

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Introduction

The Texas Commission on Environmental Quality (TCEQ) contracted Eastern Research Group, Inc. (ERG) to complete a 2008 area source inventory of speciated and total volatile organic compound (VOC) emissions for pipelines transporting ethylene, propylene, and 1,3-butadiene in the eight-county Houston-Galveston-Brazoria (HGB) ozone nonattainment area.

- Fugitive emissions from metering stations, valve stations, pumps, and other related components
- VOC emissions at the county level



Introduction (cont.)

- Emissions from ethylene, propylene, and 1,3-butadiene pipelines that were not previously inventoried by the TCEQ.
- A survey questionnaire was mailed to pipeline owners and operators to collect needed data.
- The survey results were used to calculate emissions based on United States Environmental Protection Agency (U.S. EPA) fugitive emissions guidance.



Facility Research

- Identified potential pipeline owners and operators
 - Railroad Commission of Texas (RRC) data including P5 and T4 permit information
- Filtered data results by the specific commodity transported and pipeline status (in service)
- 31 pipeline operators/owners were identified based on the criteria.



Facility Research (cont.)

Potential Pipeline Owners/Operators Located in the HGB Ozone Nonattainment Area

Ascend Performance Materials LLC	Dow Chemical Company	Intercontinental Terminal Co. LLC	TE Products Pipeline Company LLC
BASF Corporation	Dow Pipeline Company	Koch Pipeline Company LP	Texas Eastman Div, Eastman Chemco
BP Pipelines (North America), Inc.	Equistar Chemicals LP	Marathon Pipe Line LLC	TPC Group LLC
Buckeye Gulf Coast Pipelines LP	Enterprise Products Operating LLC	Mesa Operating Co.	Ultramar Oil and Gas Limited
Buckeye Products Pipeline LP	ExxonMobil Pipeline Company	Mustang Pipeline Company	UCAR Pipeline Incorporated
Chevron Pipe Line Company	Exxon Mobile Oil Corporation	OXEA Corporation	Union Carbide Corp.
ConocoPhillips Company	Houston Hydrocarbons, Inc.	Seadrift Pipeline Corporation	Valero Refining – Texas LP
ConocoPhillips Pipe Line Company	Houston Oil & Minerals Corp.	Shell Pipeline Company LP	



Calculation Methodology

- *Protocol for Equipment Leak Emission Estimates* (U.S. EPA, 1995)
- Emissions were estimated using the average emission factor approach rather than correlation equations due to the lack of screening data.
 - Synthetic Organic Chemical Manufacturing Industry (SOCMI) factors



Calculation Methodology (cont.)

- Component type and component count were needed for each pipeline system.
- The following assumptions were made:
 - all components are emitting;
 - VOC content 100% (unless indicated);
 - Leak Detection and Repair (LDAR) data not applicable (unless indicated);
 - hours of operation 8760 (unless indicated); and
 - weight % of chemicals in the mixture contained in the equipment was equal to weight % of the chemicals in the leaking material.



Survey Questionnaire

- Survey was developed to obtain as much detail as possible, within a limited time frame, while minimizing the reporting burden to encourage responses.
- Mailed to the 31 owners/operators on June 18, 2010.
- Survey responses were requested by July 16, 2010.



Survey Questionnaire (cont.)

- The survey questionnaire included:
 - general questions verifying identification and status of pipelines, referencing RRC data and indicated commodities;
 - specific pipeline data including commodities associated with each system, county location, length per county, etc.; and
 - individual site specific data including location and name and component information.
- Expected sources of emissions included metering stations, valve stations, pumps, etc.



Survey Questionnaire Results

- Of the original 31 surveys mailed, 28 were delivered successfully.
- Of the 28 delivered surveys, responses were provided by 22 owner/operators.
 - three undeliverable
 - six non-respondents
 - ten respondents with no reported component data
 - twelve respondents with reported component data



Survey Questionnaire Results (cont.)

- Thirteen commodities containing ethylene, propylene, and 1,3 butadiene were initially identified in the RRC data.
- Only nine commodities were reported by survey respondents.

Ethylene	100% ethylene
Ethylene	100% ethylene gas
Propylene	100% propylene
Polymer grade propylene	99.9% propylene
Chemical grade propylene	95% propylene
Dilute propylene	55% propylene
Propane/propylene	70% propylene
1,3-butadiene	100% 1,3-butadiene
Crude butadiene	80% 1,3-butadiene



Emissions Results

- SOCMI average emission factor method was used to estimate emissions for those pipelines with reported components.
 - Small number of LDAR controls were reported.
- Commodity-specific profiles were then developed to extrapolate emissions for other pipeline systems.
 - Divided the commodity-specific VOC and species emissions by the commodity-specific pipeline length.



Emissions Results (cont.)

Commodity-specific profiles for the nine reported commodities

Commodity	HRVOC Species	Pipeline Miles	HRVOC Species/Mile (tpy/mile)	Total VOC/Mile (tpy/mile)
Ethylene	Ethylene	437	0.43	0.43
Ethylene Gas	Ethylene	34	0.47	0.47
Propylene	Propylene	461.9	0.32	0.32
Polymer Grade Propylene	Propylene	87.9	0.38	0.38
Chemical Grade Propylene	Propylene	167.2	0.11	0.12
Dilute Propylene	Propylene	144.8	0.2	0.36
Propane/Propylene	Propylene	50.8	0.75	1.07
1,3-Butadiene	1,3-Butadiene	169	0.72	0.72
Crude Butadiene	1,3-Butadiene	156.6	0.42	0.53



Overall Emissions Inventory for HGB Nonattainment Area

County	HRVOC Species	HRVOC Species Emissions (tpy)	Total VOC Emissions (tpy)
Brazoria	1,3-Butadiene	39.3	45.8
Brazoria	Ethylene	148.8	148.8
Brazoria	Propylene	115	124.2
Chambers	1,3-Butadiene	11.2	11.4
Chambers	Ethylene	167	167
Chambers	Propylene	148.3	159
Galveston	1,3-Butadiene	3.9	4.4
Galveston	Ethylene	50.9	50.9
Galveston	Propylene	61.7	68.9
Harris	1,3-Butadiene	172.8	187.8
Harris	Ethylene	205	205
Harris	Propylene	202.1	236.2
Liberty	1,3-Butadiene	0.9	0.9
Liberty	Ethylene	35.5	35.5
Liberty	Propylene	23.9	23.9
Montgomery	Propylene	4	4
Total VOC Emissions			1,473.90
Total Ethylene Emissions		607.4	
Total Propylene Emissions		554.9	
Total 1,3-Butadiene Emissions		228.1	
Total HRVOC Emissions		1,390.40	

Note: There were no pipeline emissions estimated for Fort Bend and Waller counties because no pipelines were indicated in those two counties.



Final Report

The final project report was completed August 31, 2010 and will be available on the TCEQ website.



Questions?

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