



## MEMORANDUM

**TO:** Karla Smith-Hardison, TCEQ  
David Hitchcock, HARC

**FROM:** Richard Billings, Roger Chang, and Heather Perez, ERG

**DATE:** March 9, 2006

**SUBJECT:** Texas Railroad Emission Inventory Model (TREIM) and Results

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### 1.0 Introduction

The objective of this Texas Commission for Environmental Quality (TCEQ) and Houston Advanced Research Center (HARC) project is to improve locomotive emission estimates for the Dallas/ Fort Worth and Houston/Galveston areas by developing the Texas Railroad Emission Inventory Model (TREIM) to estimate and spatially allocate locomotive emissions. Data availability allowed the inclusion of all Texas counties into the model. Though the model is comprehensive in its geographic scope, the best quality data are associated with the two metropolitan areas that have the most railway traffic. In this project, the TCEQ project manager, Eastern Research Group (ERG) and Starcrest staff worked with the two largest railroad companies servicing the Dallas/Fort Worth and Houston/Galveston areas to provide as much detailed data as possible in a geographic information systems (GIS) format in order to develop and spatially allocate accurate estimates of emissions from locomotives operating in the area. This detailed data set was used to populate the model developed for this project.

It should be noted that the participating railroads provided significantly different activity and fuel usage data. For example, Burlington Northern Santa Fe (BNSF) estimated fuel consumption using event recorder data. As such, the emission estimating method for BNSF allows for segment-specific fuel consumption data for different railroad activities to be incorporated into the model. On the other hand, the Union Pacific (UP) data set aggregated all locomotive activities together, but the data elements were disaggregated into smaller railway segments. The fact that railroad companies compiled activity data differently to meet their different business needs was an important consideration in developing the data structure for the railroad model. The model was therefore developed to be sufficiently flexible to include both aggregated and disaggregated data. This need for flexibility necessitated that the model be developed as an Access database. By using a relational database system such as Access, data tables can be easily updated to incorporate new activity data elements and emission factors. Details concerning the structure and operation of the model are discussed in Section 2.0 of this report.

This project focuses on railroad activity data elements for the four counties of the Dallas/Fort Worth area and eight Houston/Galveston counties. It is recognized that the Dallas/Fort Worth area includes additional counties than those discussed in this report. The counties discussed here are those counties for which the railroad companies provided activity data. The compiled data elements are included in the Appendix of this report. As noted above, data for other counties were also incorporated into the model to provide a comprehensive assessment of locomotive emissions for the State of Texas.

An important attribute of this model is the geographic information system (GIS) component. The railroad companies submitted their railway activity data with segment identification codes, that were matched to railway segments in GIS shape files developed for this model. The advantage to having the railway activity and emissions data available in a GIS format is that emissions can be calculated at the segment level and viewed at a sub-county level. Prior to the development of GIS tools, State and local agencies were doing well to estimate county level emissions. Once the data is in a GIS format, it is possible to perform “what if scenarios” and identify emission “hot spots”. The GIS component is summarized in Section 5 of this report.

Initially the model was run with Gross Ton Milage (GTM) data obtained from the U.S. Department of Transportation’s Bureau of Transportation Statistics (BTS) for all counties with line haul operations in the State. Data from the railroads for the Dallas/Fort Worth and Houston/Galveston Counties replaced the BTS data.

UP provided GIS shape files directly. Some of the active segments included in their GSI files were not included in their activity data files. Emissions could not be estimated for these additional segments without additional information about rail traffic or fuel consumption for these additional segments. BNSF was not able to provide GIS shape files in a timely fashion, their activity and fuel usage data were applied to GIS segments developed from other data sources (i.e., BTS and DeskMap).

The emission estimates generated by the model are discussed in detail in Section 3 of this report and summarized in Table 1 below:

**Table 1. Total 2003 Locomotive Contributions for the State of Texas**

<b>Tons per Year by Area</b>				
<b>Area</b>	<b>CO</b>	<b>VOC</b>	<b>NOx</b>	<b>PM</b>
<b>Dallas/Fort Worth</b>	<b>815.67</b>	<b>342.64</b>	<b>5,346.19</b>	<b>203.28</b>
<b>Houston/Galveston</b>	<b>1,299.67</b>	<b>553.18</b>	<b>8,620.10</b>	<b>323.46</b>
<b>All Other Counties</b>	<b>6,012.06</b>	<b>2,260.68</b>	<b>40,232.85</b>	<b>1,514.29</b>
<b>TOTAL</b>	<b>8,127.40</b>	<b>3,156.50</b>	<b>54,199.15</b>	<b>2,041.04</b>
<b>Percentage Distribution by Area</b>				
Dallas/Fort Worth	10.04	10.86	9.86	9.96
Houston/Galveston	15.99	17.53	15.90	15.85
All Other Counties	73.97	71.62	74.23	74.19
Total	100.00	100.00	100.00	100.00

In the State of Texas in 2003, locomotives are estimated to emit approximately 8,127 tons per year (22 tons per day) of carbon monoxide (CO), 3,156 tons per year (8.6 tons per day) of Volatile Organic Compounds (VOC), 54,200 tons per year (148.5 tons per day) of nitrogen oxide (NO<sub>x</sub>) and 2,041 tons per year (5.6 tons per day) of particulate matter (PM). Collectively, the Dallas/Fort Worth and Houston Galveston counties account for approximately 25% of Texas locomotive emissions, as noted in Table 1. The Houston/Galveston area is responsible for 40% to 45% more locomotive emissions than the Dallas/Fort Worth area.

Note that yard locomotive data are currently not available for counties outside the Dallas/Fort Worth and Houston/Galveston areas. Attempts were made to estimate yard locomotives in other counties using the yard activity associated with Dallas/Fort Worth and Houston/Galveston, but as these two areas are major hubs for railroad traffic their yard activities were considered to be atypical, yielding an unreasonable estimate of yard activities for the rest of the state, therefore these estimates were not included in this model.

Section 3.0 of this report analyzes the complete emission estimate data set provided by the model for each county in the state of Texas. These results are compared with other railroad emission estimates in Section 4.0 of this report to insure that the model provides reasonable emission estimates. Section 5.0 includes a discussion of future improvements that could be made to the model. Lastly, Appendix A of this memorandum includes the railway activity dataset that was incorporated into the model and Appendix B includes emission estimates for non-Dallas/Fort Worth and Houston/Galveston counties.

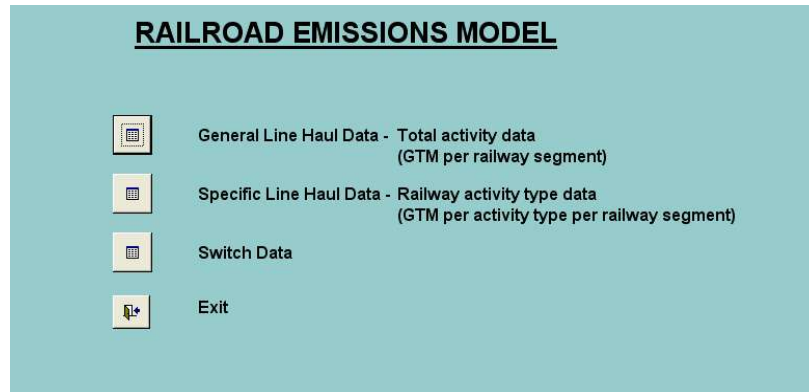
## **2.0 Texas Railroad Model**

The Texas Railroad Emission Inventory Model is very user friendly and has been loaded with the data for all Texas counties with active rail lines. As discussed earlier, only the Dallas/Fort Worth and Houston/Galveston areas data were provided directly by the railways. All other counties were developed from the BTS GIS shape files.

The railroad model was developed to easily incorporate data provided by the railway companies for line haul and switch engine operations. Projecting future activity and associated emissions were not components of the scope of work for this project, but the model can be easily modified to account for past and future changes in activity and the introduction of new fuels and control technologies. The model was also designed to use either general or specific data provided by the railways. As such, the model is divided into the following three major components:

- General line haul data,
- Specific line haul data, and
- Switch Data.

The opening screen of the model is shown in Figure 1.



**Figure 1. Opening Screen**

## 2.1 Line Haul Operations

The model structure considers line haul and switcher locomotives as two separate components. For line haul operations, the following input data tables were developed:

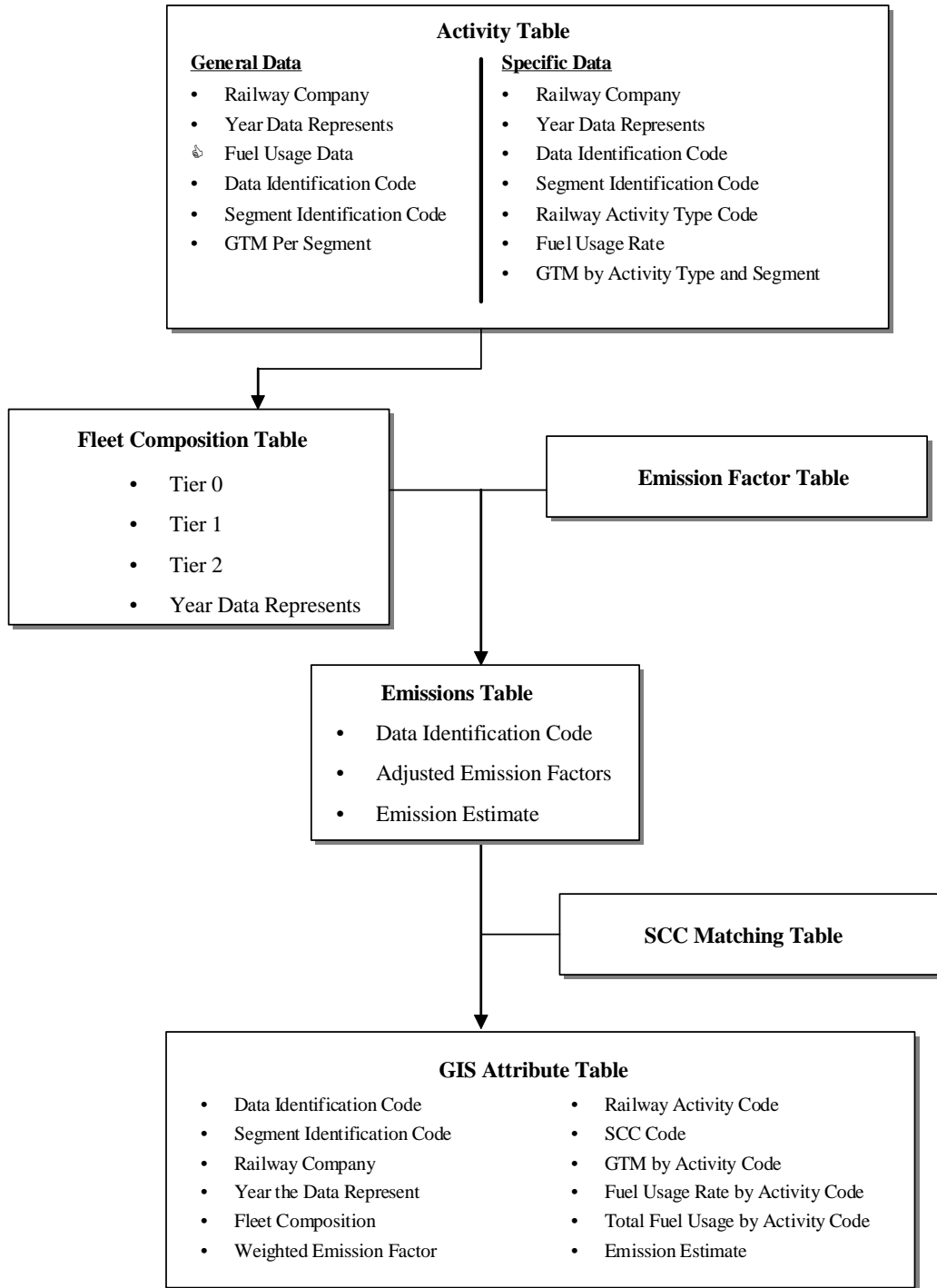
- Activity tables,
- Emission factor table,
- Fleet composition, and
- Source Classification Codes (SCC) linkage.

The model generates the following output data tables:

- Emissions table, and
- GIS attribute table.

The data tables and their linkages are shown in Figure 2. As noted above, the model has been populated with data for all counties including those that were not included in the railroad company data submittals. Emissions were estimated for these additional counties based on the GTM rating of each railway segment included in the BTS shape files. The GTM data obtained from the BTS provides a range of activity values for each railway segment. For this model the mid-point of the range was used and applied to the gallon of fuel/GTM factors developed from the data provided by the railway companies. These fuel usage estimates can be applied to available EPA emission factors to estimate emissions for each segment. Currently the model contains emissions estimates by county.

Where the railroads provided segment-level activity data, these data were used to replace the BTS activity data. The data provided for Dallas/Fort Worth and Houston/Galveston by the railway companies accounted for 29,985,017,751 (30.0 billion) GTM and replaced 26,648,781,806 (26.6 billion) GTM estimated from the BTS data for these counties. The replacement of the BTS estimate with the more accurate railroad company data suggests that the **BTS data underestimates railroad traffic by approximately 10%** (important observation). This is an important observation for non-Dallas/Fort Worth or Houston/Galveston Counties where rail traffic data were not provided by the railroad companies and BTS traffic data were used to estimate emissions. The BTS provides a reasonable



**Figure 2. Line Haul Components of Railroad Model**

estimate for railroad traffic, but more accurate data should be provided by the railway companies for these other counties to get better rail traffic data.

Two different activity tables were developed for the model to allow for the inclusion of general and specific train type data. The general line haul data section has been developed to incorporate data that reflects total activity per railway segment, regardless of railway traffic type. This generic railway type traffic is associated with the 2285002006 SCC. The specific line haul data section has been developed to manage data by railroad activity type as listed in Table 2. All of these railroad activities are associated with the Source Classification Code (SCC) 2285002006, except for Amtrak which is associated with the 2285002008 SCC.

In each component, the model gives the user the opportunity to add or edit activity data by segment. For the general activity table, the data fields included the following:

- Data identification code (Primary Key),
- Railway company,
- Calendar year of activity,
- Train count,
- Fuel usage rate (gal/1000 GTM),
- Segment identification code, and
- GTM per segment.

These data fields are shown in Figure 3. For the general line haul data, the train type is set at GENERIC and the train type code is set at AA. The primary key, noted throughout this report are unique identifiers that link the different data elements in the different data tables together to calculate emissions.

For railway companies that provided more specific data, the following activity data were incorporated into the model:

- Data identification code (Primary key),
- Railway company,
- Calendar year of activity,
- Segment identification code,
- Railway activity type code,
- Fuel usage rate (gal/1000 GTM) by railway activity type and segment, and
- GTM by activity and segment.

**Table 2. Locomotive Activity Codes**

<b>Locomotive Activity Code</b>	<b>Locomotive Activity Description</b>
A	Amtrak
B	Baretable Intermodal
C	Loaded Unit Coal
D	Lite Engine
E	Empty Unit Coal
F	Foreign Railroad Trains NSF
G	Loaded Unit Grain
H	Manifest (High Priority)
I	Deadhead Crew Moves
J	Not Used
K	Helper Service
L	Local Service
M	Manifest (Normal Priority)
N	Hours of Service Relief Crews
O	Officer Specials
P	Intermodal Premium
Q	Intermodal Guarantee
R	Road Switcher Service
S	Intermodal D-Stack
T	Transfer Service (Interchange Received/Delivered)
U	Unit (Not Grain or Coal)
V	Vehicle (Auto)
W	Work Train
X	Empty Unit Grain
Y	Yard Engines
Z	Priority Ups Intermodal

**RAILROAD EMISSIONS MODEL - GENERAL LINE HAUL DATA**

Railway Company	<input type="text" value="Union Pacific"/>	County Name	<input type="text" value="Harris County"/>
Data Year	<input type="text" value="2003"/>	State/County FIPS	<input type="text" value="48201"/>
Fuel Usage Rate	<input type="text" value="1.305"/> GAL/1000GTM	Data ID Code	<input type="text" value="2019765"/>
Train Type	<input type="text" value="GENERIC"/>	Segment ID Code	<input type="text" value="9765"/>
Train Count	<input type="text" value="17.3"/>	Fuel Usage (GAL)	<input type="text" value="2519307.74589126"/>
GTM	<input type="text" value="83519999.9999991"/>	Train Type Code	<input type="text" value="AA"/>
GTM/GAL	<input type="text" value="766.283524904215"/>		

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**Figure 3. General Line Haul Data Form**

The *Specific Line Haul Data Form* (as noted in Figure 4) is similar to the *General Line Haul Data Form*, except that the train type can be set to any of the types noted in Table 2. The train type code, as noted in Table 2, is automatically set when the train type is selected.

**RAILROAD EMISSIONS MODEL - SPECIFIC LINE HAUL DATA**

Railway Company	<input type="text" value="BNSF"/>	FIPS	<input type="text" value="48039"/>
Data Year	<input type="text" value="2004"/>	County Name	<input type="text" value="Brazoria"/>
Fuel Usage Rate	<input type="text" value="0.988468212997279"/> GAL/1000GTM	Data ID Code	<input type="text" value="03910026b"/>
Train Type	<input type="text" value="BARETABLE INTERMC"/>	Segment ID Code	<input type="text" value="10026b"/>
Train Count	<input type="text" value="24"/>	Fuel Usage (GAL)	<input type="text" value="4346"/>
GTM	<input type="text" value="4396701.82900658"/>	Train Type Code	<input type="text" value="B"/>
GTM/GAL	<input type="text" value="1011.66632052613"/>		

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**Figure 4. Specific Line Haul Data Form**

The user can also enter or edit the fleet composition for any railroad company in the data set. Figure 5 shows some example line haul fleet compositions. The fleet composition values are presented as fractions of each locomotive tier that sum to 1. The Tier definitions and associated emission factors are presented in Table 3. Tier 0 locomotives are those that have been constructed or rebuilt prior to 2001; Tier 1 locomotives are those that have been constructed or rebuilt between 2001 and 2004; and Tier 2 locomotives are those that have been constructed or rebuilt since 2004. These fractions can vary from year to year as new locomotives are added to the railway roster and older locomotives are removed from service. To allow for back casting and forecasting of locomotive emission estimates, the year associated with the Tier split must also be provided. The model has been modified to allow for the inclusion of hybrid engines and engines powered by liquid natural gas and other alternative and reformulated fuels.

**RAILROAD EMISSIONS MODEL - LINE HAUL FLEET COMPOSITION**

	RailwayCompany	DataYear	Tier0	Tier1	Tier2
▶	BNSF	2004	0.95	0.05	0
	Other	2002	1	0	0
	Union Pacific	2003	0.88	0.12	0
*		0	0	0	0

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**Figure 5. Line Haul Fleet Composition Form**

Emissions can be calculated in either the general or specific line haul components by clicking the “calculate emission” button. The emission calculations for both are derived from the reported fuel usage by segment. Where fuel usage is not provided this field is automatically calculated by dividing the reported GTM with GTM/GAL values as noted in the following equation:

$$\text{Fuel Usage} = (\text{GTM})/(\text{GTM}/\text{gal})$$

Example Calculation:

$$\text{Fuel Usage for Segment X} = (\text{GTM for Segment X})/(\text{GTM}/\text{gal})$$

$$\begin{aligned} \text{GTM for Segment X} &= 50,000,000 \\ \text{GTM}/\text{gal} &= 600 \end{aligned}$$

$$\begin{aligned} \text{Fuel Usage for Segment X} &= (50,000,000)/(600) \\ \text{Fuel Usage for Segment X} &= 83,333 \end{aligned}$$

The emission factors applied to the fuel usage data are presented in Table 3. These emission factors are weighted by the locomotive fleet composition for the specified calendar year prior to being applied to the fuel estimates, as noted in the following equation:

$$\text{Wef} = \text{T0F} * \text{T0EF} + \text{T1F} * \text{T1EF} + \text{T2F} * \text{T2EF}$$

Where:

Wef = Weighted emission factor

T0F = Tier 0 fraction

T0EF = Tier 0 emission factor

T1F = Tier 1 fraction

T1EF = Tier 1 emission factor

T2F = Tier 2 fraction

T2EF = Tier 2 emission factor

Example Calculation:

$$\text{Wef for NO}_x = \text{T0F} * \text{T0EF for NO}_x + \text{T1F} * \text{T1EF for NO}_x + \text{T2F} * \text{T2EF for NO}_x$$

Where:

Wef = Weighted emission factor

T0F = Tier 0 fraction is 10% of the fleet or 0.10

T0EF = Tier 0 emission factor for NO<sub>x</sub> is 178 grams/gal

T1F = Tier 1 fraction is 85% of the fleet or 0.85

T1EF = Tier 1 emission factor for NO<sub>x</sub> is 139 grams/gal

T2F = Tier 2 fraction is 5% of the fleet or 0.05

T2EF = Tier 2 emission factor NO<sub>x</sub> is 103 grams/gal

$$\text{Wef for NO}_x = 0.10 * 178 + 0.85 * 139 + 0.05 * 103$$

$$\text{Wef for NO}_x = 17.8 + 118.15 + 5.15$$

$$\text{Wef for NO}_x = 141.1 \text{ grams of NO}_x/\text{gal}$$

Any revisions made to the fuel data or the fleet composition are automatically incorporated into the emission estimates for each of the railway segments once the “calculate emissions” button is clicked.

**Table 3. Locomotive Emission Factors (grams/gal)**

Locomotive type	Pollutants			
	VOC	CO	NO <sub>x</sub>	PM
<i>Controlled emission rates for locomotives manufactured in 1973-2001 (Tier 0)</i>				
Line Haul	10	26.6	178	6.7
Switch	21	38.1	262	9.2
<i>Controlled emission rates for locomotives manufactured in 2002-2004 (Tier 1)</i>				
Line Haul	9.8	26.6	139	6.7
Switch	21	38.1	202	9.2
<i>Controlled emission rates for locomotives manufactured after 2004 (Tier 2)</i>				
Line Haul	5.4	5.0	103	3.6
Switch	11	7.3	152	4.3

U.S. EPA Emission Factors for Locomotives – Table 9: Fleet Average Emission Factors for all Locomotives BPR 420-F-97-051, 1997.

The emissions screen provides three views of the calculated emissions: first, emissions are presented by segment including the adjusted emission factors used in the estimate; second, emissions are presented as pollutant totals for each railway segment; and third, emissions are presented summarized to the county level. An example emission table by railway segment code is presented in Figure 6. This table shows the adjusted emission factor used as noted above.

**RAILROAD EMISSIONS MODEL - GENERAL LINE HAUL EMISSIONS**

Emissions by Data ID		Emissions by Pollutant		Emissions by County			
FIPS	COUNTYNAM1	RailwayCompany	DataIDCode	SegmentIDC	Pollutant	AdjustedEmissionFactor	Emissions
48039	Brazoria	Union Pacific	03910030	10030	CO	0.05864	52303.5601038232
48039	Brazoria	Union Pacific	03910030	10030	HC	0.0219972	19620.2570313066
48039	Brazoria	Union Pacific	03910030	10030	NOX	0.3821024	340813.708120994
48039	Brazoria	Union Pacific	03910030	10030	PM	0.01477	13174.0037983197
48039	Brazoria	Union Pacific	03910031	10031	CO	0.05864	69884.2673409686
48039	Brazoria	Union Pacific	03910031	10031	HC	0.0219972	26215.1808586759
48039	Brazoria	Union Pacific	03910031	10031	NOX	0.3821024	455370.84367711
48039	Brazoria	Union Pacific	03910031	10031	PM	0.01477	17602.1594240468
48039	Brazoria	Union Pacific	03910123	10123	CO	0.05864	7511.30087945213
48039	Brazoria	Union Pacific	03910123	10123	HC	0.0219972	2817.66009047552
48039	Brazoria	Union Pacific	03910123	10123	NOX	0.3821024	48944.1693922369
48039	Brazoria	Union Pacific	03910123	10123	PM	0.01477	1891.91531360007
48071	Chambers	Union Pacific	07112435b	12435b	CO	0.05864	1371.8880752544
48071	Chambers	Union Pacific	07112435b	12435b	HC	0.0219972	514.626472868112
48071	Chambers	Union Pacific	07112435b	12435b	NOX	0.3821024	8939.3200219319
48071	Chambers	Union Pacific	07112435b	12435b	PM	0.01477	345.5454787092
48113	Dallas	Union Pacific	11317810x	17810	CO	0.05864	3239.95716868533
48113	Dallas	Union Pacific	11317810x	17810	HC	0.0219972	1215.38175018767
48113	Dallas	Union Pacific	11317810x	17810	NOX	0.3821024	21111.7907580469
48113	Dallas	Union Pacific	11317810x	17810	PM	0.01477	816.066974445469
48113	Dallas	Union Pacific	11317810y	17810	CO	0.05864	3239.95716868533
48113	Dallas	Union Pacific	11317810y	17810	HC	0.0219972	1215.38175018767
48113	Dallas	Union Pacific	11317810y	17810	NOX	0.3821024	21111.7907580469
48113	Dallas	Union Pacific	11317810y	17810	PM	0.01477	816.066974445469
48113	Dallas	Union Pacific	11318219ex	18219e	CO	0.05864	24556.3958022096
48113	Dallas	Union Pacific	11318219ex	18219e	HC	0.0219972	9211.66353581796

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Print Emissions by Data ID

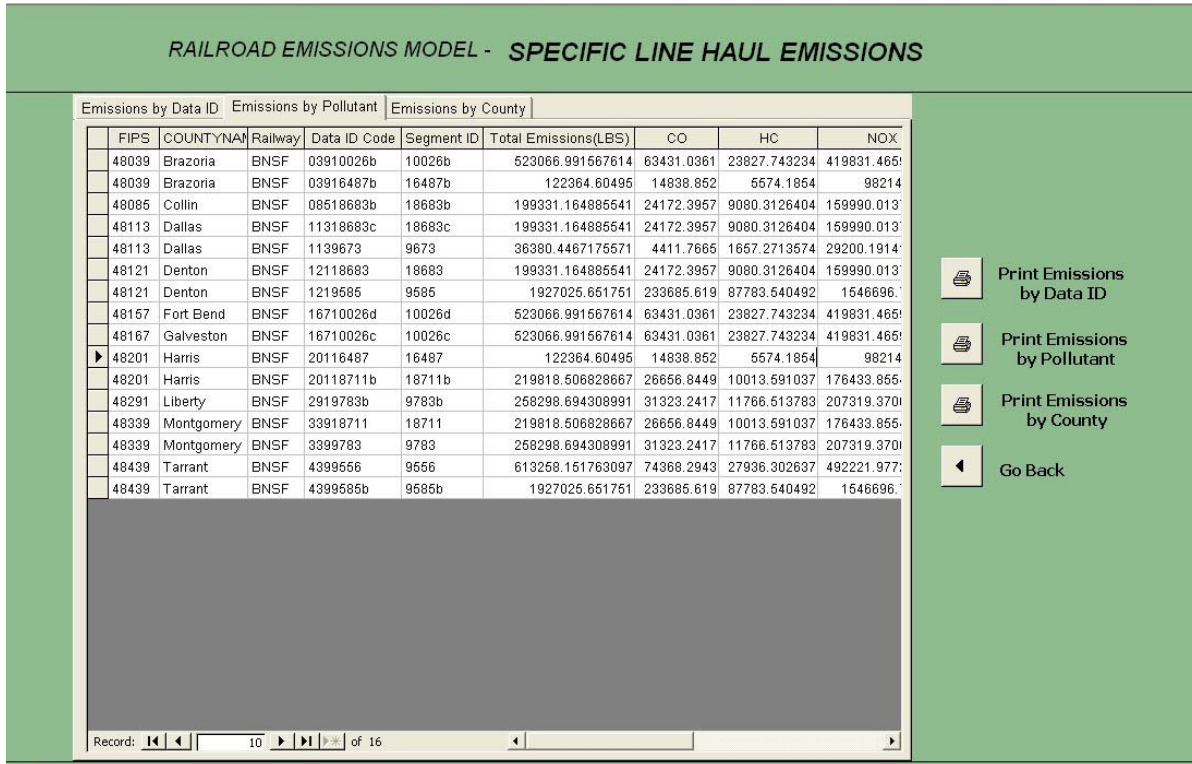
Print Emissions by Pollutant

Print Emissions by County

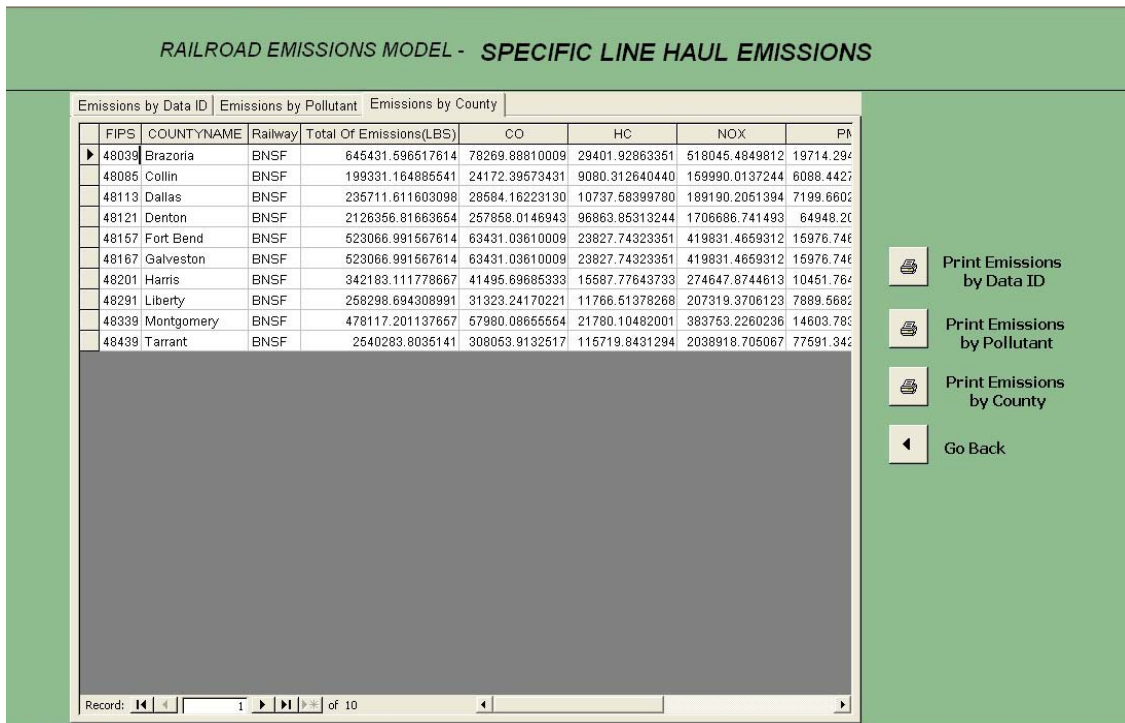
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**Figure 6. Emission Estimate Table by Data ID Code**

Figure 7 provides an example emission table by pollutant and Figure 8 provides an example emission table disaggregated by county for the specific line haul approach.



**Figure 7. Emission Estimate by Pollutant**



**Figure 8. Emission Estimate by County**

## 2.2 Yard/Switcher Engine Operations

For yard locomotives, many of the procedures discussed for line haul locomotive are applicable. As with line haul operations, the following input data tables were developed:

- Activity tables,
- Emission factor table,
- Fleet composition, and
- SCC linkage.

The model generates the following tables:

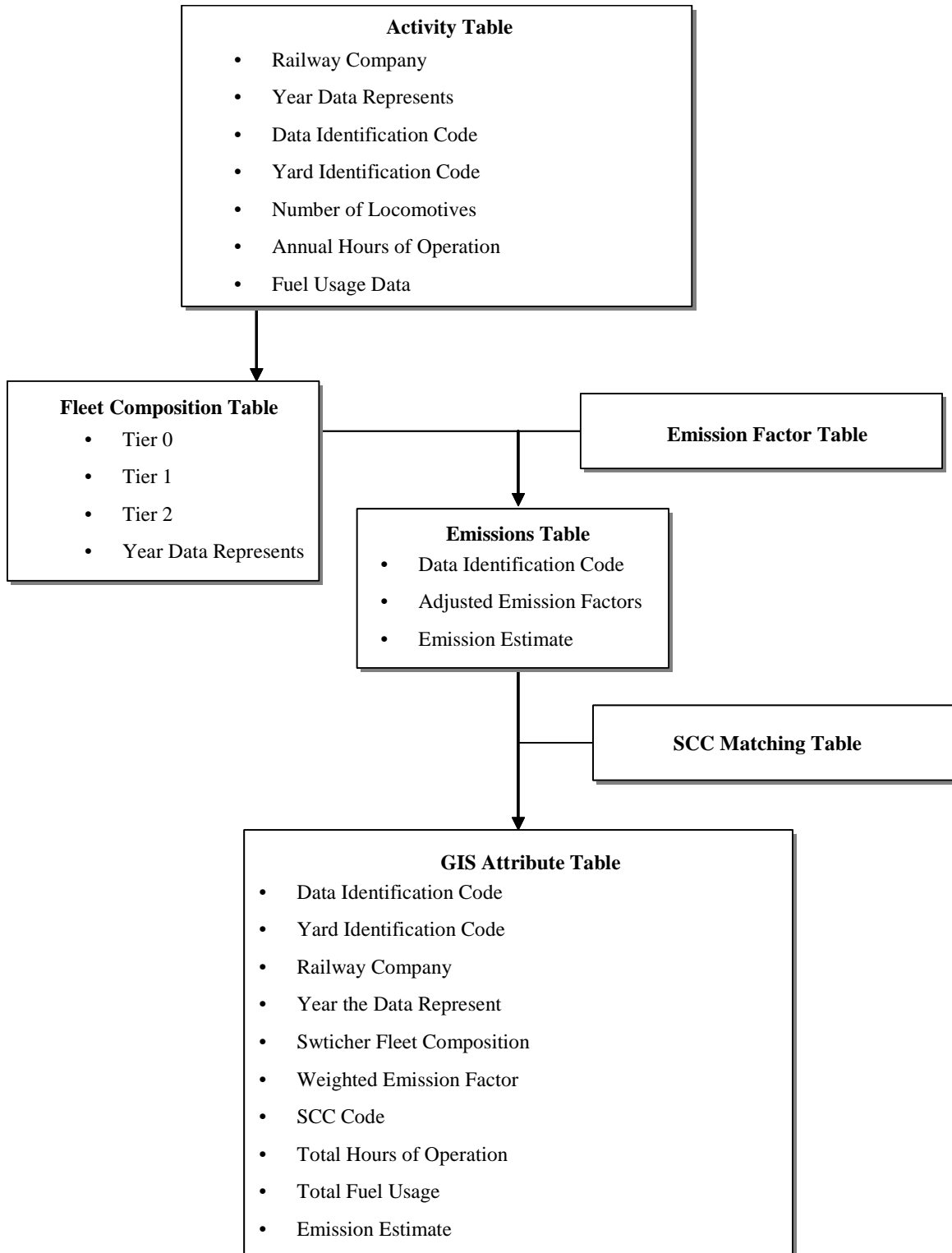
- Emissions table, and
- GIS attribute table.

The data tables and their linkages are shown in Figure 9.

Unlike the line haul component that allows for the inclusion of general or detailed railroad data, only one activity table is required for switch locomotives. The following data elements are required to run the model for switch locomotive activities:

Data identification code (Primary key),

- Railway company,
- Calendar year of activity,
- Yard identification code,
- Number of locomotives,
- Average annual hours of operation per locomotive, and
- Latitude and longitude coordinates of the centroid of the yard.



**Figure 9. Switch Locomotive Components of Railroad Model**

These data elements are shown in *Switch Data Form* (Figure 10).

RAILROAD EMISSIONS MODEL - SWITCH DATA			
Railway Company	BNSF	Data ID Code	Y004
Data Year	2004	Yard ID Code	Casey1
City	Casey	Longitude	-95.51
Train Count	4	Latitude	29.915
Fuel Usage (GAL)	329960		
Annual Hours of Operation	35040		

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View/Edit Fleet Composition Calculate Emissions Go to Previous Menu

**Figure 10. Switch Data Form**

Currently, there is only one SCC for yard locomotives (i.e., 2285002010). This code was assigned to all switch locomotive emissions estimates.

As with the line-haul emission factor table, the switcher emission factor table included the emission factors noted in Table 2 above in pounds of pollutant per gallon of fuel used. The switch engine emission estimates were developed by adjusting the emission factors to account for the fleet mix of the switch engines.

Where the composition of the switcher fleet has been affected by State grant programs such as TERP, the vehicle fleet was modified to reflect these improvements. Figure 10 shows the *Switch Engine Fleet Composition Form*. As with the line haul operations, the switcher fleet composition values are presented as fractions that sum to 1 and can vary from year to year as new switch engines are added and older engines are taken out of service.

## RAILROAD EMISSIONS MODEL - SWITCH FLEET COMPOSITION

RailwayCompany	DataYear	Tier0	Tier1	Tier2
Amtrak		1	0	0
BNSF	2004	1	0	0
CANAC		1	0	0
DGNTNR		1	0	0
Farmland AMD		1	0	0
FWWR		1	0	0
Galveston Railroad		1	0	0
KCS/Texas-Mexico		1	0	0
Port Terminal Rail Assoc.	2003	1	0	0

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**Figure 10. Switch Engine Fleet Composition Form**

The emissions calculations were derived for each yard using the fuel usage values provided by the railways. If fuel usage was not provided, the fuel usage was based on hours of operation multiplied by the number of switch engines operating at the yard. For these calculations it is assumed that 1 engine consumed 9.375 gallons of diesel fuel per hour. (U.S. EPA Procedures for Emission Inventory Preparations, Volume IV Mobile Source, EPA 420-R-92-009, 1992), as noted in the following equation and example calculation:

$$YFU = YN * 9.375 \text{ gal/hr} * 8760 \text{ hrs per year}$$

Where:

YFU = Annual Yard Fuel Usage  
YN = Number of Yard Locomotives

Example Calculation

$$YFU = YN * 9.375 \text{ gal/hr} * 8760 \text{ hrs per year}$$

Where:

YFU = Annual Yard Fuel Usage  
YN = 12

$$YFU = YN * 9.375 \text{ gal/hr} * 8760 \text{ hrs per year}$$




$$YFU = 12 * 9.375 \text{ gal/hr} * 8760 \text{ hrs per year}$$

$$YFU = 985,500 \text{ gallons of fuel per year}$$

As with the line haul operations, emission summary tables are generated by yard and pollutant as shown in Figure 11.

## RAILROAD EMISSIONS MODEL - SWITCH EMISSIONS

Emissions by Data ID			Emissions by Pollutant		
DataIDCode	YardIDCode	City	AdjustedEF(LBS/GAL)	Pollutant	Emissions(LBS)
Y001	Dallas1	Dallas	0.084	CO	23520
Y001	Dallas1	Dallas	0.0463	HC	12964
Y001	Dallas1	Dallas	0.57761	NOX	161730.8
Y001	Dallas1	Dallas	0.02028	PM	5678.4
Y002	Denton1	Denton	0.084	CO	9702
Y002	Denton1	Denton	0.0463	HC	5347.65
Y002	Denton1	Denton	0.57761	NOX	66713.955
Y002	Denton1	Denton	0.02028	PM	2342.34
Y003	Alvin1	Alvin	0.084	CO	6929.16
Y003	Alvin1	Alvin	0.0463	HC	3819.287
Y003	Alvin1	Alvin	0.57761	NOX	47647.0489
Y003	Alvin1	Alvin	0.02028	PM	1672.8972
Y004	Casey1	Casey	0.084	CO	27716.64
Y004	Casey1	Casey	0.0463	HC	15277.148
Y004	Casey1	Casey	0.57761	NOX	190588.1956
Y004	Casey1	Casey	0.02028	PM	6691.5888
Y005	Dayton1	Dayton	0.084	CO	27716.64
Y005	Dayton1	Dayton	0.0463	HC	15277.148
Y005	Dayton1	Dayton	0.57761	NOX	190588.1956
Y005	Dayton1	Dayton	0.02028	PM	6691.5888
Y006	Galveston1	Galveston	0.084	CO	34645.8
Y006	Galveston1	Galveston	0.0463	HC	19096.435
Y006	Galveston1	Galveston	0.57761	NOX	238235.2445
Y006	Galveston1	Galveston	0.02028	PM	8364.486
Y007	Houston1	Houston	0.084	CO	194016.48
Y007	Houston1	Houston	0.0463	HC	106940.036
Y007	Houston1	Houston	0.57761	NOX	1334117.3692

 Print Emissions by Data ID  
 Print Emissions by Pollutant  
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Record: 1 of 100

**Figure 11. Emission Estimate Table by Data ID Code**

It should be noted that the locational data for the yards provided by the railroads were often incomplete or contained inconsistent data. Only three yards included appropriate latitude and longitude coordinates. These coordinates were included in the model. All other yards were assigned to an appropriate county using the data provided by the railway companies.

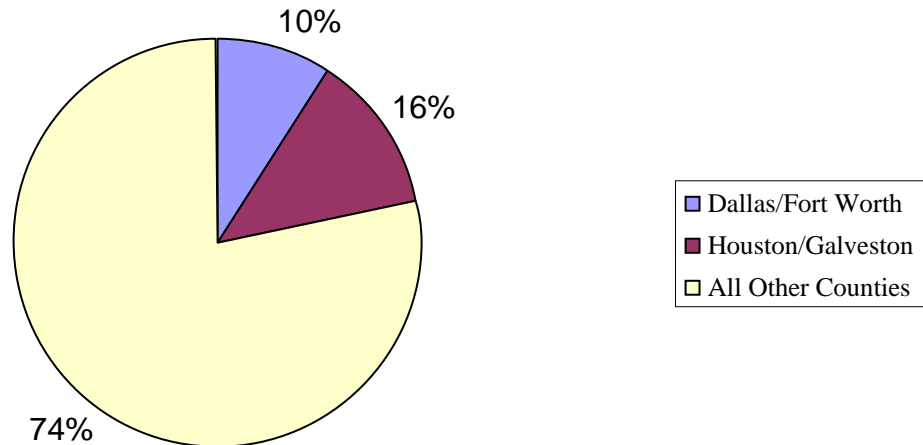
### 3.0 Emission Summary

For 2003 locomotives are estimated to emit approximately 7,700 tons per year of CO; 3,000 tons per year of HC; 51,400 tons per year of NO<sub>x</sub> and 2,000 tons per year of PM in the State of Texas (for details see Table 4 and Figure 12). These emissions are underestimated relative to actual railway emissions since they include yard locomotives only from Dallas/Fort Worth and Houston/Galveston counties. If yard locomotives were included for all other counties then the actual state total locomotive emissions would be greater than reported in these estimates. Emission estimates are provided in Appendix B for counties not included in the Dallas/Fort Worth and Houston/Galveston areas. Collectively, the Dallas/Fort Worth and Houston Galveston area counties account for approximately 20% of Texas locomotive emissions. The Houston/Galveston area emits 40% to 45% more locomotive emissions than the Dallas/For Worth area, depending upon which pollutant you consider.

**Table 4. Total 2003 Locomotive Emissions for the State of Texas (tons per year)**

Area	CO	VOC	NO <sub>x</sub>	PM
<b>Dallas/Fort Worth</b>				
Line Haul - General Activity	299.03	112.17	1,948.49	75.32
Line Haul - Specific Activity	309.33	116.20	2,047.39	77.91
Line Haul Total	608.36	228.37	3,995.88	153.23
Switch Engine Activity	207.31	114.27	1,350.31	50.05
Dallas/Fort Worth Total	815.67	342.64	5,346.19	203.28
<b>Houston/Galveston</b>				
Line Haul - General Activity	759.34	284.85	4,947.91	191.26
Line Haul - Specific Activity	167.97	63.10	1,111.71	42.31
Line Haul Total	927.31	347.94	6,059.63	233.57
Switch Engine Activity	372.36	205.24	2,560.48	89.90
Houston/Galveston Total	1,299.67	553.18	8,620.10	323.46
<b>All Other Counties</b>				
Line Haul	6,012.06	2,260.68	40,232.85	1,514.29
Grand Total	8,127.40	3,156.50	54,199.15	2,041.04

**Figure 12. Texas Locomotive Emission Contributions by Area (aggregated criteria pollutants)**

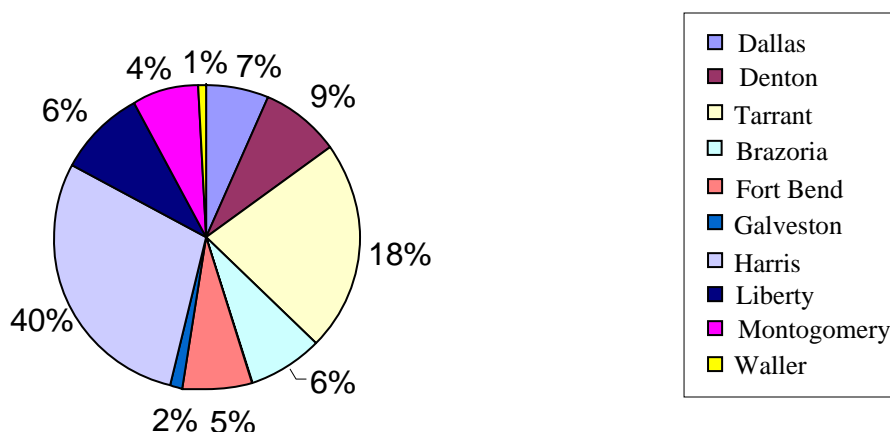


Given that UP provided only general activity data, the emission estimates provided in Table 5 and Figure 13 reflect their line haul estimates in the Dallas/Fort Worth areas. In general UP had roughly 3.7 times more emissions than BNSF for the Dallas/Fort Worth and Houston/Galveston counties. Harris County represents about half of the emissions for the Houston/Galveston Counties. Approximately 70% more of UP's traffic occurs in the Houston/ Galveston area than in the Dallas/Fort Worth area.

**Table 5. 2003 General Line Haul Emission Estimates for Dallas/Fort Worth and Houston/Galveston Counties (tons per year)**

<b>County</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
<b>Dallas/Fort Worth</b>				
Dallas	57.76	21.67	376.35	14.55
Denton	74.96	28.12	488.46	18.88
Tarrant	166.31	62.39	1,083.68	41.89
DFW Total	299.03	112.17	1,948.49	75.32
<b>Houston Galveston</b>				
Brazoria	64.85	24.33	422.56	16.33
Chambers	0.69	0.26	4.47	0.17
Fort Bend	67.20	25.21	437.85	16.92
Galveston	10.58	3.97	68.92	2.66
Harris	480.35	180.19	3,129.99	120.99
Liberty	85.05	31.90	554.17	21.42
Montgomery	43.91	16.47	286.15	11.06
Waller	6.72	2.52	43.79	1.69
HGA Total	759.34	284.85	4,947.91	191.26
DFW and HGA Total	1,058.37	397.02	6,896.40	266.58

**Figure 13. Locomotive Contributions for Dallas/Fort Worth & Houston/Galveston Counties**



On the other hand, BNSF had 2.5 times more traffic in the Dallas/Fort Worth area than in the Houston Galveston area, (see Table 6 for details). This difference between the two areas may be due to the fact that BNSF's corporate headquarters is in Tarrant County, which had an order of magnitude more emissions than the next most significant Dallas/Fort Worth County.

**Table 6. 2003 Specific Line Haul Emission Estimates for Dallas/Fort Worth and Houston/Galveston Counties (tons per year)**

County	CO	VOC	NO <sub>x</sub>	PM
<b>Dallas/Fort Worth</b>				
Collin	12.09	4.54	80.00	3.04
Dallas	14.29	5.37	94.60	3.60
Denton	128.93	48.43	853.34	32.47
Tarrant	154.03	57.86	1,019.46	38.80
DFW Total	309.33	116.20	2,047.39	77.91
<b>Houston Galveston</b>				
Brazoria	39.13	14.70	259.02	9.86
Fort Bend	31.72	11.91	209.92	7.99
Galveston	31.72	11.91	209.92	7.99
Harris	20.75	7.79	137.32	5.23
Liberty	15.66	5.88	103.66	3.94
Montgomery	28.99	10.89	191.88	7.30
HGA Total	167.97	63.10	1,111.71	42.31
DFW and HGA Total	477.30	179.30	3,159.11	120.22

One of the most surprising results from the modeled estimates is the extent to which switch engines and yard locomotives contribute to railway emissions. Yard locomotives continue to generate emissions throughout the year, while line haul locomotives only contribute emissions to a location during the brief period they transit an area. Yard locomotives accounted for between 34% and 43% (depending upon the pollutant) of the locomotive emissions in the Dallas/Fort Worth and Houston/Galveston counties. Most of the switch engine and yard locomotive emissions occur in the Houston/Galveston area (see Table 7 for details). As noted above, the elevated level of yard activity in the area is atypical as these counties are major hubs and have an exceptionally large number of yard locomotives in operation.

Line haul locomotive emission estimates for the remaining 207 Texas counties having railroad traffic can be found in Appendix B. These estimates are based on the average GTM data provided by the BTS.

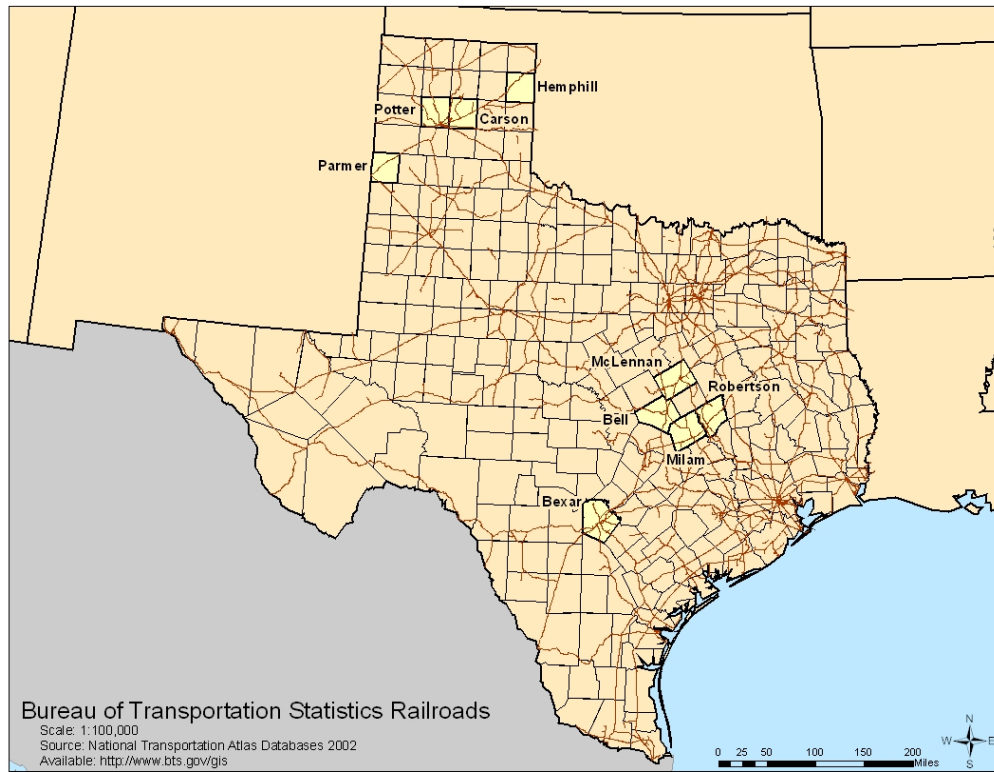
The following nine counties all had slightly elevated emission estimates (HC >35 tpy, CO >100 tpy, PM >25 tpy, and NO<sub>x</sub>>670 tpy). These higher estimates are considered reasonable as major rail lines intersect in these nine counties, as noted in Figure 14.

Bell	Hemphill	Parmer
Bexar	McLennan	Potter
Carson	Milam	Robertson

As noted above, the emission estimates for the non-Dallas/Fort Worth and Houston/Galveston counties are based on BTS railroad traffic data are estimates that include intrinsic error. More detailed data from the railroad companies for these additional counties would allow for a more accurate emission estimate and a reduction in the uncertainty associated with these estimates.

**Table 7. 2003 Switch Engine Emission Estimates for Dallas/Fort Worth and Houston/Galveston Counties (tons per year)**

	CO	VOC	NO <sub>x</sub>	PM
<b>Dallas/Fort Worth</b>				
Dallas	98.50	54.29	654.28	23.78
Denton	4.85	2.67	33.36	1.17
Tarrant	103.96	57.30	662.67	25.10
DFW Total	207.31	114.27	1,350.31	50.05
<b>Houston Galveston</b>				
Brazoria	31.18	17.19	214.41	7.53
Galveston	32.82	18.09	225.68	7.92
Harris	294.50	162.33	2,025.09	71.10
Liberty	13.86	7.64	95.29	3.35
HGA Total	372.36	205.24	2,560.48	89.90
DFW and HGA Total	579.67	319.51	3,910.79	139.95



**Figure 14. Texas Railroad Map with Additional High Traffic Counties Highlighted**

#### 4.0 Comparisons to External Studies

These findings can be converted to “tons per average ozone season weekday” measure to compare to other emission inventories in the State Implementation Plan (SIP). The Federal Clean Air Act Amendments of 1990 required a new baseline for SIP emission inventories, including non-road mobile sources such as locomotive engines. This base year inventory was updated in 1996 and every three years thereafter. A survey was conducted to support the 1990 Base Year Emissions Inventory but the response rate was low and many railway companies declined to participate. This inventory was assembled as best as practicable and subsequently was approved as part of the SIP. Due to lack of information about locomotive growth potentials, the 1996 Periodic Emissions Inventory (PEI) was reflective of the 1990 baseline, without any significant changes. The three PEIs included in the analysis for this report include:

- 1996 inventory performed by TCEQ (same as 1990 baseline).
- 1999 update: locomotive emissions appear to have been extracted from a report done by ENVIRON in which a fuel sales method was applied to railroad track miles.
- 2002 update: this was prepared by ERG and used 2001 survey data from BNSF and UP for all Texas counties, some data was available from KCS and one yard switch operator (PTRA). (TCEQ, 2002, ‘Locomotive Emissions Inventory: Update and Discussion’, Version 1.2, prepared by ERG, August 30, 2002)

As is shown in the tables below, each approach resulted in overall emissions that were not consistent over time. Results from the current study confirm the need to recalculate the baseline locomotive emissions inventory so that past, present, and future emissions may somehow be adjusted to show a more consistent trend, as expected. In addition to the three official PEI sources and this report, included are summary locomotive emissions from the ozone SIPs (i.e., “Modeling EI”) and summary locomotive emissions from the modeling inventories developed for the Houston and Dallas/Fort Worth ozone SIPs.

The Houston area, which includes eight counties has the most severe ozone problem in Texas and has been studied far more extensively as to its emissions inventory, and thus is listed first. The Dallas area is comprised of the central four counties in the Metro region. The Beaumont-Port Arthur area is also a serious ozone nonattainment area but was not included in this scope of work. Units are expressed in terms of tons per average ozone season weekday (June-August).

Tables 8 and 9 show that the 1999 PEI is the highest, possibly due to the fact that many railroad companies purchase diesel fuel in Texas but use it elsewhere (e.g., BNSF is based in Fort Worth but ships locomotive diesel all over the country). In all other inventories, except for the modeling inventories, a GTM method was used for line haul locomotives and switch yard activity as opposed to Department of Energy fuel sales data. The GTM method estimates fuel usage based on GTM traffic activity; these fuel estimate are applied to emission factors to estimate emissions.

**Table 8. Locomotive Emissions in the Houston Nonattainment Region by Scenario, Tons per Day**

Scenario	CO	VOC	NO <sub>x</sub>
1996 PEI	3.36	1.36	22.19
1999 PEI	5.18	2.09	52.74
2002 PEI	1.93	0.75	18.53
Modeling EI (2000)	n/a	1.47	35.94
<b>This Report (2003)</b>	3.83	1.62	25.40

**Table 9. Locomotive Emissions in the Dallas Nonattainment Region by Scenario, Tons per Day**

Scenario	CO	VOC	NO <sub>x</sub>
1996 PEI	1.49	0.64	10.48
1999 PEI	3.81	1.55	38.65
2002 PEI	1.68	0.65	16.29
Modeling EI (2000)	n/a	0.93	22.90
<b>This Report (2003)</b>	2.59	1.07	16.99

Adjustments may have been made to the temporal and spatial allocation of the modeling EIs causing these estimates to be different from the other inventories, but still within the range of the 1999 and 2002 PEIs for VOC and NO<sub>x</sub>.

One condition to note is that over time, locomotive emissions should have trends that reflect (1) activity growth and (2) reductions due to cleaner technology such as from the EPA Locomotive Rule (See <http://www.epa.gov/otaq/locomotv.htm>) and state initiatives such as the Texas Emission Reduction Plan (See <http://www.tnrcc.state.tx.us/oprd/sips/terp.html>).

An additional study was compared to insure the reasonableness of this study's results. CENRAP commissioned an "Emission Inventory Development for Mobile Sources and Agricultural Dust Sources for the Central States" (October 2004). As Table 10 indicates, results for this study are between 5 and 21 percent less than the CENRAP study which is understandable as the CENRAP study was derived from fuel sales data which tends to overestimate emissions as fuel sold in a given area may not necessarily be combusted in the same area.

**Table 10. CENRAP Texas Locomotive Study (tons per year)**

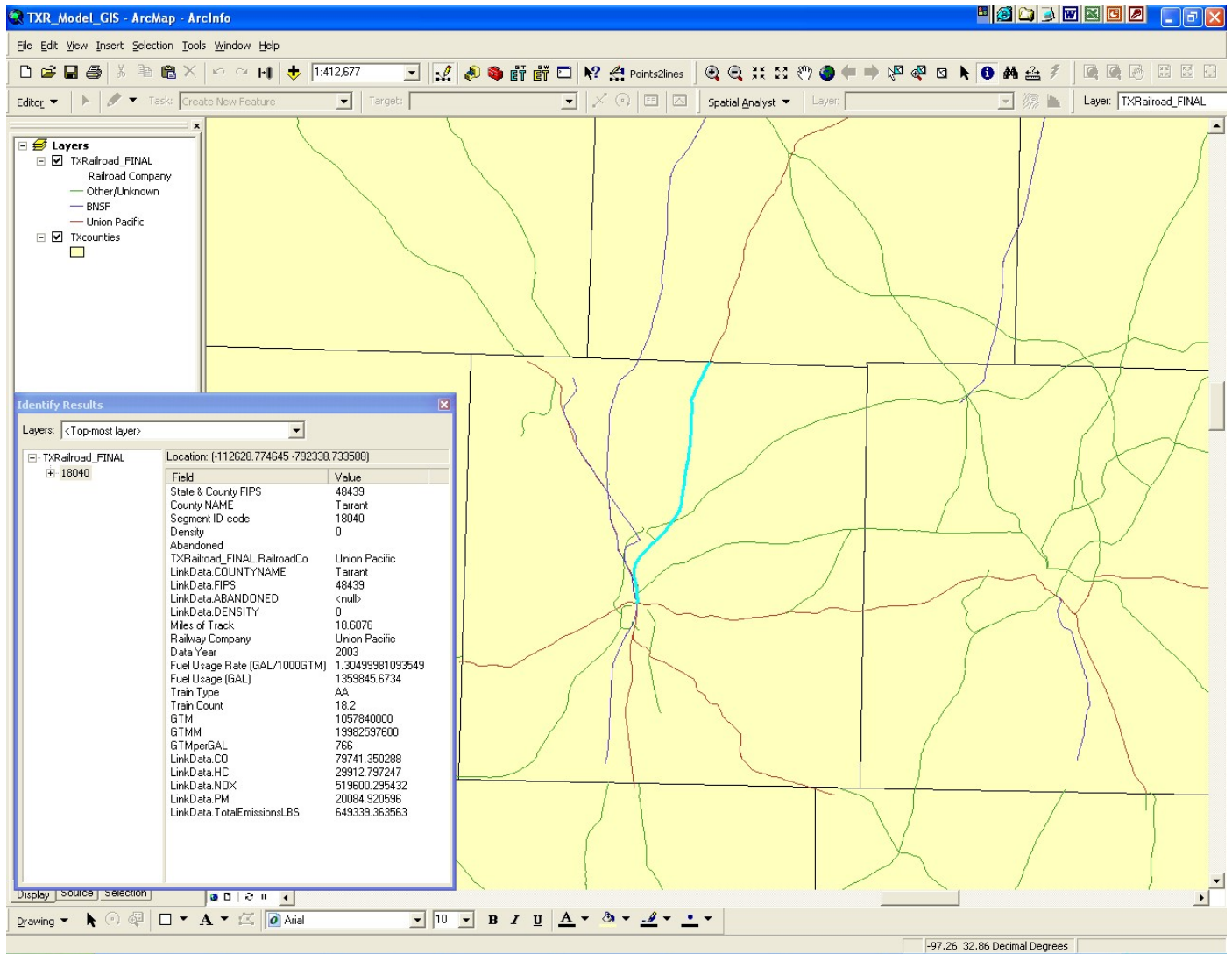
Study	CO	VOC	NO <sub>x</sub>	PM
CENRAP	9,489	3,753	68,236	2,149
This Report	8,127	3,157	54,199	2,041
% Difference	14%	19%	21%	5%

## 5.0 Geographic Information System Component

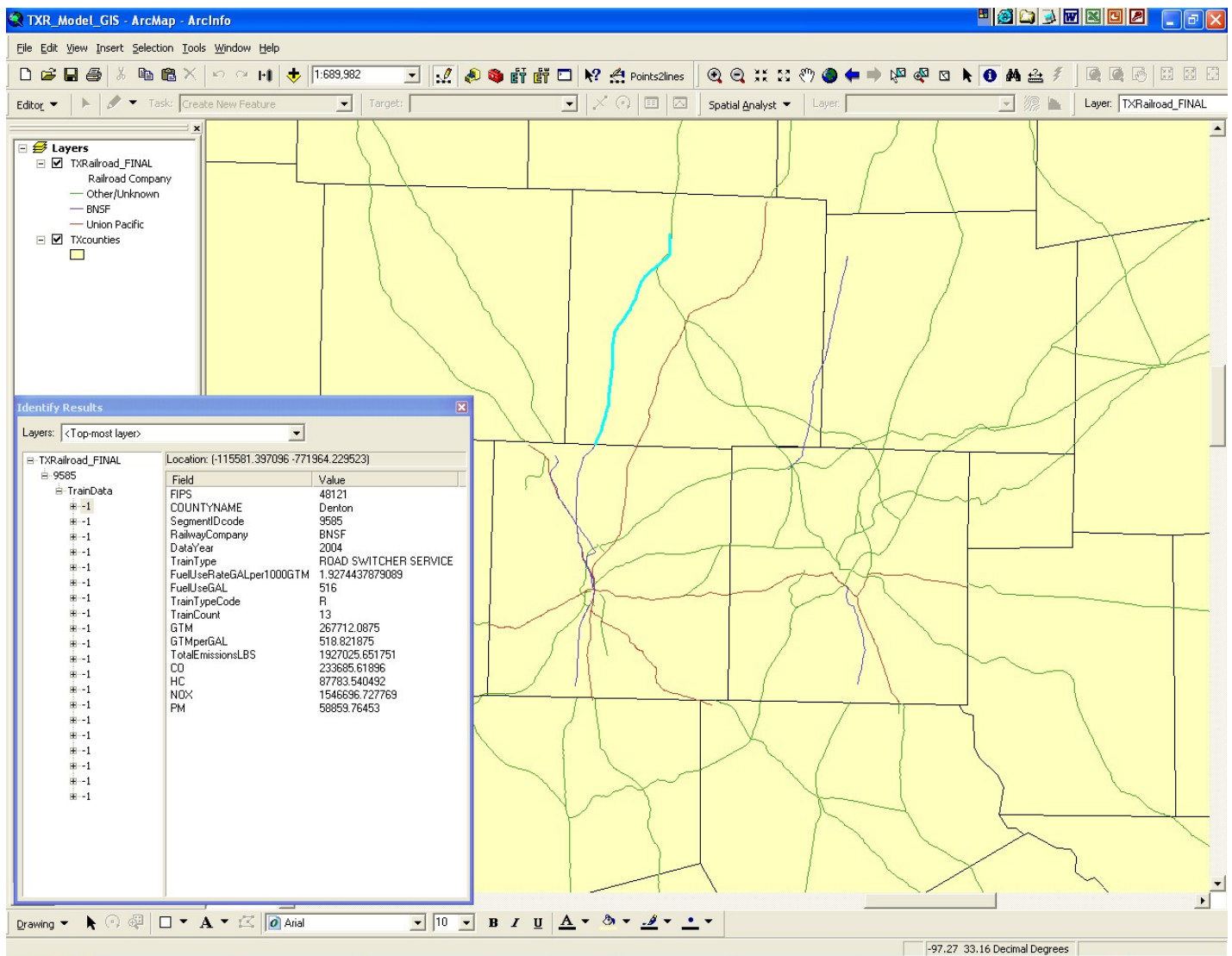
With the data in a GIS format, one can view all of the attribute data for every segment used in the model, whether the data are applied to the generic or specific emission estimating approach. As Noted in Figure 15, data using the generic approach are shown for a segment of rail line in Tarrant County running north of Fort Worth. The segment of interest is noted in bright blue. The activity data, including train counts, total gross tonnage, GTM and fuel consumption associated with that segment is noted in the information box. The information box also includes state and county FIP codes, county name, segment code, track length data as well as emission estimates.

In Figure 16, data using the specific approach are shown for a segment of rail line in Denton County running north of Fort Worth. The segment of interest is again noted in bright blue. Like the general approach data, each segment displays the segment-level activity data, including train counts, total gross tonnage, GTM and fuel consumption associated with that segment is noted in the information box. The information box also includes state and county FIP codes, county name, segment code, track length data as well as emission estimates. However, the information box contains a second level of data as the segment also contains information broken out by each train type found on that portion of rail line. This enables the user to identify how much of the total activity or emissions for that segment can be attributed to any individual train type.

Having the data in a GIS format is particularly useful as specific heavy traffic segments can be easily identified and different scenarios can be run showing what future emissions look like if the traffic is increased, decreased, or shifted to other segments. Data can also be summarized at the county or subcounty-level (e.g., metropolitan statistical areas, zip codes, census blocks, or modeling grids), by overlaying these maps onto the data. The example shown in Figures 15 and 16 provides county-level mapping. At this time, additional maps have not been incorporated into the railroad model. These can be developed and applied in the future as they are needed.



**Figure 15. Example GIS Screen for General Line Haul Data**



**Figure 16. Example GIS Screen for Specific Line Haul Data**

## 6.0 Future Enhancements to the Texas Railroad Model

Once this preliminary model was completed, an assessment was performed to identify enhancements or improvements that could be made in the future. Some of the more significant issues focused on resolving data quality issues associated with the railways GIS data and their earlier submittals. The following bullets list the major enhancements that may be considered in the future:

- Obtain and incorporate the GIS dataset for Burlington Northern Santa Fe;

- Resolve inconsistencies between the railways GIS dataset and their earlier data submittal; as noted earlier, Union Pacific's GIS dataset included active railway segments for which activity data were not included in their original data submittal;
- Work with railway companies to assign correct latitude and longitude coordinates to the yards included in their data submittal;
- Develop a method to locate and quantify yard activities in non-Dallas/Fort Worth and Houston/Galveston counties (i.e., all other remaining counties);
- Disaggregate the activity/emissions data in non-Dallas/Fort Worth and Houston/Galveston counties into individual railway segments. During discussions with Burlington Northern Santa Fe, it became apparent that they had a complete GIS data set for the whole State of Texas. It is expected that Union Pacific has a similar State-wide data set that could be used to more accurately estimate activity and emission outside the Dallas/Fort Worth and Houston/Galveston areas. Alternatively, the BTS data set could be used; and
- Resolve the issue confidential business data - at this stage, the model includes information that identify the railroad companies as it is publicly available from sources such as BTS, though the railways may be concerned that linking their earlier data, which is not part of the BTS dataset should be considered confidential. It is possible to develop a version of the model that only has publicly available data and locomotive emissions.

**APPENDIX A – ACTIVITY DATA FOR DALLAS/FORT WORTH  
AND HOUSTON/GALVESTON AREAS**

## **Dallas/Fort Worth Data**

**2003 General Line Haul for the Dallas/Fort Worth**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Subdivision</b>	<b>Track Type</b>	<b>Segment</b>	<b>Miles of Track</b>	<b>Fuel Usage (gal)</b>	<b>Train Type</b>	<b>Train Count</b>	<b>GTM</b>
UP	2003	Dallas	Dallas	SIMN	1040-0	12.91	657,054	AA	26	503,490,000
UP	2003	Dallas	Dallas	SIMN	1044-0	2.62	133,345	AA	27.7	102,180,000
UP	2003	Dallas	Dallas	SIMN	1045-0	0.44	26,413	AA	37.1	20,240,000
UP	2003	Dallas	Dallas	NO 1	1045-0	1.73	47,411	AA	18.55	36,330,000
UP	2003	Dallas	Dallas	NO 2	1045-0	1.73	56,441	AA	18.55	43,250,000
UP	2003	Dallas	Dallas	NO 1	1046-0	0.37	10,140	AA	18.55	7,770,000
UP	2003	Dallas	Dallas	NO 2	1046-0	0.37	12,071	AA	18.55	9,250,000
UP	2003	Dallas	Dallas	NO 1	1047-0	1.87	51,247	AA	18.55	39,270,000
UP	2003	Dallas	Dallas	NO 2	1047-0	1.87	61,009	AA	18.55	46,750,000
UP	2003	Dallas	Dallas	NO 1	1050-0	13.78	377,641	AA	14.65	289,380,000
UP	2003	Dallas	Dallas	NO 2	1050-0	13.78	449,572	AA	14.65	344,500,000
UP	2003	Dallas	Ennis	SIMN	1380-0	11.36	88,949	AA	2.2	68,160,000
UP	2003	Dallas	Ennis	SIMN	1381-0	3.26	25,526	AA	2.2	19,560,000
UP	2003	Denton	Choctaw	SIMN	1840-0	19.34	1,413,367	AA	18.2	1,083,040,000
UP	2003	Denton	Choctaw	SIMN	1845-0	16.17	1,181,704	AA	18.2	905,520,000
UP	2003	Tarrant	Baird	SIMN	1080-0	4.01	465,741	AA	40.3	356,890,000
UP	2003	Tarrant	Baird	SIMN	1083-0	8.18	362,947	AA	17.3	278,120,000
UP	2003	Tarrant	Choctaw	SIMN	1845-0	18.89	1,380,481	AA	18.2	1,057,840,000
UP	2003	Tarrant	Dallas	NO 1	1050-0	0.47	12,880	AA	14.65	9,870,000
UP	2003	Tarrant	Dallas	NO 2	1050-0	0.47	15,334	AA	14.65	11,750,000
UP	2003	Tarrant	Dallas	NO 1	1060-0	2.4	65,772	AA	14.65	50,400,000
UP	2003	Tarrant	Dallas	NO 2	1060-0	2.4	78,300	AA	14.65	60,000,000
UP	2003	Tarrant	Dallas	NO 1	1065-0	11.74	520,904	AA	14.5	399,160,000
UP	2003	Tarrant	Dallas	NO 2	1065-0	11.74	474,942	AA	14.5	363,940,000
UP	2003	Tarrant	Dallas	NO 1	1079-0	2.79	123,792	AA	14.5	94,860,000
UP	2003	Tarrant	Dallas	NO 2	1079-0	2.79	112,869	AA	14.5	86,490,000
UP	2003	Tarrant	Dallas	NO 1	1080-0	2.2	134,937	AA	20.15	103,400,000
UP	2003	Tarrant	Dallas	NO 2	1080-0	2.2	120,582	AA	20.15	92,400,000
UP	2003	Tarrant	Dallas	SIMN	1080-0	4.01	465,741	AA	40.3	356,890,000
UP	2003	Tarrant	Duncan	SIMN	7905-0	3.87	111,108	AA	8.1	85,140,000
UP	2003	Tarrant	Duncan	SIMN	7910-0	13.55	389,020	AA	8.1	298,100,000
UP	2003	Tarrant	Duncan	NO 1	7915-0	1.63	34,034	AA	4.05	26,080,000
UP	2003	Tarrant	Duncan	NO 2	7915-0	1.63	12,763	AA	4.05	9,780,000
UP	2003	Tarrant	Duncan	NO 1	7770-0	0.87	18,166	AA	4.05	13,920,000
UP	2003	Tarrant	Duncan	NO 2	7770-0	0.87	6,812	AA	4.05	5,220,000
UP	2003	Tarrant	Duncan	SIMN	7770-0	0.21	6,029	AA	8.1	4,620,000
UP	2003	Tarrant	Ft. Worth	SIMN	7555-0	9.04	778,615	AA	13.7	596,640,000
UP	2003	Tarrant	Ft. Worth	SIMN	7550-0	2.23	192,070	AA	26.6	147,180,000
UP	2003	Tarrant	Ft. Worth	NO 1	7550-0	1.47	84,407	AA	13.3	64,680,000
UP	2003	Tarrant	Ft. Worth	NO 2	7550-0	1.47	42,204	AA	13.3	32,340,000
UP	2003	Tarrant	Ft. Worth	NO 1	7545-0	0.34	19,523	AA	13.3	14,960,000
UP	2003	Tarrant	Ft. Worth	NO 2	7545-0	0.7	20,097	AA	13.3	15,400,000
UP	2003	Tarrant	Midlothian	SIMN	1811-0	20.74	487,183	AA	13.3	373,320,000

**2003 Specific Line Haul for the Dallas/Fort Worth Area**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Segment Code</b>	<b>Train Type</b>	<b>Fuel Usage (gal)</b>	<b>Train Type Code</b>	<b>Train Count</b>	<b>GTM</b>
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Baretable Intermodal	43	B	1	31,422
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Loaded Unit Coal	5,957	C	23	5,264,507
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Empty Unit Coal	152	E	18	104,397
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Loaded Unit Grain	342	G	2	275,057
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Manifest(High Priority)	1,088	H	7	837,035
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Manifest(Normal Priority)	29,932	M	438	29,542,683
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Officer Specials	11	O	1	5,964
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Unit(Not Grain Or Coal)	37,547	U	377	25,363,210
BNSF	2004	Dallas	DFW - MP 769.3 - 781.7	Empty Unit Grain	162	X	3	135,780
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Amtrak		A	810	
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Baretable Intermodal	20,422	B	91	12,324,677
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Loaded Unit Coal	268,787	C	316	332,872,868
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Lite Engine	228	D	3	114,777
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Empty Unit Coal	99,671	E	200	58,825,861
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Loaded Unit Grain	484,010	G	678	490,786,140
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Manifest(High Priority)	666,850	H	1117	545,149,875
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Local Service	111,490	L	281	108,907,125
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Manifest(Normal Priority)	1,115,904	M	2121	831,348,480
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Officer Specials	660	O	6	351,900
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Intermodal Premium	2,361	P	8	1,990,323
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Intermodal Guarantee	213,358	Q	673	134,948,935
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Road Switcher Service	516	R	13	267,712
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Intermodal D-Stack	22,928	S	48	12,002,808
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Unit(Not Grain Or Coal)	58,663	U	147	40,536,133
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Vehicle(Auto)	139,402	V	428	85,941,333
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Work Train	480	W	8	281,923
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Empty Unit Grain	288,636	X	680	159,615,708
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Yard Engines	112,313	Y	270	92,618,647
BNSF	2004	Tarrant	Ft.Worth - MP 333.7 - 392.2	Priority UPS Intermodal	378,410	Z	955	224,775,540
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Baretable Intermodal	54	B	1	68,418
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Loaded Unit Coal	179	C	1	473,040

**2003 Specific Line Haul for the Dallas/Fort Worth Area (Continued)**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Segment Code</b>	<b>Train Type</b>	<b>Fuel Usage (gal)</b>	<b>Train Type Code</b>	<b>Train Count</b>	<b>GTM</b>
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Lite Engine		D	1	
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Empty Unit Coal	2,155	E	11	909,534
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Loaded Unit Grain	5,982	G	35	7,722,904
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Manifest(High Priority)	427	H	3	359,781
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Local Service	42,246	L	563	40,333,232
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Manifest(Normal Priority)	26,818	M	186	23,679,598
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Officer Specials	21	O	1	12,987
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Road Switcher Service	6,136	R	329	4,549,077
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Unit(Not Grain Or Coal)	327,716	U	1890	243,656,546
BNSF	2004	Collin	MADILL - MP 673.6 - 700.6	Priority UPS Intermodal	483	Z	3	311,283
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Amtrak		A	433	
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Baretable Intermodal	2,841	B	44	2,415,390
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Loaded Unit Coal	251,148	C	1233	279,921,294
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Empty Unit Coal	197,712	E	1193	86,202,601
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Loaded Unit Grain	123,395	G	521	129,194,115
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Manifest(High Priority)	119,893	H	793	228,287,354
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Helper Service	47	K	7	19,573
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Local Service	55,352	L	358	82,747,969
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Manifest(Normal Priority)	232,224	M	1266	163,369,678
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Officer Specials	46	O	2	50,737
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Intermodal Premium	854	P	9	1,256,632
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Intermodal Guarantee	70,213	Q	976	105,530,057
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Road Switcher Service	8,766	R	119	10,200,401
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Intermodal D-Stack	12,296	S	132	17,853,316
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Unit(Not Grain Or Coal)	17,081	U	179	24,842,409
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Vehicle(Auto)	5,481	V	288	7,341,295
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Work Train	192	W	16	195,888
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Empty Unit Grain	70,403	X	489	34,497,307
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Yard Engines		Y	503	
BNSF	2004	Tarrant	Wichita Falls - MP 0-19.0	Priority UPS Intermodal	100,275	Z	1300	113,335,695

**2003 Locomotive Yards in the Dallas/Fort Worth Area**

<b>Railway Company</b>	<b>Data Year</b>	<b>Yard ID Code</b>	<b>City</b>	<b>Train Count</b>	<b>Annual Fuel Consumption (gal)</b>	<b>Annual Hours of Operation</b>
Amtrak		Dallas1	Dallas	2	280,000	4,000
Amtrak		Denton1	Denton	1	115,500	1,650
DGNTNR		DFW1	Dallas	19	867,899	63,232
FWWR		DFW1	Tarrant	11	492,024	19,422
KCS	2004	Metro1and2	Collin	2	109,788	0
KCS	2004	DAMT/MTDA & WYDA/DAWY	Dallas	2	181,528	0
KCS	2004	Wylie	Collin	2	127,022	0
TREP		DFW1	Dallas	6	540,000	22,464
UP		Browder yard1	Browder yard	4	107,989	6,708
UP		Ft Worth1	Ft Worth	51	1,323,229	79,399
UP		Grand Prairie1	Grand Prairie	4	71,504	5,330
UP		Mesquite1	Mesquite	9	220,380	13,760
UP		Miller1	Miller	9	257,495	17,960
UP		Ney Yard1	Ney Yard	6	164,980	5,840

## **Houston/Galveston Data**

**2003 General Line Haul for the Houston/Galveston Area**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Subdivision</b>	<b>Track Type</b>	<b>Segment</b>	<b>Miles of Track</b>	<b>Fuel Usage (gal)</b>	<b>Train Type</b>	<b>Train Count</b>	<b>GTM</b>
UP	2003	Brazoria	Angleton	SIMN	1640-0	24.41	923,796	AA	15.7	707,890,000
UP	2003	Brazoria	Angleton	SIMN	1650-0	22	1,205,820	AA	19.2	924,000,000
UP	2003	Brazoria	Freeport	SIMN	1645-0	10	130,500	AA	2	100,000,000
UP	2003	Chambers	Baytown	SIMN	1933-0	3.77	54,118	AA	2	41,470,000
UP	2003	Fort Bend	Glidden	SIMN	1324-0	7.44	563,134	AA	29.5	431,520,000
UP	2003	Fort Bend	Glidden	SIMN	1326-0	12.07	913,578	AA	29.5	700,060,000
UP	2003	Fort Bend	Glidden	SIMN	1328-0	11.24	621,785	AA	22.9	476,463,600
UP	2003	Fort Bend	Popp	SIMN	1215-0	6.68	34,870	AA	1	26,720,000
UP	2003	Fort Bend	Popp	SIMN	1216-0	8.45	44,109	AA	1	33,800,000
UP	2003	Galveston	Angleton	SIMN	1650-0	0.9	49,329	AA	19.2	37,800,000
UP	2003	Galveston	Galveston	SIMN	1205-0	17.64	230,202	AA	1.7	176,400,000
UP	2003	Galveston	Galveston	SIMN	1206-0	2.04	26,622	AA	1.7	20,400,000
UP	2003	Galveston	Galveston	SIMN	1207-0	3.79	49,460	AA	1.7	37,900,000
UP	2003	Harris	Baytown	SIMN	1230-0	1.06	6,917	AA	2	5,300,000
UP	2003	Harris	Baytown	SIMN	1233-0	22.63	147,661	AA	2	113,150,000
UP	2003	Harris	Baytown	SIMN	1933-0	9.76	140,105	AA	2	107,360,000
UP	2003	Harris	Beaumont	NO 1	1250-0	3.48	587	AA	8.65	450,000
UP	2003	Harris	Beaumont	NO 2	1250-0	0.15	4,111	AA	8.65	3,150,000
UP	2003	Harris	Beaumont	SIMN	1250-0	0.15	108,994	AA	17.3	83,520,000
UP	2003	Harris	Beaumont	NO 1	1665-0	3.88	106,331	AA	6.95	81,480,000
UP	2003	Harris	Beaumont	NO 2	1665-0	3.88	45,571	AA	6.95	34,920,000
UP	2003	Harris	Beaumont	SIMN	1665-0	15.78	617,787	AA	13.9	473,400,000
UP	2003	Harris	Eureka	SIMN	1370-0	34.98	319,542	AA	5.5	244,860,000
UP	2003	Harris	Galveston	SIMN	1204-0	2.05	26,753	AA	5.4	20,500,000
UP	2003	Harris	Galveston	SIMN	1205-0	21.23	277,052	AA	1.7	212,300,000
UP	2003	Harris	Glidden	SIMN	1220-0	3.51	148,118	AA	9.5	113,500,000
UP	2003	Harris	Glidden	SIMN	1221-0	4.54	121,039	AA	9.5	92,750,000
UP	2003	Harris	Glidden	SIMN	1323-0	3.71	234,639	AA	29.5	179,800,000
UP	2003	Harris	Glidden	SIMN	1324-0	3.1	75,690	AA	29.5	58,000,000
UP	2003	Harris	Glidden	SIMN	1385-0	1	82,450	AA	4.4	63,180,000
UP	2003	Harris	Hardy	SIMN	1950-0	0.74	27,040	AA	7	20,720,000
UP	2003	Harris	Houston	NO 1	1190-0	1.7	206,973	AA	14.65	158,600,000
UP	2003	Harris	Houston	NO 2	1190-0	1.7	289,658	AA	14.65	221,960,000
UP	2003	Harris	Houston	NO 1	1191-0	2.8	13,885	AA	14.65	10,640,000
UP	2003	Harris	Houston	NO 2	1191-0	2.8	19,092	AA	14.65	14,630,000
UP	2003	Harris	Houston	NO 1	1196-0	3.5	66,555	AA	19	51,000,000
UP	2003	Harris	Houston	NO 2	1196-0	3.5	46,589	AA	19	35,700,000
UP	2003	Harris	Houston	NO 1	1197-0	0.1	109,620	AA	19	84,000,000
UP	2003	Harris	Houston	NO 2	1197-0	3.2	76,734	AA	19	58,800,000
UP	2003	Harris	Houston	NO 1	1660-0	2.87	104,400	AA	15.6	80,000,000
UP	2003	Harris	Houston	NO 1	1660-0	7.93	114,188	AA	15.6	87,500,000
UP	2003	Harris	Houston	NO 2	1660-0	7.16	168,998	AA	15.6	129,500,000
UP	2003	Harris	Houston	NO 2	1660-0	1.33	138,578	AA	15.6	106,190,000

**2003 General Line Haul for the Houston/Galveston Area (Continued)**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Subdivision</b>	<b>Track Type</b>	<b>Segment</b>	<b>Miles of Track</b>	<b>Fuel Usage (gal)</b>	<b>Train Type</b>	<b>Train Count</b>	<b>GTM</b>
UP	2003	Harris	Houston	SIMN	1660-0	1.33	8,091	AA	31.2	6,200,000
UP	2003	Harris	Lafayette	SIMN	1932-0	18.22	784,644	AA	19.3	601,260,000
UP	2003	Harris	Lafayette	NO 1	1934-0	0.11	3,732	AA	9.65	2,860,000
UP	2003	Harris	Lafayette	NO 2	1934-0	0.11	1,005	AA	9.65	770,000
UP	2003	Harris	Lufkin	SIMN	1950-0	18.41	672,701	AA	7	515,480,000
UP	2003	Harris	Navasota	SIMN	1775-0	13.05	579,029	AA	11.9	443,700,000
UP	2003	Harris	Palestine	NO 1	1170-0	2.63	57	AA	4.8	43,500
UP	2003	Harris	Palestine	NO 2	1170-0	0.15	4,698	AA	4.8	3,600,000
UP	2003	Harris	Palestine	SIMN	1170-0	0.15	83,367	AA	9.6	63,882,700
UP	2003	Harris	Palestine	NO 1	1180-0	5.17	168,671	AA	9.6	129,250,000
UP	2003	Harris	Palestine	NO 2	1180-0	5.17	222,646	AA	9.6	170,610,000
UP	2003	Harris	Palestine	NO 1	1185-0	10.75	350,719	AA	9.6	268,750,000
UP	2003	Harris	Palestine	NO 2	1185-0	10.75	462,949	AA	9.6	354,750,000
UP	2003	Harris	Palestine	NO 1	1190-0	2	3,654	AA	14.65	2,800,000
UP	2003	Harris	Palestine	NO 1	1195-0	2	65,250	AA	9.6	50,000,000
UP	2003	Harris	Palestine	NO 2	1195-0	0.14	78,300	AA	9.6	60,000,000
UP	2003	Harris	Popp	SIMN	1215-0	5.87	30,641	AA	1	23,480,000
UP	2003	Harris	Strang	NO 1	1355-0	1.84	26,413	AA	5.2	20,240,000
UP	2003	Harris	Strang	NO 2	1355-0	1.84	12,006	AA	5.2	9,200,000
UP	2003	Harris	Strang	NO 1	1357-0	1.12	16,078	AA	5.2	12,320,000
UP	2003	Harris	Strang	NO 2	1357-0	1.12	7,308	AA	5.2	5,600,000
UP	2003	Harris	Strang	SIMN	1358-0	3.32	69,322	AA	10.4	53,120,000
UP	2003	Harris	Strang	SIMN	1359-0	3.51	64,128	AA	10.7	49,140,000
UP	2003	Harris	Strang	NO 1	1364-0	4.03	134,102	AA	10.7	102,760,000
UP	2003	Harris	Strang	NO 1	1366-0	0.2	3,654	AA	10.7	2,800,000
UP	2003	Harris	Strang	NO 2	1366-0	0.2	2,088	AA	5.35	1,600,000
UP	2003	Harris	Strang	SIMN	1366-0	7.34	31,555	AA	10.7	24,180,000
UP	2003	Harris	Terminal	NO 2	1319-0	3.91	70,235	AA	8	53,820,000
UP	2003	Harris	Terminal	NO 1	1320-0	3.91	70,744	AA	11	54,210,000
UP	2003	Harris	Terminal	NO 2	1320-0	3.5	54,419	AA	11	41,700,000
UP	2003	Harris	Terminal	NO 1	1321-0	3.5	67,416	AA	8	51,660,000
UP	2003	Harris	Terminal	NO 2	1321-0	2.99	52,435	AA	8	40,180,000
UP	2003	Harris	Terminal	NO 1	1322-0	2.99	89,066	AA	11	68,250,000
UP	2003	Harris	Terminal	NO 2	1322-0	2.87	68,513	AA	11	52,500,000
UP	2003	Harris	Terminal	NO 1	1934-0	2.87	132,666	AA	9.65	101,660,000
UP	2003	Harris	Terminal	NO 2	1934-0	4.17	35,718	AA	9.65	27,370,000
UP	2003	Harris	Terminal	NO 1	1935-0	4.17	173,565	AA	11.15	133,000,000
UP	2003	Harris	Terminal	NO 2	1935-0	5.25	109,620	AA	11.15	84,000,000
UP	2003	Harris	Terminal	NO 1	1936-0	5.25	54,627	AA	8	41,860,000
UP	2003	Liberty	Baytown	NO 1	1933-0	7.63	8,744	AA	1	6,700,000
UP	2003	Liberty	Baytown	NO 2	1933-0	3.35	39,346	AA	1	30,150,000
UP	2003	Liberty	Baytown	SIMN	1933-0	3.35	109,529	AA	2	83,930,000
UP	2003	Liberty	Baytown	SIMN	1933-0	0.47	6,747	AA	2	5,170,000

**2003 General Line Haul for the Houston/Galveston Area (Continued)**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Subdivision</b>	<b>Track Type</b>	<b>Segment</b>	<b>Miles of Track</b>	<b>Fuel Usage (gal)</b>	<b>Train Type</b>	<b>Train Count</b>	<b>GTM</b>
UP	2003	Liberty	Beaumont	SIMN	1665-0	28.12	1,100,898	AA	13.9	843,600,000
UP	2003	Liberty	Lafayette	SIMN	1930-0	28.38	962,933	AA	15	737,880,000
UP	2003	Liberty	Lafayette	SIMN	1932-0	6.92	298,010	AA	19.3	228,360,000
UP	2003	Liberty	Lufkin	SIMN	1950-0	6.27	229,106	AA	7	175,560,000
UP	2003	Liberty	Lufkin	SIMN	1954-0	4.06	90,071	AA	8	69,020,000
UP	2003	Montgomery	Lufkin	SIMN	1950-0	16.95	619,353	AA	7	474,600,000
UP	2003	Montgomery	Navasota	SIMN	1775-0	12.47	553,294	AA	11.9	423,980,000
UP	2003	Montgomery	Palestine	SIMN	1170-0	27.71	878,364	AA	9.6	673,075,900
UP	2003	Waller	Eureka	SIMN	1370-0	19.32	176,488	AA	5.5	135,240,000
UP	2003	Waller	Navasota	SIMN	1775-0	1.78	78,979	AA	11.9	60,520,000

**2003 Specific Line Haul for the Houston/Galveston Area**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Segment Code</b>	<b>Train Type</b>	<b>Fuel Usage (gal)</b>	<b>Train Type Code</b>	<b>Train Count</b>	<b>GTM</b>
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Lite Engine	2,669	D	7	2,296,394
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Loaded Unit Grain	17,760	G	48	32,888,986
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Manifest(High Priority)	190,400	H	467	189,621,103
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Local Service	24,441	L	315	17,657,682
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Manifest(Normal Priority)	196,929	M	639	167,881,782
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Intermodal Premium	391	P	1	351,181
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Intermodal Guarantee	432	Q	2	458,047
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Road Switcher Service	9,406	R	175	6,392,715
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Intermodal D-Stack	1,260	S	3	1,193,981
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Unit(Not Grain Or Coal)	82,157	U	417	71,790,223
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Work Train	165	W	1	115,564
BNSF	2004	Montgomery	CONROE - MP 55.6 - 111.0	Empty Unit Grain	8,151	X	33	6,387,731
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Baretable Intermodal	4,346	B	24	4,396,702
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Loaded Unit Coal	107,841	C	210	172,803,955
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Lite Engine	986	D	8	762,516
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Empty Unit Coal	69,657	E	199	30,300,971
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Loaded Unit Grain	183,905	G	577	261,696,530
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Manifest(High Priority)	109,354	H	667	104,159,782
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Local Service	80,855	L	451	86,087,473
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Manifest(Normal Priority)	142,094	M	905	118,932,771
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Officer Specials	176	O	2	182,455
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Intermodal Premium	70,974	P	359	64,206,525
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Intermodal Guarantee	696	Q	3	892,218
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Intermodal D-Stack	49,167	S	250	29,573,937
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Unit(Not Grain Or Coal)	131,200	U	303	113,555,993
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Vehicle(Auto)	39,883	V	310	27,577,672
BNSF	2004	Galveston	GALVESTON - MP 2.2 - 76.2	Empty Unit Grain	90,567	X	538	80,813,334
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Baretable Intermodal	216	B	2	195,120
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Loaded Unit Coal	10,659	C	19	14,259,880
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Lite Engine	150	D	6	117,840
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Empty Unit Coal	6,223	E	62	2,314,787
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Loaded Unit Grain	3,556	G	9	4,133,095

**2003 Specific Line Haul for the Houston/Galveston Area**

<b>Rail Company</b>	<b>Data Year</b>	<b>County</b>	<b>Segment Code</b>	<b>Train Type</b>	<b>Fuel Usage (gal)</b>	<b>Train Type Code</b>	<b>Train Count</b>	<b>GTM</b>
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Manifest(High Priority)	148,491	H	983	223,404,573
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Manifest(Normal Priority)	126,921	M	1136	124,128,945
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Officer Specials	47	O	2	40,710
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Intermodal Premium	17,162	P	113	22,526,904
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Intermodal Guarantee	106	Q	1	172,640
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Intermodal D-Stack	5,068	S	28	6,926,014
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Unit(Not Grain Or Coal)	87,830	U	277	56,913,722
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Vehicle(Auto)	196	V	2	322,400
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Work Train	100	W	2	113,056
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Empty Unit Grain	36,406	X	174	21,352,012
BNSF	2004	Harris	HOUSTON - MP 70.6 - 110.5	Yard Engines	11,455	Y	278	12,229,760
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Amtrak		A	1	
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Baretable Intermodal	1,198	B	26	1,317,945
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Loaded Unit Coal	3,001	C	11	3,894,733
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Lite Engine	416	D	10	248,527
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Empty Unit Coal	170	E	2	120,358
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Loaded Unit Grain	19,745	G	95	24,768,170
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Manifest(High Priority)	25,308	H	402	25,232,076
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Local Service	34,730	L	361	31,350,088
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Manifest(Normal Priority)	24,453	M	351	17,887,370
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Officer Specials	55	O	2	43,804
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Intermodal Premium	27,860	P	406	25,310,810
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Intermodal Guarantee	258	Q	3	248,048
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Intermodal D-Stack	27,840	S	190	27,312,938
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Unit(Not Grain Or Coal)	40,156	U	358	39,950,943
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Vehicle(Auto)	19,327	V	250	13,970,060
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Work Train	163	W	2	127,342
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Empty Unit Grain	5,786	X	65	4,943,633
BNSF	2004	Harris	MYKAWA - MP 0 - 19.4	Yard Engines	22,584	Y	656	15,846,593

**2003 Locomotive Yards in the Houston/Galveston Area**

<b>Railway Company</b>	<b>Data Year</b>	<b>Yard ID Code</b>	<b>City</b>	<b>Train Count</b>	<b>Annual Fuel Consumption (gal)</b>	<b>Annual Hours of Operation</b>
BNSF		Alvin1	Alvin	1	82,490	8,760
BNSF		Casey1	Casey	4	329,960	35,040
BNSF		Dayton1	Dayton	4	329,960	35,040
BNSF		Galveston1	Galveston	5	412,450	43,800
BNSF		Houston1	Houston	28	2,309,720	245,280
BNSF		Pearland1	Pearland	8	659,920	70,080
CANAC		Pasadena1	Pasadena	4	144,000	35,040
Farmland AMD		Unknown1	Unknown	6	494,940	52,560
Galveston Railroad		Galveston1	Galveston	6	84,000	52,560
KCS/Texas-Mexico		Galveston1	Galveston	2	164,980	17,520
Port Terminal Rail Assoc.	2003	HoustonShip1	Houston Ship Channel	25	3,005,913	219,000
Rail Link		HoustonShip1	Houston Ship Channel	3	150,000	26,280
Trans Global		HoustonShip1	Houston Ship Channel	13	1,072,370	113,880
Texas City Terminal		TXCity1	Texas City	3	120,000	26,280
UP		BASIN1	Basin Yard	3	31,392	3,900
UP		CONGRESS1	Congress Yard	1	20,056	2,990
UP		ENGLEWOOD1	Englewood	37	1,030,661	61,700
UP		EUREKA1	Eureka Yard	1	13,952	2,080
UP		GALENA1	Galena Park	10	217,352	12,737.5
UP		GALVESTON1	Galveston	2	26,160	3,900
UP		HARDY1	Hardy	4	75,841	9,940
UP		HOUSTON1	Houston	36	940,858	54,347.5

**APPENDIX B – EMISSION ESTIMATES FOR NON-DALLAS/FORT WORTH  
AND HOUSTON/GALVESTON COUNTIES  
(ALL OTHER REMAINING COUNTIES)**

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
001	Anderson	43.84	16.49	293.40	11.04
005	Angelina	11.64	4.38	77.87	2.93
007	Aransas	0.61	0.23	4.09	0.15
009	Archer	0.03	0.01	0.20	0.01
011	Armstrong	45.77	17.21	306.29	11.53
013	Atascosa	11.24	4.23	75.25	2.83
015	Austin	69.86	26.27	467.49	17.60
017	Bailey	16.15	6.07	108.04	4.07
021	Bastrop	50.02	18.81	334.72	12.60
023	Baylor	0.05	0.02	0.35	0.01
025	Bee	0.10	0.04	0.66	0.02
027	Bell	108.28	40.72	724.60	27.27
029	Bexar	124.87	46.95	835.61	31.45
035	Bosque	58.15	21.86	389.12	14.65
037	Bowie	69.83	26.26	467.30	17.59
041	Brazos	45.51	17.11	304.56	11.46
043	Brewster	40.45	15.21	270.67	10.19
045	Briscoe	0.02	0.01	0.12	0.00
047	Brooks	0.05	0.02	0.35	0.01
049	Brown	25.93	9.75	173.53	6.53
051	Burleson	98.01	36.86	655.91	24.69
053	Burnet	0.06	0.02	0.41	0.02
055	Caldwell	33.77	12.70	225.99	8.51
057	Calhoun	1.65	0.62	11.04	0.42
059	Callahan	28.21	10.61	188.76	7.10
061	Cameron	20.56	7.73	137.61	5.18
063	Camp	18.33	6.89	122.65	4.62
065	Carson	105.66	39.73	707.09	26.61
067	Cass	75.50	28.39	505.28	19.02
069	Castro	9.78	3.68	65.48	2.46
073	Cherokee	44.22	16.63	295.93	11.14
075	Childress	43.91	16.51	293.84	11.06
077	Clay	49.38	18.57	330.42	12.44
079	Cochran	0.04	0.01	0.24	0.01
081	Coke	0.04	0.02	0.29	0.01
083	Coleman	39.51	14.86	264.38	9.95
087	Collingsworth	1.05	0.40	7.06	0.27
089	Colorado	57.98	21.80	387.98	14.60
091	Comal	32.99	12.40	220.75	8.31
093	Comanche	0.07	0.03	0.47	0.02

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas) (Continued)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
097	Cooke	34.20	12.86	228.84	8.61
099	Coryell	9.30	3.50	62.20	2.34
101	Cottle	0.06	0.02	0.41	0.02
103	Crane	0.50	0.19	3.33	0.13
105	Crockett	0.00	0.00	0.01	0.00
107	Crosby	0.03	0.01	0.19	0.01
109	Culberson	59.35	22.32	397.17	14.95
111	Dallam	82.25	30.93	550.39	20.72
115	Dawson	0.03	0.01	0.18	0.01
117	Deaf Smith	65.50	24.63	438.31	16.50
119	Delta	0.01	0.00	0.08	0.00
123	DeWitt	6.78	2.55	45.39	1.71
127	Dimmit	0.05	0.02	0.36	0.01
129	Donley	59.32	22.31	396.96	14.94
131	Duval	0.07	0.03	0.45	0.02
133	Eastland	28.74	10.81	192.33	7.24
135	Ector	29.20	10.98	195.38	7.35
141	El Paso	96.98	36.47	649.00	24.43
139	Ellis	18.98	7.14	127.00	4.78
143	Erath	0.07	0.03	0.45	0.02
145	Falls	43.95	16.53	294.14	11.07
147	Fannin	0.08	0.03	0.54	0.02
149	Fayette	81.01	30.46	542.12	20.40
151	Fisher	17.39	6.54	116.39	4.38
153	Floyd	0.14	0.05	0.94	0.04
155	Foard	0.03	0.01	0.23	0.01
159	Franklin	2.26	0.85	15.13	0.57
161	Freestone	19.35	7.28	129.51	4.87
163	Frio	33.79	12.70	226.10	8.51
165	Gaines	0.01	0.00	0.06	0.00
169	Garza	39.30	14.78	263.00	9.90
175	Goliad	0.05	0.02	0.31	0.01
177	Gonzales	54.67	20.56	365.84	13.77
179	Gray	59.95	22.54	401.20	15.10
181	Grayson	73.97	27.81	494.98	18.63
183	Gregg	39.01	14.67	261.03	9.82
185	Grimes	20.58	7.74	137.71	5.18
187	Guadalupe	85.43	32.13	571.73	21.52
189	Hale	9.94	3.74	66.53	2.50
191	Hall	24.24	9.12	162.23	6.11

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas) (Continued)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
195	Hansford	0.09	0.03	0.60	0.02
197	Hardeman	47.09	17.71	315.10	11.86
199	Hardin	10.84	4.08	72.57	2.73
203	Harrison	97.18	36.54	650.34	24.48
205	Hartley	87.33	32.84	584.42	22.00
207	Haskell	0.10	0.04	0.64	0.02
209	Hays	27.67	10.41	185.18	6.97
211	Hemphill	100.12	37.65	670.02	25.22
213	Henderson	11.09	4.17	74.24	2.79
215	Hidalgo	1.62	0.61	10.82	0.41
217	Hill	91.36	34.35	611.39	23.01
219	Hockley	6.24	2.35	41.77	1.57
221	Hood	0.04	0.02	0.30	0.01
223	Hopkins	16.56	6.23	110.81	4.17
225	Houston	16.82	6.33	112.57	4.24
227	Howard	30.38	11.42	203.27	7.65
229	Hudspeth	121.03	45.51	809.94	30.48
231	Hunt	7.23	2.72	48.41	1.82
233	Hutchinson	0.05	0.02	0.32	0.01
235	Irion	0.07	0.02	0.44	0.02
239	Jackson	22.53	8.47	150.75	5.67
241	Jasper	14.91	5.61	99.78	3.76
243	Jeff Davis	30.42	11.44	203.55	7.66
245	Jefferson	43.11	16.21	288.51	10.86
247	Jim Hogg	0.02	0.01	0.14	0.01
249	Jim Wells	0.12	0.04	0.80	0.03
251	Johnson	70.01	26.33	468.53	17.63
253	Jones	0.07	0.03	0.48	0.02
255	Karnes	0.05	0.02	0.30	0.01
257	Kaufman	23.67	8.90	158.42	5.96
261	Kenedy	22.34	8.40	149.51	5.63
271	Kinney	43.48	16.35	290.99	10.95
273	Kleberg	9.54	3.59	63.83	2.40
275	Knox	0.07	0.03	0.45	0.02
283	La Salle	40.54	15.25	271.32	10.21
277	Lamar	0.10	0.04	0.66	0.02
279	Lamb	30.65	11.53	205.13	7.72
281	Lampasas	36.63	13.77	245.14	9.23
285	Lavaca	5.66	2.13	37.87	1.43
287	Lee	24.06	9.05	161.03	6.06

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas) (Continued)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
289	Leon	56.03	21.07	374.96	14.11
293	Limestone	16.33	6.14	109.31	4.11
295	Lipscomb	31.40	11.81	210.11	7.91
297	Live Oak	11.03	4.15	73.79	2.78
299	Llano	0.03	0.01	0.20	0.01
303	Lubbock	40.64	15.28	271.95	10.24
305	Lynn	0.57	0.21	3.79	0.14
313	Madison	6.69	2.52	44.77	1.69
315	Marion	38.28	14.40	256.19	9.64
317	Martin	10.71	4.03	71.65	2.70
321	Matagorda	24.72	9.30	165.42	6.23
323	Maverick	13.94	5.24	93.32	3.51
307	McCulloch	0.02	0.01	0.16	0.01
309	McLennan	127.04	47.77	850.18	32.00
325	Medina	50.05	18.82	334.94	12.61
329	Midland	25.96	9.76	173.72	6.54
331	Milam	120.56	45.33	806.80	30.37
333	Mills	30.61	11.51	204.82	7.71
335	Mitchell	28.56	10.74	191.12	7.19
337	Montague	26.91	10.12	180.07	6.78
341	Moore	15.06	5.66	100.75	3.79
343	Morris	14.79	5.56	98.95	3.72
345	Motley	0.05	0.02	0.37	0.01
347	Nacogdoches	15.46	5.81	103.46	3.89
349	Navarro	30.48	11.46	204.00	7.68
351	Newton	5.82	2.19	38.94	1.47
353	Nolan	43.20	16.24	289.11	10.88
355	Nueces	17.68	6.65	118.33	4.45
357	Ochiltree	0.05	0.02	0.34	0.01
359	Oldham	24.52	9.22	164.11	6.18
361	Orange	64.35	24.20	430.61	16.21
363	Palo Pinto	33.29	12.52	222.76	8.38
365	Panola	7.10	2.67	47.53	1.79
367	Parker	14.22	5.35	95.16	3.58
369	Parmer	125.06	47.03	836.92	31.50
371	Pecos	7.18	2.70	48.08	1.81
373	Polk	6.84	2.57	45.76	1.72
375	Potter	122.15	45.93	817.44	30.77
377	Presidio	39.45	14.84	264.03	9.94
381	Randall	96.09	36.13	643.04	24.20

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas) (Continued)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
383	Reagan	0.05	0.02	0.31	0.01
387	Red River	0.05	0.02	0.34	0.01
389	Reeves	42.11	15.84	281.81	10.61
391	Refugio	34.80	13.09	232.91	8.77
393	Roberts	51.38	19.32	343.81	12.94
395	Robertson	101.29	38.09	677.81	25.51
399	Runnels	0.07	0.03	0.45	0.02
401	Rusk	17.60	6.62	117.80	4.43
403	Sabine	4.58	1.72	30.63	1.15
405	San Augustine	4.00	1.50	26.77	1.01
409	San Patricio	26.58	9.99	177.85	6.69
411	San Saba	0.05	0.02	0.35	0.01
415	Scurry	34.18	12.85	228.75	8.61
419	Shelby	20.23	7.61	135.40	5.10
421	Sherman	36.06	13.56	241.31	9.08
423	Smith	23.48	8.83	157.10	5.91
427	Starr	0.03	0.01	0.17	0.01
429	Stephens	4.92	1.85	32.94	1.24
433	Stonewall	0.00	0.00	0.03	0.00
437	Swisher	7.84	2.95	52.45	1.97
441	Taylor	64.94	24.42	434.56	16.36
443	Terrell	54.57	20.52	365.22	13.75
445	Terry	0.06	0.02	0.39	0.01
449	Titus	15.12	5.68	101.15	3.81
451	Tom Green	0.08	0.03	0.53	0.02
453	Travis	25.86	9.73	173.08	6.51
455	Trinity	7.45	2.80	49.84	1.88
457	Tyler	0.06	0.02	0.39	0.01
459	Upshur	36.01	13.54	240.99	9.07
461	Upton	0.05	0.02	0.35	0.01
463	Uvalde	43.72	16.44	292.60	11.01
465	Val Verde	82.80	31.13	554.07	20.85
467	Van Zandt	25.96	9.76	173.75	6.54
469	Victoria	32.02	12.04	214.30	8.07
471	Walker	6.43	2.42	43.05	1.62
475	Ward	39.62	14.90	265.14	9.98
477	Washington	30.99	11.65	207.39	7.81
479	Webb	0.13	0.05	0.90	0.03
481	Wharton	1.71	0.64	11.45	0.43
483	Wheeler	0.09	0.04	0.63	0.02

**2003 Line Haul Locomotive Emission Estimates for Texas Counties (tons per year)  
(excluding Dallas/Fort Worth and Houston/Galveston Areas) (Continued)**

<b>FIPS</b>	<b>County Name</b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>PM</b>
485	Wichita	50.48	18.98	337.82	12.72
487	Wilbarger	51.63	19.42	345.53	13.01
489	Willacy	8.56	3.22	57.26	2.16
491	Williamson	67.57	25.41	452.15	17.02
493	Wilson	0.04	0.01	0.26	0.01
495	Winkler	0.04	0.02	0.28	0.01
497	Wise	18.15	6.83	121.49	4.57
499	Wood	25.05	9.42	167.64	6.31
507	Zavala	0.06	0.02	0.40	0.01
	Total	6,012.06	2,260.68	40,232.85	1,514.29