MEMORANDUM

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

FROM: Sam Wells, Starcrest
Richard Billings, Heather Perez, Rick Baker and Paula Fields, ERG

DATE: November 15, 2004

SUBJECT: Summary of Houston/Galveston Area Railroad Data Collection and Model Development

1.0 Overview

The objective of this project is to improve locomotive emission estimates for the Houston/Galveston area. Recent studies have indicated that locomotive emission estimates are associated with a large degree of uncertainty because the data elements needed to accurately calculate emissions were often not readily available. There is also considerable error between estimates based on fuel consumption versus activity. Currently, there are no state, federal, or local statues requiring railroads to provide the necessary data to estimate emissions, although the Texas Commission on Environmental Quality (TCEQ) does have a Memorandum of Understanding with the two class I railways in Texas. In the absence of system-wide requirements, stakeholders are reluctant to spend time and resource compiling the necessary data.

In this project, Starcrest and ERG staff have consulted with the two most important railroad companies servicing the Houston/Galveston area to provide as detailed data as possible to develop accurate estimates of emissions from locomotives operating in the area.

Initially, it was envisioned that the railroads would provide event recorder data to develop profiles of the horsepower by throttle notch setting and locomotive speed for individual railway segments. Unfortunately, event recorder data has turned out to be difficult to obtain and convert into a format appropriate for this inventory effort. Instead the two major railroad companies Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) provided information by railway segment for their line haul operations, using the Gross Ton-Mile (GTM) method. These line-haul as well as switch locomotive data are discussed in Section 2.2 and the submitted data are included in the Appendix.

The railroad activity data elements were compiled into a Microsoft Access database along with emission factors recently developed for the EPA's locomotive rulemaking. Preliminary locomotive emission estimates for the Houston/Galveston area are summarized in Section 2.3 of this memorandum.

The activity data elements and emission factors were compiled in terms suitable for the development of a locomotive emission estimating model that can be used by different shareholders to estimate emissions. At this time, we anticipate that the model will 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. A preliminary structure for the model is discussed in Section 2.3.

Section 2.4 discusses the steps that will be taken to finalize the model and provide and appropriate training session, in support of the model.

In Section 3.0 of this report, there is a discussion of issues that need to be addressed in the follow-on project to ensure that the model is developed correctly.

The references that support this memorandum are listed in Section 4.0.

2.0 Project Tasks

The following tasks were defined in the original scope of work:

1. Proof of Concept
2. Data Collection
3. Model Development
4. Final Model and Presentation/Training.

Each of these tasks is discussed in greater detail below, noting the current work status of the task.

2.1 Proof of Concept

Originally it was anticipated that detailed data would be obtained from locomotive event recorders. The event recorders are similar to "black boxes" used on jet airliners and while their primary use is for safety, they do contain valuable data that can be used to estimate air emissions. These event recorders track locomotive operating parameters such as time stamp, throttle notch setting, horsepower, train speed, brake air pressure, and a variety of other operational data elements. These data elements were to be combined with train count information and horsepower associated with individual locomotive train sets to accurately estimate activity and resulting emissions. This method was proposed

by the Texas Transportation Institute's railway group because it would be a powerful way to profile train trips by train type and route.

The introduction of event data recorders is a relatively new phenomenon, such that these devices tend to only be found on the newer engines. Such devices are not used by any UP trains operating in the Houston/Galveston area. An unknown number of BNSF trains are equipped with these event recorders, but BNSF could provide only fuel consumption data from the recorders. Even if every one of the trains were equipped with these devices, the data recorders provide output in a format that must be manually converted from proprietary software code into a compatible database format, which could become a problematic and expensive undertaking. Because event recorder data were not directly available for the Houston/Galveston area, an alternative approach to estimate locomotive emissions was developed.

The revised approach encouraged the railroads to provide the necessary data elements to estimate emissions from locomotive directly from their GTM data. Though this approach does not provide as detailed data elements as might be obtained from the locomotive event recorders, it still has provided sufficient information to estimate emissions by railroad segment. Section 2.2 discusses this project's data collection efforts more fully.

It should be noted that one railway, BNSF, estimated fuel consumption estimates using event recorder data. As such, the BNSF method is a hybrid approach. This is a vast improvement over the recent guidance known as the "Carretto Method" because it clearly shows the difference between light intermodal trains and heavy bulk trains. While the other class I railways (i.e., UP and Kansas City Southern [KCS] and its affiliate Texas-Mexico [T-M]) cited logistical problems in obtaining event recorder data, it may be practical to incorporate a hybridized approach for all line-haul locomotive subtypes within the next five years. Finally, some switch engine companies were able to estimate time-in-mode throttle settings such as from computerized trip recorders (PTRA) or manual survey methods (small switch companies).

2.2 Data Collection

This Houston Advanced Research Center (HARC) project focuses on compiling railroad activity data elements for the eight Houston nonattainment counties. The two main class I railroads operating in this area are UP and BNSF. In addition, KCS/T-M lease lines over UP tracks and have some GTM in the Houston area. These railways provided railroad activity data elements by segment in mid-September – the submitted data elements are included in the Appendix.

Though the information provided by both railways is sufficient to estimate locomotive emissions, the two data sets include very different levels of detail. For example, BNSF data set disaggregates locomotive activity by the locomotive activity types listed in Table 1, whereas UP assumes a single activity for all train types. Generally speaking, the BNSF train types are by commodity and whether they are loaded or unloaded.

Table 1. BNSF Locomotive Activity Codes

BNSF Code	Locomotive Activity Type
A	Amtrak
B	Baretable Intermodal
C	Loaded Unit Coal
D	Lite Engine
E	Empty Unit Coal
F	Foreign Railroad Trains Over Bnsf
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

The advantage of disaggregating activity by type is the more appropriate fuel usage rates can be associated with each activity. For example, loaded coal operations will have a lower GTM/gal fuel usage value than unloaded coal operations.

As noted above, the UP data set aggregated all locomotive activities together, but the data elements were disaggregated into smaller railway segments. The fact that railroad companies compile activity data differently to meet their different business needs is an important observation in developing the data structure for the model. The model should be sufficiently flexible to include aggregated and disaggregated data. For data elements that are disaggregated by locomotive activity types it is important that the same codes be used or a crosswalk table needs to be developed to link the submitted codes to the

model's set of activity codes, for the time being we recommend using the BNSF codes in the model.

It should be noted that neither submitted data sets included segment identification codes that could not be matched to any of the publicly available GIS shape files. At this time it will not be possible to generate emission estimates at the link level, although this goal is presented below under Section 3.0 of this report. In order to do this it will be necessary for this research team to work with the railways to develop a crosswalk data file that associates their segment codes to codes used in the Bureau of Transportation Statistics (BTS) railway shape file.

It should be noted that an entirely different method is used for estimating emissions from the shortline and yard switch locomotives, based on the fuel consumption instead of GTM. In addition to the class I railways which all have switching operations in the Houston-Galveston area, there are several independent companies that provide yard and switch services. Many of the shuttle services are associated with exports (e.g., grain) and imports (e.g., intermodal shipping containers) in addition to the petrochemical and energy industries. For yard and short haul class II/III switching locomotives, data elements were obtained by TCEQ and Starcrest from a variety of railway companies as summarized in Table 2.

Table 2. Houston/Galveston Switch Engine Census

Railway	Area	Switchers
UP	[Varies]	94
BNSF	Casey	4
BNSF	Dayton	4
BNSF	Galveston	5
BNSF	Houston	28
BNSF	Pearland	8
BNSF	Alvin	1
Texas City Terminal	Texas City	3
Galveston Railroad	Galveston	6
KCS/Texas-Mexico	Galveston	2
Rail Link	Houston Ship Channel	3
Trans Global	Houston Ship Channel	13
Farmland AMD	[UNK]	6
Port Terminal Rail Assoc.	Houston Ship Channel	25
CANAC	Pasadena	4
Total		206

Note: Farmland should be "ADM", the massive Archer Daniels-Midland grainery concern in Galveston, TX.

The line haul and yard data elements were compiled into a Microsoft Access database table that allows for relatively easy inclusion into the model's database structure. The model's preliminary data structure is discussed more fully in Section 2.3 of this report.

2.3 Model Development

One of the most interesting aspects of this project is the integration of the submitted data elements into a computer model that can generate spatially allocated emission estimates and provide output files in NIF 3.0 format. Spatial allocation is very important to the ozone attainment modelers, and converting the data into the National Inventory Format (NIF) for submitting emission statements to the EPA. The preliminary model is being developed for use by staff from state and local agencies as well as railway companies to accurately evaluate emissions from the operation of their locomotives.

The first step in developing this model is to use the submitted data to estimate emissions for the Houston/Galveston area to ensure that appropriate and sufficient data were provided and to gain insight on how the data should be organized in the model.

Line haul and switch locomotives will be handled separately in the calculation of the emissions and the development of the model. After the emission estimates have been developed a preliminary model structure will be proposed to HARC. This preliminary model will include only the basic elements needed to estimate locomotive emissions. Further refinements can then be discussed that incorporate additional details or add useful features.

2.3.1 *Houston/Galveston Annual Emission Estimates*

To ensure that the railroad provided sufficient and appropriate data elements to estimate emissions, the submitted data elements were used to calculate annual locomotive emission estimates for the Houston/Galveston area (see Figure 1). This exercise also provided useful insight about the different types of data elements that were submitted and how they should be linked in the model to provide comparable emission estimates.

Emissions for both line-haul locomotive and switch engines are derived by applying the emission factors in Table 3 to the fuel usage data provided or estimated by the railroads. Based on the fleet mix provided by UP, 88% of the current line haul fleet is Tier 0 or earlier and 12% are Tier 1. The situation is similar for BNSF, with 95% of the fleet being classified as Tier 0 or earlier and 5% of the fleet being Tier 1. For Yard locomotives UP estimated that 47% of the switch engine fleet is Tier 0 and 53 % are Tier I. BNSF only provided construction and rebuild dates for locomotives included in the TERP program, therefore it was assumed that all of their switch locomotives were Tier 0 based on the dates provided.

Figure 1. Railroads of Houston/Galveston

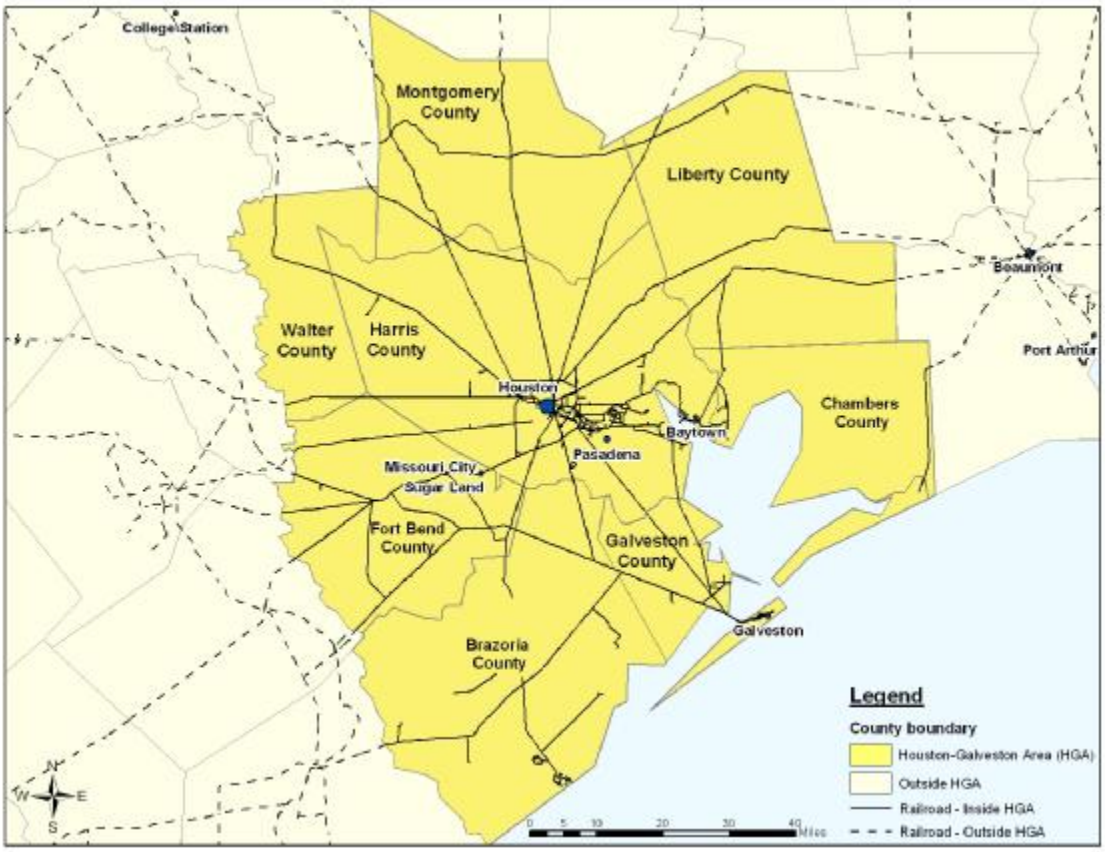

Table 3. Locomotive Emission Factors (g/gal)

Locomotive type	Pollutants			
	HC	CO	NOx	PM
Controlled emission rates for locomotives manufactured in 1973-2001 (Tier 0)				
Line Haul	10	26.6	178	6.7
Switch	21	38.1	262	9.2
Controlled emission rates for locomotives manufactured in 2002-2004 (Tier 1)				
Line Haul	9.8	26.6	139	6.7
Switch	21	38.1	202	9.2
Controlled emission rates for locomotives manufactured after 2004 (Tier 2)				
Line Haul	5.4	5.0	103	3.6
Switch	11	7.3	152	4.3

Because class I line-haul and even switch engines are rotated throughout the country, our initial estimates do reflect the general make up of the locomotive fleet based upon the weighted average of locomotives that fall into selected “TIER” groupings. Unregulated engines were manufactured prior to 1973. Engines rebuilt after 1973 would fall into

TIER 0 standards (it should be noted that some locomotives date back to 1949, and are completely exempt from the EPA certification program). TIER 1 and 2 apply to increasingly stringent emission standards implemented beginning in 2001 and 2004, respectively. Note that over the next year, EPA is considering a new TIER 3 standard, which could be incorporated into the model also.

As discussed above, line-haul data elements were provided by UP and BNSF railways with different levels of detail. The UP data provided an estimate of GTM by railway segment to which they applied to a system wide average fuel usage rate (1.305 gal/1000 GTM) to calculate fuel usage by segment.

BNSF provided similar data, but disaggregated it by locomotive activity type. Each locomotive type had specific ton-miles per gallon factor that was applied to the ton mileage data associated with individual railway links in order to estimate fuel usage by link. The fuel usage rates ranged from 252 to 2643 gross ton miles per gallon, which compares to UP's system wide value of 766. The BNSF ton-mile per gallon factors were developed from information obtained from data recorder.

The fuel usage for each railroad segment was applied to emission factors from Table 3 that were weighted to reflect the line haul fleet composition of Tier 0 and Tier 1 locomotives.

For switch engines it should be noted that some switchers operate within the confines of a designated yard, but also do local "road switch" hauls outside their principal yards. The data submitted by the railroad companies represent a census of switch engines, but does not provide any additional insight to quantify off-site yard operations. Such activities may already be accounted for by the assumptions that we are using about locomotive operations.

The UP data provided an estimate of the total annual hours of all locomotives operating at a given yard location. They then converted these hours of operation to 24 hour equivalence and applied that fraction to the fuel consumption rate (226 gal per day * 365 days per year) provided in the U.S. EPA SIP Guidance. The other railways just provided a count of yard locomotives for which it was assumed that their operation was 24 hours a day, 365 days per year. We appreciate that such an assumption will overestimate actual emissions, but may account for off-yard activities. The fuel consumption data elements for UP were applied to emission factors obtained from Table 3, weighted to reflect the Tier composition of their switch engines. All other yard locomotive fuel data elements were applied to the Tier O switch engine emission factors to estimate their emissions.

The compiled emission estimates for line haul and switch engines are summarized in Table 4 for annual emissions and Table 5 for daily emissions. Once the submitted railway segment data are linked to individual railway segments in the BTS railway shape file, then emissions can be summarized by individual counties. As discussed above, none of the submitted data used the segment codes found in the BTS data set. This issue will have to be addressed in the follow-on project.

Table 4. Houston/Galveston Locomotive Annual Emission Estimates

Locomotive type	Pollutants (tpy)			
	HC	**CO**	**NOx**	**PM**
Union Pacific				
Line Haul	205.8	548.6	3,575	138.2
Switch	54.5	99.0	597.9	23.9
Burlington Northern Santa Fe				
Line Haul	25.6	68.1	450.9	17.2
Switch	95.5	173.2	1,191.2	41.8
Combined				
Line Haul	231	617	4,026	155
Switch	150	272	1,789	66
Total	381	889	5,817	221
NEI Rev. 2002	478	1,176	11,585	148
% Difference	20.3%	24.4%	49.8%	49.3%

What is interesting about these estimated emissions is that UP has approximately an order of magnitude more tonnage traffic than BNSF and this fact is reflected in the emission estimates. What is particularly interesting is that for yard locomotives, UP has about half of the locomotives, but because they provided hours of operation their 94 locomotives equate to only 17 full time (24 hours per day, 365 days per year) locomotives. For the BNSF yard locomotive data set, hours of operation were not provided, such that it was assumed that they operated 8,760 hours per year, which is probably an over estimation of actual hours operations.

Table 5. Houston/Galveston Locomotive Daily Emission Estimates

Locomotive type	Pollutants (tpd)			
	HC	**CO**	**NOx**	**PM**
Union Pacific				
Line Haul	0.56	1.50	9.79	0.38
Switch	0.15	0.27	1.64	0.06
Burlington Northern Santa Fe				
Line Haul	0.07	0.18	1.24	0.05
Switch	0.26	0.47	3.26	0.18
Combined				
Line Haul	0.63	1.68	11.03	0.43
Switch	0.41	0.74	4.90	0.24
Total	1.04	2.42	15.93	0.67

These preliminary Houston/Galveston estimates are similar to the values that are included in the EPA's revised 2002 National Emission Inventory (NEI) locomotive estimates for the 8 counties that make up the Houston/Galveston area (to be released later this month). The preliminary Houston/Galveston yard locomotive emissions were generally very similar to those reported in the revised 2002 NEI particularly for VOC/HC (11% higher), CO (2% lower), and PM (4% lower). The notable exception was for NO_x, which was 52% lower than the NEI emission estimate. Line haul emission estimates were significantly lower for the preliminary Houston/Galveston emission inventory, particularly for VOC/HC (50% lower), CO (45% lower), and NO_x (120% lower). Once we have successfully matched railway segments to available GIS shape files, we need to check to see that all active railways lines are being reported in the Houston/Galveston inventory. The NO_x emissions are particularly troublesome for both yard and locomotive source categories and will need further study during the follow-on project to ensure that they are calculated correctly. PM emission estimates for line haul operations were another exception as they were 12% higher in the preliminary Houston/Galveston inventory than in NEI.

The NO_x emissions are especially important to rate-of-progress, ozone attainment modeling, and voluntary reduction programs such as the Texas Emission Reduction Plan (TERP). The preliminary value of 5,817 tons per year of NO_x is roughly equivalent to 16 tons per day, which is similar to previous inventories conducted in 1994 and 2001 that used the GTM approach.

2.3.2 *Lessons Learned*

Based on the review of the data provided by the railways and the development of this preliminary Houston/Galveston locomotive emission inventory developed for this memorandum, the following lessons were learned:

- The model will need to be developed to accept aggregated data such as that provided by UP or disaggregated train activity type data such as provided by BNSF.

- One of the railway companies requested that their data be classified as confidential business information (CBI). If we wish to honor this request, distribution of a populated version of the model may be constrained to CBI certified staff.

- The model should also be able to adjust the emission factors based on the fleet composition of Tier 0, 1, and 2 engines.

- The model should retain all segment and train activity codes and crosswalk data files should be developed that correctly link the data.

- The train activity codes will need to be matched with available SCC codes.

- Default parameters need to be developed to extrapolate the data to other railway operations across the state.

- Output from the model needs to be developed as GIS attribute tables to allow for accurate spatial allocation of the emission estimates and summation at the county level.

- The model will need to be modified to reflect the effect on locomotive emissions of state grant programs such as TERP, introduction of low sulfur diesel fuels, and idle reduction programs.

- Growth factors will need to be developed to allow for back-casting and fore-casting based on readily available data.

The preliminary model presented in Section 2.3.3 of this memo will address some, thought not all of the issues listed above due to time constraints associated with this project.

2.3.3 *Preliminary Model Structure*

The preliminary model structure will consider line haul and switcher locomotives as two separate components whose emission estimates will be compiled together in the later stages of the model process.

For line haul operations, the following data tables will be developed:

- Activity table
- SCC matching table
- Fuel usage table
- Emission factor table
- Emissions table
- GIS attribute table
- NIF File Output

The data tables and their linkages are shown in Figure 2.

Two different activity tables will be developed to allow for the inclusion of generic or train activity type data. It should be noted that data submitted by the railroad companies need only be applied to the activity data tables. For the generic activity table the data fields will be limited to the following:

- Railway company
- Year data represents
- Fuel usage rate (gal/1000 GTM)
- Fleet composition (% Tier 0, 1 and 2)

- Data identification code (Primary Key)
- Segment identification code
- GTM per segment

It should also be noted that the first four data fields will be entered only once for a railway company's submittal. The remaining data fields will vary for each railway segment reported.

For railway companies that provide more detailed data the following activity data elements will be required:

- Railway company
- Year data represents
- Fleet composition (% Tier 0, 1 and 2)
- Data identification code (Primary key)
- Segment identification code
- Railway activity type code
- Fuel usage rate (gal/1000 GTM) by railway activity type and segment
- GTM by activity type and segment

As in the previous activity data table, the first three elements need only be entered once, all other data elements will vary for the individual railway segments.

The railway activity codes will be matched to SCC codes included in the SCC table. These SCC codes will be used later in generating output in NIF file format.

The fuel usage table will generate fuel usage estimates for each segment based on either a generic fuel usage rate which will be applied to the GTM of the segment or for disaggregated data, fuel usage rates specific for a given railway activity. These values will be multiplied by the GTM associated with that activity for each segment. The fuel usage table will contain the following data fields:

- Data identification code
- Fuel usage estimate

For generic data, the railway activity code will be noted as "generic".

The emission factor table will include the emission factors noted in Table 3 above, converted to pounds of pollutant per gallon of fuel used. In the future, other pollutants can be added as long as they too are in terms of pounds of pollutant per gallon of fuel used.

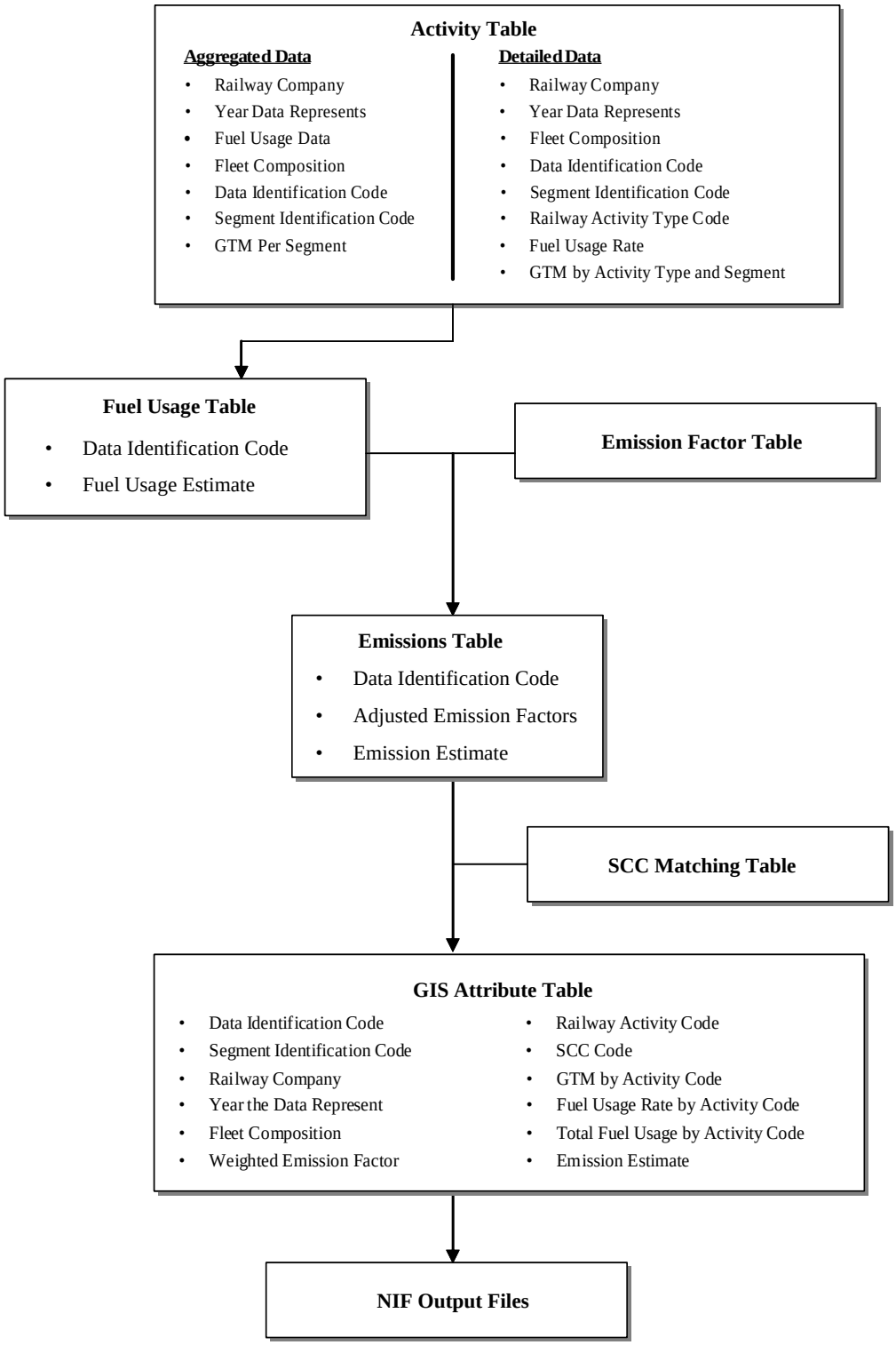

Figure 2. Line Haul Components of Railroad Model

The emissions table, adjusts the emission factors to represent the fleet mix of the railway. These adjusted emission factors are applied to the fuel usage values compiled in the fuel usage table to estimate emission per railway segment. The emissions table will include the following data fields:

- Data identification code
- Adjusted emission factors
- Emission estimate

The GIS attribute table will compile all relevant data for each segment, such that when a user of this model clicks on any railway link, all of the associated data will be presented. This will include the following data elements:

- Data identification code
- Segment identification code
- Railway company
- Year the data represent
- Fleet composition
- Weighted emission factor
- Railway way activity code
- SCC code
- GTM by activity code
- Fuel usage rate by activity code
- Total fuel usage by activity code
- Emission estimate

For yard locomotives many of the procedures discussed for line haul locomotive will be applicable for this source category as well. As with line haul operations, the following data tables will need to be developed:

- Activity table
- SCC matching table
- Fuel usage table
- Emission factor table
- Emissions table
- GIS attribute table
- NIF output files

The data tables and their linkages are shown in Figure 3.

Only one activity table is required for switch locomotives. Again, it should be emphasized that data submitted by the railroad companies need only be applied to the activity data tables. For switch locomotive activity data the following elements will be required:

- Railway company

- Year data represents
- Switch fleet composition (% Tier 0, 1 and 2)
- Data identification code (Primary key)
- Yard identification code
- Number of locomotives
- Annual hours of operation

As in the previous activity data tables, the first three elements need only be entered once, all other data elements will vary for the individual yards that are reported.

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

The fuel usage table will generate fuel usage estimates for each yard based on the hours of operation times the number of switch locomotives times the generic yard fuel consumption rate provided in U.S. EPA SIP guidance. Where idle time reduction programs are in place, the hours of activity can be adjusted to reflect the impact of this control program. The fuel usage table will contain the following data fields:

- Data identification code
- Fuel usage estimate

As with the line-haul emission factor table, the switcher emission factor table will include the emission factors noted in Table 3 above and will be converted to pounds of pollutant per gallon of fuel used. In the future, other pollutants can be added as long as they are in terms of pounds per gallon.

The emissions table includes adjusted emission factors to account for the fleet mix of the switch engines. Where the composition of the switcher fleet has been changed by state grant programs such as TERP, the vehicle fleet can be modified at this point to reflect these improvements.

These adjusted emission factors are applied to the fuel usage values compiled in the fuel usage table to estimate emission per railway yard. The emissions table will include the following data fields:

- Data identification code
- Adjusted emission factors
- Emission Estimate

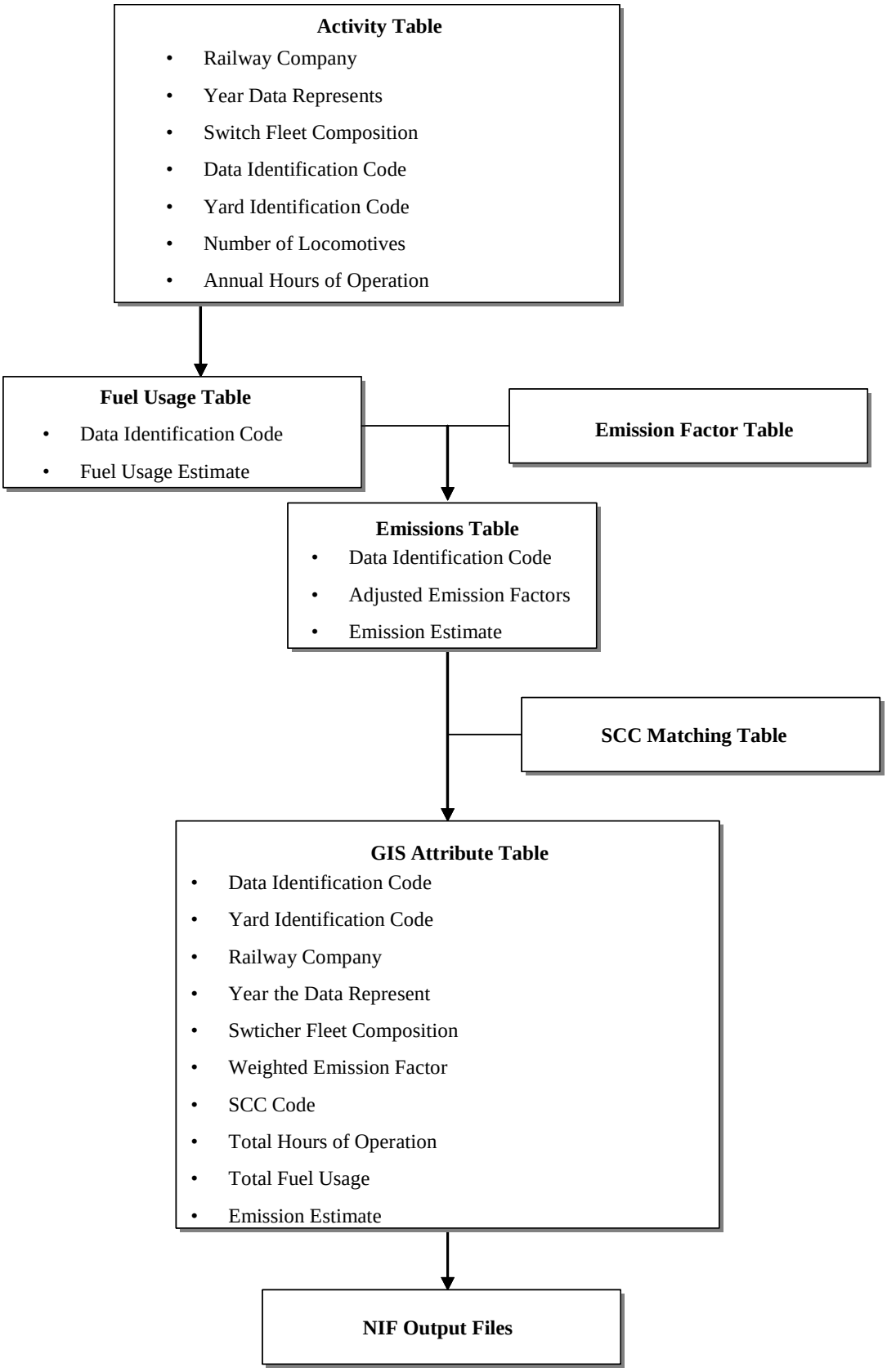

Figure 3. Switch Locomotive Components of Railroad Model

As with line haul operations, a GIS attribute table will be compiled with all relevant data for each railway yard, such that when a user of this model clicks on any railway yard all of the associated data will be presented. This will include the following data elements:

- Data identification code
- Yard identification code
- Railway company
- Year the data represent
- Switcher Fleet composition
- Weighted emission factor
- SCC code
- Total hours of operation
- Total fuel usage
- Emission estimate

Both the line haul and yard data elements can be applied to GIS shape files of railway segments and yard locations. These compiled data elements can be viewed using any standard GIS software, such as Arc Explorer (available for free from http://www.esri.com).

The NIF emission table data files will be provided as an output from the GIS shape files. GIS tools will be used to sum up railway emissions by SCC for each county using the GIS railway segment data overlaid with county boundary maps. This output file will be developed using the current NIF standard for the emission table.

2.4 Final Model and Presentation/Training

After all of the modifications are made to the model's database structure, a final beta version of the model will be developed for testing and debugging. The beta version will be provided to HARC on a CD-ROM which will also include a summary report of the project and documentation of the model structure including information about the format for input data. To allow railroad companies to download their data as a single batch file.

To ensure that the documentation meets HARC needs, a draft copy will be developed for review by HARC and TCEQ staff. A final version of the documentation that is to be included on the CD will be developed that incorporates HARC and TCEQ's comments and observations.

To facilitate correct usage of the model, the project is anticipating the need for a short training session that explains the general structure of the model and provides hands on exercises that demonstrate the functions built into the model. It is hoped that this training session can be preformed remotely using an interactive webcast. This approach is a cost effective method to demonstrate software models to a diverse collection of stakeholders residing in different locations.

Because the beta version has not undergone widespread testing, it may be necessary to continued to provide support and debugging services to HARC. This continuation of support will depend upon availability of future resources.

3.0 Issues That Need to Addressed in the Follow-on Project

Once the data structure is agreed upon, the data tables will have to be populated and linked. At this point we have all of the data needed to populate these tables.

As discussed above, one of the most important activities that will need to be addressed in the follow-on project will be associating the segment codes used in the data that have been submitted to individual links in the BTS' railway shape files. This will allow us to accurately assign emissions to the correct railway segments.

We prefer using the BTS data set as it includes GTM values for all other railway segments in Texas, allowing us to extrapolate the emission estimating approach discussed in this memorandum to the rest of the state. These calculations can be performed as a GIS shape file allowing emissions to be summed up to county level using appropriate county boundary maps and generating output as NIF 3.0 files. This approach only addresses line haul operations as the BTS data do not include activity or location data for yard operations.

Yards will have to be identified by their latitude and longitude coordinates. This will include active yards in the Houston/Galveston area as well as other parts of the state of Texas.

When we actually develop the model, we need to decide on how best to quantify the state and local control programs and pull this information into the model.

The pollutant list should also be reviewed, adding additional pollutants if necessary. This might include SO_x or speciated PM and VOC emissions as individual HAP species.

4.0 References

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Appendix: Railroad Submitted Data

Burlington Northern Santa Fe Data

BNSF

Michael E. Clift, CHMM
Manager Environmental Operations

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September 14, 2004

Via Overnight Delivery

Ms. Karla Hardison
TCEQ Air Division
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Austin, TX 78753

Re: BNSF 2003 Locomotive Emissions for Dallas / Ft. Worth and Houston / Galveston Area

Dear Ms. Hardison:

As requested by the TCEQ, BNSF is supplying locomotive fuel use and fleet data for the Dallas/ Ft. Worth and Houston / Galveston area for August 2003 to July 2004. Specifically, the data request has been addressed as follows:

1. LH-1 – GTM by train type. Attachment A contains the total annual fuel burn data by railroad line segment and train type. All foreign traffic, except Amtrak, is excluded. Fuel burn data for foreign traffic has been estimated and is included in Attachment B
2. LH-2 – Fleet Mix. The BNSF locomotive fleet data is provided in Attachment C.
3. LH-3 – Number of locomotive trips. See Attachment A. Train trip times are not available.
4. LH-4 – End point coordinates for line segments. See Attachment D
5. LH 5-7 - Data calculation methodology. See Attachment E
6. SE-1 - Locomotive ID and main yard assignment. See Attachment F. Switch engines are listed by yard in which they operate. Local and road switch engines are listed by the city they operate out of. Locomotive ID's are not provided.
7. SE-2 – End point coordinates for each railyard. See Attachment G.
8. SE-3 – Model year and locomotive certification. Model year is not available. It is believed that all of the switch engines, except eight Motive Power units in Houston, are exempt from rebuild requirements.
9. SE-4 Switch engines under the TERP program. See Attachment H.
10. SE-5 Fuel use by switch engines. Not available. All switch engines in the Houston area are fueled via tank truck. The paperwork for the fuel delivery does not include the locomotive being serviced. Switch engines in the Dallas area are fueled at fixed facilities and via tank truck. Again, no records to indicated fuel use for a specific locomotive are available.
11. SE 6-7 – Calculations and event recorder data. BNSF switch engines are not equipped with event recorders. No calculations on switch engine fuel use or emissions were conducted.

If you have any questions regarding this submittal, please contact me at the letterhead phone number.

Sincerely,

Michael E. Clift
Manager Environmental Operations

Enclosure

Burlington Northern and Santa Fe Railway
Locomotive Fleet Average Implementation Progress Report

			2002 (January 1 – December 31)	2003 (January 1 – December 31)
1.	**Locomotive Inventory**			
	a.	*Pre-1973*	1009	1004
	b.	*Pre-2000 locomotive that have not been Retrofit*	2977	3346
	c.	*Tier 0 locomotives*	746	1046
	d.	*Tier 1 locomotives*	100	281
	e.	*Tier 2 locomotives*	0	22
	f.	*Test or Experimental locomotives*	35	25
	g.	*Retired locomotives*	146	57
2.	**Projected Changes**		Between: January 1, 2003 and December 31, 2003	Between: January 1, 2004 and December 31, 2004
	a.	*Number of pre-2000 locomotives expected to be remanufactured to Tier 0*	284	352
	b.	*New Tier 1 locomotives*	50	400
	c.	*New Tier 2 locomotives*	30	4
	d.	*New Test or Experimental locomotives*	6	8
	e.	*Projected retired locomotives*	180	42
3.	**New Technologies**		***a. The Participating Railroads will continue to work with manufactures to explore the feasibility of implementing new technologies.***	***a. The Participating Railroads will continue to work with manufactures to explore the feasibility of implementing new technologies.***
			b. The Participating Railroads remain committed to the current research and development program underway with the ARB.	***b. The Participating Railroads remain committed to the current research and development program underway with the ARB.***
4.	**Technology for Tracking Locomotive Activity**		***a. The Participating Railroads believe that technology already exists that will enable locomotive activity within the South Coast Non-attainment Area to be accurately measured.***	***a. The Participating Railroads believe that technology already exists that will enable locomotive activity within the South Coast Non-attainment Area to be accurately measured.***
5.	**5-year Locomotive Purchase Plan**		**2002-2007**	**2003-2008**
	a.	*Locomotives on plan*	915	637
	b.	*Locomotives have been delivered*	150	110
	c.	*HBO/DNT only - locomotive retirements (depends on business levels)*	1000+	124

DFW and Houston / Galveston Station Names for Air Emissions

County	Line Segment	Station Names	Longitude	Latitude
DFW				
Tarrant	7500	Crowley	97.35	32.57
		AllAuto	97.32	32.98
	951	FTWMP02	97.33	32.77
		Centerport	97.04	32.81
	485	Towfiffiv	*	*
		Avondale	97.4	32.97
Dallas	951	East Tex	*	*
		NJCT	*	*
	8010	Forest Ave	96.78	32.75
		Lancaster	96.75	32.59
	1046	Bliss	96.9	32.95
		South Irving	96.94	32.81
	7509	Hale	96.86	32.71
		Cedar Hill	96.96	32.58
Denton	1046	Frisco	96.82	33.15
		Hebron	96.86	33.02
	7500	Alliance	97.35	33.01
		Sanger	97.16	33.36
Collin	1046	Frisco	96.82	33.15
		Celina	96.78	33.32
Houston Galveston				
Brazoria	7500	Arcola	95.46	29.5
		Angleton	UP	UP
	7501	Alvin	95.25	29.42
		Mykawa	95.3	29.61
Fort Bend	7500	Arcola	95.46	29.5
		Orchard	95.75	29.6
Galveston	7500	Algoa	95.17	29.4
		Galveston	94.83	29.29
Harris	7501	Mykawa	95.3	29.61
		T&NO Jct	95.32	29.69
	492	Tomball	95.61	30.09
		Oak Forest	95.43	29.81

Liberty	7502	Cleveland	95.08	30.34
		Romayor	94.84	30.45
Montgomery	7502	Montgomery	95.69	30.37
		Security	95.24	30.31
	492	Ventura	95.65	30.19
		Simmons	95.78	30.43

* unable to locate longitude and latitude
UP Union Pacific

Emissions Report Documentation:

This report contains information around the Houston/Galveston and Dallas/Ft. Worth, TX areas. For the specific areas, see attached. This report does not contain foreign emissions data on BNSF tracks, or BNSF emissions data on foreign tracks.

TRAFFIC_PORTION:
Originally the source data was taken from Data Warehouse, Operating Model, Train Events data, however; this data was scraped, as it was not able to get the small portions of track that was requested. Therefore, the source data for the traffic portion was taken from the Marketing database, which determines our annual traffic density, which was provided by Brian Medart. The fields in the report which were taken from the traffic portion, are:

*Sub-Div MP
*Timetable Direction
*Train Type
Count of Train Symbol
Average Trains/Day
Sum of Gross Tons Train
Average of Gross Tons Train

*Indicates fields in both the Traffic portion and the Fuel portion of this report. Details for the traffic portion of how this information was pulled, is as follows:

Data was pulled from August 2003 – July 2004, by the seven subdivisions requested (Ft.Worth, DFW, Houston, Madill, Conroe, Galveston, Mykawa), and limited to the mileposts (see the reports for the mileposts). System foreign traffic was excluded, as well as, foreign train types. Weighted averages were used to calculate this information.

Count of Train Symbol was calculated by taking the sum of the train count, then take the sum of the train count times the number of miles, then take the sum of the mile count, then get a weighted count by dividing the sum of the miles count by the sum of the miles.

SUM_CNT = sum of TRN_CNT
MILECNT = SUM_CNT * MILES
SUM_MCNT = sum of MILECNT
WGT_CNT = SUM_MCNT / SUM_MILE

Average Trains per Day is the above calculations then divide by 365 days per year.

TRN_DAY = WGT_CNT / 365

Sum of Gross Tons Train was calculated by taking the sum of the train tons, then take the sum of the train tons times the number of miles, then take the sum of the mile tons, then get weighted tons by dividing the sum of the mile tons by the sum of the miles.

SUM_TON = sum of TON_TOT
MILETON = SUM_TON * MILES
SUM_MTON = sum of MILETON
WGT_TON = SUM_MTON / SUM_MILE

Average of Gross Tons Train is the above calculations dividing the weighted ton by the weighted count.

AVG_TON = WGT_TON / WGT_CNT

FUEL PORTION:

The source data for the fuel portion was taken from Data Warehouse, Operations Model, Fuelburn data. This data is taken from the trains, which have locomotive event recorders. When fuel data was not available from a locomotive which was not equipped with an event recorder, train modeling was used to compute the fuel usage. Information used for the fuel portion of the Emissions Report is as follows:

*Sub-Div (without MP)
*Timetable Direction
*Train Type
Gross Ton Miles per Gallons
Gallons per Average Train
Total Annual Fuel

*Indicates fields in both the Traffic portion and the Fuel portion of this report. Details for how the fuel portion of this information was pulled, is as follows:

Data was pulled from October 2003 – June 2004, by trains departing and ending within each of the seven subdivisions requested (Ft.Worth, DFW, Houston, Madill, Conroe, Galveston, Mykawa).

BNSF TRAIN TYPE

A	AMTRAK
B	BARETABLE INTERMODAL
C	LOADED UNIT COAL
D	LITE ENGINE
E	EMPTY UNIT COAL
F	FOREIGN RAILROAD TRAINS OVER BNSF
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

Conroe Subdivision - Montgomery MP 55.6 - Romayor MP 111.0 (55.4 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
CONROE - MP 55.6 - 111.0	E	D ***	5	-	30,943	5,747	880	362	1,810
		H ***	358	1.0	2,410,267	6,739	913	409	146,422
		L ***	159	0.4	161,086	1,014	646	87	13,833
		M	284	0.8	1,712,254	6,039	954	253	71,940
		P ***	1	-	6,339	6,339	898	391	391
		R ***	89	0.2	68,051	767	625	68	6,052
		S ***	3	-	20,385	7,184	948	420	1,260
		U ***	227	0.6	791,407	3,493	787	246	55,842
		W ***	1	-	2,086	2,086	700	165	165
		X ***	33	0.1	114,278	3,494	784	247	8,151
	TOTAL EAST **		**1,160**	**3.1**	**5,317,096**	**4,290**			**305,866**
	W	D	2	-	18,221	7,607	841	430	859
		G ***	48	0.1	588,508	12,368	1,852	370	17,760
		H	109	0.3	598,977	5,477	1,079	403	43,978
		L ***	156	0.4	153,127	981	799	68	10,608
		M	355	1.0	1,858,130	5,230	751	352	124,989
		Q ***	2	-	8,269	4,134	1,060	216	432
		R ***	86	0.2	44,288	517	734	39	3,354
		U	190	0.5	1,373,936	7,216	961	139	26,315
	TOTAL WEST **		**948**	**2.5**	**4,643,456**	**5,441**			**228,296**
CONROE TOTAL **			**2,108**	**5.6**	**9,960,552**	**4,866**			**534,162**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 82 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

DFW Subdivision - Forest Ave. MP 769.3 - Lancaster MP 781.7 (12.4 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
DFW - MP 769.3 - 781.7	E	E	18	-	61,655	3,425	686	8	152
		H	7	-	59,032	8,433	769	155	1,088
		M	245	0.7	1,380,263	5,634	973	67	16,378
		O ***	1	-	481	481	542	11	11
		U	189	0.5	517,846	2,740	842	121	22,861
		X ***	3	-	10,950	3,650	838	54	162
	TOTAL EAST **		**463**	**1.2**	**2,030,227**	**4,061**			**40,652**
	W	B ***	1	-	2,534	2,534	731	43	43
		C ***	23	0.1	424,555	18,459	884	259	5,957
		G ***	2	-	22,181	11,091	804	171	342
		M	193	0.5	1,129,931	5,855	1,001	70	13,554
		U	188	0.5	1,794,857	9,547	509	78	14,687
	TOTAL WEST **		**407**	**1.1**	**3,374,058**	**9,497**			**34,583**
DFW TOTAL **			**870**	**2.3**	**5,404,285**	**6,779**			**75,235**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 99 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

Ft.Worth Subdivision - North Alliance MP 364.6 - Sanger MP 392.2 (27.6 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
Ft.Worth - MP 364.6 - 392.2	N	A	382	1.0	1,662				
		B	85	0.2	206,952	2,441	622	25	2,091
		D ***	4	0.0	1,859	492	543	25	100
		E	14	0.0	54,565	3,897	447	136	1,908
		G	8	0.0	78,232	9,779	888	244	1,953
		H	886	2.4	7,035,658	7,941	776	226	200,063
		L	1	0.0	3,281	3,281	774	117	117
		M	1,214	3.3	6,655,126	5,484	668	99	119,616
		O	5	0.0	4,644	1,020	306	92	460
		P	7	0.0	32,397	4,628	913	102	714
		Q	255	0.7	543,703	2,131	696	23	5,908
		S	1	0.0	1,989	1,989	615	18	18
		U	84	0.2	252,682	3,008	438	68	5,730
		V	123	0.3	495,293	4,027	605	47	5,752
		X	770	2.1	2,870,456	3,729	508	151	115,950
		Z	622	1.7	2,397,754	3,858	538	37	22,949
	TOTAL NORTH **		**4,079**	**10.9**	**20,634,591**	**3,847**			**483,328**
	S	A	633	1.7	271				
		B	62	0.2	138,032	2,234	585	78	4,850
		C	20	0.1	357,124	17,856	1,186	249	4,988
		D ***	2	0.0	1,018	509	169	83	166
		G	743	2.0	10,368,571	13,955	1,140	264	196,355
		H	344	0.9	2,985,902	8,680	859	186	64,050
		L ***	1	0.0	136	136	38	98	98
		M	1,427	3.9	11,427,503	8,008	822	111	158,153
		O	5	0.0	4,673	1,027	398	13	67
		Q	287	0.8	561,256	1,953	569	24	6,772
		S	1	0.0	2,002	2,002	432	104	104
		U	82	0.2	477,432	5,822	944	88	7,188
		V	331	0.9	1,139,924	3,442	628	64	21,159
		X	6	0.0	16,923	2,930	598	72	432
		Z	710	1.9	2,822,179	3,972	650	28	20,205
	TOTAL SOUTH **		**4,021**	**10.9**	**30,302,675**	**5,180**			**484,587**
FT WORTH TOTAL **			**8100**	**21.8**	**50,937,266**	**4,514**	**612**	**96**	

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 3176 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

Galveston Subdivision - Galveston MP 2.2 - Orchard MP 76.2 (74 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
GALVESTON - MP 2.2 - 76.2	E	B ***	14	-	33,078	2,348	812	214	2,996
		C ***	1	-	17,690	17,690	1,384	946	946
		D	7	-	13,063	2,005	518	123	863
		E	199	0.5	787,363	3,953	435	350	69,657
		G	9	-	90,947	10,182	1,344	363	3,265
		H	318	0.9	1,442,239	4,528	471	181	57,462
		L ***	182	0.5	350,042	1,921	894	159	28,938
		M	434	1.2	3,042,252	7,005	766	134	57,958
		O ***	1	-	1,195	1,195	876	101	101
		P ***	19	0.1	119,588	6,361	1,012	465	8,835
		S	210	0.6	1,612,914	7,672	577	221	46,331
		U	144	0.4	578,829	4,019	311	480	69,190
		V ***	103	0.3	358,788	3,477	919	280	28,840
		X	531	1.5	1,901,970	3,583	539	168	89,188
	TOTAL EAST **		**2,172**	**6.0**	**10,349,958**	**5,424**			**464,570**
	W	B ***	10	-	21,310	2,210	1,211	135	1,350
		C	209	0.6	3,673,582	17,580	1,821	511	106,895
		D	1	-	4,051	4,051	1,028	124	124
		G	568	1.6	7,671,856	13,509	1,502	318	180,640
		H	349	1.0	2,315,753	6,635	1,434	149	51,892
		L ***	269	0.7	867,929	3,222	1,235	193	51,917
		M	471	1.3	2,225,762	4,730	908	179	84,136
		O ***	1	-	1,214	1,214	1,198	75	75
		P	340	0.9	1,806,712	5,319	797	183	62,139
		Q ***	3	-	12,057	4,019	1,282	232	696
		S	40	0.1	208,966	5,258	626	71	2,836
		U	159	0.4	1,190,512	7,484	1,420	390	62,010
		V	207	0.6	540,639	2,607	464	53	11,043
		X	7	-	24,065	3,316	1,246	197	1,379
	TOTAL WEST **		**2,634**	**7.2**	**20,564,408**	**5,797**			**617,133**
GALVESTON TOTAL **			**4,806**	**13.2**	**30,914,366**	**5,610**			**1,081,703**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 125 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

Houston Subdivision - Casey MP 70.6 - Simmons MP 110.5 (40 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
HOUSTON - MP 70.6 - 110.5	N	B ***	2	-	4,878	2,439	903	108	216
		C ***	19	0.1	356,488	18,763	1338	561	10,659
		D ***	6	-	2,945	491	786	25	150
		G ***	7	-	82,384	11,769	1290	365	2,555
		H	63	0.2	369,253	5,845	1109	50	3,131
		M	809	2.2	4,710,608	5,822	888	93	74,918
		O ***	1	-	481	481	663	29	29
		P ***	6	-	31,859	5,061	916	221	1,326
		S ***	7	-	37,487	5,469	919	238	1,666
		U	129	0.4	1,221,980	9,488	421	236	30,460
		W ***	1	-	1,383	1,186	832	57	57
		X	1	-	4,475	4,475	542	212	212
		Y	129	0.4	235,959	1,830	719	7	876
	TOTAL North **		**1,180**	**0.3**	**7,060,180**	**5,625**			**126,255**
	S	E	62	0.2	205,910	3,321	372	100	6,223
		G	2	-	24,030	12,015	1035	500	1,001
		H ***	920	2.5	6,907,050	7,505	1900	158	145,360
		M	327	0.9	1,679,187	5,139	1068	159	52,003
		O ***	1	-	481	481	1069	18	18
		P ***	107	0.3	678,486	6,324	1709	148	15,836
		Q ***	1	-	4,316	4,316	1629	106	106
		S ***	21	0.1	153,224	7,347	1814	162	3,402
		U	148	0.4	543,654	3,662	875	388	57,370
		V ***	2	-	8,060	4,030	1645	98	196
		W ***	1	-	1,536	1,536	1429	43	43
		X	173	0.5	614,824	3,551	631	209	36,194
		Y ***	149	0.4	375,674	2,514	1416	71	10,579
	TOTAL South **		**1,914**	**0.4**	**11,196,432**	**4,749**			**328,330**
HOUSTON TOTAL **			**3,094**	**0.7**	**18,256,612**	**5,187**			**454,585**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 743 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

Madill - Celina MP 673.6 - Carrollton MP 700.6 (27 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Gross Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
MADILL - MP 673.6 - 700.6	E	D ***	1	-	406	406	522	21	
		E	11	-	36,811	3,346	422	196	2,155
		H	3	-	26,430	8,810	842	142	427
		L ***	283	0.8	558,137	1,974	650	82	23,206
		M ***	1	-	3,508	3,508	644	147	147
		O ***	1	-	481	481	618	21	21
		R ***	169	0.5	92,919	550	619	24	4,056
		U	945	2.6	3,147,718	3,331	384	143	135,066
		Z ***	3	-	11,528	3,843	644	161	483
	**TOTAL EAST ** **		**1,417**	**3.9**	**3,877,938**	**2,917**			**165,561**
	W	B ***	1	-	2,534	2,534	1267	54	54
		C ***	1	-	17,520	17,520	2643	179	179
		G	35	0.1	314,358	8,982	1291	171	5,982
		L ***	280	0.8	888,273	3,172	1259	68	19,040
		M	185	0.5	1,108,035	5,989	1122	144	26,671
		R ***	160	0.4	66,521	416	864	13	2,080
		U	945	2.6	6,613,490	6,999	1103	204	192,650
	**TOTAL WEST ** **		**1,607**	**4.4**	**9,010,731**	**6,516**			**246,656**
**MADILL TOTAL ** **			**3,024**	**8.3**	**12,888,669**	**4,716**			**412,217**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 98 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

Mykawa Subdivision - Alvin MP 0 - T&NO Jct MP 19.4 (19.4 Miles)

Sub-Div - MP	Timetable Direction	Train Type	Count of Train Symbol	Average Trains/Day	Sum of Gross Tons Train	Average of Gross Tons Train	Ton Miles per Gallons *	Gallons per Average Train	Total Annual Fuel
MYKAWA - MP 0 - 19.4	S	A	1	-	684	1,327			
		B ***	16	-	35,094	2,240	749	58	928
		C ***	2	-	34,612	17,306	1277	263	526
		D	2	-	14,221	5,796	252	128	256
		E ***	2	-	6,203	3,102	708	85	170
		G ***	10	-	137,784	13,459	1214	215	2,150
		H	42	0.1	269,338	6,437	911	114	4,788
		L ***	305	0.8	1,032,214	3,379	728	90	27,450
		M	169	0.5	911,572	5,382	682	93	15,717
		O ***	1	-	1,090	1,090	661	32	32
		P	28	0.1	175,463	6,187	444	77	2,156
		S ***	155	0.4	1,199,984	7,742	969	155	24,025
		U ***	173	0.5	921,017	5,310	963	107	18,511
		V ***	83	0.2	285,486	3,421	737	90	7,470
		W ***	1	-	3,138	3,138	823	74	74
		X ***	58	0.2	205,142	3,537	738	93	5,394
		Y ***	281	0.8	402,556	1,431	712	39	10,959
	TOTAL South **		**1,328**	**3.6**	**5,634,914**	**5,560**			**120,606**
	N	B	10	-	22,590	2,238	1451	27	270
		C ***	9	-	168,280	18,698	1319	275	2,475
		D ***	8	-	8,247	972	943	20	160
		G ***	85	0.2	1,170,548	13,811	1294	207	17,595
		H	360	1.0	2,334,927	6,479	1083	57	20,520
		L ***	56	0.2	407,639	7,217	1077	130	7,280
		M	182	0.5	978,695	5,363	781	48	8,736
		O ***	1	-	1,105	1,105	932	23	23
		P	378	1.0	1,775,960	4,701	1373	68	25,704
		Q ***	3	-	10,854	4,262	961	86	258
		S ***	35	0.1	192,781	5,580	993	109	3,815
		U ***	185	0.5	1,145,825	6,194	1027	117	21,645
		V ***	167	0.5	433,967	2,592	708	71	11,857
		W ***	1	-	3,394	3,394	740	89	89
		X	7	-	26,457	3,535	971	56	392
		Y ***	375	1.0	414,720	1,105	692	31	11,625
	TOTAL North **		**1,862**	**5.0**	**9,095,989**	**5,453**			**132,444**
MYKAWA TOTAL **			**3,190**	**8.6**	**14,730,903**	**5,506**			**253,050**

Note: Gross ton values include weight of locomotives

Traffic calculated from Marketing database, Aug 2003 - July 2004

* Ton Mile per Gallon derived from event recorder data Oct 2003 thru Jun 2004 - 309 fuel records

** All total exclude Amtrak - no fuel data available

*** Actual fuel data not available - estimated from modeling

To: KASMITH@tceq.state.tx.us
Cc: swells22@swbell.net; Paula Fields
Subject: BNSF Switch Engines in the Houston and DFW area

Karla,

Here is the info on the BNSF switch engines in the DFW and Houston / Galveston area. Please let me know if you have any questions regarding this.

Mike

	At	Casey	-	2	4 axle intermediate units (1799 - 2900 HP)
	At	Casey	-	2	4 axle small units (1000 - 1799 HP)
	At	Dayton	-	4	4 axle intermediate units (1799 - 2900 HP)
	At	Galveston	-	2	4 axle intermediate units (1799 - 2900 HP)
	At	Houston	-	14	4 axle intermediate units (1799 - 2900 HP)
	At	Houston	-	4	4 axle small units (1000 - 1799 HP)
	At	Houston	-	8	6 axle 3000 HP units
	At	Pearland	-	5	4 axle intermediate units (1799 - 2900 HP)
	At	Pearland	-	3	4 axle small units (1000 - 1799 HP)
	At	Alliance TX	-	11	4 axle intermediate units (1799 - 2900 HP)
	At	Ft Worth TX	-	8	4 axle intermediate units (1799 - 2900 HP)

There are Locals and Road Switchers that run out of these terminals:

	At	Bay City (Local only)	-	2	4 axle intermediate units (1799 - 2900 HP)
	At	Beaumont (Rd SW)	-	3	4 axle intermediate units (1799 - 2900 HP)
	At	Galveston (Locals)	-	2	4 axle small units (1000 - 1799 HP)
	At	Galveston (Locals)	-	2	6 axle 3000 HP units
	At	Houston (Locals)	-	2	6 axle 3000 HP units
	At	Rosenberg (Local only)	-	1	4 axle intermediate units (1799 - 2900 HP)
	At	Alvin (Local only)	-	1	4 axle intermediate units (1799 - 2900 HP)
	At	Ft Worth TX (Rd Sw)	-	2	4 axle intermediate units (1799 - 2900 HP)
	At	Irving TX (Rd Sw)	-	2	4 axle intermediate units (1799 - 2900 HP)

Latitude and Longitude Coordinates of BNSF Yards in the DFW and Houston / Galveston

DFW Area

Yard	County	Latitude	Longitude (degrees)
Alliance	Denton	33.01	97.35
		32.98	97.35
Saginaw	Tarrant	32.84	97.35
		32.82	97.35
North	Tarrant	32.93	97.33
		32.81	97.33

Houston / Galveston Area

Galveston	Galveston	29.30	94.82
		29.29	94.85
New South	Harris	29.73	95.33
		29.70	95.33
Casey Yard	Harris	29.92	95.52
		29.91	95.50

DFW and Houston / Galveston Station Names for Air Emissions				2003 County FRGN Line Gallons
County	**Line Segment**	**Mile Post**	**Station / County Line**	
DFW				
Tarrant	7500	332.026	Johnson County	*Tarrant*
		362.673	Denton County	88,835
	485	0	E. Ft. Worth	
		19.9468	Wise County	
Dallas	951		n/a	*Dallas*
			n/a	2,968
	8010	769.3	Forest Ave	
		785.439	Ellis County	
	1046	697.455	Denton County	
		700.09	MP 704, TX	
	7509		n/a	
			n/a	
Denton	1046	687.518	Collin County	*Denton*
		697.455	Dallas County	31,832
	7500	363.673	Tarrant County	
		396.498	Cooke County	
Collin	1046	667.921	Grayson County	*Collin*
		687.518	Denton County	1,304
Houston Galveston				
Brazoria	7500	25.458	Galveston County	*Brazoria*
		41.8715	Fort Bend County	916,623
	7501	0	Alvin	
		12.3883	Harris County	
Fort Bend	7500	41.8715	Brazoria County	*Fort Bend*
		79.6014	Austin County	199,764
Galveston	7500	6.3	Virgina Point, TX	*Galveston*
		25.458	Brazoria County	246,288
Harris	7501	12.3883	Brazoria County	*Harris*
		19.482	New South Yard, TX	335,607
	492	60.6	Shepard Dr, TX	
		87.0092	Montgomery County	
Liberty	7502	90.2589	Montgomery County	*Liberty*
		118.718	Hardin County	379
Montgomery	7502	47.1183	Grimes County	*Montgomery*
		90.2589	Liberty County	1,335
	492	87.0092	Harris County	
		115.588	Grimes County	

BNSF Switch Engines under TERP

Area	County	Type	number		built	rebuilt	
Silsbee		GP38	BNSF	2219	1970	1984	
							1
Beaumont		GP38	BNSF	2211	1970	1985	
Beaumont		GP38	BNSF	2233	1970	1985	
Beaumont		GP7	BNSF	1352	1952	1980	
							3
Longview		GP38	BNSF	2213	1970	1984	
Longview		GP38	BNSF	2214	1970	1984	
							2
Alliance		GP38	BNSF	2203	1970	1985	
Alliance		GP38	BNSF	2236	1970	1985	
Alliance		GP38	BNSF	2242	1970	1984	
Alliance		GP7	BNSF	1307	1952	1981	
Alliance		GP7	BNSF	1368	1952	1981	
Alliance		GP9	BNSF	1642	1957	1978	
Alliance		GP9	BNSF	1673	1956	1979	
Alliance		GP9	BNSF	1684	1956	1980	
							8
Cleburne		GP50	BNSF	3132	1985		
Cleburne		GP50	BNSF	3163	1981		
Cleburne		SD40-2	BNSF	7824	1974		
Cleburne		SD40-2	BNSF	7825	1974		
							5
Fort Worth		GP38	BNSF	2210	1970	1984	
Fort Worth		GP38	BNSF	2215	1970	1985	
Fort Worth		GP38	BNSF	2217	1970	1984	
Fort Worth		GP38	BNSF	2238	1970	1985	
Fort Worth		GP50	BNSF	3155	1985		
Fort Worth		GP50	BNSF	3156	1985		
Fort Worth		GP50	BNSF	3181	1981		
Fort Worth		GP50	BNSF	3182	1981		
Fort Worth		SD40-2	BNSF	7819	1977		
Fort Worth		SD40-2	BNSF	7822	1974		
Fort Worth		SD40-2	BNSF	7823	1974		
							11
Irving		GP38	BNSF	2223	1970	1985	
Irving		GP38	BNSF	2224	1970	1985	
Irving		GP38	BNSF	2226	1970	1985	
Irving		GP38	BNSF	2231	1970	1985	
Irving		GP50	BNSF	3177	1981		
Irving		GP50	BNSF	3185	1981		
							6
Venus		GP50	BNSF	3133	1985		
Venus		GP50	BNSF	3134	1985		
Venus		GP50	BNSF	3167	1981		
Venus		GP50	BNSF	3169	1981		
Venus		GP50	BNSF	3170	1981		
							7
TOTAL							**43**

Union Pacific Data

September 16, 2004

MS KARLA SMITH-HARDISON
TEXAS DEPT OF ENVIRONMENTAL QUALITY
12100 PARK 35 CIRCLE
AUSTIN TX 78753

SUBJECT: LOCOMOTIVE INVENTORY AND ACTIVITY DATA FOR HGA AREA

Dear Ms. Smith-Hardison:

Enclosed please find locomotive inventory and activity data you have requested from Union Pacific Railroad for the Houston-Galveston area. Your request and our response regarding the data are shown below:

Line Haul data:

LH-1 Gross ton-miles (GTM) by train type.

Response: *Gross ton-miles are not available by train type. Gross-ton miles and limits of track segments within county boundaries are generated from data generated provided by UPRR Engineering Department. We have provided gross ton-miles for the requested counties, as well as estimated emissions based on US EPA factors.*

Reference: US EPA Office of Air and Radiation, Technical Highlights - Emission Factors for Locomotives EPA420-F-97-051 Dec. 1997 (Table 3).

LH-2 Fleet mix (percentage trips for unregulated, TIER 0, TIER 1, TIER 2 engines).

Response: *Due to the transcontinental nature of our fleet, this information is not available for any particular segment of track or regional area; we have provided a breakdown of our fleet as found in our Annual Report R-1 to the Surface Transportation Board for the year ending December 31, 2003.*

Locomotive Type	As of 12/31/2003
Pre-1973 Unregulated	470
Pre-2000 Not Rebuilt	4,476
Tier 0	1,375
Tier 1	794
Tier 2	0
Test/Experimental*	5
TOTAL	7,120

LH-3 Number of locomotive trips by mainline track, annual and/or typical day and times.

Response: *Not available in the format requested; we have enclosed 4th Quarter 2003 maps from our Network Design department as a typical example of similar information.*

M. J. (Jon) Germer
Manager Environmental Field Operations

UNION PACIFIC RAILROAD
1400 Douglas Street, STOP 1030, Omaha, Nebraska 68179-1030
ph. (402) 544-2235 fx. (402) 233-3004
mjgermer@up.com

LH-4 End point coordinates (latitude and longitude) for each track segments

Response: *We have enclosed a map of the PMSA to assist you in determining this data.*

LH-5 Estimate of burn rate (i.e., GTM per gallon of diesel) by train type, with documentation of how burn rate was calculated.

Response: *Burn rate by train type is not available.*

LH-6 Discussion of how data from 1 - 5 were compiled, references, etc.

Response: *See LH-1through LH-5, above*

LH-7 Discussion of how event recorder data was, could, or might be incorporated into the results.

Response: *Event recorder is not incorporated in results. UP does not track burn rate, tonnage, or event data by train type. Event recorders are not present on many locomotives, notwithstanding the download technology issues and the proprietary nature of this data.*

Switch Engine data:

SE-1 Locomotive ID and main switch yard of operation

Response: *The actual pool of locomotives available for duty at any given location is based not upon locomotive identification number, but rather by horsepower required to perform the required jobs.*

SE-2 Centroid coordinates (latitude and longitude) or address for each switchyard

Response: *We are working to provide addresses as soon as practicable.*

SE-3 Model year, locomotive certification TIER by engine ID

Response: *There are currently 50 Tier I switch locomotives, and no Tier 2 switch locomotives. It likely the remainder are all non-regulated; however, a few switch locomotives in the fleet may have been rebuilt to Tier 0, although pools vary daily.*

SE-4 Whether the engine is subject to a TERP grant (indicate technology if yes)

Response: *None of the locomotives currently operating in the HGA are subject to a TERP agreement.*

SE-5 Gallons of annual fuel consumption by engine ID, with method described

Response: *Based on transportation plan, i.e., number of assigned days/week and hour/day, and using US EPA estimate of 82,490 gallons/year if operated 24x7x365, fuel consumption is based on switcher "24 hour equivalents". See attached worksheet for methodology.*

SE-6 Discussion of how data from 1-5 were compiled, emissions calculated, references, etc.

Response: *See SE-5, above.*

Reference: US EPA Procedures for Emission Inventory Preparation - Vol IV: Mobile Sources; Publication EPA420-R-92-009, December 1992, p. 207

SE-7 Optional: annual hours of operation and/or event recorder data (may be required for TERP grant engines), typical schedule for day and time.

Response: *Not available.*

Total emissions estimates (in tons) for the subject area are as follows:

HC	CO	NOx	PM
248.25	635.72	5,412.90	157.77

We have made every effort to provide the data you requested, given the capabilities of our systems.

Please consider and handle all of the enclosed attachments as confidential business information.

If you have questions, please contact me at telephone 402-544-2235 or via electronic mail at mjgermer@up.com

Sincerely,

M. J. (Jon) Germer

/mjg

Encl.

CC: Lanny Schmid

UPRR 2003 LINE HAUL DATA C Factor : 1.305 Gal/1000GTM 0.001305

Tonnage Records for the year 2003 - Selected Texas Counties

Emissions Factors from USEPA Office of Air and Radiation, Office of Mobile Sources
Technical Highlights - Emission Factors for Locomotives EPA420-F-97-051 Dec. 1997 (Table 3)
Emission factors (g/gal) HC=10.7 CO=27.4 NOx=233.3 PM=6.8

County	Subdivision	Segment	Track Type	County Beg MP	County End MP	Miles of Track	Tonnage Incr MP	Tonnage Decr MP	Annual Avg MGT/Mile	Total Gross Tons	Total Fuel (gallons)	Train Counts	Tons HC Emissions	Tons CO Emissions	Tons NOx Emissions	Tons PM Emissions
Brazoria	ANGLETON SUB	1640-0	SIMN	295.83	320.24	24.41	16	13	29.00	707,890,000	923,796	15.7	10.886	27.877	237.359	6.918
Brazoria	ANGLETON SUB	1650-0	SIMN	320.24	342.24	22.00	24	18	42.00	924,000,000	1,205,820	19.2	14.210	36.387	309.821	9.030
Brazoria	FREEPORT SUB	1645-0	SIMN	0	10	10.00	3	7	10.00	100,000,000	130,500	2	1.538	3.938	33.530	0.977
Chambers	BAYTOWN SUB	1933-0	SIMN	33.45	37.22	3.77	9	2	11.00	41,470,000	54,118	2	0.638	1.633	13.905	0.405
Fort Bend	GLIDDEN SUB	1324-0	SIMN	17	24.44	7.44	28	30	58.00	431,520,000	563,134	29.5	6.636	16.993	144.691	4.217
Fort Bend	GLIDDEN SUB	1326-0	SIMN	24.44	36.51	12.07	28	30	58.00	700,060,000	913,578	29.5	10.766	27.568	234.733	6.842
Fort Bend	GLIDDEN SUB	1328-0	SIMN	36.51	47.75	11.24	21.03	21.36	42.39	476,463,600	621,785	22.9	7.327	18.763	159.760	4.657
Fort Bend	POPP SUB	1215-0	SIMN	5.87	12.55	6.68	3	1	4.00	26,720,000	34,870	1	0.411	1.052	8.959	0.261
Fort Bend	POPP SUB	1216-0	SIMN	12.55	21	8.45	3	1	4.00	33,800,000	44,109	1	0.520	1.331	11.333	0.330
Galveston	ANGLETON SUB	1650-0	SIMN	342.24	343.14	0.90	24	18	42.00	37,800,000	49,329	19.2	0.581	1.489	12.675	0.369
Galveston	GALVESTON SUB	1205-0	SIMN	23.28	40.92	17.64	3	7	10.00	176,400,000	230,202	1.7	2.713	6.947	59.148	1.724
Galveston	GALVESTON SUB	1206-0	SIMN	40.92	42.96	2.04	3	7	10.00	20,400,000	26,622	1.7	0.314	0.803	6.840	0.199
Galveston	GALVESTON SUB	1207-0	SIMN	42.96	46.75	3.79	3	7	10.00	37,900,000	49,460	1.7	0.583	1.493	12.708	0.370
Harris	BAYTOWN SUB	1230-0	SIMN	0	1.06	1.06	4	1	5.00	5,300,000	6,917	2	0.082	0.209	1.777	0.052
Harris	BAYTOWN SUB	1233-0	SIMN	1.06	23.69	22.63	4	1	5.00	113,150,000	147,661	2	1.740	4.456	37.940	1.106
Harris	BAYTOWN SUB	1933-0	SIMN	23.69	33.45	9.76	9	2	11.00	107,360,000	140,105	2	1.651	4.228	35.998	1.049
Harris	BEAUMONT SUB	1250-0	SIMN	377.98	381.46	3.48	3	21	24.00	83,520,000	108,994	17.3	1.284	3.289	28.005	0.816
Harris	BEAUMONT SUB	1250-0	NO 1	381.46	381.61	0.15	3	0	3.00	450,000	587	8.65	0.007	0.018	0.151	0.004
Harris	BEAUMONT SUB	1250-0	NO 2	381.46	381.61	0.15	0	21	21.00	3,150,000	4,111	8.65	0.048	0.124	1.056	0.031
Harris	BEAUMONT SUB	1665-0	NO 1	381.61	385.49	3.88	21	0	21.00	81,480,000	106,331	6.95	1.253	3.209	27.321	0.796
Harris	BEAUMONT SUB	1665-0	NO 2	381.61	385.49	3.88	6	3	9.00	34,920,000	45,571	6.95	0.537	1.375	11.709	0.341
Harris	BEAUMONT SUB	1665-0	SIMN	385.49	401.27	15.78	27	3	30.00	473,400,000	617,787	13.9	7.280	18.642	158.733	4.627
Harris	EUREKA SUB	1370-0	SIMN	0	34.98	34.98	3	4	7.00	244,860,000	319,542	5.5	3.766	9.643	82.103	2.393
Harris	GALVESTON SUB	1204-0	SIMN	0	2.05	2.05	3	7	10.00	20,500,000	26,753	5.4	0.315	0.807	6.874	0.200
Harris	GALVESTON SUB	1205-0	SIMN	2.05	23.28	21.23	3	7	10.00	212,300,000	277,052	1.7	3.265	8.360	71.185	2.075
Harris	GLIDDEN SUB	1385-0	SIMN	1.14	4.65	3.51	7	11	18.00	63,180,000	82,450	4.4	0.972	2.488	21.185	0.617
Harris	GLIDDEN SUB	1220-0	SIMN	4.65	9.19	4.54	12	13	25.00	113,500,000	148,118	9.5	1.745	4.470	38.057	1.109
Harris	GLIDDEN SUB	1221-0	SIMN	9.19	12.9	3.71	12	13	25.00	92,750,000	121,039	9.5	1.426	3.652	31.099	0.906
Harris	GLIDDEN SUB	1323-0	SIMN	12.9	16	3.10	28	30	58.00	179,800,000	234,639	29.5	2.765	7.081	60.288	1.757
Harris	GLIDDEN SUB	1324-0	SIMN	16	17	1.00	28	30	58.00	58,000,000	75,690	29.5	0.892	2.284	19.448	0.567
Harris	HARDY ST. CONNECTION	1950-0	SIMN	0	0.74	0.74	8	20	28.00	20,720,000	27,040	7	0.319	0.816	6.948	0.202
Harris	HOUSTON EAST BELT SUB	1196-0	NO 1	0	1.7	1.70	30	0	30.00	51,000,000	66,555	19	0.784	2.008	17.101	0.498
Harris	HOUSTON EAST BELT SUB	1196-0	NO 2	0	1.7	1.70	0	21	21.00	35,700,000	46,589	19	0.549	1.406	11.970	0.349
Harris	HOUSTON EAST BELT SUB	1197-0	NO 1	1.7	4.5	2.80	30	0	30.00	84,000,000	109,620	19	1.292	3.308	28.166	0.821
Harris	HOUSTON EAST BELT SUB	1197-0	NO 2	1.7	4.5	2.80	0	21	21.00	58,800,000	76,734	19	0.904	2.316	19.716	0.575
Harris	HOUSTON EAST BELT SUB	1660-0	NO 1	4.5	8	3.50	25	0	25.00	87,500,000	114,188	15.6	1.346	3.446	29.339	0.855
Harris	HOUSTON EAST BELT SUB	1660-0	NO 2	4.5	8	3.50	0	37	37.00	129,500,000	168,998	15.6	1.991	5.100	43.422	1.266
Harris	HOUSTON EAST BELT SUB	1660-0	SIMN	8	8.1	0.10	25	37	62.00	6,200,000	8,091	31.2	0.095	0.244	2.079	0.061
Harris	HOUSTON EAST BELT SUB	1660-0	NO 1	8.1	11.3	3.20	25	0	25.00	80,000,000	104,400	15.6	1.230	3.150	26.824	0.782
Harris	HOUSTON EAST BELT SUB	1660-0	NO 2	8.1	10.97	2.87	0	37	37.00	106,190,000	138,578	15.6	1.633	4.182	35.606	1.038
Harris	HOUSTON WEST BELT SUB	1190-0	NO 1	228.76	236.69	7.93	20	0	20.00	158,600,000	206,973	14.65	2.439	6.246	53.179	1.550
Harris	HOUSTON WEST BELT SUB	1190-0	NO 2	229.53	236.69	7.16	0	31	31.00	221,960,000	289,658	14.65	3.413	8.741	74.424	2.169

UPRR 2003 LINE HAUL DATA C Factor : 1.305 Gal/1000GTM 0.001305

Tonnage Records for the year 2003 - Selected Texas Counties

Emissions Factors from USEPA Office of Air and Radiation, Office of Mobile Sources
Technical Highlights - Emission Factors for Locomotives EPA420-F-97-051 Dec. 1997 (Table 3)
Emission factors (g/gal) HC=10.7 CO=27.4 NOx=233.3 PM=6.8

County	Subdivision	Segment	Track Type	County Beg MP	County End MP	Miles of Track	Tonnage Incr MP	Tonnage Decr MP	Annual Avg MGT/Mile	Total Gross Tons	Total Fuel (gallons)	Train Counts	Tons HC Emissions	Tons CO Emissions	Tons NOx Emissions	Tons PM Emissions
Harris	HOUSTON WEST BELT SUB	1191-0	NO 1	236.69	238.02	1.33	8	0	8.00	10,640,000	13,885	14.65	0.164	0.419	3.568	0.104
Harris	HOUSTON WEST BELT SUB	1191-0	NO 2	236.69	238.02	1.33	0	11	11.00	14,630,000	19,092	14.65	0.225	0.576	4.906	0.143
Harris	LAFAYETTE SUB	1932-0	SIMN	334.67	352.89	18.22	26	7	33.00	601,260,000	784,644	19.3	9.246	23.678	201.605	5.876
Harris	LAFAYETTE SUB	1934-0	NO 1	352.89	353	0.11	26	0	26.00	2,860,000	3,732	9.65	0.044	0.113	0.959	0.028
Harris	LAFAYETTE SUB	1934-0	NO 2	352.89	353	0.11	0	7	7.00	770,000	1,005	9.65	0.012	0.030	0.258	0.008
Harris	LUFKIN SUB	1950-0	SIMN	1.92	20.33	18.41	8	20	28.00	515,480,000	672,701	7	7.927	20.300	172.843	5.038
Harris	NAVASOTA SUB	1775-0	SIMN	0	13.05	13.05	13	21	34.00	443,700,000	579,029	11.9	6.823	17.473	148.775	4.336
Harris	PALESTINE SUB	1170-0	SIMN	208.06	210.69	2.63	0.29	24	24.29	63,882,700	83,367	9.6	0.982	2.516	21.420	0.624
Harris	PALESTINE SUB	1170-0	NO 1	210.69	210.84	0.15	0.29	0	0.29	43,500	57	4.8	0.001	0.002	0.015	0.000
Harris	PALESTINE SUB	1170-0	NO 2	210.69	210.84	0.15	0	24	24.00	3,600,000	4,698	4.8	0.055	0.142	1.207	0.035
Harris	PALESTINE SUB	1180-0	NO 1	210.84	216.01	5.17	25	0	25.00	129,250,000	168,671	9.6	1.988	5.090	43.338	1.263
Harris	PALESTINE SUB	1180-0	NO 2	210.84	216.01	5.17	0	33	33.00	170,610,000	222,646	9.6	2.624	6.719	57.206	1.667
Harris	PALESTINE SUB	1185-0	NO 1	216.01	226.76	10.75	25	0	25.00	268,750,000	350,719	9.6	4.133	10.583	90.113	2.627
Harris	PALESTINE SUB	1185-0	NO 2	216.01	226.76	10.75	0	33	33.00	354,750,000	462,949	9.6	5.455	13.970	118.949	3.467
Harris	PALESTINE SUB	1195-0	NO 1	226.76	228.76	2.00	25	0	25.00	50,000,000	65,250	9.6	0.769	1.969	16.765	0.489
Harris	PALESTINE SUB	1195-0	NO 2	226.76	228.76	2.00	0	30	30.00	60,000,000	78,300	9.6	0.923	2.363	20.118	0.586
Harris	PALESTINE SUB	1190-0	NO 1	228.76	228.9	0.14	20	0	20.00	2,800,000	3,654	14.65	0.043	0.110	0.939	0.027
Harris	POPP SUB	1215-0	SIMN	0	5.87	5.87	3	1	4.00	23,480,000	30,641	1	0.361	0.925	7.873	0.229
Harris	STRANG SUB	1355-0	NO 1	0	1.84	1.84	11	0	11.00	20,240,000	26,413	5.2	0.311	0.797	6.787	0.198
Harris	STRANG SUB	1355-0	NO 2	0	1.84	1.84	0	5	5.00	9,200,000	12,006	5.2	0.141	0.362	3.085	0.090
Harris	STRANG SUB	1357-0	NO 1	1.84	2.96	1.12	11	0	11.00	12,320,000	16,078	5.2	0.189	0.485	4.131	0.120
Harris	STRANG SUB	1357-0	NO 2	1.84	2.95	1.12	0	5	5.00	5,600,000	7,308	5.2	0.086	0.221	1.878	0.055
Harris	STRANG SUB	1358-0	SIMN	2.96	6.28	3.32	11	5	16.00	53,120,000	69,322	10.4	0.817	2.092	17.811	0.519
Harris	STRANG SUB	1359-0	SIMN	6.28	9.79	3.51	6	8	14.00	49,140,000	64,128	10.7	0.756	1.935	16.477	0.480
Harris	STRANG SUB	1366-0	SIMN	9.79	13.82	4.03	6	0	6.00	24,180,000	31,555	10.7	0.372	0.952	8.108	0.236
Harris	STRANG SUB	1366-0	NO 1	13.82	14.02	0.20	6	8	14.00	2,800,000	3,654	10.7	0.043	0.110	0.939	0.027
Harris	STRANG SUB	1366-0	NO 2	13.82	14.02	0.20	0	8	8.00	1,600,000	2,088	5.35	0.025	0.063	0.536	0.016
Harris	STRANG SUB	1364-0	NO 1	14.02	21.36	7.34	6	8	14.00	102,760,000	134,102	10.7	1.580	4.047	34.456	1.004
Harris	TERMINAL SUB	1934-0	NO 1	353	356.91	3.91	26	0	26.00	101,660,000	132,666	9.65	1.563	4.003	34.087	0.994
Harris	TERMINAL SUB	1934-0	NO 2	353	356.91	3.91	0	7	7.00	27,370,000	35,718	9.65	0.421	1.078	9.177	0.267
Harris	TERMINAL SUB	1935-0	NO 1	356.91	360.41	3.50	38	0	38.00	133,000,000	173,565	11.15	2.045	5.238	44.596	1.300
Harris	TERMINAL SUB	1935-0	NO 2	356.91	360.41	3.50	0	24	24.00	84,000,000	109,620	11.15	1.292	3.308	28.166	0.821
Harris	TERMINAL SUB	1936-0	NO 1	360.41	363.4	2.99	8	6	14.00	41,860,000	54,627	8	0.644	1.648	14.036	0.409
Harris	TERMINAL SUB	1319-0	NO 2	360.41	363.4	2.99	10	8	18.00	53,820,000	70,235	8	0.828	2.119	18.046	0.526
Harris	TERMINAL SUB	1321-0	NO 1	363.4	366.27	2.87	18	0	18.00	51,660,000	67,416	8	0.794	2.034	17.322	0.505
Harris	TERMINAL SUB	1321-0	NO 2	363.4	366.27	2.87	0	14	14.00	40,180,000	52,435	8	0.618	1.582	13.473	0.393
Harris	TERMINAL SUB	1320-0	NO 1	366.27	370.44	4.17	13	0	13.00	54,210,000	70,744	11	0.834	2.135	18.177	0.530
Harris	TERMINAL SUB	1320-0	NO 2	366.27	370.44	4.17	0	10	10.00	41,700,000	54,419	11	0.641	1.642	13.982	0.408
Harris	TERMINAL SUB	1322-0	NO 1	370.44	375.69	5.25	13	0	13.00	68,250,000	89,066	11	1.050	2.688	22.885	0.667
Harris	TERMINAL SUB	1322-0	NO 2	370.44	375.69	5.25	0	10	10.00	52,500,000	68,513	11	0.807	2.067	17.603	0.513
Liberty	BAYTOWN SUB	1933-0	SIMN	37.22	44.85	7.63	9	2	11.00	83,930,000	109,529	2	1.291	3.305	28.142	0.820
Liberty	BAYTOWN SUB	1933-0	NO 1	44.85	48.2	3.35	0	2	2.00	6,700,000	8,744	1	0.103	0.264	2.247	0.065
Liberty	BAYTOWN SUB	1933-0	NO 2	44.85	48.2	3.35	9	0	9.00	30,150,000	39,346	1	0.464	1.187	10.109	0.295
Liberty	BAYTOWN SUB	1933-0	SIMN	48.2	48.67	0.47	9	2	11.00	5,170,000	6,747	2	0.080	0.204	1.734	0.051
Liberty	BEAUMONT SUB	1665-0	SIMN	401.27	429.39	28.12	27	3	30.00	843,600,000	1,100,898	13.9	12.973	33.221	282.863	8.245
Liberty	LAFAYETTE SUB	1930-0	SIMN	299.37	327.75	28.38	22	4	26.00	737,880,000	962,933	15	11.347	29.058	247.414	7.211
Liberty	LAFAYETTE SUB	1932-0	SIMN	327.75	334.67	6.92	26	7	33.00	228,360,000	298,010	19.3	3.512	8.993	76.570	2.232
Liberty	LUFKIN SUB	1950-0	SIMN	37.28	43.55	6.27	8	20	28.00	175,560,000	229,106	7	2.700	6.914	58.866	1.716
Liberty	LUFKIN SUB	1954-0	SIMN	43.55	47.61	4.06	1	16	17.00	69,020,000	90,071	8	1.061	2.718	23.143	0.675

UPRR 2003 LINE HAUL DATA C Factor = 1.305 Gal/1000GTM 0.001305

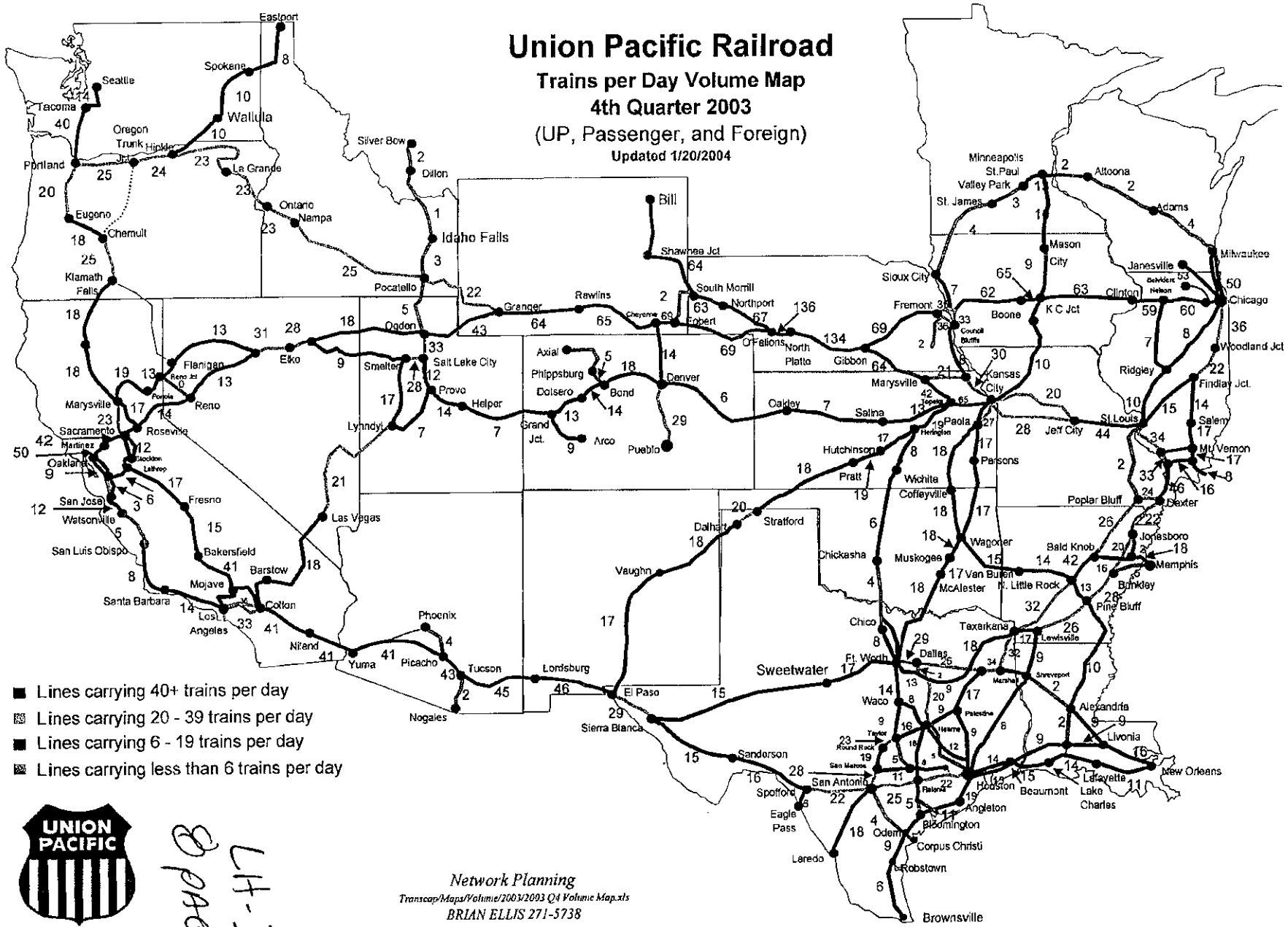
Tonnage Records for the year 2003 - Selected Texas Counties

Emissions Factors from USEPA Office of Air and Radiation, Office of Mobile Sources
Technical Highlights - Emission Factors for Locomotives EPA420-F-97-051 Dec. 1997 (Table 3)
Emission factors (g/gal) HC=10.7 CO=27.4 NOx=233.3 PM=6.8

County	Subdivision	Segment	Track Type	County Beg MP	County End MP	Miles of Track	Tonnage Incr MP	Tonnage Decr MP	Annual Avg MGT/Mile	Total Gross Tons	Total Fuel (gallons)	Train Counts	Tons HC Emissions	Tons CO Emissions	Tons NOx Emissions	Tons PM Emissions
Montgomery	LUFKIN SUB	1950-0	SIMN	20.33	37.28	16.95	8	20	28.00	474,600,000	619,353	7	7.299	18.690	159.136	4.638
Montgomery	NAVASOTA SUB	1775-0	SIMN	13.05	25.52	12.47	13	21	34.00	423,980,000	553,294	11.9	6.520	16.696	142.162	4.144
Montgomery	PALESTINE SUB	1170-0	SIMN	180.35	208.06	27.71	0.29	24	24.29	673,075,900	878,364	9.6	10.351	26.506	225.685	6.578
Waller	EUREKA SUB	1370-0	SIMN	34.98	54.3	19.32	3	4	7.00	135,240,000	176,488	5.5	2.080	5.326	45.347	1.322
Waller	NAVASOTA SUB	1775-0	SIMN	25.52	27.3	1.78	13	21	34.00	60,520,000	78,979	11.9	0.931	2.383	20.293	0.591
								LINE HAUL TOTALS		14,337,675,700	**18,710,667**	---	220.489	564.617	4,807.487	140.124
								SWITCH TOTALS	**# of Switchers** 30	**2,356,271**	---	27.767	71.103	605.416	17.646
								COMBINED TOTALS		**21,066,938**	---	248.256	635.720	5,412.904	157.770

ASSUMPTIONS

1) *GT/M figures represent a daily average gross tons of through and local freight (including locomotives) that traveled the segment multiplied by 365 days/year.*
2) *"C Factor" is the system-wide (UPRR operates in 23 states) average fuel consumption rate for the calendar year identified above.*


Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(UP, Passenger, and Foreign)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
Network Planning
Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls
BRIAN ELLIS 271-5738
Eastport
Seattle
Spokane
Tacoma
Wallula
Oregon Trunk Jct
Hinkle
Portland
La Grande
Ontario
Nampa
Silver Bow
Dillon
Idaho Falls
Eugene
Chemult
Klamath Falls
Pocatello
Bill
Shawnee Jct
South Morrill
Northport
Minneapolis
St.Paul
Valley Park
St. James
Attoona
Adams
Milwaukee
Mason City
Janesville
Sioux City
Fremont
Boone
K C Jct
Clinton
Chicago
Woodland Jct
Ridgley
Findlay Jct.
Salem
Granger
Rawlins
Ogden
Flanigan
Elko
Smelter
Salt Lake City
Axial
Phippsburg
Dolsero
Bond
Denver
Prove
Helper
Grand Jct.
Arco
Pueblo
Oakley
Salina
North Platte
Gibbon
Marysville
Kansas City
Paola
St Louis
Jeff City
Mt Vernon
Marysville
Reno
Roseville
Sacramento
Martinez
Oakland
Stockton
Lathrop
Lyndyl
Hutchinson
Pratt
Wichite
Coffeyville
Parsons
Poplar Bluff
Dexter
Jonesboro
Bald Knob
Memphis
Blytheville
Pine Bluff
San Jose
Watsonville
Fresno
Las Vegas
Dalhart
Stratford
Vaughn
Chickasha
Muskogee
Wagoner
Van Buren
McAlester
N. Little Rock
San Luis Obispo
Bakersfield
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Mojave
Santa Barbara
Los Angeles
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Chico
Texarkana
Lewisville
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Sweetwater
Waco
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Lordsburg
El Paso
Sierra Blanca
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Sanderson
Spofford
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Robstown
Brownsville
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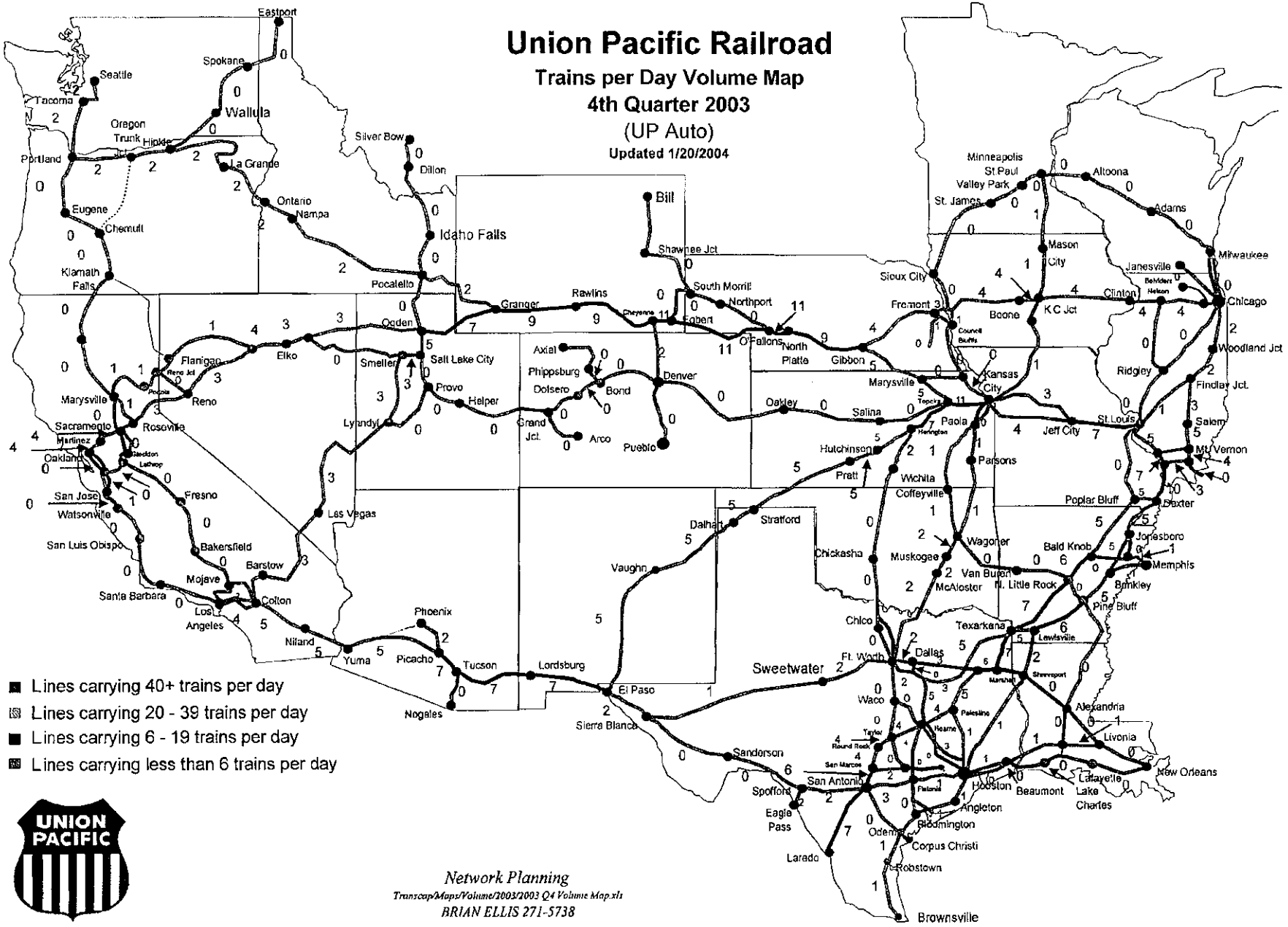
Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(UP Auto)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
UNION PACIFIC
Network Planning
Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls
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Ridgley
Findlay Jct.
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Van Buren
McAlester
Muskogee
Wagoner
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Texarkana
Lawtsville
Dallas
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Waco
Palestine
Hearne
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Parsons
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Oakley
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Jeff City
St Louis
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Marysville
Denver
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Grand Jct.
Pueblo
Helper
Provo
Salt Lake City
Smelter
Lyndyl
Elko
Flanigan
Reno Jct
Pocatello
Reno
Marysville
Sacramento
Martinez
Oakland
Stockton
Lathrop
Roseville
San Jose
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Fresno
San Luis Obispo
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Mojave
Santa Barbara
Los Angeles
Colton
Las Vegas
Phoenix
Niland
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Picacho
Tucson
Nogales
Lordsburg
Sierra Blanca
El Paso
Vaughn
Dalhart
Stratford

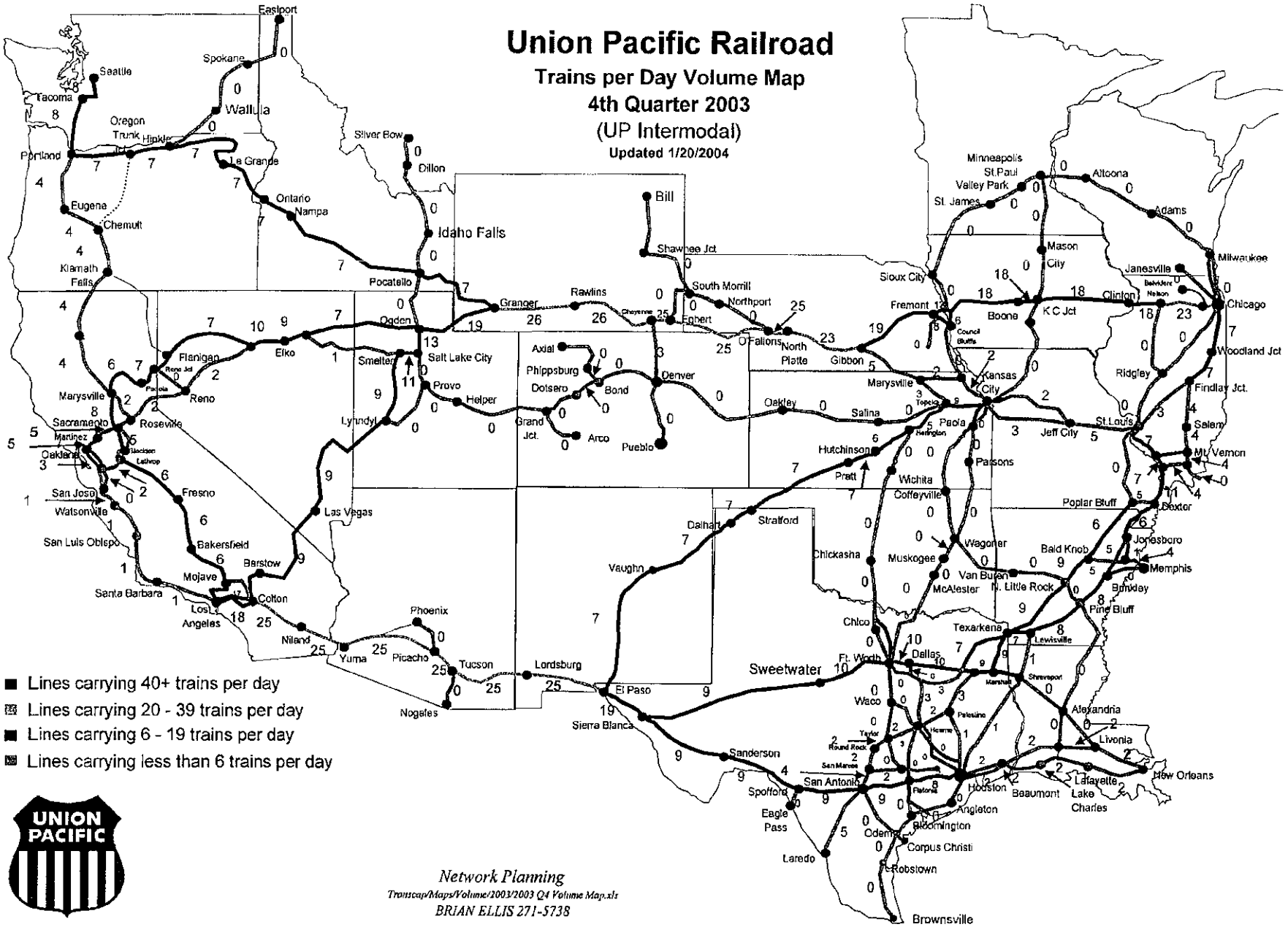
Union Pacific Railroad

Trains per Day Volume Map

4th Quarter 2003

(UP Intermodal)

Updated 1/20/2004



- Lines carrying 40+ trains per day
- Lines carrying 20 - 39 trains per day
- Lines carrying 6 - 19 trains per day
- Lines carrying less than 6 trains per day

Network Planning

Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls

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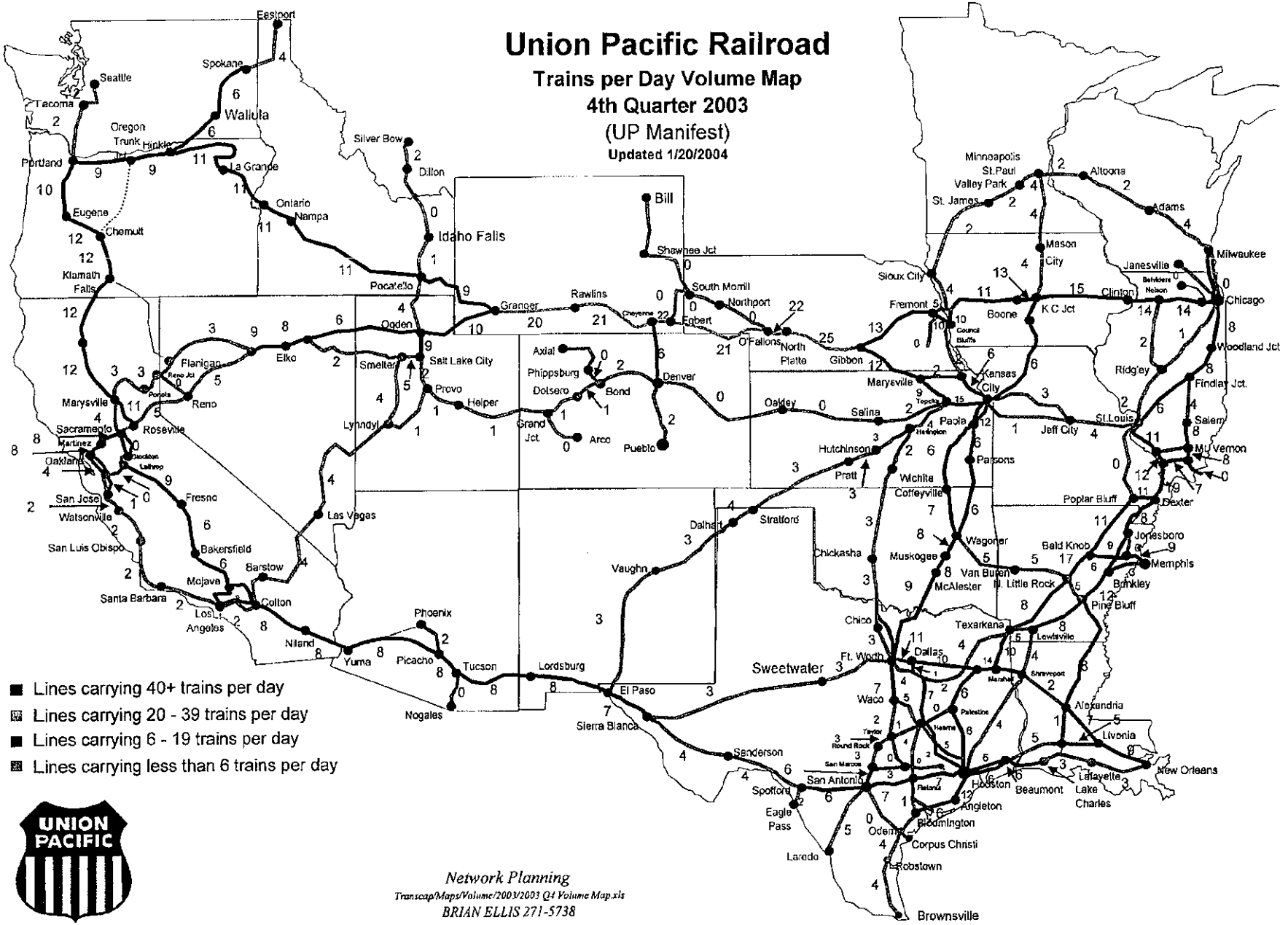
Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(UP Manifest)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
UNION PACIFIC
Network Planning
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Council Bluffs
Boone
Minneapolis
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Belvidere
Nelson
Milwaukee
Chicago
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Adams
Clinton
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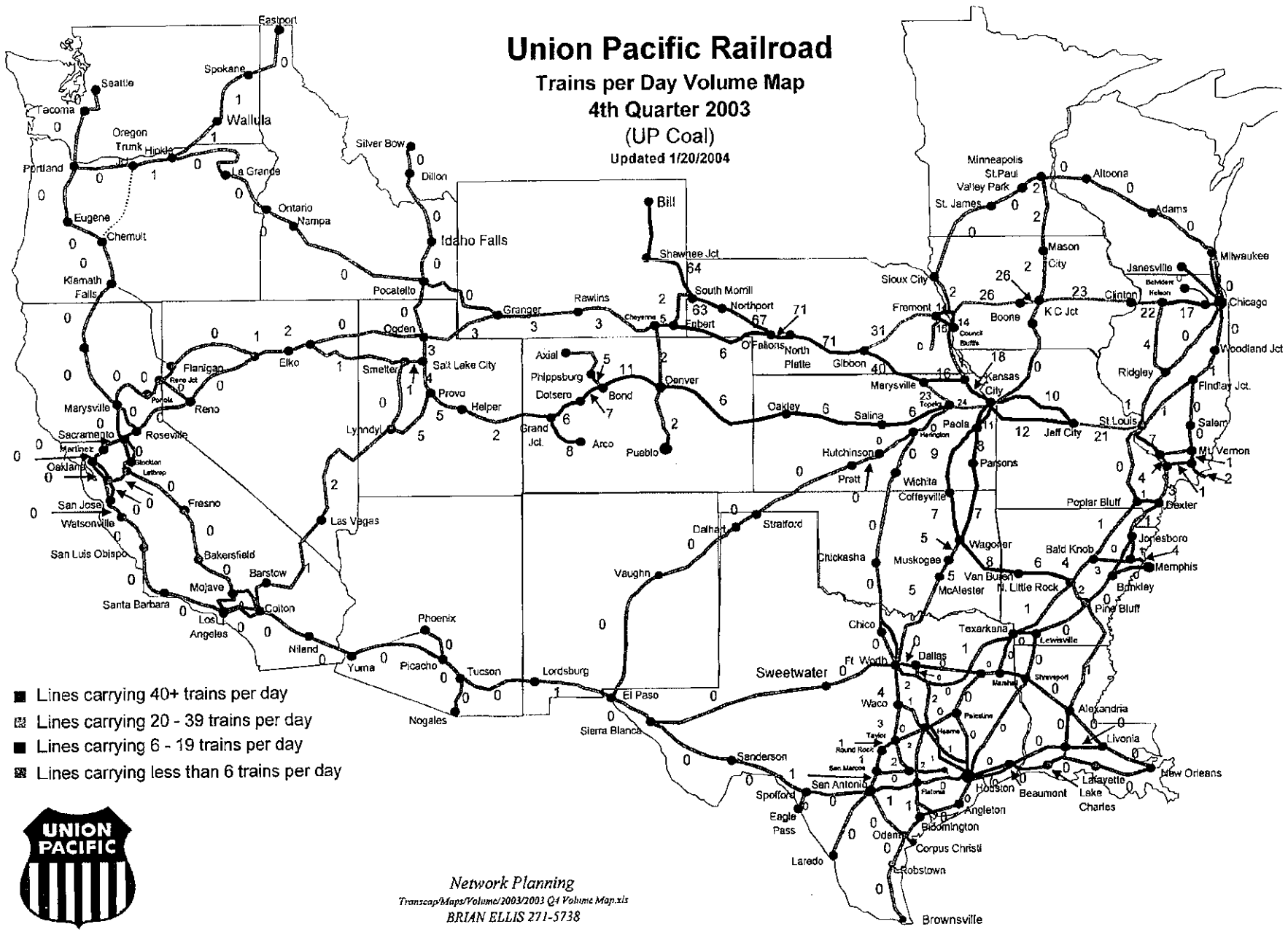
Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(UP Coal)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
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Mt Vernon
Axial
Phippsburg
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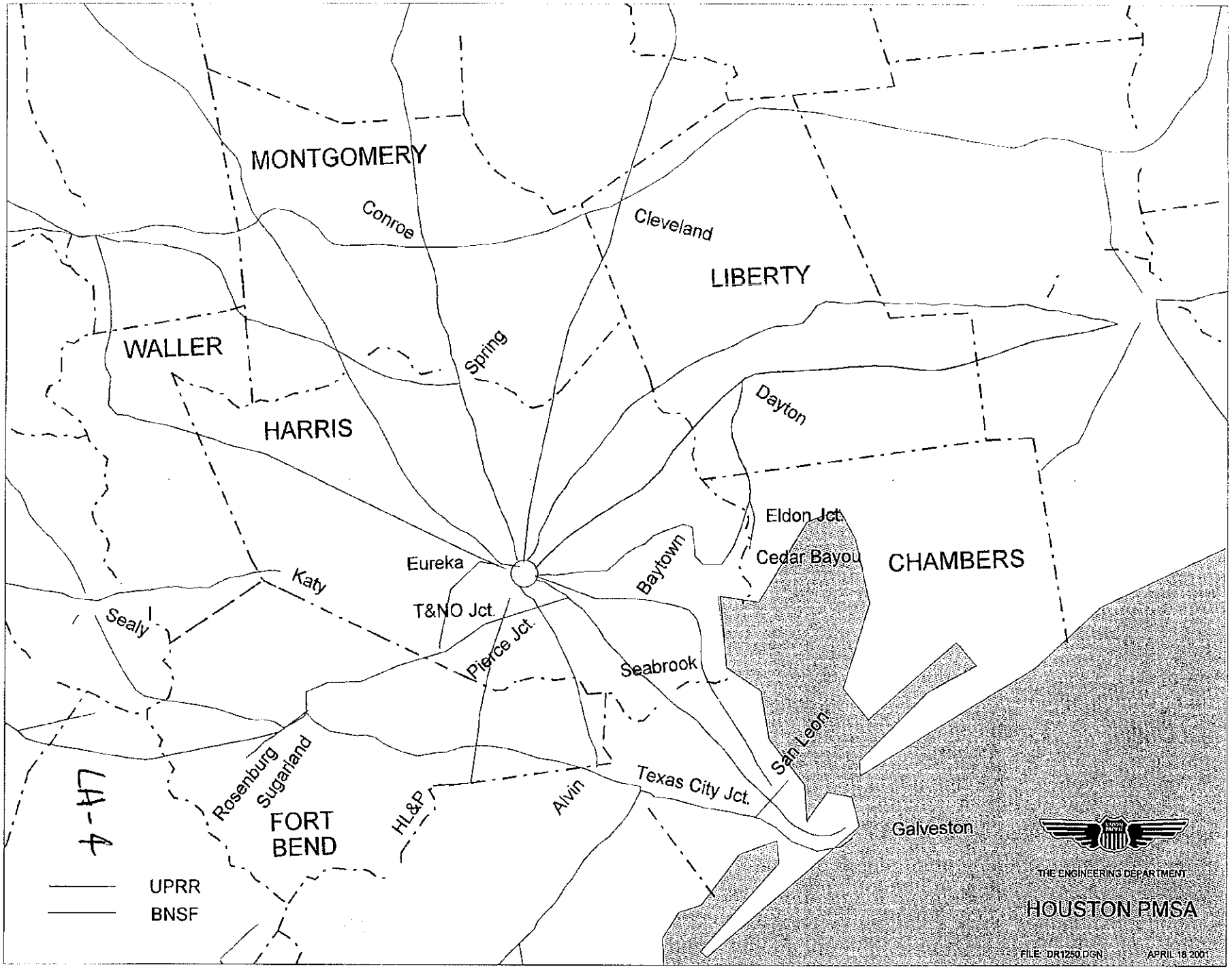
Minneapolis
St.Paul
Valley Park
St. James
Altoona
Adams
Milwaukee
Janesville
Belvidere
Nelson
Chicago
Clinton
Mason City
Sioux City
Fremont
Boone
K C Jct
Council Bluffs
North Platte
Gibbon
O'Fallons
Cheyenne
Marysville
Kansas City
Topeka
Ridgley
Findlay Jct.
Woodland Jct


Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(UP Bulk excl. Coal)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
UNION PACIFIC
Network Planning
Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls
BRIAN ELLIS 271-5738
Eastport
Seattle
Tacoma
Spokane
Wallula
Oregon Trunk
Portland
Eugene
Chemult
Klamath Falls
La Grande
Ontario
Nampa
Silver Bow
Dillon
Idaho Falls
Pocatello
Bill
Shawnee Jct
South Morrill
Northport
Ogden
Grenger
Rawlins
Cheyenne
Ft Morgan
Fallons
North Platte
Gibbon
Flanigan
Reno Jct
Reno
Eiko
Smolter
Salt Lake City
Provo
Helper
Axial
Phippsburg
Dolsero
Bond
Denver
Grand Jct.
Arco
Pueblo
Oakley
Salina
Marysville
Sacramento
Martinez
Roseville
Oakland
Stockton
Lathrop
San Jose
Watsonville
Fresno
Las Vegas
Lyndyl
San Luis Obispo
Bakersfield
Barstow
Mojave
Santa Barbara
Los Angeles
Colton
Niland
Yuma
Phoenix
Picacho
Tucson
Nogales
Lordsburg
El Paso
Sierra Blanca
Sweetwater
Vaughn
Dalhart
Stratford
Hutchinson
Pratt
Wichita
Coffeyville
Parsons
Paola
Hedrington
Topeka
Kansas City
Marysville
Fremont
Sioux City
Council Bluffs
Boone
K C Jct
Minneapolis
St.Paul
Valley Park
St. James
Mason City
Altoona
Adams
Janesville
Beloit
Nelson
Milwaukee
Chicago
Clinton
Woodland Jct
Ridgley
Findlay Jct.
Salem
Mt Vernon
St Louis
Jeff City
Poplar Bluff
Dexter
Jonesboro
Bald Knob
Memphis
Bunkley
Pine Bluff
N. Little Rock
Van Buren
McAlester
Muskogee
Wagoner
Chickasha
Texarkana
Lewisville
Dallas
Ft. Worth
Shreveport
Marshall
Waco
Palestine
Hearne
Taylor
Round Rock
San Marcos
San Antonio
Spofford
Eagle Pass
Laredo
Odem
Corpus Christi
Robstown
Brownsville
Houston
Beaumont
Angleton
Bloomington
Lafayette
Lake Charles
New Orleans
Alexandria
Livonia


Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(Passenger)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
Network Planning
Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls
BRIAN ELLIS 271-5738
Eastport
Seattle
Tacoma
Spokane
Wallula
Oregon Trunk
Hinkle
Portland
La Grande
Ontario
Nampa
Eugene
Chemult
Klamath Falls
Silver Bow
Dillon
Idaho Falls
Pocatello
Bill
Shawnee Jct
South Morrill
Northport
Granger
Rawlins
Cheyenne
Ogden
Elko
Flanigan
Reno Jct
Reno
Marysville
Sacramento
Martinez
Oakland
Stockton
Lathrop
Rosevile
San Jose
Watsonville
Fresno
San Luis Obispo
Bakersfield
Barstow
Mojave
Santa Barbara
Los Angeles
Colton
Las Vegas
Smelter
Salt Lake City
Provo
Helper
Lynndyl
Axial
Phippsburg
Dotsero
Bond
Denver
Brand Jct.
Arco
Pueblo
Fairbanks
North Platte
Gibbon
Oakley
Salina
Hutchinson
Pratt
Dalhart
Stratford
Vaughn
Phoenix
Yuma
Niland
Picacho
Tucson
Nogales
Lordsburg
El Paso
Sierra Blanca
Sanderson
Spofford
Eagle Pass
Laredo
Sweetwater
Chickasha
Wichita
Coffeyville
Parsons
Paola
Harrington
Topeka
Kansas City
Marysville
Fremont
Sioux City
Minneapolis
St.Paul
Valley Park
St. James
Mason City
Boone
K C Jct
Council Bluffs
Clinton
Janesville
Belvidere
Nelson
Chicago
Milwaukee
Altoona
Adams
Ridgley
Woodland Jct
Findlay Jct.
Salem
Mt. Vernon
Dexter
Poplar Bluff
Jonesboro
Memphis
Bald Knob
Brinkley
Pine Bluff
N. Little Rock
Van Buren
McAlester
Muskogee
Wagoner
Jeff City
St Louis
Texarkana
Lewisville
Dallas
Ft. Worth
Shreveport
Marshall
Waco
Palestine
Taylor
Round Rock
San Marcos
San Antonio
Houston
Beaumont
Lafayette
Lake Charles
New Orleans
Alexandria
Livonia
Angleton
Bloomington
Odem
Corpus Christi
Robstown
Brownsville


Union Pacific Railroad
Trains per Day Volume Map
4th Quarter 2003
(Foreign & Trackage Rights only)
Updated 1/20/2004
Lines carrying 40+ trains per day
Lines carrying 20 - 39 trains per day
Lines carrying 6 - 19 trains per day
Lines carrying less than 6 trains per day
UNION PACIFIC
Network Planning
Transcap/Maps/Volume/2003/2003 Q4 Volume Map.xls
BRIAN ELLIS 271-5738
Eastport
Seattle
Spokane
Tacoma
Wallula
Oregon Trunk Jct
Hinkle
Portland
La Grande
Silver Bow
Dillon
Ontario
Nampa
Eugene
Chemult
Idaho Falls
Klamath Falls
Pocatello
Bill
Shawnee Jct
South Morrill
Northport
Granger
Rawlins
Ogden
Flanigan
Elko
Smelter
Salt Lake City
Axial
Phippsburg
Dotsero
Bond
Denver
Provo
Helper
Lyndyl
Grand Jct.
Arco
Pueblo
O'Fallons
North Platte
Gibbon
Oakley
Salina
Marysville
Reno
Roseville
Sacramento
Oakland
San Jose
Watsonville
Fresno
Las Vegas
San Luis Obispo
Bakersfield
Barstow
Mojave
Santa Barbara
Colton
Los Angeles
Niland
Yuma
Phoenix
Picacho
Tucson
Nogales
Lordsburg
El Paso
Sierra Blanca
Sanderson
Spofford
Eagle Pass
Laredo
Dalhart
Vaughn
Stratford
Sweetwater
Minneapolis
St.Paul
Valley Park
St. James
Sioux City
Fremont
Boone
K C Jct
Council Bluffs
Mason City
Janesville
Clinton
Chicago
Milwaukee
Altoona
Adams
Woodland Jct
Ridgley
Findlay Jct.
Kansas City
St Louis
Salem
Mt Vernon
Jeff City
Paola
Parsons
Hutchinson
Pratt
Wichita
Coffeyville
Poplar Bluff
Dexter
Jonesboro
Memphis
Bald Knob
Wagoner
Muskogee
Chickasha
Van Buren
McAlester
N. Little Rock
Pine Bluff
Binkley
Chico
Texarkana
Lewisville
Dallas
Ft. Worth
Shreveport
Waco
Alexandria
Livonia
New Orleans
Lafayette
Lake Charles
Houston
Beaumont
Angleton
San Antonio
Bloomington
Corpus Christi
Robstown
Brownsville


MONTGOMERY
Conroe
Cleveland
LIBERTY
WALLER
Spring
HARRIS
Dayton
Eldon Jct.
Cedar Bayou
CHAMBERS
Eureka
Katy
Baytown
T&NO Jct.
Sealy
Pierce Jct.
Seabrook
San Leon
Rosenburg
Sugarland
HL&P
Alvin
Texas City Jct.
FORT BEND
Galveston
LA-4
UPRR
BNSF
THE ENGINEERING DEPARTMENT
HOUSTON PMSA
FILE: DR1250.DGN
APRIL 18 2001

HGA YARD JOBS

** Annual Fuel Usage based on EPA factor of 226 gal/day (see Note 3 below)*

	State	Job	County	City	No. of Locos	Days per Week	Days per Year	Hours per Day	Hours per Year	24 Hr Equivalent	Annual Fuel (gal)*
1	TX	YGA64	GALVESTON	GALVESTON	1	5	260	7.0	1820	0.21	12,208
2	TX	YGV55	GALVESTON	GALVESTON	1	5	260	8.0	2080	0.24	13,952
3	TX	YBS39	HARRIS	BASIN YARD	2	5	260	3.0	780	0.18	10,464
4	TX	YBS80	HARRIS	BASIN YARD	1	5	260	12.0	3120	0.36	20,928
5	TX	YBS88	HARRIS	CONGRESS YARD	1	5	260	11.5	2990	0.34	20,056
6	TX	YEW04	HARRIS	ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
7	TX	YEW11	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
8	TX	YEW12	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
9	TX	YEW13	HARRIS	ENGLEWOOD	1	5	260	7.5	1950	0.22	13,080
10	TX	YEW16	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
11	TX	YEW17	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
12	TX	YEW18	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
13	TX	YEW21	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
14	TX	YEW22	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
15	TX	YEW24	HARRIS	ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
16	TX	YEW25	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
17	TX	YEW26	HARRIS	ENGLEWOOD	2	7	365	8.5	3102.5	0.71	58,430
18	TX	YEW28	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
19	TX	YEW29	HARRIS	ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
20	TX	YEW31	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
21	TX	YEW32	HARRIS	ENGLEWOOD	2	7	365	12.0	4380	1.00	82,490
22	TX	YEW33	HARRIS	ENGLEWOOD	1	5	260	8.0	2080	0.24	13,952
23	TX	YEW35	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
24	TX	YEW36	HARRIS	ENGLEWOOD	2	7	365	8.5	3102.5	0.71	58,430
25	TX	YEW37	HARRIS	ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
26	TX	YEW38	HARRIS	ENGLEWOOD	2	7	365	9.0	3285	0.75	61,868
27	TX	YHS55	HARRIS	EUREKA YARD	1	5	260	8.0	2080	0.24	13,952
28	TX	YGP13	HARRIS	GALENA PARK	2	7	365	7.5	2737.5	0.63	51,556
29	TX	YGP54	HARRIS	GALENA PARK	2	5	260	8.0	2080	0.47	27,904
30	TX	YGP55	HARRIS	GALENA PARK	2	7	365	8.0	2920	0.67	54,993
31	TX	YGP63	HARRIS	GALENA PARK	2	5	260	8.0	2080	0.47	27,904
32	TX	YGP64	HARRIS	GALENA PARK	2	7	365	8.0	2920	0.67	54,993
33	TX	YHS52	HARRIS	HARDY	1	7	365	8.0	2920	0.33	27,497
34	TX	YHS53	HARRIS	HARDY	1	5	260	9.0	2340	0.27	15,696
35	TX	YHS53B	HARRIS	HARDY	1	2	104	9.0	936	0.11	2,511
36	TX	YHS71	HARRIS	HARDY	1	6	312	12.0	3744	0.43	30,137
37	TX	YHO10R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
38	TX	YHO11R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
39	TX	YHO12R	HARRIS	HOUSTON	1	7	365	9.5	3467.5	0.40	32,652
40	TX	YHO13R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
41	TX	YHO14R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
42	TX	YHO15R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
43	TX	YHO20R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
44	TX	YHO21R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
45	TX	YHO22R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
46	TX	YHO23R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
47	TX	YHO24R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
48	TX	YHO25R	HARRIS	HOUSTON	2	5	260	8.0	2080	0.47	27,904
49	TX	YHO27R	HARRIS	HOUSTON	1	7	365	8.0	2920	0.33	27,497

HGA YARD JOBS

** Annual Fuel Usage based on EPA factor of 226 gal/day (see Note 3 below)*

	State	Job	County	City	No. of Locos	Days per Week	Days per Year	Hours per Day	Hours per Year	24 Hr Equivalent	Annual Fuel (gal)*
50	TX	YHO30R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
51	TX	YHO31R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
52	TX	YHO32R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
53	TX	YHO33R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
54	TX	YHO34R	HARRIS	HOUSTON	2	7	365	8.0	2920	0.67	54,993
55	TX	YHO35R	HARRIS	HOUSTON	2	5	260	8.0	2080	0.47	27,904
				TOTALS						**29.91**	**2,356,271**

ASSUMPTIONS

1) Yard job data were taken from a current UPRR transportation plan.
2) A yard job equivalent is equal to one switch locomotive operating 24 hours per day.
3) USEPA estimates an average yard locomotive operating 24x7x365 consumes 82,490 gallons of fuel per year.
   Source: *Procedures for Emission Inventory Preparation - Vol IV: Mobile Sources*; Publication EPA420-R-92-009, December 1992, p. 207

Compiled Switcher Engine Data

Railway	Area	Switchers	Comment-Fuel Notes
UP	[Varies]	94	See next EXCEL page; shift hours used to est. fuel
BNSF	Casey	4	DEFAULT
BNSF	Dayton	4	DEFAULT
BNSF	Galveston	5	DEFAULT
BNSF	Houston	28	DEFAULT
BNSF	Pearland	8	DEFAULT
BNSF	Alvin	1	DEFAULT
Texas City Terminal	Texas City	3	40,000 gal/year/engine
Galveston Railroad	Galveston	6	14,000 gal/year/engine
KCS/Texas-Mexico	Galveston	2	DEFAULT
Rail Link	Houston Ship Channel	3	50,000 gal/year/engine (CHECK TOTAL NO#)
Trans Global	Houston Ship Channel	13	DEFAULT
Farmland AMD	[UNK]	6	DEFAULT (Asking Clyde where this is)
Port Terminal Rail Assoc.	Houston Ship Channel	25	Sam to get detailed fuel consumption/2003
CANAC	Pasedena	4	36,000 gallons/year/engine
		206	

Union Pacific Switch Engines

City	Switchers	Shift_Days	Days_Year	Hours_Day	Hours_Yea	Year_Frac	Gallons
GALVESTON	1	5	260	7.0	1820	0.21	12,208
GALVESTON	1	5	260	8.0	2080	0.24	13,952
BASIN YARD	2	5	260	3.0	780	0.18	10,464
BASIN YARD	1	5	260	12.0	3120	0.36	20,928
CONGRESS YARD	1	5	260	11.5	2990	0.34	20,056
ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	1	5	260	7.5	1950	0.22	13,080
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.5	3102.5	0.71	58,430
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	1	7	365	8.0	2920	0.33	27,497
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	12.0	4380	1.00	82,490
ENGLEWOOD	1	5	260	8.0	2080	0.24	13,952
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	8.5	3102.5	0.71	58,430
ENGLEWOOD	2	7	365	8.0	2920	0.67	54,993
ENGLEWOOD	2	7	365	9.0	3285	0.75	61,868
EUREKA YARD	1	5	260	8.0	2080	0.24	13,952
GALENA PARK	2	7	365	7.5	2737.5	0.63	51,556
GALENA PARK	2	5	260	8.0	2080	0.47	27,904
GALENA PARK	2	7	365	8.0	2920	0.67	54,993
GALENA PARK	2	5	260	8.0	2080	0.47	27,904
GALENA PARK	2	7	365	8.0	2920	0.67	54,993
HARDY	1	7	365	8.0	2920	0.33	27,497
HARDY	1	5	260	9.0	2340	0.27	15,696
HARDY	1	2	104	9.0	936	0.11	2,511
HARDY	1	6	312	12.0	3744	0.43	30,137
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	1	7	365	9.5	3467.5	0.40	32,652
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	5	260	8.0	2080	0.47	27,904
HOUSTON	1	7	365	8.0	2920	0.33	27,497
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	7	365	8.0	2920	0.67	54,993
HOUSTON	2	5	260	8.0	2080	0.47	27,904