Eastern Research Group, Inc.

Ozone Science and Air Modeling Research Project H43T163: Diesel Construction Equipment Activity and Emissions Estimates for the Dallas/Ft. Worth Region

Final Report

Prepared for:

The Houston Advanced Research Center

Prepared by:

Eastern Research Group, Inc.

August 31, 2005

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OZONE SCIENCE AND AIR MODELING RESEARCH

PROJECT H43T163: DIESEL CONSTRUCTION EQUIPMENT ACTIVITY AND EMISSIONS ESTIMATES FOR THE DALLAS/FT. WORTH REGION

FINAL REPORT

Prepared for:

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Executive Summary

Detailed data on diesel construction equipment (DCE) populations and activity were collected in order to estimate emissions levels of ozone precursors and other pollutants. The study area included the 9-county Dallas/Ft. Worth (DFW) ozone non-attainment area. Emissions were estimated for the 2004 base year, and were extrapolated for several analysis years including 1999, 2002, 2007, 2009, and 2012, corresponding to key State Implementation Plan and Conformity Analysis evaluation dates. The level of disaggregation is unique among DCE inventory efforts to date, and provides a substantial advance in the precision of previous emissions estimates for these sources.

A review of existing literature was performed and regional stakeholders were consulted to identify the types of projects that employ diesel construction equipment on a regular basis. The study employed several different data collection methods, including surveys of equipment operators, field observations at various project sites, and equipment activity profiles from professional construction cost estimators and other experts. Data collection efforts were tailored to the requirements of the different project categories to estimate equipment populations, types, horsepower (hp) requirements, age distributions, and hours of use. Activity surrogates were also identified and collected for each project category, to extrapolate the collected population and activity data to each county, for each analysis year.

Once the different sources of data were compiled and quality assured, composite activity profiles were developed for each project category. Surrogates were applied to each profile to provide estimates of total population and hours of use for each equipment type and hp range. These values were then input into EPA's NONROAD emission factor model to estimate total annual and ozone season weekday emissions for each county and analysis year.

Emission Estimates

The NONROAD model was run using the sector-specific inputs and external files to generate annual and ozone season daily emission estimates for various pollutants. County level outputs were generated for scenario years 1999, 2002, 2004, 2007, 2009, and 2012. Figure ES-1 groups the NOx emissions data to show temporal trends by sector/equipment type for key analysis years. Figure ES-2 shows trends for each pollutant in total over time, while Figure ES-3 shows the relative contribution to total NOx emissions at the county level in the base year. Finally Figure ES-4 provides side-by-side comparisons of the revised NOx ozone season daily emission estimates and NONROAD default values for the 9-county region for each analysis year.

Figure ES-1. DFW Area Diesel Construction Inventory by Sector for Key Analysis Years

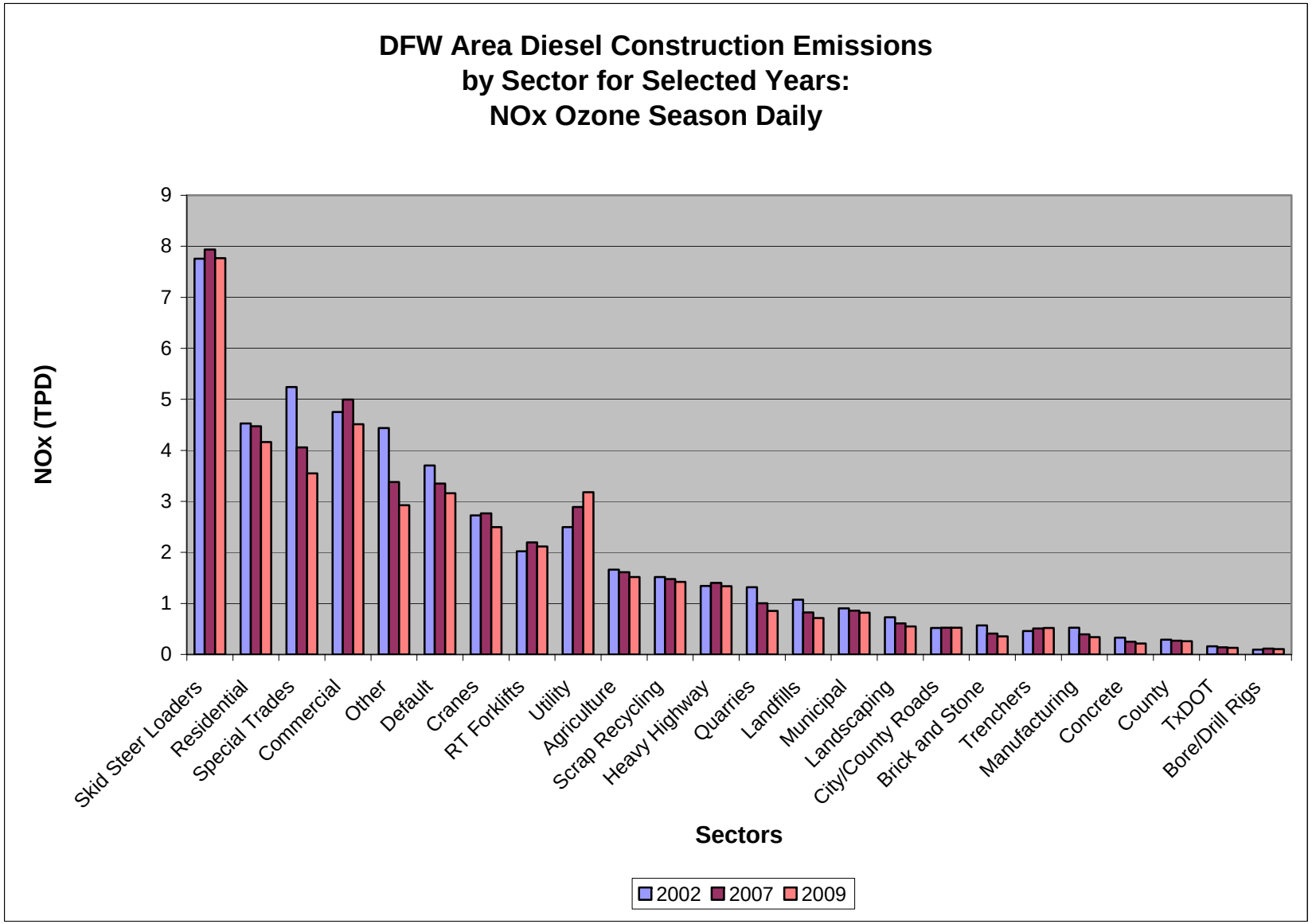


Figure ES-2. DFW Area DCE Pollutant Totals, All Years

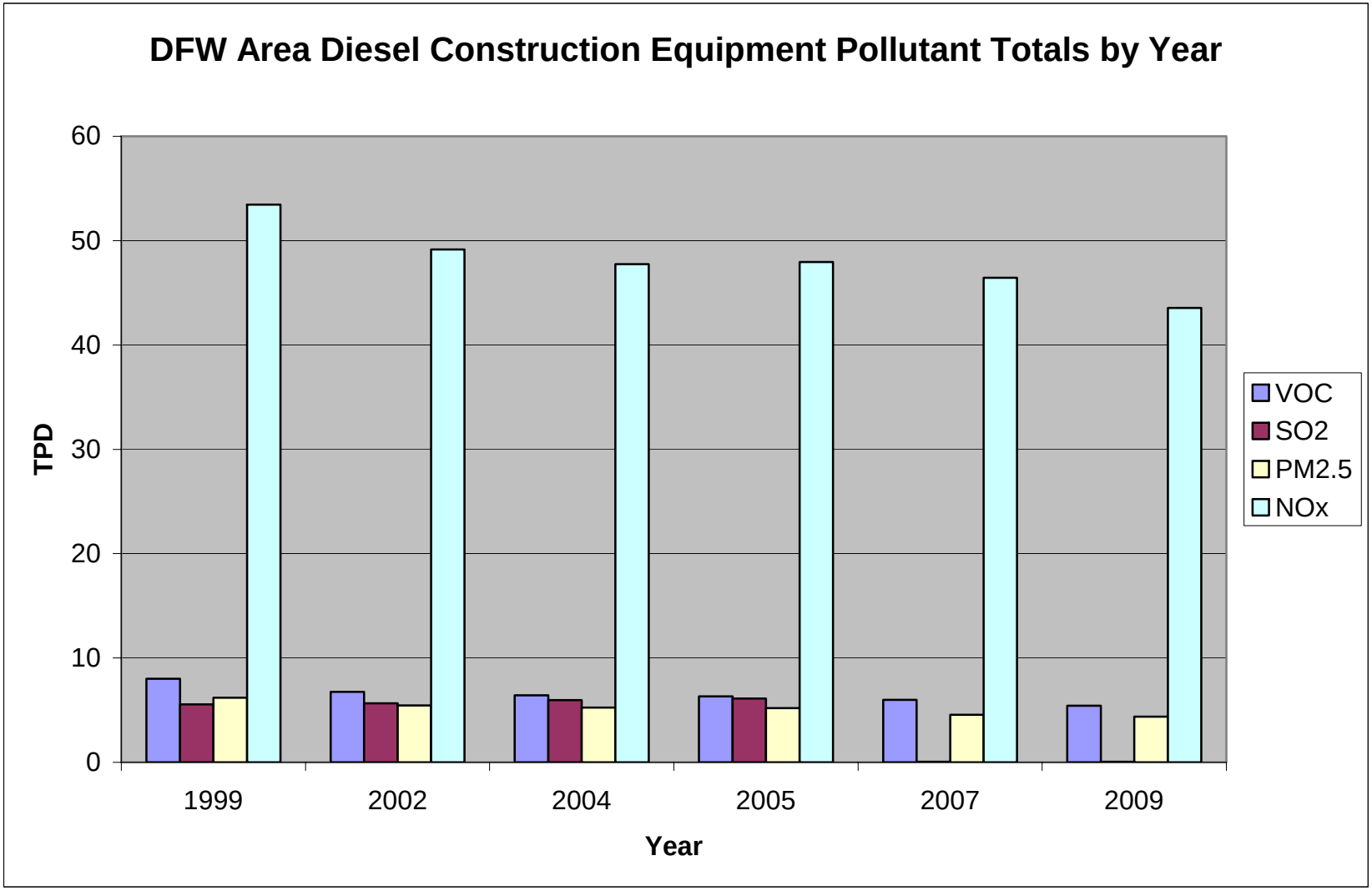


Figure ES-3. County Allocation of NOx Emissions (2004)

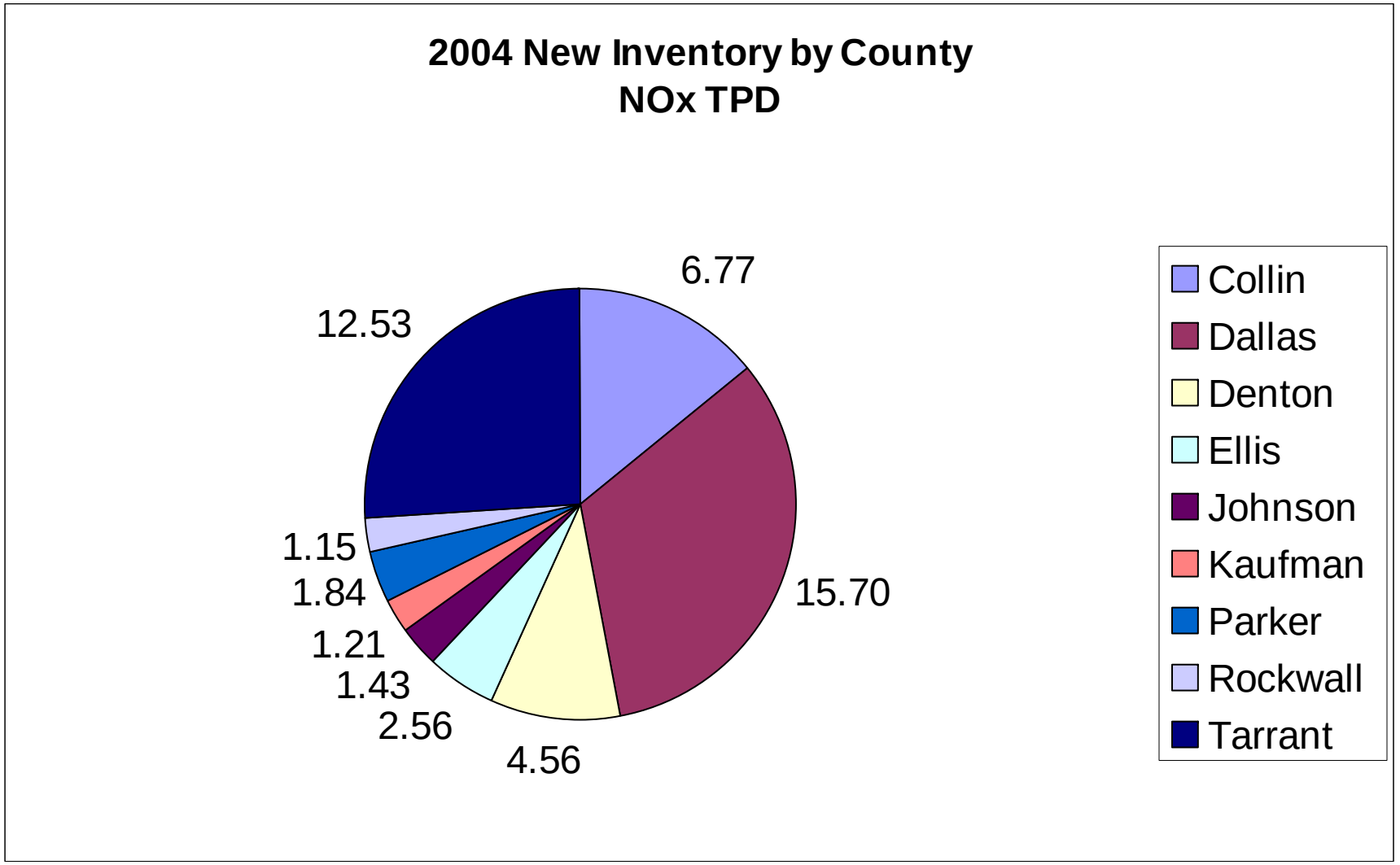
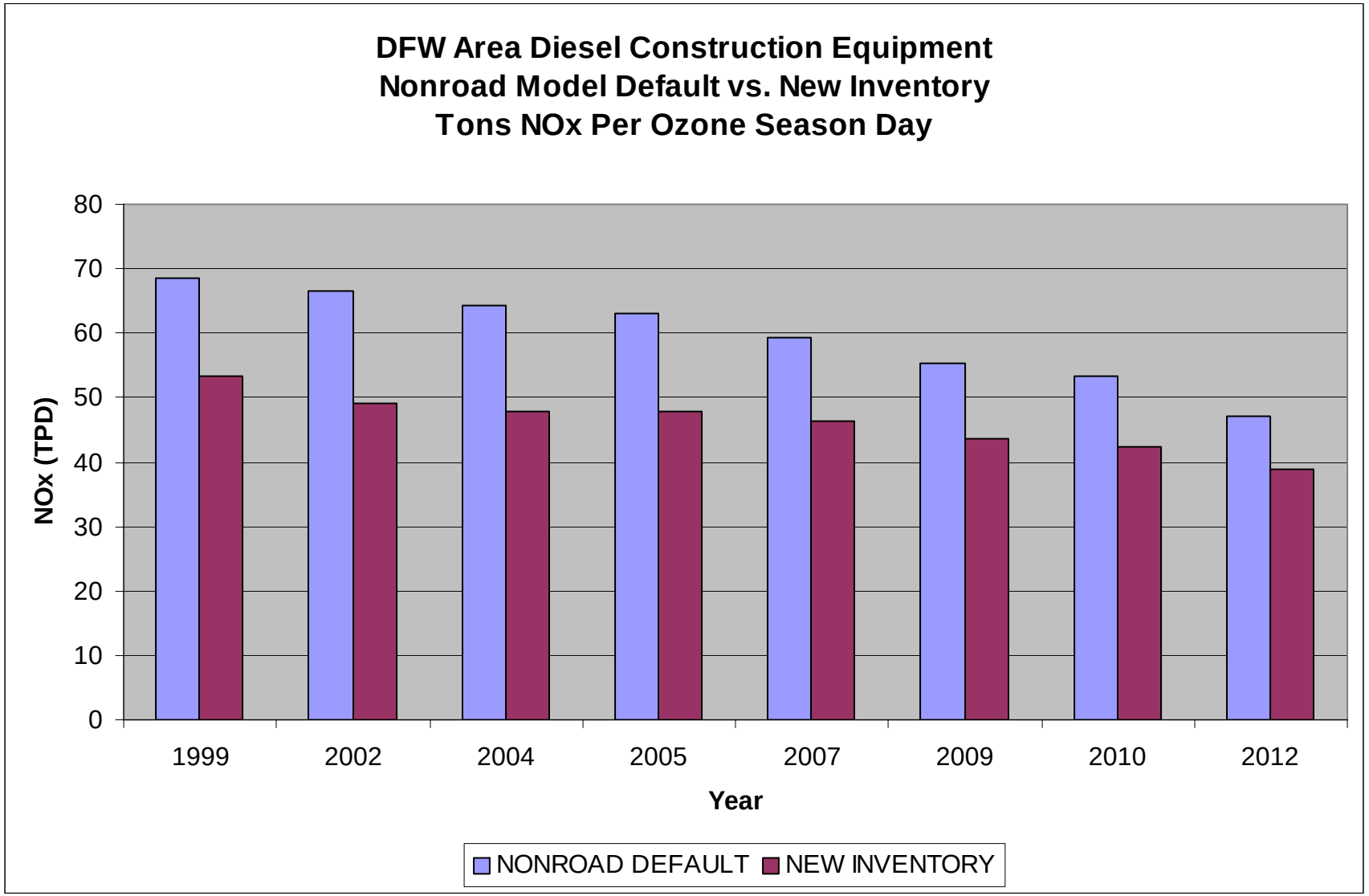


Figure ES-4. HARC DCE and NONROAD Default Ozone Season Day NOx Emissions (9-County Totals)



Inventory Adjustments - TERP

The Texas Emission Reduction Program (TERP) has been providing subsidies for NOx reduction strategies for both on and off-road diesel engines since 2002. The latest TERP funding project summary, available from the TCEQ website, is provided in Appendix L. Only TERP projects that were exclusively dedicated to nonroad DCE equipment are included in our calculations. **To date the TERP program claims 1.57 tons per day of cumulative NOx emission reduction for DCE in the 9-county area, involving 302 pieces of equipment, through at least 2007.** Given that many of the DCE projects on the list have an expected life of 5 years, reductions from these projects will begin to decline after this time, although additional reductions from some unknown amount of future TERP projects should make up at least a portion of this decline.

Accounting for TERP reductions claimed to date, the adjusted NOx ozone season daily DCE inventory for the area is 44.88 tons per day in 2007.

Conclusions

The current DCE evaluation for the 9-county DFW area found NOx emissions estimates consistently about 75-80% of the default NONROAD DCE values for the region. The following observations are apparent from the summary figures and tables above.

- Dallas and Tarrant counties are the highest emitters of NOx, responsible for 59% of all diesel construction equipment NOx emissions in the area.
- NOx, VOC, and PM remain relatively stable across all years with a slight downward trend. Given the increase in most growth indicators over this period the downward trend is attributable to the influence of new emission standard penetration.
- $S0_2$ is virtually eliminated by 2007 due to the introduction of the new federal diesel fuel requirements.
- In spite of their relatively lower horsepower, skid steer loaders[1] are collectively the highest emitters of NOx.
- Several other "specialty" equipment categories had NOx emissions comparable to the earthwork sectors, often due to the shear number derived from equipment sales data (e.g., cranes and rough terrain forklifts).

[1] Skid steer loaders are small loaders, often referred to as "Bobcats", that may be 'skid' mounted to transport to job site.

- The Special Trades construction sector is estimated to produce much more NOx than originally anticipated, due to a surprisingly large number of earthwork machines reported for this SIC group in the equipment sales data.
- The "Other" industry category containing transportation, sales, and services had higher emission estimates than many other earthwork sectors, apparently due to the shear number of establishments in this large SIC grouping.
- The "Default" category shown in the figures, which includes those equipment types without reasonable population and activity estimates in this study, contribute a relatively large amount of NOx to the inventory. Of these equipment types approximately 1/3 of the NOx (~1 ton per day) is attributable to off-highway tractors.
- While most sectors have a general downward trend, utility has an upward trend for key years, due to the use of the dollar value projections for this sector.
- Commercial emissions peak in 2007 (a key evaluation year for the area)
- The NONROAD model consistently predicts higher emissions for the 9-county area as a whole, across all years compared to the current study.
- The NONROAD model estimates lower emissions for the less populous counties of Ellis, Johnson, Kaufman, Parker, and Rockwall. The finer–scale resolution of this analysis allows us to allocate specific projects to these counties – something not possible using the standardized EPA model.

The results of this analysis significantly improve the precision of previous emission inventory efforts for the construction sector, and provide a more accurate baseline for future modeling assessments. In addition, the data collection and extrapolation methods were designed to be extrapolated to other areas of Texas, and to be easily replicable for future year updates.