ERG #3538.00

Minor Source NO_x Inventory of Boilers, Process Heaters, and Stationary Engines and Gas Turbines (including Duct Burners)

FINAL PROJECT REPORT

HARC Contract No. H-57-2005-T2-ERG

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EXECUTIVE SUMMARY

This project was undertaken on behalf of the Texas Environmental Research Consortium (TERC) to address the situation with the Dallas-Ft. Worth (DFW) metropolitan area not being in attainment with the National Ambient Air Quality Standards (NAAQS) for ozone. The Texas Commission on Environmental Quality (TCEQ) is actively investigating the causes of nonattainment in the DFW region in terms of identifying and quantifying nitrogen oxides (NO_x) and volatile organic compound (VOC) emissions sources. Since most of the larger emissions sources have already been identified and controlled, the focus has shifted to the identification of smaller emissions sources. These sources, while having lower unit emissions, are much more numerous, and when taken as a group, can represent significant emissions. The project was conducted under contract to the Houston Advanced Research Center (HARC), Contract No. H-57-2005-T2-ERG.

The TCEQ has already developed a rule to address one segment of these minor source emissions for NO_x in the Houston-Galveston ozone nonattainment area. This rule, which can be found under Chapter 117, Subchapter D, Division 2 of the Texas Administrative Code, addresses a specific segment of boiler, process heater, and stationary internal combustion engine and turbine sources known as minor combustion sources. As a part of its State Implementation Plan (SIP) process, the TCEQ is considering implementing a similar rule for the DFW nonattainment area, consisting of nine counties: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant. The DFW rule would also address minor NO_x boiler, process heater, and engine/turbine sources as defined within the existing Houston-Galveston rule.

The purpose of this project was to identify as many of the site-specific locations of minor boiler, process heater, and engine/turbine sources as possible in the DFW nonattainment area and prepare an emissions inventory of all criteria pollutants for these sources. The core focus of the inventory effort was the nine DFW counties; however, the inventory process was expanded to also include minor NO_x emissions sources within a 200 km radius from the DFW area. This expansion pulled in an additional 76 east Texas counties into the analysis. The planned procedure was to develop as much site-specific data as possible for the DFW area sources and develop emissions surrogates from these data that could be extrapolated to estimate emissions in the other 76 counties.

The emissions inventory was conducted by first performing an intensive survey of potential emissions sources in the DFW area. Because of the highly compressed schedule of the project, this survey was performed mainly using an extensive telephone calling campaign and other readily available data references such as online databases (e.g., Texas Department of Licensing and Regulation for Boilers database, Railroad Commission of Texas online databases). One of the purposes of these calls and inquiries was to determine if the potential sources met the definition of a minor NO_x source. Minor NO_x sources were defined to be sources with NO_x emissions less than 25 tons/year (actual) and/or less than 50 tons/year (potential/allowable). The calls were also used to determine if the sources met the lower cutoff size thresholds contained in the Houston-Galveston rule. Sources below a certain size are exempt from the rule (and similarly would be exempt from a prospective DFW area rule). If sources met all the conditions to be considered a minor NO_x source, more detailed questions were pursued to develop

comprehensive activity data for the source (e.g., fuel use data, maximum design capacity data, hours of operation, burn characteristics, equipment makes and models, mode of operation data, installation dates, etc.). These activity data were then combined with emission factors to yield emission inventory estimates.

The State of Texas Air Reporting System (STARS) was also an important data source as it provided actual 2002 emission estimates for major sources for the 85 counties of interest. None of the engines or process heaters reported in the STARS database met the minor NO_x source criteria (i.e., either emissions, sizes, or exemptions) for inclusion in this study. For boilers, 149 boilers were identified in the STARS database that could be matched to boilers in the TDLR listing. The matching of STARS boilers with TDLR boilers was performed manually, as the STARS database sometimes aggregated boilers to the facility level and it was not always possible to disaggregate the STARS estimates into individual boilers in TDLR. In many cases that was not necessary as the STARS facilities often met the definition for a major NO_x source, and the associated TDLR boilers were excluded from further consideration. A total of 57 individual TDLR boilers were identified at STARS facilities that were considered major for a pollutant other than NO_x meaning they could be counted as minor NO_x sources for the purposes of this study. The STARS data were then linked to the TDLR boilers providing actual emission estimates for 2002.

Several different types of inventories were developed for the prospective DFW rule analysis process. The first inventory developed was for a 2002 base year. The 2002 base year inventory was backcast using growth factors to also produce a 1999 base year, since 1999 vintage activity data were not readily identifiable from the activity data survey process. The 2002 inventory was also projected forward to 2009 using economic growth factors produced by the U.S EPA's Economic Growth Analysis System (EGAS) model, in conjunction with a Texas-specific version of REMI's Policy Insight Model. The 2009 projection year inventory was further refined by overlaying the impact of emission controls required as a function of the potential implementation of a DFW minor NO_x sources rule. In essence this represented a controlled 2009 projection, or potential emissions levels in 2009 under a DFW minor NO_x sources rule. These data could be used in air quality modeling to gain an understanding of the potential benefits of rule implementation. For all four inventory years, all pollutant emissions were presented in terms of actual and maximum annual emissions and actual and maximum ozone season daily emissions.

The final minor NO_x sources emissions inventory contained data on over 4,000 specific point sources. The majority of the source population consisted of boiler units, with a total 3,994 sources. There were only 10 process heater sources and about 30 engines. Many more than 30 engines were identified; however, they were not counted in the inventory since they were either in one of the exemption categories or had emissions beyond the minor source definition. For boilers and heaters, sources in both the nine-county DFW area and the surrounding 200 km counties were inventoried directly as point sources. No extrapolations as nonpoint area sources were necessary for these categories for the 200 km counties. For engines, the 30 units identified as point sources were all in the nine DFW area counties. Engine emission estimates for the 200 km counties were determined as nonpoint area sources using surrogate factors developed for the 30 DFW engines. Two categories of engines, well-head compressor and agricultural irrigation engines, were estimated completely as nonpoint area sources for both the DFW and 200 km areas

because the category numbers were so large and it was not feasible within the time constraints of this project to determine individual unit activity data.

Table ES-1 contains a summary of the inventory results for NO_x. From 2002 to 2009, actual annual NO_x emissions in the DFW area (from all source types), without any additional rules application, are projected to increase about 11.5% (517 tons/yr). With the potential application of a DFW minor NO_x sources rule factored into the analysis, emissions in 2009 are projected to decrease about 49% (2,209 tons/yr) from 2002 levels. Similar results occur with the boiler and engine/turbine source categories as well. Boiler emissions are projected to decrease in 2009 with rule implementation from 2002 levels by 41% (961 tons/yr). With no rule assumed, NO_x emissions show a 12% increase (274 tons/yr). Comparable numbers for engines are a 60% (1,251 tons/yr) NO_x decrease in 2009 with a rule and an 11% (227 tons/yr) increase without. The situation with process heaters is a little different due to the projected growth factors and the basis for 2002 emissions. Without a rule in 2009, NO_x emissions are projected to increase 134% (16.2 tons/yr); however, assuming a rule is in place, this increase would drop to only 25% (3 tons/yr).

Table ES-1. Summary of Minor Source NO_x Emissions (tons) for the Nine DFW Nonattainment Counties

Year	Basis[a]	Boilers	Process Heaters	Engines[b]	Total
1999 Base Year	Actual Annual TPY	2,070.84	23.14	1,885.10	3,979.07
	Max Annual TPY	5,009.39	27.47	3,997.14	9,034.00
	Actual Ozone Season TPD	5.66	0.06	5.15	10.87
	Max Ozone Season TPD	13.69	0.08	10.92	24.68
2002 Base Year	Actual Annual TPY	2,367.03	12.07	2,101.08	4,480.18
	Max Annual TPY	5,872.44	31.36	4,183.20	10,087.01
	Actual Ozone Season TPD	6.42	0.03	5.74	12.19
	Max Ozone Season TPD	16.04	0.09	11.43	27.56
2009 Projection Year	Actual Annual TPY	2,640.84	28.24	2,327.73	4,996.80
	Max Annual TPY	6,523.45	33.55	4,601.57	11,158.58
	Actual Ozone Season TPD	7.22	0.08	6.36	13.65
	Max Ozone Season TPD	17.82	0.09	12.57	30.49
2009 Controlled Projection Year	Actual Annual TPY	1,406.24	15.06	849.72	2,271.02
	Max Annual TPY	3,476.18	17.90	1,870.66	5,364.74
	Actual Ozone Season TPD	3.84	0.04	2.32	6.20
	Max Ozone Season TPD	9.50	0.05	5.11	14.66

[a] TPY = tons per year; TPD = tons per day

[b] Emission totals include non-agricultural and agricultural application engines

Given the time constraints under which this project was conducted, good coverage of the subject minor NO_x sources was obtained in the inventory; however, more could likely be done to identify additional minor NO_x source contributors. A more thorough and site-specific set of source activity data could be collected with additional time and data collection procedures. The use of written surveys submitted under some type of TCEQ authority would likely have increased the amount and quality of data that could be collected. Additional time would also foster the ability to work more closely and directly with the TCEQ permitting and point source

inventory staffs, which could provide very helpful results. These groups provided invaluable assistance during the course of this project, but the ability to interact more directly and review their files more thoroughly would be an asset to identifying probable minor NO_x sources. In the course of trying to identify missing NO_x emissions sources, this project showed that there were a significant number of sources falling below or above the various thresholds present in minor NO_x source rule exemptions, permit-by-rule programs, etc. (e.g., almost 20,000 boilers were below the 2 million Btu/hr cutoff in the current minor NO_x source rule; any engine less than 240 hp does not have to be registered in the permit-by-rule program). The exemption of potential minor NO_x sources occurring at facilities already defined as major for NO_x also resulted in a significant number of sources being left out of this inventory. Altering the approach to such sources would increase the minor NO_x source population to be inventoried. Other combustion sources were also identified in the course of the investigation (e.g., curing/drying ovens, baking ovens, dryers, furnaces, non-liquid process heaters) that were not part of the subject population. Expanding the minor NO_x source definition could take in these additional sources for inventory purposes as well.