Cotton Belt Corridor Regional Rail

Air Quality Existing Conditions Technical Memorandum

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The following sections discuss the regulatory guidance, methodology and existing conditions related to air quality. Although the source of funding for the Cotton Belt project is unknown at this time, the potential exists for the use of federal money for the project. Due to the possible need for federal funding assistance, federal regulatory guidance will be followed. In addition, regulations not dependent on federal funding will also be followed.

The U.S. Environmental Protection Agency (EPA) regulates air quality. The EPA delegates this authority to the governor, who has delegated authority to the Texas Commission on Environmental Quality (TCEQ) for monitoring and enforcing air quality regulations in Texas. The North Central Texas Council of Governments (NCTCOG) conducts air quality modeling for the region.

2.0 REGULATORY CONTEXT

The federal Clean Air Act (CAA) of 1970 and the Clean Air Act Amendments (CAAA) of 1977 and 1990 require that states adopt ambient air quality standards. The standards have been established to protect the public from potentially harmful amounts of pollutants. The EPA has set national ambient air quality standards (NAAQS) for the following six criteria pollutants: ozone (O_3), particulate matter (PM10, PM2.5), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2) and lead (Pb). **Table 2-1** lists the NAAQS for these six pollutants. The CAA established two types of standards for these major air pollutants: primary and secondary. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation and buildings.

The CAAA requires all states to submit a list identifying those air quality regions, or portions thereof, which meet or exceed the NAAQS or cannot be classified because of insufficient data. Portions of air quality control regions that are shown by monitored data or air quality modeling to exceed the NAAQS for any criteria pollutant are designated “nonattainment” areas for that pollutant. The CAAA also establishes time schedules for the states to attain the NAAQS.

According to the EPA, the Dallas-Fort Worth region does not meet NAAQS for O_3 and is classified as a “moderate” nonattainment area for that pollutant effective July 20, 2012 (TCEQ, 2012a). For O_3, the federal CAA establishes nonattainment area classifications ranked according to the severity of the area’s air pollution problem. These classifications—*marginal, moderate, serious, severe* and *extreme*—translate to varying requirements with which Texas and nonattainment areas must comply. The “serious” classification requires that certain emission control programs be implemented under federal law (NCTOG, 2011.)

State regulations that apply to emissions from the DART vehicle fleet include SB 681 (Section 382.133 of the *Health and Safety Code*) and Chapters 451-53 of the *Texas Transportation Code*.

Table 2-1 Air Pollution Concentrations Required to Exceed the NAAQS				
Pollutant	**Averaging Period**	**Standard**	**Primary NAAQS***	**Secondary NAAQS****
Ozone (O_3)	8-hour	The average of the annual fourth highest daily eight-hour maximum over a three-year period is not to be at or above this level.	76 ppb	76 ppb
Carbon Monoxide (CO)	1-hour	Not to be at or above this level more than once per calendar year.	35.5 ppm	--
	8-hour	Not to be at or above this level more than once per calendar year.	9.5 ppm	--
Sulfur Dioxide (SO_2)	1-hour	Three year average of the annual 99th percentile of the daily maximum 1-hour averages not to be at or above this level.	76 ppb	--
	3-hour	Not to be at or above this level more than once per calendar year.	--	550 ppb
Nitrogen Dioxide (NO_2)	1-hour	Three year average of the annual 98th percentile of the daily maximum 1-hour averages not to be at or above this level.	101 ppb	--
	Annual	Not to be at or above this level.	54 ppb	54 ppb
Respirable Particulate Matter (10 microns or less) (PM10)	24-hour	Not to be at or above this level on more than three days over three years with daily sampling.	155 $\mu g/m^3$	155 $\mu g/m^3$
	Annual	The three-year average of the annual arithmetic mean concentrations at each monitor within an area is not to be at or above this level.	51 $\mu g/m^3$	51 $\mu g/m^3$
Respirable Particulate Matter (2.5 microns or less) (PM2.5)	24-hour	The three-year average of the annual 98th percentile for each population-oriented monitor within an area is not to be at or above this level.	36 $\mu g/m^3$	36 $\mu g/m^3$
	Annual	The three-year average of annual arithmetic mean concentrations from single or multiple community-oriented monitors is not to be at or above this level.	15.1 $\mu g/m^3$	15.1 $\mu g/m^3$
Lead (Pb)	3-Month	Three-month rolling average not to be at or above this level.	0.16 $\mu g/m^3$	0.16 $\mu g/m^3$
	Quarter	Not to be at or above this level.	1.55 $\mu g/m^3$	1.55 $\mu g/m^3$

Source: TCEQ Web site, May 2012 (TCEQ, 2012b)

*Primary NAAQS: the levels of air quality that the EPA judges necessary, with an adequate margin of safety, to protect the public health.

**Secondary NAAQS: the levels of air quality that the EPA judges necessary to protect the public welfare from any known or anticipated adverse effects.

Notes: ppb = parts per billion, ppm = parts per million, $\mu g/m^3$ = microgram per cubic meter

2.1 Conformity

The study area is located in Tarrant, Dallas and Collin counties, which have been designated as a "moderate" nonattainment area for eight-hour O_3 by the EPA. In addition, Collin County has been designated as a nonattainment area for Pb by the EPA (EPA, 2012a and 2012b). Therefore, the transportation air quality conformity rule does apply to the region and is subject to a regional air quality analysis. Transportation air quality conformity is a CAAA requirement that calls for EPA, U.S. Department of Transportation, and various regional, state and local government agencies to integrate the air quality and transportation planning process. Transportation air quality conformity supports the development of transportation plans, programs and projects that enable areas to meet and maintain national air quality standards for O_3, PM and CO. Transportation plans, programs and projects have to support, and must be in conformity with, the State Implementation Plan (SIP) for achieving the NAAQS.

Under Section 176(c) of the CAA [42 USC Section 7670(c)], federal agencies such as the Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) are prohibited from engaging in, supporting in any way, providing financial assistance for, licensing or permitting or approving any activity that does not conform to an approved SIP. Because this project is located in a nonattainment area, the federal implementing agency would be responsible for ensuring that projects conform to the SIP. A conforming project definition is one that conforms to the SIP objectives of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards.

Under the transportation conformity rule, if a project is included in the emissions analysis of the Metropolitan Transportation Plan (MTP) or Transportation Improvement Plan (TIP), and the FTA or FHWA and EPA have approved this plan or program as confirming to the SIP, then the project is presumed to conform. If the project's emissions are not analyzed in the MTP or TIP, then a separate project-level conformity determination is required. Showing that emissions under a build alternative are less than the no build alternative demonstrates project level conformity.

The Cotton Belt project is included in the NCTCOG Transportation Conformity. In addition, NCTCOG has demonstrated that Mobility 2035: The Metropolitan Transportation Plan for North Central Texas and 2011-2014 Transportation Improvement Program for North Central Texas – 2011 Amendment meet all transportation air quality conformity requirements of the CAAA, the air quality plan, the transportation conformity rule and transportation conformity related provisions contained in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (NCTCOG, 2011).

2.2 Pollutants of Concern

Air quality is affected by pollutants that are generated by both natural and man-made sources. In general, the largest man-made contributors to air emissions are transportation vehicles and power-generating equipment, both of which typically burn fossil fuels. The main criteria pollutants of interest for transportation projects are CO, particulate matter, O_3 and the O_3 precursors, volatile organic compounds (VOCs) and oxides of nitrogen (NOx). Both federal and state standards regulate these pollutants, along with two other criteria pollutants, SO_2 and Pb.

The largest contributors of pollution related to transportation projects are motor vehicles. The main pollutants emitted from motor vehicles are CO, particulates, O_3, greenhouse gases and air toxic pollutants. Motor vehicles also emit pollutants that contribute to the formation of ground-level O_3. This section discusses the main pollutants of concern and their effect on public health and the environment.

2.2.1 Carbon Monoxide

In assessing the localized air quality impacts of transportation projects, CO is the main pollutant of concern. CO is a colorless, odorless and tasteless gas that results from the incomplete combustion of fuel. CO is ingested into the body by breathing. In low concentrations, CO can cause fatigue in healthy people and chest pain in people with heart conditions. At higher concentrations, CO can cause dizziness, impaired vision and coordination, confusion, headaches and nausea. In exceptionally high concentrations, CO can be fatal.

The major source of CO is vehicular traffic, along with industry, wood stoves and slash burns. For urban areas, the internal combustion engines of motor vehicles are the principal sources of CO that cause ambient air quality levels to exceed the NAAQS. CO concentration increases occur during vehicle coldstarts and winter months when meteorological conditions favor the build-up of directly emitted contaminants. CO is a pollutant whose impact is usually localized, with the highest ambient concentrations of CO occurring near congested roadways and intersections.

2.2.2 Particulate Matter

The EPA has set standards for two different size categories of PM. The first standard set is for PM10: particles that are larger than 2.5 micrometers and smaller than 10 micrometers in size. These particles are considered "inhalable course particles" and can be found near roadways and dusty industries. The second set of standards is for PM2.5: particles that measure 2.5 micrometers in size and smaller. These particles are called "fine particles" and can usually be found in smoke and haze. These particles are normally directly emitted from forest fires or they can be formed from gases emitted from power plants and automobiles. The EPA has also determined the health effects of fine PM and has set the standard PM of 2.5 microns or less (PM2.5) to ensure the protection of public health. The PM2.5 standard was finalized on December 18, 2006 and the final rule for state plans for PM2.5 nonattainment areas were issued on March 29, 2007. PM2.5 refers to particulates that are 2.5 microns or less in diameter, roughly $1/28^{th}$ the diameter of a human hair. The EPA designated the Dallas-Fort Worth region as in attainment for PM2.5 on December 18, 2007.

Particulate matter consists of small particles of dirt, soot, metals and organic matter. PM of 10 micrometers in diameter and smaller pose the greatest health problems because it can bypass the natural filtration systems of the nose and throat and enter deep into the lungs, heart and even the bloodstream, which can cause difficulty with breathing, aggravation of asthma, irregular heartbeat, nonfatal heart attacks and death in people with heart or lung problems. Due to the size of PM10 and PM2.5, the wind easily picks up the particles and transports them over long distances to settle on either the ground or water. PM that lands on the ground has the potential to deplete nutrients in the soil, damage sensitive crops and change the structure of the ecosystem. PM that lands on water can change the acidity in lakes and streams and change the nutrient balance in coastal waters and large river basins. Major sources of PM are construction activity, smokestacks, fires, power plants and automobiles.

2.2.3 Ozone

Normally, O_3 is not emitted directly into the air; however, at ground level, NOx and VOCs react under the presence of sunlight to form O_3. Emissions from industrial and electric facilities, motor vehicle exhaust, gasoline vapors and chemical solvents are major sources of NOx and VOCs.

Ground-level and stratosphere-level O_3 share the same chemical structure; however, their effects differ greatly due to their positions in the atmosphere. Ground-level O_3 has adverse effects due to its potential impacts to human health, while stratospheric O_3 has a protective effect by shielding the earth's surface from harmful radiation. When O_3 is inhaled, it can cause a variety of health problems, such as chest pain, coughing, throat irritation and congestion. The effects can potentially worsen to bronchitis, emphysema and asthma, reducing lung function and inflaming the linings of the lungs. Repeated exposure can eventually lead to permanent scarring of the lung tissue. Not only does O_3 cause negative human health effects, but it also causes damage to the environment. O_3 can cause sensitive plants to be more susceptible to certain diseases, insects and other pollutants, which can lead to reduced crop yields, forest growth and potential impacts on species diversity in ecosystems.

O_3 is also the primary element of smog. Sunlight and hot weather are the main causes of the formation of ground-level O_3. As a result, O_3 is referred to as a summertime air pollutant. Many urban areas tend to have high levels of O_3, although even rural areas are subject to increased O_3 levels because the wind can carry O_3 and the pollutant that form O_3 miles away from their original sources.

2.2.4 Climate Change and Greenhouse Gases

Global climate change refers to changes in average climatic conditions on Earth as a whole, including changes in temperature, wind patterns, precipitation and storms. Global warming is a regional and ultimately a worldwide concern. Historical records indicate that global climate changes have occurred in the past due to natural phenomena. However, data indicate that the current global conditions differ from past climate changes in rate and magnitude. Since greenhouse gas (GHG) effects are experienced on a global scale, it is impossible to discuss direct effects of a single development project with future specific climate change.

GHGs include CO_2, methane (CH_4), O_3, water vapor, nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). CO_2 is the most abundant GHG and the primary GHG pollutant emitted by the combustion of fossil fuels. Although they are released by natural processes, the burning of fossil fuels by humans produces substantial amounts of these gases. Changes in global CO_2 emissions from fossil fuel combustion are influenced by many long-term and short-term factors, including population and economic growth, energy price fluctuations, technological changes and seasonal temperatures.

In contrast to most criteria pollutants, emissions of GHGs have been rising from many sources (i.e., industrial, residential, commercial and transportation). Two of the largest contributors to GHG emissions in the U.S. are transportation and energy production, although residences, offices and industries contribute as well. In 2003, it was found that combustion of transportation fuels, the largest source of CO_2, contributed 28 percent of the U.S. GHG emissions.

GHG emissions from transportation sources are directly related to energy consumption and primarily result from the combustion of fossil fuels in vehicles. The GHG emission associated with electrical transportation vary widely depending on the source of electricity. For example hydro-electric generation produces much less GHG emissions than coal plants do. Generally, combusting fuel at a power plant to produce electricity is more efficient than fuel combustion in vehicles. To reduce GHG emissions from transportation sources, effective planning must incorporate modes of transport that use less energy per person per mile traveled and/or use energy derived from fuels that have low carbon content per unit of energy. For example, by changing bus fleets from diesel to natural gas, GHG emissions can be reduced through the use of a low carbon-intensity fuel, and they can be further reduced by increasing regional transit ridership, which uses less energy per person per mile traveled than single-occupant vehicles.

Currently, transit is expected to reduce the automobile use that causes a high percentage of GHG emissions. It is anticipated that the Cotton Belt project would result in lower vehicle miles traveled and would reduce GHG emissions. Additional savings in vehicle miles traveled can be attained from transit-oriented development that is expected to occur around rail stations.

2.2.5 Mobile Source Air Toxics

In addition to the criteria, air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the CAAA. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead federal agency for administering the CAAA and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources [72 FR 8430 (February 26, 2007)]. This rule was issued under the authority in Section 202 of the CAAA. In its rule, the EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements and its proposed heavy-duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 1999 and 2050, FHWA projects that even with a 145 percent increase in vehicle miles traveled, these programs would reduce on-highway emissions by a combined 72 percent.

The technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. Reliable methods do not exist to estimate accurately the health impacts of MSATs at the project level.

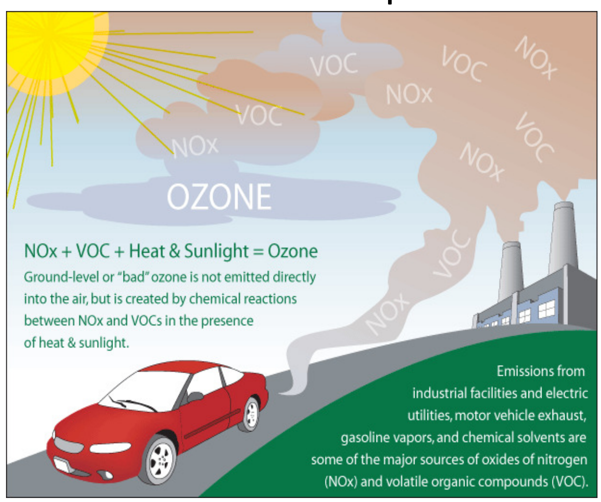
3.0 METHODOLOGY

Air monitoring station locations were identified using the NCTCOG GIS database and determining the nearest active federal air monitoring stations. Specific monitor readings were obtained through the TCEQ air monitoring data web site. The NCTCOG web site for air quality identified specific programs implemented by the region to improve air quality.

4.0 EXISTING CONDITIONS

Air quality is a regional concern, not a localized condition. The study area is located in Tarrant, Dallas and Collin counties, which has been designated as a moderate nonattainment area for eight-hour O_3 and Pb in Frisco, TX—Collin County by the EPA. The NCTCOG eight-hour O_3 nonattainment region includes Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall and Tarrant counties. In addition, Hood, Hunt and Wise counties have been proposed to be added as nonattainment for eight-hour O_3 standards (EPA, 2012c). These additional counties are in review by the EPA. The formation of O_3 is directly related to emissions from motor vehicles and point sources (**Figure 4-1**) (AIRNow, 2012). The primary pollutants from motor vehicles are VOCs, CO, and NOx. VOCs and NOx can combine under the right conditions in a series of photochemical reactions to form O_3. The Dallas-Fort Worth region is in attainment for CO, sulfur dioxide, nitrogen dioxide and PM.

Figure 4-1
Ozone in the Atmosphere



> *Meteorology plays a critical role in ozone formation, as wind and temperature dictate if this pollutant forms; and if so, how long it remains in the atmosphere. Calm weather days with low wind speed and warm temperatures are favorable conditions for ozone formation. As expected, daily ozone concentrations are highest during the summer months, which is why the period between March 1 and October 31 is designated as "Ozone Season" in North Central Texas. The intensity of sunlight necessary for photochemically initiated reactions is highest during this time period.* (NCTCOG, *2011.*)

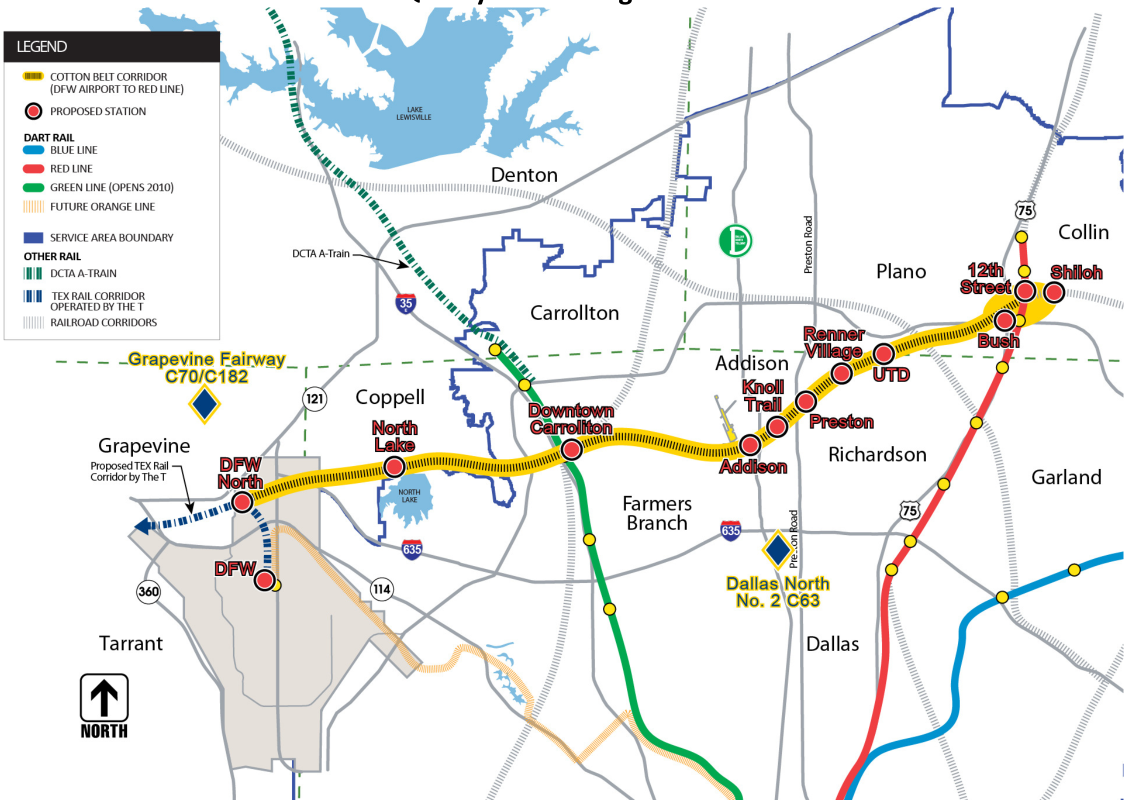
The modeling procedures for O_3 require long-term meteorological data, detailed area-wide emission rates and activity levels for all emission sources (on-road, non-road, point and area). Accordingly, concentrations of O_3 are modeled by the regional air quality planning agency for the SIP. The TCEQ monitors airborne pollutants in the Dallas-Fort Worth region on a continuous basis. O_3 is monitored every hour of the day, every day. **Table 4-1** lists the four highest daily maximum eight-hour O_3 concentrations recorded annually from 2000 to 2012 at the Dallas North No.2 (Continuous Air Monitoring Station [CAMs] 63) and Grapevine Fairway (CAMS 70) monitoring stations, which are the closest active monitoring stations to the study area. **Figure 4-2** shows the locations of the air monitoring sites in relation to the study area.

Table 4-1
Four Highest Eight-Hour Ozone Concentrations

Year	Highest		Second Highest		Third Highest		Fourth Highest	
	Date	Level*	Date	Level*	Date	Level*	Date	Level*
CAMS 63 Dallas North No. 2								
2000	07/14/00	128	08/02/00	126	09/02/00	121	08/24/00	118
2001	08/19/01	113	08/04/01	111	09/12/01	105	09/14/01	100
2002	08/09/02	111	06/23/02	103	09/14/02	102	09/27/02	98
2003	08/07/03	135	05/18/03	120	05/31/03	118	07/18/03	107
2004	08/02/04	121	08/04/04	107	07/19/04	104	07/16/04	101
2005	07/14/05	120	06/15/05	120	09/01/05	117	05/20/05	116
2006	08/31/06	103	07/21/06	100	09/01/06	96	08/23/06	93
2007	08/14/07	101	09/21/07	101	08/15/07	94	07/25/07	93
2008	08/14/08	108	07/01/08	92	08/21/08	92	06/23/08	91
2009	08/25/09	111	07/01/09	107	07/07/09	105	07/02/09	100
2010	08/12/10	94	08/17/10	88	08/23/10	87	08/05/10	84
2011	08/26/11	98	09/29/11	97	08/25/11	90	09/28/11	88
2012**	06/25/12	97	08/09/12	92	06/26/12	92	08/7/12	86
CAMS 70 Grapevine Fairway* **								
2000	08/24/00	122	08/25/00	98	07/19/00	94	08/23/00	93
2001	08/04/01	133	08/03/01	118	06/16/01	112	08/19/01	110
2002	08/09/02	150	07/09/02	130	06/24/02	128	06/23/02	120
2003	06/28/03	122	07/31/03	113	09/09/03	110	08/07/03	110
2004	08/02/04	125	09/11/04	119	06/24/04	109	07/20/04	104
2005	06/15/05	112	07/14/05	111	08/02/05	110	06/21/05	106
2006	09/01/06	115	08/31/06	106	07/18/06	106	07/09/06	104
2007	08/14/07	123	07/25/07	108	08/15/07	107	09/21/07	102
2008	09/29/08	93	08/14/08	91	06/23/08	91	07/01/08	86
2009	08/25/09	111	07/02/09	110	06/05/09	105	08/26/09	103
2010	08/17/10	104	09/17/10	104	08/23/10	98	08/12/10	97
2011	08/25/11	98	08/28/11	97	09/29/11	91	09/12/11	91
2012**	06/26/12	97	06/25/12	97	06/27/12	92	06/24/12	86

Source: TCEQ Air Monitoring Stations (TCEQ, 2012c)
* All ozone measurements are in parts per billion
** 2012 results as of September 21, 2012
*** CAMS 70 began monitoring on 7/19/00

Figure 4-2
Air Quality Monitoring Stations



In addition to controls included in the next SIP and in the MTP, several efforts have been initiated at the local level through the NCTCOG to improve air quality. The following list gives some of the major programs that NCTCOG has implemented to improve air quality (NCTCOG, 2012):

AirCheckTexas – Provides financial aid of up to $600 for vehicles failing the emissions portion of the state inspection for specific financially constrained persons and families.

Clean Fleet Vehicle Program – Promotes replacement of fleet vehicles with low-emitting vehicles, and provides tools to assist fleet managers with making clean vehicle decisions, decreasing a fleet's impact on air quality.

Diesel Idling Reduction Program – A program to assist owners of heavy-duty diesel vehicles with the purchase of idle reduction technology.

Light-Emitting Diode (LED) Traffic Signal Replacement Program – A program to convert incandescent traffic signal lamps with LED lamps, thereby reducing energy needs.

North Central Texas Clean School Bus Program – Retrofit and replace school buses in the Dallas-Fort Worth area with cleaner technology and provide educational resources for reducing school bus emissions.

Regional Smoking Vehicle Program – Encourages drivers to voluntarily repair and maintain their vehicles through public awareness and vehicle reporting.

Try Parking It – A web site that provides a method to track, log, and reward work-based trips that utilize alternative commutes and also provides statistics on reduced miles and trips.

EPA emission reducing rules are expected to reduce air pollution by 2020. The ongoing improvements in vehicle emissions and industry emissions will have positive impacts on reducing air pollution for the future. Regional programs will also contribute in the decrease from NAAQS and MSATs. With the combined federal and local efforts, air quality is expected to improve in the future.

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Alliance Transportation Group
Arredondo, Zepeda & Brunz
Bowman Engineering
Connetics Transportation Group
Cox|McLain Environmental Consulting
CP&Y
Criado & Associates
Dunbar Transportation Consulting
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KAI Texas
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