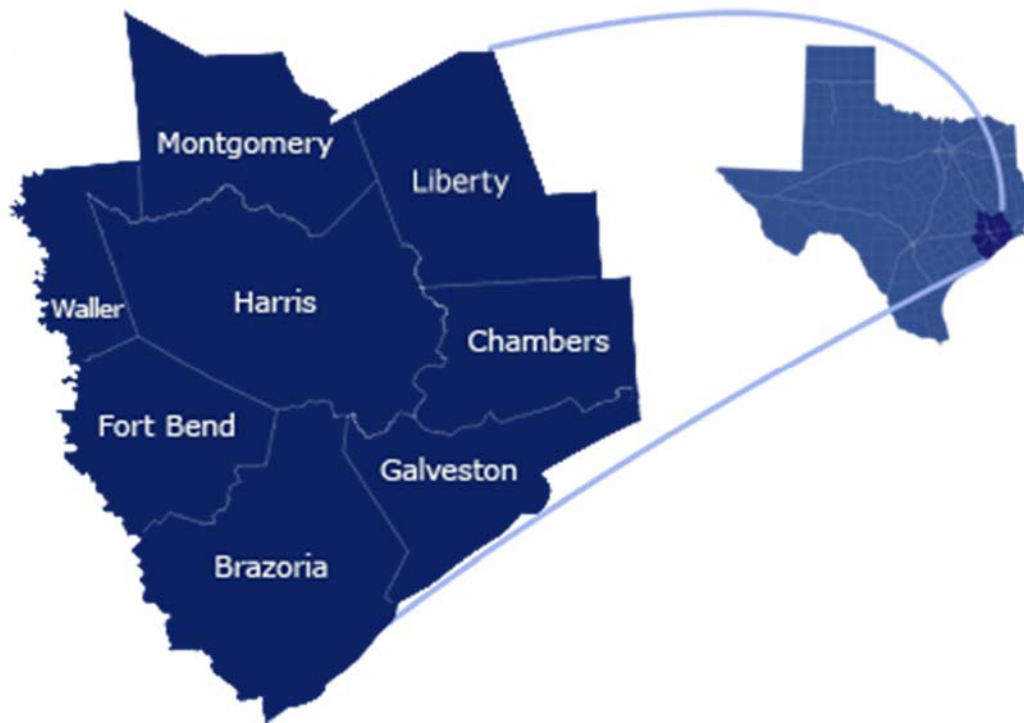

Houston-Galveston-Brazoria (HGB)

PM_{2.5} Advance

Path Forward Update



PREPARED IN PARTNERSHIP WITH MEMBERS OF THE
H-GAC REGIONAL AIR QUALITY PLANNING ADVISORY COMMITTEE

2017 UPDATE



HOUSTON-GALVESTON-BRAZORIA (HGB) PM_{2.5} ADVANCE PATH FORWARD

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EXECUTIVE SUMMARY

H-GAC has developed the following Path Forward update in partnership with the Regional Air Quality Planning Advisory Committee (RAQPAC), as part of our involvement in the voluntary EPA Particulate Matter (PM) Advance Program. Participation in this program is a result of significant collaboration between local governments, key citizen/environmental groups, industry representatives and other regional stakeholders to assist our region in meeting the PM_{2.5} air quality standard.

This Path Forward Update includes a variety of voluntary regional air quality improvement efforts. These projects range from the replacement of older heavy-duty truck and marine engines with newer, cleaner models, to funding electric vehicle charging equipment, to voluntary industry and local government air quality initiatives. H-GAC programs alone have resulted in PM_{2.5} reductions in our region. Over 50 current H-GAC and partner programs and projects as well as nearly 20 additional potential future initiatives presented in this document will continue to achieve reductions. This report includes updates to ongoing projects as well as detailing new PM_{2.5} reducing project within the region. Work will continue in future years as this effort continues to document and expanded upon programs within the Houston region.

On January 12, 2015, the EPA designated the Houston-Galveston-Brazoria (HGB) region as “unclassifiable/attainment” for the 2012 primary annual PM_{2.5} annual NAAQS. The HGB region remains below the National Ambient Air Quality Standard for fine particle pollution. By maintaining and expanding regional collaboration on voluntary projects, our region continues to reduce PM_{2.5} concentrations, position itself to avoid a nonattainment designation, and be prepared for potentially more stringent future standards.

INTRODUCTION

OVERALL PROGRAM OBJECTIVE

The Particulate Matter (PM) Advance Program is a voluntary, collaborative effort between local government and key regional stakeholders to organize and report on efforts to continue to meet the revised PM_{2.5} National Ambient Air Quality Standard (NAAQS). The current standard, which includes a 12.0 µg/m³ annual standard and a 35 µg/m³ 24-hour standard, became effective on December 14, 2012. The NAAQS are health-based air quality standards that follow rules laid out initially as part of the federal Clean Air Act. Another goal of the PM Advance Program is to foster an understanding of local air quality issues and promote implementation of near-term initiatives that maintain and/or improve ambient PM_{2.5} levels.

MISSION OF THE LOCAL PROGRAM

The mission of the PM Advance Program is to promote, identify, expand, and improve voluntary PM reduction efforts (both existing and potential future opportunities) within the areas where compliance with the 2012 PM_{2.5} NAAQS may be at risk. The Program also serves as a catalyst to encourage accelerated implementation of voluntary clean air strategies as well as to develop additional participation in PM reduction efforts such as vehicle replacement programs. Participation in the PM Advance program also provides an opportunity for stakeholders to promote their own PM reduction efforts and take advantage of funding opportunities that may be available for additional reduction activities.

VOLUNTARY PROGRAM SCOPE

Participation in PM Advance has allowed the region to create a collaborative platform to identify and launch potential PM reduction efforts. Regional stakeholders have worked together voluntarily to develop this Path Forward to meet the stated mission. Program participation does not create or remove any statutory or regulatory requirements but can serve as an early action framework to maintain compliance with air quality standards. Please note: this Path Forward update remains a living document. This is the fourth iteration of this report and additional periodic re-evaluation of local measures is anticipated and will be reflected in future versions of this report.

PROGRAM DEVELOPMENT PROCESS

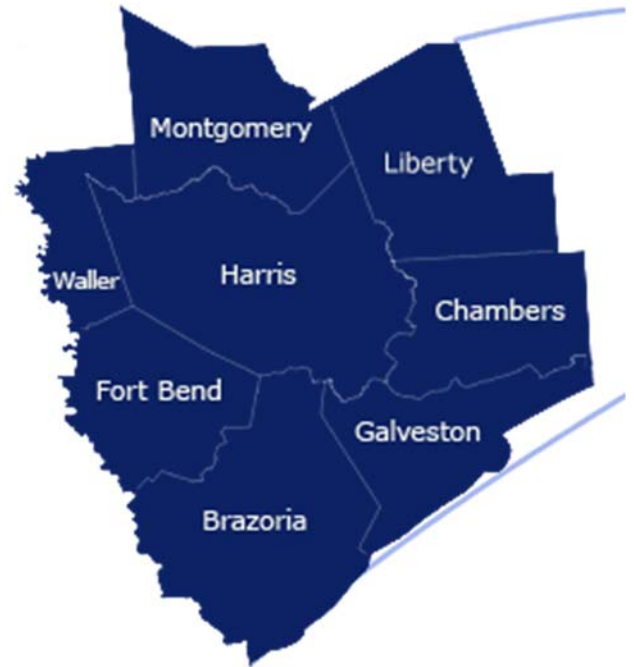
The H-GAC Regional Air Quality Planning Advisory Committee (RAQPAC) – representing local governments, citizen/environmental groups and business/industry stakeholders – has examined potential voluntary actions to continue to quickly reduce levels of fine particulate matter in the form of PM_{2.5}. To this end, the H-GAC Board of Directors has authorized H-GAC staff to develop voluntary strategies to reduce fine particulate matter as recommended by RAQPAC and the PM_{2.5} Task Force.

The RAQPAC PM_{2.5} Task Force convened to collaborate on the development of the original PM Advance Path Forward. Task Force efforts included meetings to discuss and review of past, present, and potential future PM reduction projects within the eight-county HGB ozone nonattainment area amongst RAQPAC members, stakeholders and interested public. Efforts also included presentations on PM_{2.5} composition in Houston by TCEQ and others. This Task Force was reconvened in May of 2017 to begin work on this most recent update of this report. Following this meeting, H-GAC staff and Task Force members began the task of updating this document to include the most up-to-date information on regional PM_{2.5} reduction efforts.

THE REGION

HOUSTON-GALVESTON AREA COUNCIL

The Houston-Galveston Area Council (H-GAC) is the region-wide voluntary association of local governments for the 13-county Gulf Coast Planning region of Texas. H-GAC is also the Metropolitan Planning Organization (MPO) for the eight-county Houston-Galveston-Brazoria (HGB) area. This area includes Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller Counties. The scope of this report focuses on the eight-county HGB area.



POPULATION & EMPLOYMENT¹

The HGB region has experienced dramatic changes in its population size and composition over the last few decades, and these trends are expected to continue. The region is projecting a significant increase in population and employment over the next 25 years. There are currently nearly 6.5 million residents and 3.1 million jobs within the region. By 2040, the regional population is expected to reach 9.6 million residents (an increase of 3.1 million people). Similarly, the region is expected to create an additional 1.1 million jobs for a total of more than 4 million and see an almost 60% increase in vehicular travel and a doubling of the movement of freight. Projected population growth will also result in economic changes stemming from increased purchasing power and tax revenue.

TRANSPORTATION SYSTEM

Every day, more than 163 million miles are traveled on the system's roadways². Within our region, there are approximately 26,000 centerline miles of locally-owned roads and almost 4,000 centerline miles of state-owned facilities³. In addition, the region currently has more than 190 miles of High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) lanes in operation⁴. Regional transit includes bus routes, the METRORail light rail system, commuter transit routes, smaller vehicle routes, and ferries. The HGB region's transportation system also includes bikeways, freight rail, ports, airports, and pipelines.

Congestion remains a major challenge facing the HGB region. The number of morning and evening peak hours continues to increase as the number of commuters travelling to and from work increase. It is anticipated that congestion in our region will continue to grow given the projected population, employment, and economic growth facing our region.

¹ H-GAC 2040 Regional Transportation Plan: www.h-gac.com/taq/plan/2040/

² H-GAC TDM, 2016 (typical fall weekday VMT - all HGB roadways)

³ TxDOT Standard Reports 2012

⁴ H-GAC 2015 Regional Mobility Report

AIR QUALITY BACKGROUND: AIR POLLUTION

Air pollution occurs when the air contains gases, particles, fumes, or odors that could be harmful to the health or comfort of humans and animals or which could cause damage to plants and materials. These pollutants may result from naturally occurring sources such as windblown dust or volcanic eruptions as well as stationary sources such as factories, power plants, or other industrial sites or mobile sources such as cars, trucks, or airplanes

The U.S. Environmental Protection Agency (EPA) has set both primary and secondary standards (National Ambient Air Quality Standards or NAAQS) for six “criteria” pollutants. These include: carbon monoxide, lead, nitrogen dioxide, 10 micrometer particulate matter (PM₁₀), 2.5 micrometer particulate matter (PM_{2.5}), ground-level ozone, and sulfur dioxide. The region has historically been most troubled by high concentrations of ground-level ozone, however there have been additional concerns about elevated concentrations of PM_{2.5}. It is these elevated concentrations that resulted in regional participation in the PM Advance program.

It is through this program, as well as through other EPA-led programs, that H-GAC and its partners continue to work to reduce air pollution and help the region meet federal air quality standards. Through these efforts, the region has made considerable progress towards reducing both ground-level ozone and particle matter emissions over the last decade.

PARTICULATE MATTER (PM)

Particle pollution is a complex mixture of extremely small particles. This type of pollution is generally referred to as particulate matter or PM. Components of PM include particles or liquids such as dust, fly ash, soot, smoke, aerosols, fumes, and mists as well as condensed vapors that can be suspended in the air. EPA groups particle pollution into two categories: Inhalable coarse particles (PM₁₀) and fine particles (PM_{2.5}). The size of particles is directly linked to their potential for causing health problems. Particles that are smaller than 10 micrometers in diameter (PM₁₀ and PM_{2.5}) are able to pass through the throat and deep into the lungs where they can cause serious health effects. Fine particulate matter (PM_{2.5}) generally consists of soot, which is generally made up of elemental organic carbon from sources including soil and sources of sulfates, nitrates as well as other ionic species formed in the atmosphere.

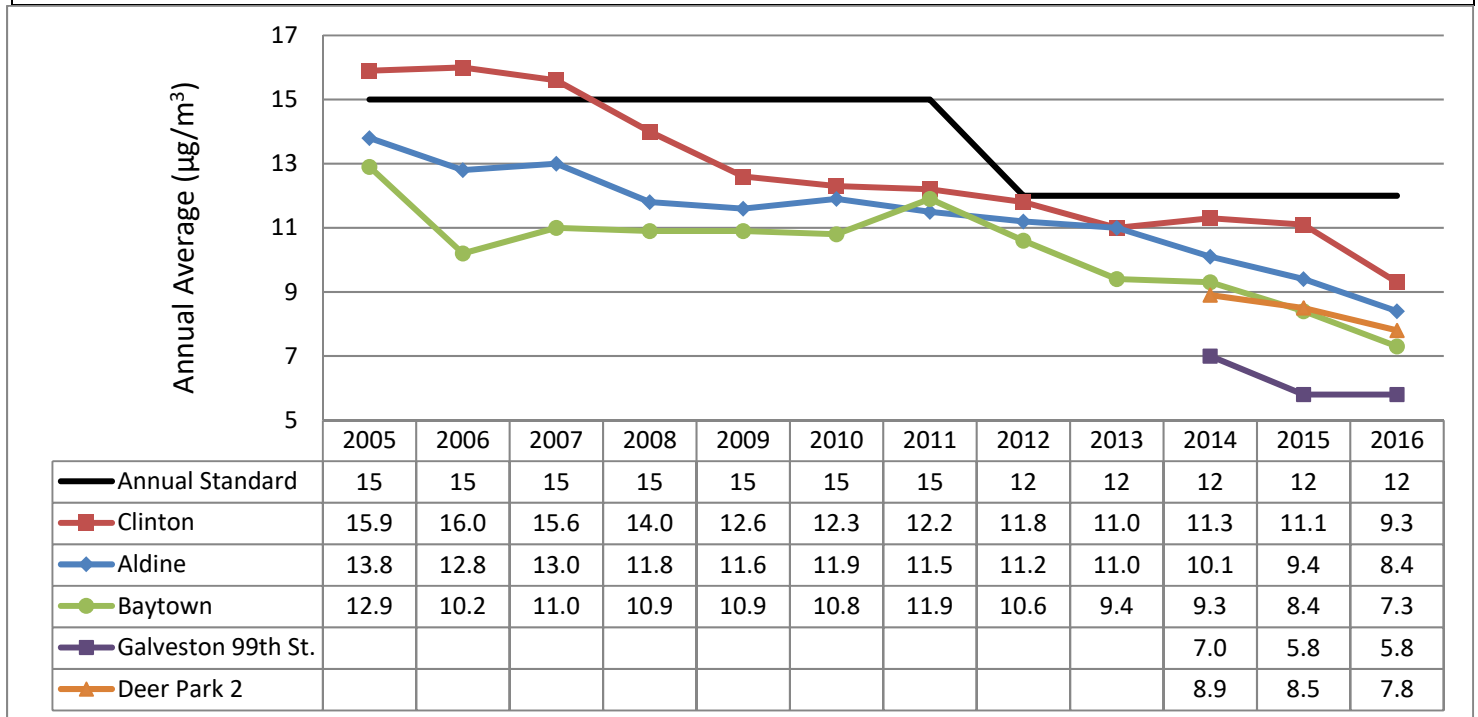
PAST AND PRESENT STATUS OF PM_{2.5} IN HGB

The HGB area has experienced significant improvements in PM_{2.5} levels over the past ten years. Historically, the HGB area has been designated as “unclassified/attainment” for particulate matter standards for both the PM_{2.5} and PM₁₀ standards. Details of the particulate matter NAAQS are found in the table below. Note that in 2012, EPA lowered the primary annual NAAQS for fine particles (PM_{2.5}) to 12.0 µg/m³ to be more protective of public health.

Pollutant	Primary NAAQS	Averaging Period	Designation
Particulate Matter (PM ₁₀)	150 µg/m ³	24-hour	Attainment/ Unclassifiable
Particulate Matter (PM _{2.5})	12.0 µg/m ³ (2012 standard)	Annual (Arithmetic Mean)	Attainment/ Unclassifiable
	15.0 µg/m ³ (1997 standard)	Annual (Arithmetic Mean)	Attainment/ Unclassifiable
	35 µg/m ³	24-hour	Attainment/ Unclassifiable
	35 µg/m ³	24-hour	Attainment/ Unclassifiable

Air monitoring data collected, compiled, and validated by the Texas Commission of Environmental Quality (TCEQ) identifies the certified PM_{2.5} annual design value⁵ for 2010-2012 for the HGB region as 12.1 micrograms per cubic meter (µg/m³). Over the subsequent years, TCEQ closely monitored PM_{2.5} concentrations and found a continuing decline in annual PM_{2.5} averages in the HGB area (see table below). On January 15, 2015, the EPA published designations for the 2012 primary annual PM_{2.5} NAAQS. The HGB region was classified as “unclassifiable/attainment.”

Preliminary Annual PM_{2.5} Averages for Clinton, Aldine and Baytown Regulatory Monitors⁶



EPA promulgated final area designations for the 2012 PM_{2.5} NAAQS on December 18, 2014. Air monitoring data can be retrieved from the TCEQ Texas Air Monitoring Information System (TAMIS) web: www17.tceq.texas.gov/tamis/.

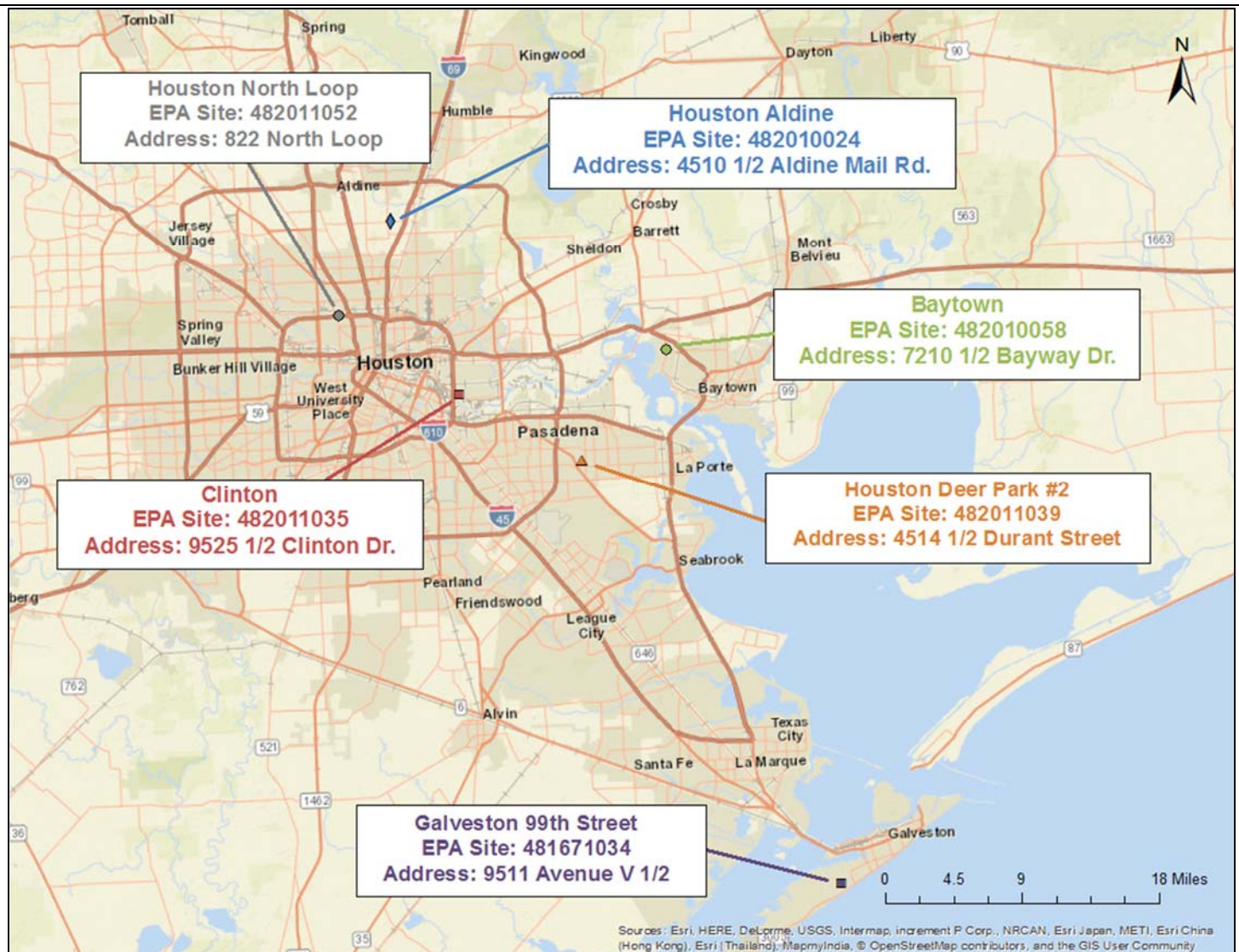
⁵ A “design value” for an area is a statistic that is compared to the National Ambient Air Quality Standards (NAAQS) to determine the attainment status of the area. An areas value is calculated using an arithmetic mean of the annual PM_{2.5} averages for three consecutive years at each regulatory monitor. If an area has more than one regulatory monitor, the monitor with the highest value sets the design value for the area (EPA, 2014).

⁶ All values within this chart are certified. Only the data from these regulatory monitors will be used by EPA for attainment demonstration purposes. Source: TCEQ

HGB MONITORING NETWORK

Over time, the monitoring system in the HGB region has expanded significantly. There six sites with regulatory PM_{2.5} monitors within the region, 11 local conditions (acceptable) monitors, and many more non-regulatory monitors in our region. The City of Houston, Harris County, University of Houston, Texas Commission on Environmental Quality (TCEQ), and Houston Regional Monitoring Corporation (HRM) and others operate these monitors. Most of these monitoring stations measure the concentrations of the criteria pollutants in the air, as well as air temperature, wind velocity, and other meteorological parameters. Some of the monitoring stations also measure the levels of an additional set of selected chemicals, and some measure pollen and mold spores.

HOUSTON-GALVESTON-BRAZORIA REGION PM_{2.5} REGULATORY MONITORING SITES



The following table of monitoring sites lists the six HGB PM_{2.5} monitor sites which are also classified as Federal Reference Method (FRM) monitor sites by the EPA. PM_{2.5} data from the Houston Aldine, Baytown, Clinton, Galveston, and Deer Park monitors determine HGB attainment with the PM_{2.5} NAAQS. The Houston North Loop PM_{2.5} monitor is shaded in gray below because it was only added recently and has not yet collected a full three years of PM_{2.5} data and thus cannot yet be included in the attainment demonstration.

These federal reference monitors utilize the appropriate sampling and analysis methods and quality assurance/quality control (QA/QC) protocols for use in determining attainment demonstration status with the fine particulate matter standard. Monitoring sites with FRM monitors are considered regulatory monitors. There are numerous additional PM_{2.5} monitors within our region that are not considered regulatory monitors, but data from these other monitoring sites is used by TCEQ to help understand air quality data and trends and help predict possible alerts.

HGB Region PM _{2.5} Regulatory Monitoring Sites ⁷						
Region	Name	CAMS ID	Address	AQS Number	Sampler Type	Operational Date
12	Baytown	C0148	7210½ Bayway Dr, Baytown	482010058	PM _{2.5} (FRM)	1/6/1999
12	Clinton	C0403	9525 Clinton Dr, Houston	482011035	PM _{2.5} (FRM & co-located)	1/1/1999 & 4/6/1999
12	Houston Aldine	C0008	4510½ Aldine Mail Rd, Houston	482010024	PM _{2.5} (FRM)	8/14/2000
12	Galveston 99 th Street	C1034	9511 Avenue V½, Galveston Airport, Galveston	481671034	PM _{2.5} (FRM)	5/1/2013
12	Houston Deer Park2	C0035	4514½ Durant St, Deer Park	482011039	PM _{2.5} (FRM & FEM)	8/10/2013
12	Houston North Loop	C1052	822 North Loop, Houston	482011052	PM _{2.5} (FRM)	4/13/2015

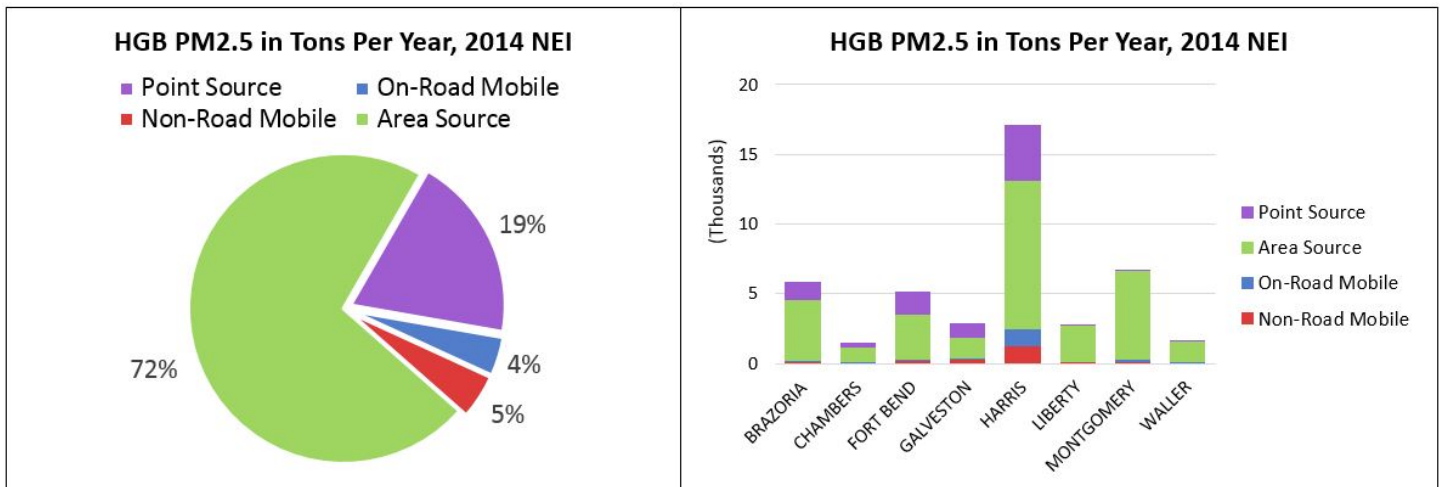
Monitor in gray has become operational within the last three years. As such, this monitor cannot yet be used to determine attainment. To view the data from all continuous TCEQ monitors, please follow this link: www.tceq.texas.gov/airquality/monops/sites/mon_sites.html. Please be aware that the PM_{2.5} monitors at the Houston North Loop site is a non-continuous monitor. Data from this monitor is made available by TCEQ quarterly after results have been manually collected and analyzed in the laboratory.

HGB PM_{2.5} INVENTORY

The following PM_{2.5} inventory is based on TCEQ's adjusted 2014 National Emissions Inventory (NEI) data. The NEI is a comprehensive, detailed estimate of criteria and hazardous air emissions sources. The NEI is prepared every three years by the EPA based primarily upon emission estimates and emission model inputs provided by State, Local, and Tribal air agencies for sources in their jurisdictions, and supplemented by data developed by EPA. The 2014 NEI was built from emissions data in the Emissions Inventory System (EIS). The 2014 version of the NEI is the most current edition available. Publication of the 2017 inventory is expected in late-2019.

⁷ The Houston North Loop PM_{2.5} monitor was added in 2015 and has not yet collected a full data set for inclusion in this report.

TCEQ PM_{2.5} Inventory for HGB⁸



These data are split into four emission categories: point, on-road mobile, non-road mobile and area (non-point) sources. Point sources are individually inventoried and usually located at a fixed, stationary location (heaters, boiler and cooling water towers at large industrial facilities), although portable sources are also included (some rock crushing operations). On-road mobile sources include emissions from vehicles found on roads and highways (cars, trucks, and buses); while non-road mobile sources include mobile sources not found on roads and highways (lawn mowers, construction vehicles, farm machinery, rail, airplanes, and commercial marine vessels). Area (non-point) sources include those sources that are inventoried collectively because they are too small in magnitude or too numerous to inventory as individual point sources, and which can often be estimated more accurately as a single aggregate source (residential heating, leaf blowers, and unpaved roads). The estimated emission values for TCEQ non-point sources in the chart below are taken from the Texas Air Emissions Repository (TexAER).

TCEQ PM_{2.5} Inventory for HGB (tons per year)⁹

	Point Source	On-Road Mobile	Non-Road Mobile	Area Source
Brazoria	1,262.53	72.71	133.78	4,357.80
Chambers	336.30	65.84	25.68	1,024.44
Fort Bend	1,640.62	119.80	156.64	3,222.63
Galveston	1,057.68	62.96	298.78	1,455.90
Harris	4,041.63	1,230.24	1,199.67	10,675.29
Liberty	5.56	41.62	59.63	2,599.84
Montgomery	85.95	146.40	124.62	6,330.31
Waller	7.00	30.72	28.10	1,543.45
Total	8,437.27	1,770.29	2,026.90	31,209.66

⁸ TCEQ's adjusted 2014 NEI data follows the same quality assurance and quality control process as data in the Reasonable Further Progress (RFP) and Attainment Demonstration (AD) State Implementation Plan (SIP).

⁹ All data is subject to revisions or updates.

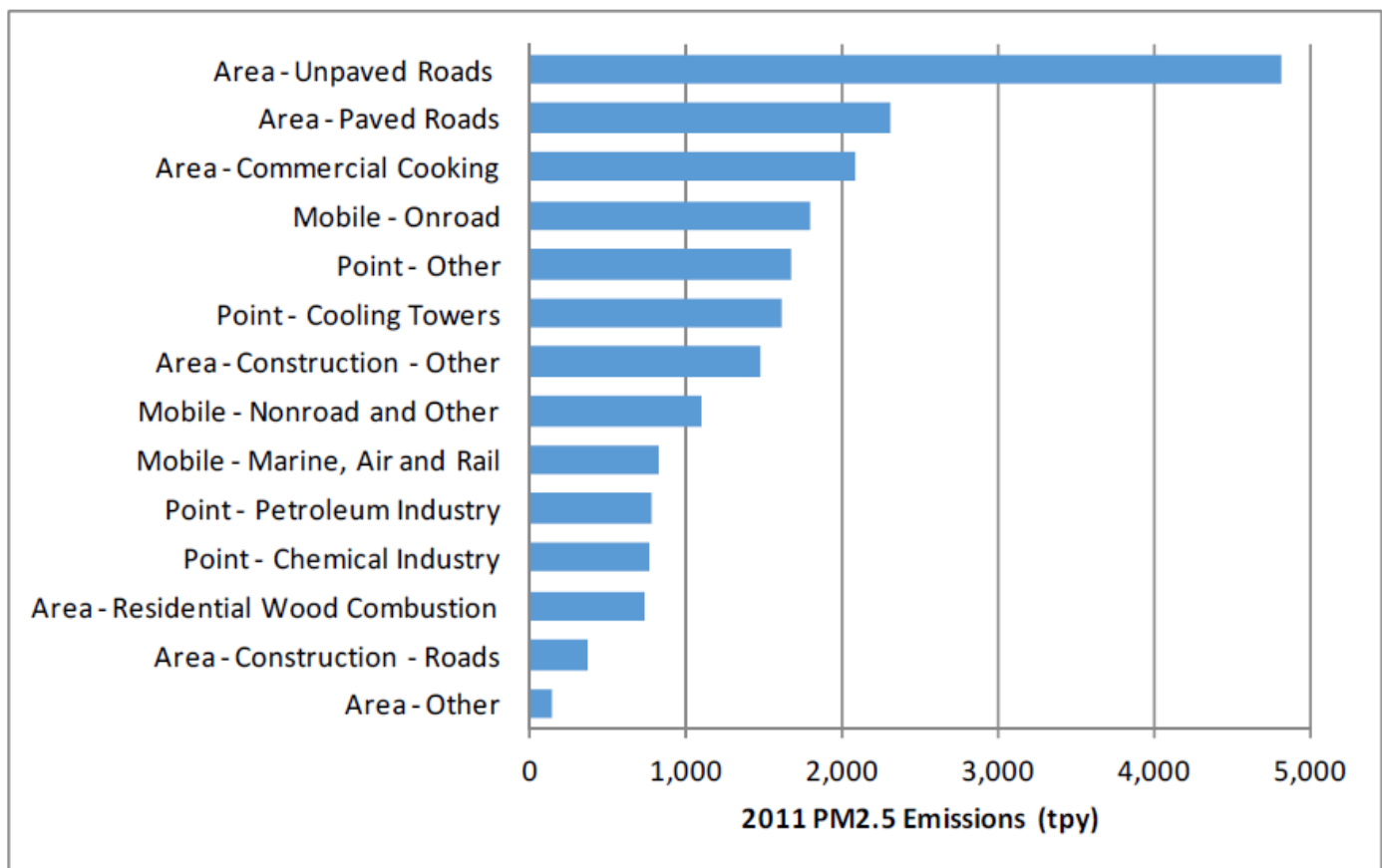
HARRIS COUNTY PM_{2.5} INVENTORY SUMMARY

Houston Advanced Research Center (HARC), in partnership with Harris County, spearheaded an effort to further investigate sources of PM_{2.5} within Harris County: the Harris County PM_{2.5} Emissions Inventory project. At the time of the creation of this inventory, ambient air quality monitoring data indicated that the Houston area (and in particular the Clinton Drive PM_{2.5} monitor) measured at near the level of the annual average PM_{2.5} NAAQS.

This project was funded by a Coastal Improvement Assistance Program (CIAP) grant, administered by the U.S. Fish and Wildlife Service through Harris County. The aim of this portion of the grant was to review the PM_{2.5} inventories developed by TCEQ and EPA for Harris County, make adjustments when technically justified, and provide a list of potential controls, including their efficiencies and costs that might be used to reduce PM_{2.5} emissions based on the revised inventory.

This inventory summary is broken down into three categories of emissions: point, mobile and area sources using NEI inventory definitions. This inventory summary identifies unpaved roads as the predominant source of PM_{2.5} within Harris County.

2011 Harris County Annual PM_{2.5} Emissions



Since the creation of this inventory, PM_{2.5} monitors within the Houston region have shown significant reductions of approximately 25% or more. It is anticipated that future versions of this inventory will show a similar magnitude of reduction.

PAST AND PRESENT INITIATIVES

AIR QUALITY PROGRAMS AT H-GAC

H-GAC has partnered with local and regional government agencies, citizen and environmental groups, business and industry-based organizations and other stakeholders to proactively pursue air quality improvements within our region. Currently, more than 12 major emission reduction programs are underway at H-GAC due to the region's ozone non-attainment status. These programs have multi-pollutant benefits and, despite their main focus on reducing ground-level ozone, have produced significant PM_{2.5} reductions in the past. In 2016 alone, these programs resulted in more than 10 tons of PM_{2.5} reductions within the region.

2016 Current Control Programs Reductions (tons per year - tpy) ¹⁰			
Measure	PM _{2.5} (tpy)	NO _x (tpy)	VOC (tpy)
Clean Vehicles Program			
<i>Non-Drayage Projects</i>		64.87	
<i>Drayage Trucks</i>	6.10	97.73	5.39
Regional Texas Emission Reduction Plan (TERP)			
<i>Drayage Trucks</i>	3.47	38.07	1.84
<i>Local Government Projects</i>		20.81	
Clean Vessels for Texas Waters	0.50	7.46	0.53
Clean School Bus Program		20.52	
Commute Solutions (Clean Air Champions, Ridematch and Telework)	0.07	3.89	2.87
Commute Solutions: METRO Star Vanpool	0.18	13.13	0.04
Commute Solutions: Commuter and Transit Pilot Projects	0.01	0.85	0.04
Totals	10.33	267.33	10.71

CLEAN VEHICLES & CLEAN SCHOOL BUS PROGRAMS

Since 1995, the Clean Vehicles Program has provided grant assistance to replace older diesel engines in both public and private fleets within the HGB region. This fuel neutral program is designed to reduce on-road vehicle emissions by rapid turnover to newer lower emitting engines, retrofit of existing engines with approved devices, or introduce new lower emission technologies. In 2015, the Clean Vehicles Program reduced over 6 tons of PM_{2.5} emissions.

The Clean School Bus program serves the following counties: Angelina, Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Hardin, Harris, Houston, Jasper, Jefferson, Liberty, Matagorda, Montgomery, Nacogdoches, Newton, Orange, Polk, Sabine, San Augustine, San Jacinto, Trinity, Tyler, Walker, Waller, and

¹⁰ 2014 Air Quality Program emission reductions calculated using EPA MOVES 2014a emission factors.

Wharton. The goal of the program is to reduce children’s exposure to diesel exhaust and reduce the amount of air pollution created by diesel school buses.

CLEAN VESSELS FOR TEXAS WATERS

In 2011, EPA awarded H-GAC almost \$1 million to repower 3 high-emitting tug vessels with 8 new, cleaner engines. The repowered vessels mainly operate in the HGB non-attainment area—docking ships and fueling marine vessels. The project has already completed the replacement of 8 engines, and reduces approximately half a ton of PM_{2.5} emissions annually.

COMMUTE SOLUTIONS: CLEAN AIR CHAMPIONS

The Clean Air Champion program is an outreach program designed to partner with local employers to implement alternative commuting and clean fleet policies. Organizations that meet the requirements of the Clean Air Champion program earn the distinction of being recognized as a regional leader of employee benefits offerings—a designation that gives them a competitive advantage in recruiting the best and brightest employees.

COMMUTE SOLUTIONS: RIDE MATCH

The H-GAC ridesharing program rewards Houston-area commuters for trips in which they choose to walk, bike, telecommute, carpool, vanpool, take transit, or work a compressed week. To date this program has registered more than 30,000 users and resulted in nearly 12.5 million VMT reduced in 2016 alone.

COMMUTE SOLUTIONS: TELEWORK

The Telework Program helps regional employers and employees by educating about the benefits of teleworking and offering financial incentives to develop and implement telework as well as alternative work schedule programs. 2016 participants in this program resulted in reducing more than 3 million VMT during the year.

COMMUTE SOLUTIONS: METRO STAR VANPOOL PROGRAM

STAR, the regional vanpool and rideshare program provided by METRO is one of the largest programs of its kind in the nation. The program provides a 7- to 15-passenger van along with insurance, maintenance, roadside assistance and administrative coordination. Average fares are about \$135 per month, and the average round-trip traveled is 58 miles. Additionally, program participants benefit from a capital subsidy¹¹ toward the cost of the vehicle to help offset vanpool costs. Volunteers within the vanpool groups do the driving. For the last fiscal year, there was an average of 650 vanpools in operation with more than 6,500 riders in the region. This program reduced nearly 55 million VMT in 2016.

¹¹ Average capital subsidy for 2016 was \$420 per van per month.

COMMUTE SOLUTIONS: PILOT PROJECTS

A total of 13 pilot projects have been implemented in the HGB region using a combination of federal funds and local matching funds. The resulting new transit service has resulted in reducing over 43 million VMT since these projects began and more than 3.5 million in 2016.

ENERGY CORRIDOR DISTRICT'S CARSHARE PROGRAM

The Energy Corridor in partnership with Enterprise Holdings provides commuters access to vehicles on days they use a commute alternative. CarShare vehicles are available for hourly rental at two different sites for personal or work errands throughout the day, with fuel, physical damage/liability protection, vehicle maintenance, and 24/7 roadside and member assistance included. This program assists in making alternative mode use more attractive to users.

DRAYAGE LOAN PROGRAM

Since 2010, the H-GAC Drayage Loan Program has offered independent owner operator and/or trucking companies servicing HGB ports the opportunity to apply for financing to support the purchase of cleaner, safer and more fuel-efficient drayage trucks. Almost 900 tons of NO_x reductions and 14 tons of PM emission reductions are anticipated over the life of the program. This program has been a collaborative effort between H-GAC, Environmental Defense Fund, and Port Houston.

PEDESTRIAN & BICYCLIST PROGRAM

In Houston, 1% to 3% of trips are made by biking or walking resulting in a reduction of between 40,000 and 120,000 trips per day within the region. This is equivalent to a daily VMT reduction of between 60,000 and 175,000 miles. Additionally, according to a frequency distribution analysis of trips by trip length (prepared by the Texas Transportation Institute¹²), there are nearly 4 million trips per day that are two miles or less in length for home-based work, home based non-work, and non-home based non-work trips.

To this end, there is a vibrant move within the region toward more bicycle use. The City of Houston offers approximately 270 of high-comfort bicycle facilities, and adopted a new Bicycle Plan in March 2017. The network includes bike lanes, bike routes, signed-shared lanes and shared-use paths, commonly referred to as 'hike and bike' trails, which includes rails to trails, and other urban multi-use paths. In addition to these bicyclist transportation facilities, there are nearly 130 miles of hike and bike and nature trails found in City of Houston parks. In addition, Harris County and many municipal utility districts have constructed more than 160 miles of bikeways within the City limits.

These facilities and mode shifts to walking and biking have resulted in real and tangible annual pollutant reductions within the region. This has resulted in reducing 11.6 tons of VOCs, 12.6 tons of NO_x, 0.33 tons of PM_{2.5}, and 9,550 tons of CO₂ annually.

¹² TTI analysis of the 2009 Houston Household Travel Survey transmitted by H-GAC on 1/24/12

VOLUNTARY IDLING REDUCTION PROGRAM

In 2012, in partnership with local governments, citizen and environmental groups, business and industry-based organizations and other stakeholders H-GAC developed a voluntary idling reduction program and adopted a voluntary diesel idling reduction policy. This anti-idling policy aims to lower nitrogen oxide (NO_x) and other emissions by placing a five-minute idle limit on motor vehicles. Along with promoting this voluntary policy region-wide, H-GAC provides idling reduction bumper stickers and signs within our region free of charge. Port Houston has been a major partner in developing and supporting this program, posting many idle reduction signs at the Turning Basin terminal within the Port.

The following organizations within the 8-county nonattainment region have anti-idling policies in place:

Alain Garcia Independent Trucking	Danbury ISD	Klein ISD Magnolia ISD
Alief ISD	Davenport Transportation & Rigging	Liberty ISD
Alvin ISD	Dickinson ISD	Museum Park Super Neighborhood
Angleton ISD	Fast Trac Transportation	North Forest ISD
AT&T	Fort Bend ISD	Our Lady Queen of Peace Catholic School
Barbers Hill ISD	Friendswood ISD	Pasadena ISD
Brazosport ISD	Galena Park ISD	Pearland ISD
Transportation Services	Galveston ISD	Santa Fe ISD
City of Galena Park	Goose Creek Consolidated ISD	Sheldon ISD
City of Houston	Harris County	Spring ISD
City of Houston Clear Creek ISD	High Island ISD	Sweeny ISD
Columbia-Brazoria ISD	Houston Astros	Texas City ISD
Conroe ISD Transportation Department	Houston Biodiesel	Tomball ISD
Cypress-Fairbanks ISD	Houston ISD	TxDOT
Transportation Department	Huffman ISD	UPS Waller ISD
Damon ISD	Humble ISD	Westside High School, HISD
	Jacinto City	
	Jose Alfaro Independent Trucking	

REGIONAL TCEQ TEXAS EMISSION REDUCTION PLAN (TERP)

The Texas Commission on Environmental Quality's (TCEQ) regional Texas Emission Reduction Plan (TERP) program - established by the 77th Texas Legislature in 2001, through enactment of Senate Bill (SB) 5 - has been an important voluntary project in Texas. TCEQ provides TERP funding for emission reduction projects to participants in Texas. These projects include a number of voluntary financial incentive programs (including Emission Reduction and Incentive Grants, Rebate Grants, Third-Party and American Recovery and Reinvestment Act Rebate Grants, as well as other assistance programs), to help improve the air quality in Texas. Between 2008 and 2013 TCEQ regional TERP has funded more than 3,200 vehicle replacements totaling more than \$160 million dollars. During the 84th Session of the Texas Legislature in 2015, the TERP program was extended for an additional two years with a 50% increase in funding. These TERP grants are estimated to reduce between 65 and 275 tons of PM emissions per year¹³.

¹³ ENVIRON 2014

REGIONAL TEXAS EMISSION REDUCTION PLAN (TERP)

The first H-GAC Regional TERP program has provided more than \$3 million in grant funds, resulting in more than 405 tons of NO_x emission reductions from on-road vehicles and off road equipment (Local Government and Drayage Loan Trucks). PM reductions were not enumerated, but are estimated to be in the range of 10 to 40 tons.

The second H-GAC Regional TERP program, which was open to Local Governments, provided \$78,015 grant funds to local fleets for a NO_x emission reduction of 7.8 tons from off road equipment. Again, PM reductions were not enumerated but estimated to be at least 0.2 to 0.7 tons.

CLEAN AIR EDUCATION

AIR QUALITY FORECAST AND PM ACTION DAY E-MAIL ALERT SYSTEM. TCEQ provides free e-mail alerts for the Today's Texas Air Quality Forecast and PM Action Days for several metropolitan areas throughout Texas, including the Houston area. The TCEQ informs the public typically a day in advance when conditions are forecast to be favorable for high PM levels in any of the participating areas

DRIVE CLEAN ACROSS TEXAS is the nation's first statewide public outreach and education campaign designed to raise awareness and change attitudes about air pollution.

OZONE VIEWER MOBILE APP. The Houston Clean Air Network (Houston CAN) is a coalition of clean air advocates and health, science and environmental professionals representing businesses, government agencies, schools, community groups and the general public. The Houston CAN in partnership with Air Alliance Houston, American Lung Association and others - has developed an Ozone Viewer Mobile App to help increase education and awareness surrounding air quality in our area. This app can be viewed online at: houstoncleanairnetwork.com.

AIR QUALITY REFERENCE GUIDE. The Air Quality Reference Guide provides up to date information about air pollution in the Houston-Galveston region.

DUST SUPPRESSION PROJECTS IN THE CLINTON DRIVE AREA

TCEQ, EPA Region 6, the City of Houston, Harris County Precinct 2, Port Houston, Port Terminal Railroad Association (PTRA) and local industry have partnered to address PM_{2.5} sources and implement dust suppression strategies to reduce PM_{2.5} emissions near the Clinton Drive area.

TCEQ approved a supplemental environmental project (SEP) to pave the parking lot directly adjacent to the Clinton Drive monitoring station. The paving was completed in Summer 2009.

The City of Houston has installed barriers to keep trucks from driving onto the unpaved shoulder. Additionally, a traffic light was installed at Clinton Drive and Industrial Park East to control traffic. Since implementation, these dust suppression projects have proven PM_{2.5} reduction benefits (not solely PM₁₀ benefits). Speciation data from the Clinton Drive monitor show decreases in dust and soil following the implementation of dust suppression measures.

Port Houston has established a program to regularly apply emulsified asphalt to reduce dust emissions at Industrial Park East (IPE) at the Turning Basin Terminal (since 2007). Port Houston has also paved 18 acres of land and 6,658 feet of the 6,783 feet of roadway at IPE. Since 2008, Port Houston has sprayed approximately 48 acres with emulsified asphalt. Additionally, DuPont, a previous tenant, no longer stores bulk fluorspar at IPE. While most of the road at IPE are now paved, the tenants' properties at IPE are still unpaved. Although they are sprayed with emulsified asphalt, standing water after a heavy rain can still cause dirt to be tracked out on the paved roads. To help with this, Port Houston is now improving the IPE storm water drainage infrastructure.

In the western part of the Turning Basin Terminal, Port Houston has also reconstructed the High Level Road at Turning Basin, which added capacity from two lanes to four lanes from the main entry gate off of I-610 to the Port Coordination Center. Before the reconstruction of High Level Road, trucks would pass other trucks that were stopped to make a turn by traveling in the dirt shoulder which would create dust. The widening of the road to 2 lanes each direction eliminates this practice and has reduced dust created from shoulders. Furthermore, the Port operates sweepers (about 1,600 hours a year) on High Level Road and have been working with our tenants to eliminate the dirt that is tracked out from their leased yards onto High Level Road.

In addition, industry has undertaken dust suppression efforts near the Port. The PTRAs has stopped steel loading activities on a dirt area to the south of the Clinton Drive monitor to reduce dust. Valero Asphalt paved its large land leases located across Clinton Drive to the southeast of the Clinton monitor.

CITY OF HOUSTON

RENEWABLE ENERGY

The City is the largest municipal purchaser of green power in the nation with more than 89 percent of the City's energy supply coming from either wind or solar sources. In 2017, the City expanded its portfolio with the addition of a 50 MW solar power purchase agreement which allows 100% solar power be used at City facilities such as the Houston Zoo, the Bob Lanier Public Works Building, passenger terminals at IAH, and wastewater treatment plants.

GREEN BUILDINGS AND ENERGY EFFICIENCY

For City buildings, there is an aggressive program in place to improve energy efficiency. So far, 6 million square feet of city facilities have been retrofitted and are reducing energy usage by 30 percent each year. By 2020, the City has also committed to improving energy efficiency by 20 percent at an additional 30 million square feet of facilities. The City has also adopted an aggressive stance on the creation of LEED certified buildings targeting Silver certification for all new construction. So far, this has resulted in the completion of 23 LEED certified projects with another nine currently being planned.

Green Fleets

Through the City's Houston Drives Electric program, Houston has become a leader in government electric vehicle (EV) fleets. Through this program, the City has recently added 27 Nissan Leafs to its vehicle fleet for a total of 42 electric and plug-in hybrid fleet vehicles. In addition to the purchase of these more efficient vehicles, the City has created the Houston Fleet Share program to serve as a central, shared motor pool. This has resulted in a 50% increase in vehicle utilization with more needs met using fewer vehicles. As a result, 44 older and less efficient vehicles have been sold and 84 others have been reassigned.

Participation in Department of Energy's (DOE) EV Project, with partner Ecotality, added 77 additional Blink charging stations in Houston, including 24 at the airports and 29 in downtown Houston. Through this program participants, including the City of Houston and other businesses, received charging stations at no cost and an additional credit to install the charging station. In addition, the City has offers 24-hour permitting for residential charging stations and is working on additional incentives to spur the adoption of EV technology.

ANTI-IDLING POLICIES

The City enacted an anti-idling ordinance for all motor vehicles over 14,000 pounds operated within the city limits of Houston and is actively enforcing this ordinance at 1-2 facilities with fleets, in response to citizen's complaints regarding facilities with idling delivery trucks.

HOUSTON AIRPORT SYSTEM EMISSIONS REDUCTIONS

To reduce emissions from flights, winglets are being utilized to reduce fuel consumption by 6%. Improvements to airfield runways, taxiways, and gates/ramp reduced aircraft taxi and idle times which resulted in both fuel consumption and associated emissions reductions and improved air quality. Additionally, the use of auxiliary power units (APUs). APUs are small on-board turbines that are operated to provide electrical power and air conditioning to an aircraft when it is parked at a gate and the main engines are shut down. Installation of gate electrification equipment enables parked aircraft to forego the use of APUs which results in a reduction in both jet-fuel consumption and associated emissions. In total, emission reductions from ground service equipment have resulted in a 75% NO_x reduction equal to 1.150 tons per day.

At Houston George Bush Intercontinental Airport, rental car companies formerly operated out of separate facilities located both on and off airport property. Houston Airport System constructed a Consolidated Rental Car Facility on airport property south of the terminal area which significantly reduced the mix of numbers, types, and ages of the existing buses operated by the various rental car companies. This resulted in a reduction in both diesel fuel consumption and associated emissions. A similar facility is being planned for William P. Hobby airport. In 2014, the IAH's Rental Car Bus Fleet was replaced with clean burning diesel engines, which resulted in PM_{2.5} and other emissions reductions.

BIKE SHARE PROGRAM

In 2015 the City of Houston was awarded a federal grant to expand Houston BCycle. This funding will more than triple the size of bike share in Houston over the next two years by adding 71 stations, 568 bikes and 2 transport vehicles to the existing bike share network. The network will be expanded to include the Texas Medical Center, Rice University, University of Houston, Texas Southern University, Near Northside and other surrounding neighborhoods.

METAL RECYCLERS TASK FORCE (MAPPS)

The City continues to collaborate with researchers from the University of Texas Health Science Center at Houston School of Public Health (who are in the lead) and Rice University, area metal recycling facilities, community members, and Air Alliance Houston in a project to study and address potential health risks associated with air emissions from metal recycling facilities in Houston.

This is a three-phase project. Phase 1 is currently being completed and consists of collaborators working to conduct outdoor air monitoring, determine health risks and describe residents' environmental health concerns. Phase 2 of the project consists of development and application of a Public Health Action Plan to recommend best emissions-mitigating-practices and educate the community, metal recyclers and policy makers about environmental health. Phase 3 of the project consists of follow up activities to evaluate the effectiveness of the Public Health Action Plan.

SAFE PASSAGE ORDINANCE AND COMPLETE STREETS POLICY

The City approved a Safe Passage ordinance in May 2013 to keep bicyclists and pedestrians safer on city streets and encourage more outdoor activity. In November 2013, Mayor Parker signed the Complete Streets Executive Order, which unveiled a transformative new policy for Houston streets to accommodate the needs of all users, not just those behind the wheel. The Complete Streets and Transportation Plan is meant to provide safe, accessible and convenient use by motorists, public transit riders, pedestrians, bicyclists, and people of all ages and abilities. In 2014, the City and BikeHouston created a bike safety campaign, Goal Zero, to enforce and educate motorists and cyclists about the Safe Passage Ordinance. Houston City Council adopted the Houston Bike Plan in March 2017. A key goal of the Bike Plan is to provide a safer bicycle network for people of all ages and abilities through improved facilities, education, and enforcement.

VOLUNTARY ENVIRONMENTAL COMPLIANCE AGREEMENTS

The City and industrial businesses have voluntarily implemented environmental compliance agreements that help reduce emissions. By these agreements businesses have modified operational controls minimizing particulate and visible emissions, such as from painting and abrasive blasting operations in the ship channel area.

CONCRETE BATCH PLANTS

There are approximately 180 concrete batch plants in the Houston area – twice as many as Dallas and the most of any area in Texas. A concrete batch plant is a facility that produces concrete. These facilities mix cement, sand, and water to make concrete and load it into trucks for delivery. If not properly controlled, these operations can expose residents to large amounts of particulate matter (fine dust). Particulate matter is a dangerous and widespread air pollutant that is associated with causing cardiovascular and respiratory harm, cancer, and premature death.¹⁴ Particulate matter produced during concrete batch plant operations may contain crystalline silica and metals.¹⁵ Last year, the City of Houston conducted an investigation of thirty-five concrete batch plants and discovered over forty violations including but not limited to, the lack of use of adequate dust controls and visible emissions leaving property lines among the most frequent. Given the increasing number of concrete batch plants in our region, efforts should be made to collaborate with the cement industry to ensure best practices are implemented to protect the public health of communities.

HARRIS COUNTY ENHANCED ENFORCEMENT PROGRAM FOR SMOKING VEHICLES

The Harris County Sheriff's Department, the Precinct 4 Constable's Office, and the Precinct 5 Constable's Office have implemented an emissions enforcement program to ensure that all vehicles on our roads are in compliance with air quality standards. This enforcement program is conducted in collaboration with the Harris County District Attorney's office, the Harris County Judge's office, the Harris County Attorney's office, the Texas Department of Public Safety, and the Houston-Galveston Area Council. Law enforcement personnel target high emitting vehicles, smoking vehicles, and suspicious vehicles to verify that the state inspection certificates attached to these vehicles are legitimate.

METROPOLITAN TRANSIT AUTHORITY OF HARRIS COUNTY

LIGHT RAIL EXPANSION & NEW BUS NETWORK

The Metropolitan Transit Authority of Harris County (METRO) operates 3 light rail lines, 77 local bus routes (including two free downtown circulators), and 31 Park & Ride commuter bus routes as part of its fixed-route system. The original 7.5-mile Red Line light rail opened in January 2004. But the recent additions of the North Line light rail extension in May of 2014 and the opening of the Green and Purple Lines in May 2015 have increased the light rail system's total mileage to 22.5 miles. These openings contributed to annual boardings on METRORail increasing 64% from FY2013 to FY2016. Additionally, METRO implemented a complete overhaul of the local bus network (termed "New Bus Network") in August 2015 to curtail declining ridership and improve service by moving to a frequency-based network. By the close of FY2016, local bus ridership increased 2% over FY2015.

¹⁴ U.S. Environmental Protection Agency, *Integrated Science Assessment for Particulate Matter*, December 2009. EPA 600/R-08/139F

¹⁵ <https://www3.epa.gov/ttnchie1/ap42/ch11/final/c11s12.pdf>

BUS FLEET

As of September 30, 2016, METRO operated a fleet of 1,239 buses devoted to fixed-route service, which handled 67.1 million boardings in Fiscal Year 2016.¹⁶ The fleet includes 437 clean running, diesel-electric hybrid technology buses (37% of the fleet) and an additional 50 compressed natural gas (CNG) buses (4% of the fleet), both of which contribute to PM reductions for the HGB region.

METRO BIKES ON BUSES

There are a growing number of bicycle and pedestrian paths and walkways and a concentrated effort to connect these walkways with activity centers and transit nodes. All METRO buses are equipped with bike racks, with the exception of park and ride buses (which have cargo areas for bike storage). METRO's annual bike boardings continue to increase from 2011 through 2016. In METRO's FY2013, there were 167,421 bike boardings that were recorded and in FY 2014 that number increased by 50% to 251,072 and by another 4.6% in FY 2016, totaling 262,649 bike boardings.¹⁷

PORT HOUSTON

BAYPORT EXPANSION AND INCREASED EFFICIENCY

Port Houston was awarded a \$10 million Transportation Investment Generating Economic Recovery (TIGER) grant in 2013 to be used toward the expansion of the berth at its Bayport Container Terminal. The grant is funding the extension of Bayport's wharf and the purchase of three new all-electric, rail-mounted gantry cranes to handle the increase in container throughput. The project will allow Bayport to handle more than 2 million 20-foot-equivalent units (TEUs), doubling its present capacity, and will help support international trade with more than 1,000 ports in more than 200 countries. Increased productivity as a result of the expansion is projected to reduce truck waiting and idling times by an estimated 7.6 minutes on average.

CLEANER, MORE-EFFICIENTLY OPERATING CRANES

Port of Houston recently replaced ten (10) Tier-2 755-horsepower rubber-tire gantry cranes (RTGs) at Barbours Cut with eight (8) newer Tier-3 665-horsepower RTGs. These RTGs will operate approximately 2,500 hours a year and will be able to handle the same amount of cargo plus additional cargo as the eight retired cranes because the older cranes averaged about 4 moves an hour while the new cranes average about 12 to 15 moves per hour. The increased efficiency associated with these cleaner, faster cranes reduces the truck idling and associated emissions at the Port.

LYNX AND CONTAINER TRACKING MOBILE APP

Port Houston's online information system that tracks vessel arrivals and container movements at its Barbours Cut and Bayport terminals is called Lynx. The Port has recently expanded access to Lynx to trucking companies and cargo owners so that container availability can be tracked and the trucking company can be automatically notified when a container is ready for pickup. Additionally, the Port has

¹⁶ METRO's Fiscal Year 2016 is October 1, 2015 through September 30, 2016

¹⁷ Metro Bike Boarding Running Count FY 2011 - FY 2016

developed a mobile app that allows drivers to check on the status of a container and its pick up availability. Information on how to access Lynx online and how to access the mobile app can found at: <http://porthouston.com/portweb/terminal-toolbox/container-terminals/access-to-shipping-information/>.

The expanded access to Port Houston container status at its container terminals through Lynx and the mobile app reduces unwarranted truck trips to the terminals and therefore results in less criteria pollutant emissions.

BAYPORT TERMINAL OPERATIONAL IMPROVEMENTS

The stop sign at the truck exit at the Bayport Container Terminal has been removed and Port Road has been restriped to allow two lanes of truck traffic to exit without stopping. This eliminates idling for all trucks exiting Bayport plus eliminates a source of congestion during peak times.

GATE AUTOMATION

Port Houston has implemented an automated gate system with optical character recognition (OCR) portal to automate equipment identification, traffic processing and damage inspection imaging at the entry gate of the Barbours Cut and Bayport container terminals. The system automatically identifies containers, chassis, and license plates associated with the equipment. Since implementation, gate OCR installation enabled Port Houston to process trucks twice as fast and reduced idling time by 48%, dramatically reducing emissions.

PARTNERSHIPS

As part of Port Houston's efforts to exchange older engines with cleaner burning technologies, the Port created public/private partnerships with tenants and stakeholders to implement emission reduction strategies and policies. Port Houston has established a proven track-record in securing state and federal grants for emission reduction benefits for Port and Port tenant and stakeholder engines and equipment.

Through the 2009 American Recovery and Reinvestment Act (ARRA)/Diesel Emission Reduction Act (DERA), the Port and six tenant/stakeholder partners used \$2.8 million in grant funds for the replacement, repower and retrofit of 115 diesel engines used in port activity which will result in lifetime reduction 6 tons of PM_{2.5}. Furthermore, the Port provided \$50,000 in matching dollars as leverage for a \$9 million EPA SmartWay grant to fund the revolving Drayage Loan Program

In 2010 the Port was also awarded a DERA grant of \$1.5 million to cover the incremental costs associated with fuel switching activities for all Maersk vessels calling at the Port's container terminals prior to the EPA's mandated North America Emission Control Area implementation in 2012. The fleet of 26 vessels performed 163 vessel calls and fuel switches which resulted in a decrease in emissions of 32 tons of PM_{2.5}.

In early 2015, the Port was awarded almost \$1.8 million dollars for two different DERA grants that will be used to replace older drayage trucks. The funds from one grant are passed through to H-GAC to fund an expansion to its Houston-Galveston Drayage Truck Program. This grant is expected to replace 14 older on-road drayage trucks with newer 2010 model year compliant drayage trucks and is expected to reduce 2.5

tons of PM_{2.5} over the lifetime of the trucks. The funds from the second grant are passed through to two (2) of Port Houston's tenants and will replace 25 older drayage trucks (13 on-road trucks used only on Port Houston turning basin terminal and 12 on-road terminal tractors used to pick up containers at the Bayport and Barbours Cut terminals) with newer on-road terminal tractors with 2010 model year compliant on-road engines. This grant is expected to reduce 5.03 tons of PM_{2.5} over the life of the trucks.

Regional partners, including the Port, planned to apply for additional DERA funding during the 2016 funding opportunity however were unable to finalize a submitting during this year. However, the Port has applied for DERA funding in 2017 for Port owned work trucks and buses. It is expected that these projects will result in further PM_{2.5} reductions within the region.

TEXAS DEPARTMENT OF TRANSPORTATION

The Texas Department of Transportation (TxDOT) has been working to reduce both NO_x and PM_{2.5} through a variety of different strategies. TxDOT has encouraged contractors in both construction and maintenance to limit work hours to times which would have the least impact on air quality. For construction contractors in high-volume corridors, this includes limiting construction to night time and other off-peak periods. For maintenance contractors, this focuses on curtailing work during ozone action days. In addition, for TxDOT staff is encouraged to limit idling of agency vehicles when possible.

In addition to these efforts, TxDOT has also undertaken a multi-year project to expand the use of alternative fueled vehicles for areas within the so-called TERP Triangle. A roughly triangular region with vertices in Houston, San Antonio, And Dallas-Fort Worth that includes most of the major metropolitan areas in the State of Texas. This program will work to replace older gasoline and diesel vehicles with new, alternative fueled models, including all-electric one. The first phase of this project will focus on the HGB area and will take place in the biennium that includes 2018 and 2019.

RAILROAD PROJECTS

ANTI-IDLING ENGINE CONTROLS

Approximately 75% of Union Pacific (UP) switcher engines operating in the HGB area have anti-idling controls, which reduce PM emissions. This is an improvement over 60% as reported in the 2016 version of this report.

REFURBISHED SWITCHER AND LOW EMISSION ENGINES

The Port Terminal Railroad Association (PTRA) and UP are operating newly refurbished switcher engines on the Clinton line. UP currently has 51 new low-emission genset¹⁸ engines in the Houston area. In addition, UP has 13 Tier 2 locomotives funded by Texas Emissions Reduction Plan (TERP). At present, there are no

¹⁸ Genset locomotives are powered by ultra-low-emission diesel engines that are connected to electric generators, thus the name "Generator-Set," or "Genset" switcher. http://www.tceq.texas.gov/assets/public/implementation/air/sip/hgb/hgb_mveb_2012/12002SIP_ado_complete.pdf

Tier 4 locomotives assigned to the Houston region, however it is likely that a number of the vehicles are operating within the Houston region at a given time.

REGULATORY PROJECTS

A number of regulatory projects have reduced fine particulate matter emissions in the HGB region. Some of these initiatives are outlined below.

EPA'S CONTROL OF EMISSIONS FROM SHIPS

In March 2010, the International Marine Organization (IMO) officially designated waters off North American coasts as an Emission Control Area (ECA) with stringent international emission standards for ships. The first-phase fuel sulfur standard began in 2012, which required that all marine diesel fuels used by ships in the North American ECA be limited to a maximum fuel sulfur content of 10,000 ppm (1 %). In January 2015, a more stringent maximum of 1,000 ppm (0.1 percent) came into force for all ships in the North American ECA. It is anticipated that the implementation of the ECA will reduce PM_{2.5} shipping emissions in the Gulf Coast region by 86%.

FEDERAL MOTOR VEHICLE CONTROL PROGRAM

The Federal Motor Vehicle Control Program has significantly reduced exhaust emissions from both light duty and heavy duty vehicles in the HGB area.

INDUSTRY PROJECTS

As of January 2011, approximately 90% of the nation's refinery capacity is under lodged or entered 'global' settlements to reduce SO₂ emissions at both refineries and sulfuric acid plants¹⁹.

An East Harris County company reduced particulate emissions by an estimated 24 tons per year during 2005 to 2007 with several projects including boiler shutdown, process changes and cooling tower equipment upgrades. Another company upgraded cooling tower equipment and decreased particulate emissions (quantity not estimated).

Shell Deer Park made several equipment upgrades that reduced particulate and/or sulfur dioxide emissions, including the 2003 installation of a wet gas scrubber on refinery's cat cracker, resulting in the reduction of 61 tpy of PM and 4674 tpy of SO₂²⁰. Shell also installed a flare gas recovery compressor system on the Deer Park Refinery's East Property Flare at end of 2012—resulting in the reduction of 2475 tons of SO₂²¹ annually.

Valero Refining has implemented control measures to reduce SO₂ emissions by 3,500 tpy. The Rhodia sulfuric acid plant was projected to decrease its SO₂ emissions by 8,984 tons per year from 2005 to 2012.

¹⁹ <http://www2.epa.gov/sites/production/files/documents/refineryinitiative-powerpoint021111.pdf>

²⁰ Based on comparison of 2002/2003 emissions to 2004/2005 emissions

²¹ Based on comparison of 2011 emissions versus 2013 preliminary-AEI emissions

The Dow Chemical Company completed several shutdowns and upgrades to facilities at Freeport and Deer Park that reduced PM emissions by 192.97 tpy. These projects include: a shutdown of the Acetylene plant (Deer Park), 2008; Latex plant shutdown (Freeport), 2009; Upgrades to the Dow Pyridine derivatives facility and cooling tower (Freeport), 2009; Power 3, Power 6 and Poly 2 facilities shutdown (Freeport), 2010; EDC VCM facility shutdown (Freeport), 2011; Styrene 1, 2, EBA and distribution facilities shutdown (Freeport), 2012; and improvements to HT cooling Tower in Deer Park, including drift eliminators, 2013.

ENERGY EFFICIENCY IN HGB

In 1999, the Public Utility Commission of Texas (PUCT) adopted rules for the state's Renewable Energy Mandate, establishing a renewable portfolio standard (RPS), a renewable-energy credit (REC) trading program, and renewable-energy purchase requirements for competitive retailers in Texas²².

The State has established the Texas Energy Efficiency resource goal of 20% incremental load growth in 2011, which is equivalent to approximately 0.10% annual savings, with 25% in 2012, 30% in 2013 and onward²³.

In Fort Bend County, NRG Energy added a 75-megawatt natural gas generating unit to its W.A. Parish power plant. This natural gas unit has higher energy efficiency and less PM_{2.5} emissions than a conventional power plant.

Port Houston also increased its renewable energy purchases from 25% to 30%.

POTENTIAL AND FUTURE PROJECTS

These ideas are NOT commitments of future action. They are merely ideas, and their implementation would be contingent on funding availability, and an affirmative commitment from the proposing agency. All ideas are voluntary and would result in PM benefits.

AIR QUALITY PROGRAMS & PARTNER PROJECTS

CLEAN VEHICLES & CLEAN SCHOOL BUS PROGRAMS

The Clean Vehicles Program will continue to provide significant emission reductions within our region. This program has funded replacements of school buses, private fleets, drayage trucks, transit vehicles and more. Since its start, the program has provided more than \$78 million in financial aid, replaced more than 2,700 engines and developed several alternative fueling stations. In the future, the Clean Vehicles Program will target heavy-duty fleet replacements which will continue to result in both PM and NO_x emission reductions for the region.

In 2015, EPA awarded a total of \$240,000 to three school districts in Texas to replace older diesel school buses with new buses that emit 90 percent cleaner emissions²⁴. The Aldine Independent, Lone Star Public School and Spring Branch Independent School Districts will receive rebates through EPA's Diesel

²² http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX03R&re=1&ee=1

²³ <http://www.aceee.org/sector/state-policy/texas>

²⁴ <http://www.epa.gov/cleandiesel/dera-rebate-schoolbus.htm>

Emissions Reduction Act to replace 12 of their existing diesel school buses. Since 2008, the DERA program has funded more than 600 clean diesel projects across the country. These projects have reduced emissions for more than 60,000 engines. Over 500 school bus fleets applied to EPA's Rebate Program, requesting more than \$32 million in funding.

DOE ZERO-EMISSION DELIVERY VEHICLE DEMONSTRATION PROJECT

The goal of H-GAC's Zero Emission Truck project is to demonstrate the effectiveness of all-electric delivery vehicles in the Houston region. H-GAC received more than \$2 million from the U.S. Department of Energy for this project. H-GAC has partnered with United Parcel Service (UPS) and Workhorse to develop, assemble, and deploy all-electric delivery vehicles along with an electric vehicle charging station (EVSE) for each vehicle at facilities within the HGB region. This has resulted in the deployment of 18 of these all-electric vehicles on regional roads. These vehicles will be tested over two years to measure emission reductions and evaluate vehicle performance. It is anticipated that an additional 12 vehicles will be deployed with local fleets before completion of the project. By deploying zero emission trucks, the project will reduce petroleum consumption and emissions of harmful air pollutants, including PM.

REGIONAL TERP

H-GAC received \$3 million from TCEQ to establish the second Regional Texas Emission Reduction Program (TERP). The Regional TERP provided grants to local governments for the replacement of non-road equipment and on-road vehicles powered by heavy duty diesel engines, and aids in the replacement of drayage trucks associated with the Drayage Loan Program. Regional TERP grant amounts are based upon the NO_x reduction created by the equipment and vehicle replacement. These replacements will also result in PM_{2.5} reductions in the HGB area.

EXPANSION OF MASS EMISSIONS CAP AND TRADE PROGRAM

In Texas, the Mass Emissions Cap and Trade Program (MECT) is a market-based cap and trade program that implements an annual NO_x emissions cap for major source facilities within the Houston-Galveston-Brazoria ozone nonattainment area. H-GAC and other local stakeholders including ExxonMobil, Environmental Defense Fund, and others have been working with TCEQ to expand the existing MECT program to allow the inclusion of exhaust capture systems and emissions treatment systems for oceangoing vessels and locomotives as eligible candidates for the cap and trade program. At present, these facilities are not eligible to participate in the program. It is anticipated that, should they become part of the program, that they will help to encourage the introduction and expansion of these control measures within the region.

CLEAN AIR EDUCATION

PM FILTER OUTREACH CAMPAIGN

H-GAC is considering the potential application and impact of a PM filter outreach and education campaign for truck drivers. Diesel particulate filters are ceramic devices that collect PM in exhaust steam. The high temperature of the exhaust heats the ceramic structure and allows the particles inside to break down (or oxidize) into less harmful components. When maintained correctly, PM filters reduce emissions of PM,

hydrocarbons and carbon monoxide by 60 to 90 percent²⁵. To function appropriately, manufacturers recommend that filters be cleaned every 100,000 miles to prevent clogged filters. The educational component of this campaign would focus on appropriate use and maintenance of PM filters and associated emission reduction technology.

HOUSTON INDEPENDENT SCHOOL DISTRICT (HISD)

HISD ELECTRIC VEHICLE SCHOOL BUS DEMONSTRATION PROJECT

This potential future project is being led by National Strategies LLC as part of a commitment made under the Clinton Global Initiative (CGI), with the support of Houston Independent School District (HISD), TransPower and NRG and others. The demonstration project being considered includes the repower of 4 conventional type-C HISD school buses to all-electric, battery powered vehicles (EV) with vehicle-to-grid (V2G) technology and vehicle-to-building (V2B) capability. The project duration is anticipated to be 2.5 to 3 years, including a 9-month bus operation cycle in summer and winter seasons with a total cost of approximately \$2 million. The overall objectives of the project are to demonstrate the economic viability and air quality benefits of EV V2G school buses in order to speed the adoption of zero-emission school buses and associated emission reductions across the U.S.

CITY OF HOUSTON

RENEWABLE ENERGY

In 2014, EPA recognized the City of Houston for its use of green power practices and technologies²⁶. Houston signed a two-year agreement to purchase more than 620 million kilowatt-hours of certified renewable energy certificates from wind projects. This purchase accounts for half of the city's municipal power needs and make Houston the largest municipal purchaser of renewable power in the Green Power Partnership. The City is planning to continue to expand this renewable energy portfolio through the construction of 30 MW of solar power which will be used to power City facilities.

PORT HOUSTON²⁷

FUTURE DUST SUPPRESSION PROJECTS

Fugitive road dust entrainment rates, whether from parking lots or on the transit network, depend upon the dust loading, vehicle speed and number of vehicles. Dust loading has been controlled by paving unpaved surfaces and regular pavement cleaning or watering or other treatment of unpaved surfaces. The

²⁵ EPA http://www.epa.gov/region1/eco/diesel/pdfs/particulate_matter_filter_fact%20sheet.pdf

²⁶ <http://www.epa.gov/greenpower/awards/winners.htm>

²⁷ These ideas are NOT commitments of future action. They are merely ideas, and their implementation would be contingent on funding availability, and an affirmative commitment from the proposing agency. These ideas can be considered as factors in the PM Advance discussion, but they themselves are not open for discussion before RAQPAC. All ideas are voluntary and would result in PM benefits. Contingent on funding, and in conjunction with TxDOT, railroads, the City of Houston, H-GAC, and Harris County

benefits of these programs are proportional to the activity on those surfaces. Analysis of these projects is relatively straightforward given the level of activity and understanding of the dust loading of those areas.

Port Houston is planning dust suppression projects in future years. Approximately 30 acres will continue to have emulsified asphalt sprayed following this initial effort.

BROADWAY DOUBLE TRACK PROJECT

Access to the entire rail network serving the south side of the Houston Ship Channel (HSC) is constrained by a short, but critical bottleneck segment of single track. Port Houston owns the track segment, which is operated by Port Terminal Railroad Association (PTRA). All trains serving the industrial and port facilities on the south side of the HSC must operate over this 0.28-mile segment of single track, which includes a single-track bridge over Broadway Street

To remedy this, the construction of a second track through this bottleneck segment is needed and the Port was successful in getting this project into the H-GAC Transportation Improvement Program (TIP). Having two main tracks on this segment would reduce delays to trains awaiting clearance to enter onto the single track, improving the flow of cargoes to and from industrial and port facilities and reducing emissions. The single-track segment already is operating above its original design capacity which is causing 2 1/2 hours of train delay per day, and will become totally constrained in 2018. The additional capacity provided by a second track would be sufficient to handle anticipated volume growth for the next thirty years.

NATURAL GAS

Port Houston will be working with CenterPoint Energy on a feasibility study for converting diesel powered terminal tractors to natural gas.

BARBOURS CUT AND BAYPORT EXTENDED GATE HOURS

To respond to the increases resin production that will come on line in last quarter of 2017 that will be exported through the Port Houston, container terminals, the Port plans to extend gate hours at its Bayport and Barboours Cut container terminals. This will help reduce any potential congestion from the expected increased traffic as well as allow other container truck traffic the availability to come at night and not contribute to peak traffic during the day.

OTHER REGIONAL PORT PROJECTS

OVERWEIGHT CONTAINER ROUTE BETWEEN HGB REGION PORTS

An overweight or dedicated truck route can improve emissions by reducing stop-and-go emissions and reducing the number of truck trips. During the most recent rulemaking session, the Texas legislature passed a rule that allows shipping companies to purchase permits that allow overweight trucks on regional roads. These rules may allow more cargo to be shipped with fewer trucks as well as help to smooth traffic flow around Port areas which can result in improved emissions. In other transportation measures, such as traffic signal improvements, traffic flow improvements have been shown to reduce emissions rates by fine

(5) to ten (10) percent for regional fleets. The relative benefit may be higher with heavy-duty trucks than for light-duty vehicles because braking, idling, and acceleration are high emissions modes for trucks.

Overall emission reductions will also depend on the dedicated truck routes and the expected usage of routes. Other considerations include whether infrastructure costs are incurred to allow overweight trucks, create grade separation, or overcome obstacles to allow such trucks routes to be constructed.

RAILROAD PROJECTS

REPLACEMENT OF RAILROAD SWITCHER ENGINES

In the Houston area, there has been discussion regarding a potential future railroad demonstration project involving the replacement of traditional switcher engines with natural-gas-powered engines. Powering long-haul locomotives with LNG would result in PM reduction benefits for the HGB region.

REGULATORY PROJECTS

TIER-3 MOTOR VEHICLE FUEL AND EMISSION STANDARDS

The Tier-3 emission standards include a lower PM emission standard for light-duty gasoline vehicles beginning in 2017 and phasing in through 2025. This means that in addition to the 2007 PM standards for heavy-duty diesel that is reducing PM emissions in the near term, as the fleet turns over, on-road vehicle PM emissions will continue to decrease in the future. The table below shows the effect of Tier-3 emission standards in years 2018 and 2030.

Comparison of Emission Reductions from On-Road Inventories ²⁸				
Pollutant	2018		2030	
	National Inventory Reduction	Air Quality Inventory Reduction	National Inventory Reduction	Air Quality Inventory Reduction
PM _{2.5}	-0.1%	-0.4%	-10.0%	-10.4%
NO _x	-9.6%	-9.9%	-24.6%	-25.5%
VOC	-2.8%	-2.4%	-15.5%	-14.4%
CO	-1.6%	-1.6%	-23.4%	-25.3%
SO ₂	-56.3%	-55.9%	-55.7%	-55.0%

²⁸ <http://www.epa.gov/otaq/tier3.htm>

CONCLUSION

H-GAC's participation in PM Advance has been, and continues to be, a successful example of voluntary collaboration between local government, business, industry, citizens, and environmental groups in our region. In the past, the HGB region has faced potential nonattainment designations for PM. Since that time, our region has made significant improvements and successfully avoided nonattainment status in 2015.

This Path Forward document continues a framework for the region to continue to meet air quality standards and achieve the Program mission to encourage voluntary accelerated implementation of current clean air strategies and programs. Our region needs to continue to collectively work together to better understand PM. Future growth will inevitably impact particulate matter emissions in our region—whether due to population, industry or economic growth. Through this program, we will continue to work together to understand regional PM emissions and meet our air quality and attainment goals.