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Connecticut Emissions Program

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April 17, 2017

Lt. Chris Smith
Division Manager
Department of Motor Vehicles
Emissions Division
60 State Street
Wethersfield, CT 06161

Re: **2016 On-Road Vehicle Survey**

Dear Lt. Smith:

In accordance with Section 2.6.6 of Contract DMV-EM-11-001, Applus Technologies, Inc. is pleased to provide the enclosed On-Road Vehicle Survey for 2016.

Pursuant to Title 40 of the Code of Federal Regulations, Sections §51.351 and §51.371, the EPA outlines the requirement for an out-of-cycle emissions test for program evaluation on at least 0.5% of the vehicle fleet tested or 20,000 vehicles, whichever is less. During a typical testing cycle, the Connecticut Vehicle Inspection Program ("CT VIP") performs approximately 2.2 million emissions tests every two years. Therefore, the target number for collection is roughly 11,000 valid "reads", however, for 2016 we targeted 15,000.

Since 2005, on-road vehicle surveys have been performed using remote sensing devices instead of the more intrusive roadside pullovers. Utilizing remote sensing technology remains the preferred and most cost-effective method for completing this survey for the State of Connecticut. For the 2016 study, Applus once again enlisted Hager Environmental & Atmospheric Technologies ("H.E.A.T."), to perform the data and emissions collection. Applus worked closely with H.E.A.T. to analyze the data and complete the attached report.

In total, H.E.A.T. captured 39,184 qualified measurements over a five-day span during the month of August 2016. That number was reduced to 33,942, after filtering out vehicles with unreadable plates, commercial vehicles, motorcycles, and vehicles from other jurisdictions.

The sample was further reduced once the license plates were matched to the vehicle data provided by Applus from the Emissions Data Base Management System ("EDBMS"); in total 18,182 were successfully matched. Another 1,553 had to be excluded for interfering plumes from another lane or vehicle, which resulted with a final sample of 16,629 vehicles/reads. As the report explains, a small percentage of the vehicles were identified as high emitters. High emitting vehicles were identified as those exceeding cut points used in past remote sensing studies (500 ppm HC, 3% CO, 2000 ppm NO). In total, 195 vehicles exceeded at least one of these cut points. To complete a thorough review, H.E.A.T. provided images for

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all 195 vehicles. Applus analyzed each image and matched the vehicle information to the EDBMS registration data with a high success rate; only four vehicles were not matched. These four included two heavy-duty vehicles and two vehicles with dealer/repair plates. In total, eighteen vehicles were identified as exempt at the time of the study or unknown, which reduced the number to 177 vehicles.

After completing the analysis of the remaining 177 vehicles, 47 vehicles were not in compliance with the emissions testing requirement at the time of the study. Since the study, nine vehicles were tested, passed, and are in full compliance leaving 38 vehicles. Of the 38 remaining vehicles, 21 had the registration status set to inactive at the time of the study or became inactive since August 2016. In addition, two vehicles have become non-compliant since the study.

The remaining 17 vehicles continue to have valid registrations, however, are not compliant for the emissions testing requirement. These vehicles are either grievously overdue for an emissions test or failed, and in some cases have never returned.

| | |
|---|---|
| Total High Emitters: | **195** |
| In compliance at the time study: | **130** |
| Exempt/Unknown: | **18** |
| In compliance since the study: | **9** |
| Registrations inactive or became inactive since August 2016: | **21** |
| Non-Compliant with current active registrations: | **17** |

An image library of the 195 vehicles was provided, via an FTP site, on Tuesday, March 7, 2017, for the DMV's review. Enclosed with the report you'll find the list of the 195 unique license plate numbers, along with images of 40 vehicles. These images represent the 38 vehicles that were non-compliant at the time of the study and the two vehicles that since became non-compliant.

Should you have any questions related to the report completed by H.E.A.T., or the summary completed by Applus, or require additional information please feel free to contact me.

Sincerely,

Mario DaPonte

Mario Daponte
Program Manager
Connecticut Vehicle Inspection Program

CC: Mr. John Getsie, CT DMV
Mr. Richard Pirolli, CT DEEP
Mr. Darrin Green, Chief Executive Officer and Country Manager US, Applus Technologies, Inc.
Ms. Brenda Ackarman-Sioson, Director of Operations, Applus Technologies, Inc.

# Connecticut Emissions and Safety Program

# 2016 On-Road Vehicle Survey

PREPARED FOR:

AND

## THE STATE OF CONNECTICUT DEPARTMENT OF MOTOR VEHICLES

December 6, 2016

# Connecticut Emissions and Safety Program

# 2016 On-Road Vehicle Survey

Prepared for:

Darrin Greene
**Applus Technologies**
444 North Michigan Avenue, Suite 1110
Chicago, IL 60611

December 6, 2016

Prepared By:

**Hager Environmental & Atmospheric Technologies (H.E.A.T.)**

Dr. Stewart Hager

539 Milwaukee Way

Knoxville TN, 37932

865-288-7890

www.HEATremotesensing.com

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Connecticut Emissions and Safety Program
2016 On-Road Vehicle Survey

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## TABLE OF EXHIBITS

## TABLE OF ABBREVIATIONS

| | |
|---|---|
| 2D | Two Dimensional |
| ASM | Acceleration Simulation Mode |
| BAR | California Bureau of Automotive Repair |
| C | Degrees Celsius |
| CFR | Code of Federal Regulations |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| DOT | US Department of Transportation |
| EDAR | Emission Detection And Reporting |
| EPA | US Environmental Protection Agency |
| F | Degrees Fahrenheit |
| FTP | US Federal Test Procedure for certifying vehicles |
| g/mi | Grams per mile |
| GVWR | Gross Vehicle Weight Rating |
| HEAT | Hager Environmental & Atmospheric Technologies |
| HC | Hydrocarbon(s) |
| I/M | Inspection and Maintenance |
| IM240 | Vehicle emissions test driven on a dynamometer, 240 seconds in length |
| kg | Kilograms |
| kw | Kilowatts |
| lbs | Pounds |
| LDGV | Light Duty Gasoline Vehicle |
| LDGT | Light Duty Gasoline Truck |
| m | Meter |
| n | Number of samples |
| NO | Nitric Oxide |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Oxides of Nitrogen |
| OBDII | On Board Diagnostics, Second Generation |
| OREMS | On-Road Emissions Measurement Standards |
| PEMS | Portable Emissions Monitoring System |
| ppm | Parts Per Million |
| QA | Quality Assurance |
| QC | Quality Control |
| SNR | Signal to Noise Ratio |
| t | Ton |
| TPD | Tons per Day (of pollutant emissions) |
| TSI | Two Speed Idle emissions test |
| VIN | Vehicle Identification Number |
| VIP | Vehicle Inspection Program |
| VMT | Vehicle Miles Traveled |
| VSP | Vehicle Specific Power |

# 1 EXECUTIVE SUMMARY

As part of the biennial reporting to the EPA, the State of Connecticut Department of Motor Vehicles (DMV) requires the Connecticut Vehicle Inspection Program (CT VIP) to perform on-road emissions testing for program evaluations, as specified in 40CFR §51.351 and §51.371.

According to 40CFR §51.351 and §51.371, on-road emissions testing is not required on every vehicle or in every season. However, the requirement includes the testing of at least 0.5% of the subject vehicle population, or 20,000 vehicles; whichever is less. In the case of Connecticut, 0.5% of the testable vehicle fleet is just under 11,000 vehicles.

The on-road emission testing study is required to test vehicles out of its normal periodic testing cycle, for Hydrocarbons (HC), Carbon Monoxide (CO), Nitrogen Oxides ($NO_x$) and Carbon Dioxide ($CO_2$). The on-road emissions testing data is then compared to the most recent periodic test data for program evaluation. This can be accomplished by measuring on-road emissions through roadside pullovers or with the use of remote sensing devices. Roadside pullovers can include tailpipe and/or evaporative emission testing or a check of the onboard diagnostic (OBD) system. Since roadside pullovers can be considered intrusive, Connecticut has opted to use the non-intrusive remote sensing method. In addition, 40CFR §51.371 provides guidance to notify owners and require an out of cycle emissions inspection for vehicles identified as a high emitter through the on-road emissions testing survey.

In 2014, Applus Technologies, the contractor for the CT VIP, subcontracted with Hager Environmental & Atmospheric Technologies (HEAT) to perform the study using their proprietary Emissions Detecting and Reporting (EDAR) on-road remote sensing system.

For the 2016 biennial report, Applus Technologies once again contracted the services of HEAT. HEAT designed and performed the study in accordance with the requirements set in 40CFR Section §51. HEAT's proprietary EDAR on-road remote sensing system was used to measure the required pollutants and collect associated data such as speed, acceleration, license plate, etc. The EDAR also allows for the measurement of exhaust temperature (to determine if the vehicle was warmed up) and the ability to determine vehicle shape. This report contains the collected emissions testing data and results of analysis of the data.

The Connecticut on-road remote emissions survey was performed in the month of August of 2016. The survey was completed in 67.5 hours of active testing time, over a period of five days, at nine different locations, resulting in 43,080 measurements.

Due to vehicles outside of the allowed Vehicle Specific Power (VSP) limits (3 to 22 kW/t) 3,896 measurements were excluded, resulting in a total of 39,184 qualified measurements. Of those measured vehicles, 1,239 had unreadable plates, which further reduced the valid samples to 37,945. Commercial vehicles and motorcycles from Connecticut and other states represented another 1,681 samples. However, since the CT VIP does not currently test commercial vehicles or motorcycles, these samples were also excluded from the overall analysis.

In addition, 2,322 vehicles were from states other than Connecticut. This reduced the valid samples of Connecticut vehicles to 33,942 with valid and complete sample information (speed, acceleration, emission measurements).

The 33,942 samples were compared to registration data provided by Applus. In total, 18,182 vehicles were successfully matched. Analysis of the emissions data for the 18,182 vehicles, found that 1,553 had to be excluded due to interfering plumes (emissions from vehicles in adjoining lanes also being measured, etc.) resulting in a final sample of 16,629 vehicles. The survey identified a small percentage of the vehicles as high emitters (1.2% of the final sample). High emitting vehicles were identified as those exceeding cut points used in past remote sensing studies (500 ppm HC, 3% CO, 2000 ppm NO). In total, 195 vehicles exceeded at least one of these cut points. Vehicle data will be provided to DMV and Applus to allow for motorist notification or further evaluation. Please reference Section 4 on page 30 of this report for a detailed breakdown of high emitters.

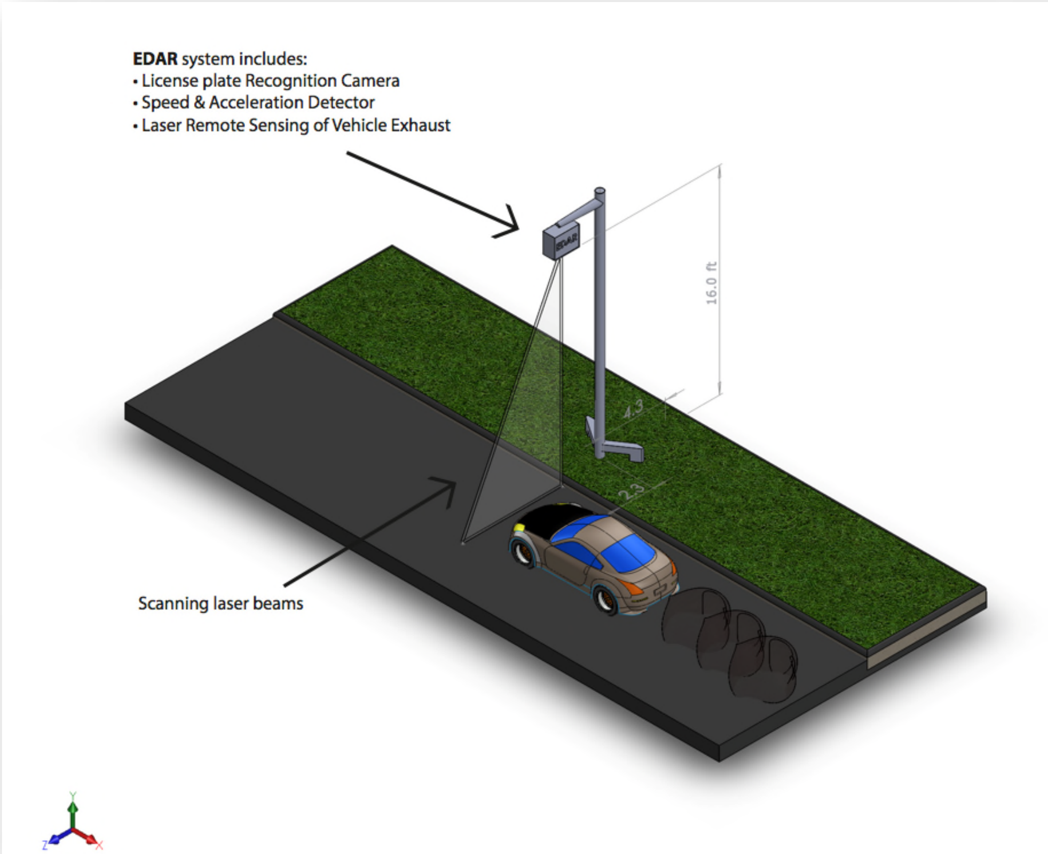
# 2 STUDY DESIGN

## 2.1 Equipment Description

The Connecticut study was performed using HEAT's proprietary EDAR (Emission Detection And Reporting) on-road remote sensing system. EDAR is an eye-safe laser-based technology capable of remotely detecting and measuring the infrared absorption of environmentally critical gases coming out of virtually any moving vehicle: specifically, pollutants emitted by in-use vehicles. EDAR measures the entire exhaust plume as the vehicle passes allowing for the determination of the mass emission rates of the vehicle. Infrared lasers are scattered off the road surface and the back-scattered light is then collected by EDAR and focused onto the detector. The system is comprised of an eye-safe, laser-based infrared gas sensor, a vehicular speed/acceleration sensor, and a license plate reader.

The EDAR system is an unmanned, automated vehicle emissions measurement system, which collects data on four pollutants (CO, $CO_2$, $NO_x$ and HC). Speed and acceleration measurement sensors and the license plate camera are housed inside or near the EDAR unit. The entire system is designed so that it can be locked down to deter vandalism and theft. The all-in-one EDAR system is fully weatherproofed to protect it from environmental elements (heat, rain, snow, wind, etc.). In addition, EDAR occupies a relatively small footprint, sitting on a single pole that is deployable roadside in either a temporary or permanent application. See Exhibit 1.

**Exhibit 1 - Example of EDAR Roadside Implementation**




The gas sensor emits a sheet of invisible laser light from above that can unambiguously measure specified molecules emitted from any vehicle that breaks the beam. The lasers are tuned for the pollutants $CO_2$, CO, NO, and HC. Due to the fact that the gas sensor looks down from above and can "see" a whole lane of traffic, EDAR can detect an entire exhaust plume as it exits the vehicle. Seeing the whole plume is advantageous since it allows for consistently high SNR (signal to noise ratio) and measurements that other systems were previously incapable of measuring such as absolute amounts which allows for determination of emissions rates in mass per unit travelled (grams/mile), which can be used to calculate the quantity of emissions produced. In addition, EDAR is able to take passive infrared images of the vehicles passing below the sensor, allowing the vehicle's shape to be determined (whether it is a heavy truck, car, motorcycle or a vehicle pulling a trailer), as well as any pollution hot spots such as evaporative HC emissions leaks on the vehicle. The position of the tailpipe can also be determined by the $CO_2$ plume's position with respect to the image of the vehicle. Furthermore, vehicle speed and acceleration rates during the measurement that could negatively impact the measurements are detected, thus facilitating a precise and controlled data collection.

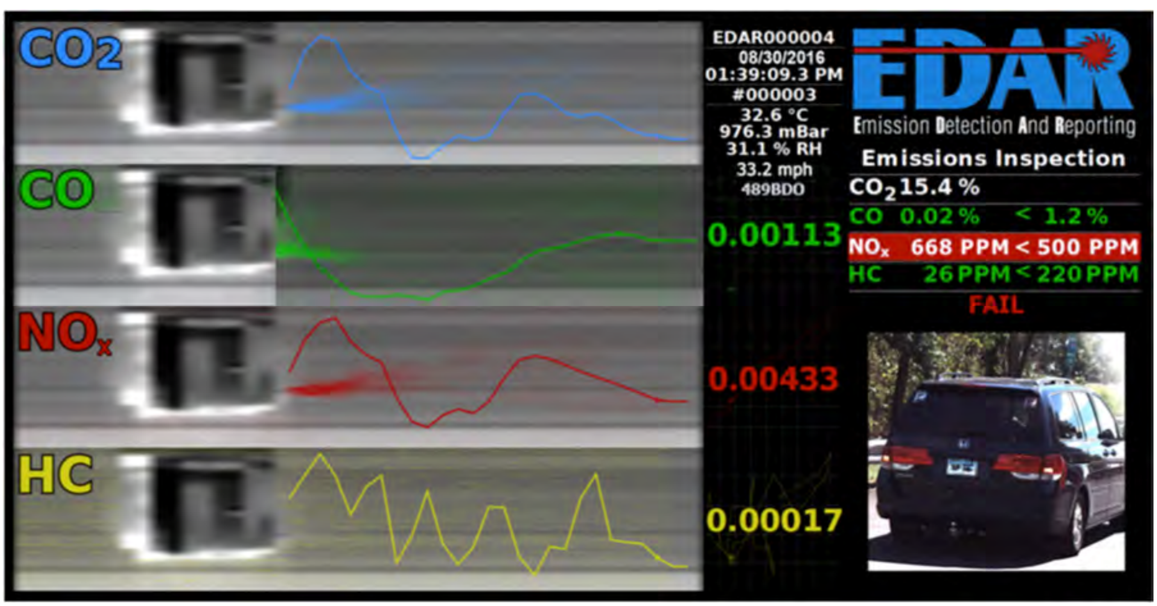
The EDAR system also gathers vehicle characteristic data necessary for analysis of the emissions results. These include:

- A laser range finder-based system for vehicle detection for speed and acceleration measurements. The rangefinder detects the vehicles from above in the same manner as the gas sensor. It also measures the profile of the vehicle to enhance identification of vehicle type.
- A system to measure current weather conditions, including ambient temperature, barometric pressure, relative humidity and, wind speed and direction.)
- A license plate reader that identifies the plate of each vehicle when its emissions are measured along with a picture of each license plate. The reader automatically transcribes the license plate number for further analysis.

In addition to the above features, EDAR has a capability that other remote sensing technologies do not. Using infrared spectroscopic methods, EDAR is able to measure the temperature of the gases it can detect. For each vehicle, EDAR finds the exhaust plume at the location where it exits the tailpipe of the vehicle at the moment when the plume becomes visible. This gives a reasonable measure of the temperature of the exiting exhaust gases. The temperature of the exhaust gases relative to the ambient temperature are an indication of if the vehicle is in a warmed up condition, that is, not in cold start. If the vehicle were in cold start, it may have high emissions appearing to indicate the vehicle has an emissions problem. However, the EDAR unit can be used to identify these vehicles so they are not identified as false positive high emitters as opposed to the true high emitters.

Exhibit 2 demonstrates an example of the report that is produced by EDAR for every vehicle detected and evaluated. As displayed in Exhibit 2, EDAR captures a 2D image of the vehicle and plume for the four gases as well as the license plate, date, time, speed, acceleration, temperature, barometric pressure, humidity, wind speed, a pass or fail indication, and an actual image of the vehicle itself.

**Exhibit 2 - Example EDAR Report**



## 2.2 Equipment QA/QC Audits

### 2.2.1 Factory Testing and Certification

The Connecticut on-road emissions study was performed using EDAR systems, which were assembled by a highly specialized electro-optical manufacturer in the U.S under the direction of HEAT's strict quality assurance requirements. After the units are built and aligned they undergo several tests and verifications before they are deployed in the field. Each EDAR unit arrives assembled from the factory with known spectroscopic settings.

The quality assurance process includes HEAT further confirming the pollutant measurement calibrations in our laboratory using test cells with known gas quantities. HEAT then configures each EDAR with unique field settings catered to the unit's deployment.

HEAT also performs outdoor validation of EDAR using test gas tanks mounted to an electric vehicle and vehicles with extended tailpipes that deposit its exhaust outside the field of view with a simulated exhaust pipe and gas flow controllers. The test vehicle provides a known ground truth to verify that each EDAR is operating properly at various speeds. HEAT obtains tanks where each test gas is mixed with specified target pollutants and varies between low and high concentrations for each pollutant. The test vehicle is driven past the EDAR a number of times for each test gas flowing at a constant volumetric rate. The test takes place in a controlled area to eliminate unknown emission sources. The results are then checked to confirm that each EDAR unit is calibrated properly and measuring within normal specifications. After outdoor calibration is complete, each EDAR unit is tested under various environmental extremes (temperature and humidity) in a specially designed environmental test chamber.

Due to the absolute nature of EDAR's spectroscopic measurements, it can measure the targeted pollutants without explicit field calibration and still remain within normal specifications. In other words, EDAR doesn't need to be calibrated in the field for correct operating and highly accurate measurements. Nonetheless, simple field tests are always performed to ensure that no gross errors exist before lengthy operations begin.

### 2.2.2 Detector Accuracy

EDAR measurements are well within the range of the certified gas sample accuracy and the detector accuracy standards of the California Bureau of Automotive Repair (BAR) On-Road Emissions Measurement Standards (OREMS). The United States EPA has stated in a presentation at a worldwide emissions conference that EDAR is "much more accurate than current remote sensing systems" on the market today.

Minimum accuracies according to California BAR are:

- The carbon monoxide (CO%) reading will be within ± 10% of the Certified Gas Sample, or an absolute value of ± 0.25% CO (whichever is greater), for a gas range less than or equal to 3.00% CO. The CO% reading will be within ± 15% of the Certified Gas Sample for a gas range greater than 3.00% CO.

- The hydrocarbon reading (recorded in ppm propane) will be within ± 15% of the Certified Gas Sample, or an absolute value of ± 250 ppm propane, (whichever is greater).

- The nitric oxide reading (ppm) will be within ± 15% of the Certified Gas Sample, or an absolute value of ± 250 ppm NO, (whichever is greater).

The integrity of HEAT'S data has been validated by various studies comparing EDAR to a Portable Emissions Measurement System (PEMS) conducted in conjunction with the University of Tennessee and the Oak Ridge National Transportation Center, and other in-situ measurement devices. In addition, EDAR meets or exceeds current California BAR OREMS requirements as proven by the report published by an independent blind validation study which was performed by the Colorado Department of Public Health and Environment (CDPHE), the United States EPA and ERG using an RSD audit truck and a series of passes made with controlled gases. The following are accuracies of the blind study of the CDPHE, RSD audit truck.

EDAR accuracies are:

- The carbon monoxide (CO%) reading will be within an absolute value of ± 0.0060% of the Certified Gas Sample.

- The nitric oxide reading (ppm) will be within an absolute value of ± 16 ppm NO.

- The hydrocarbon reading (recorded in ppm propane) will be within an absolute value of ± 100 ppm hexane.

- The EDAR system has been found to have no drift allowing for the unit to be set up to run continuously collecting accurate data without any need for calibration.

- The r-squares of the linear regression between the EDAR measurements and known concentrations of each gas at the various speeds were calculated. A "r squared" of one means perfect fit and an "r squared" of zero means no fit. EDAR's r-squares show excellent correlation and high linearity for all gases:
    - Methane – 0.983
    - Propane – ranged 0.996 to 0.934
    - NO – 0.998
    - CO – 0.996

### 2.2.3 Speed and Acceleration

The vehicle speed measurement is recorded to within ± 1.0 miles per hour. The vehicle acceleration measurement is recorded to within ± 0.5 miles per hour per 1.0 second.

### 2.2.4 Daily Audits

EDAR's temporary deployment system was used in Connecticut with two EDAR units that were deployed using specially designed transportable gantry mounts. For this study, HEAT deployed EDAR systems using the temporary deployments that were set up and taken down daily.

Once the EDAR unit is deployed on the transportable gantry, the operator aligns the unit to reflective tape that is used on road to enhance surface albedo. After this alignment is complete, operators check to ensure that all equipment is running properly. As shown in the previous diagram (exhibit 1), the EDAR unit is attached to the gantry along with the license plate camera and the speed and acceleration recording unit.

Each session during the study was monitored remotely from Knoxville via the Internet for correct operation and data collection. Any unforeseen events were either handled with remote or on-site adjustments.

As noted earlier, the nature of EDAR's technology eliminates the need for field calibration. EDAR's patented technology uses similar principals as active satellite remote sensing platforms that constantly subtracts the background. It can remotely measure quantities and relative amounts of targeted pollutants in an exhaust plume due to the absolute nature of the measurement – long term – without the need for calibration. This gives HEAT's data unprecedented accuracy, precision and consistency, and allows for minimal human operational intervention.

### 2.2.5 NO to $NO_x$ Conversion Assumptions

The units used for this study were EDAR units that were programed to measure pollutants from light duty vehicles. Therefore, the vast majority of nitric oxides emitted from the vehicle tailpipe are in the form of NO. The NO is later oxidized to NO2, and other oxides of nitrogen, which are collectively referred to as NOx. The particular EDAR units used in this study were factory calibrated to measure NO. Since only NO is measured, in order to determine the total amount of NOx in the exhaust a conversion factor of 1.03 can be applied (as suggested by US EPA IM240 guidance). However, there is evidence in other countries to suggest that the NO to NOx conversion factor should be slightly higher. For simplicity, we report only NO measurements for this study. All exhibits in this report display NO values.

### 2.2.6 Humidity Impact

It has been known as early as 1970 that the intake air temperature and humidity are the ambient conditions having the dominant effect on the formation of NOx in internal combustion engines. The impact of ambient temperature and humidity on emissions is of interest because it is difficult to compare $NO_x$ emissions from engines tested at different locations due to the variations in emission rates caused by the varying ambient conditions.

In order to convert all of the $NO_x$ measurements to the same basis (adjust measurements for ambient conditions), a "$NO_x$ correction factor" can be applied to account for ambient conditions. The $NO_x$ correction factor is defined as $KNO_x$. It is applied in the following manner:

$$NO_x - \text{actual} = KNO_x * NO_x - \text{reference}$$

For light-duty, spark-ignition engines, the recommended practice is whatever procedure is used in MOVES. The equation for the correction factor is:

$$K_{NOX}=1 + 0.00446(T-25) - 0.018708(H - 10.71) \text{ for SI units}$$

Adjusted for consistent units of °C and grams per kg of dry air

$$K_{NOX}=1 + 0.0076(T-85) - 0.00216(H - 75) \text{ for English units}$$

Adjusted for consistent units of °F and grains per lb. of dry air

## 2.3 Measurement Sites

HEAT selected nine sites in the Connecticut I/M area based on the following criteria:

- Demonstrate a sampling of the I/M area fleet
- Have high enough traffic volume to obtain sufficient measurements
- Have a slight grade to ensure the vehicles were operating under load
- Have a limit on speed into an acceptable range
- Be free from hazardous conditions

Exhibit 3 below provides the details about each site including the exact location and road grade. Exhibit 4 shows the locations on a map.

**Exhibit 3 - Description of Sites where Sampling was Performed**

| Site | Description | City | County | Grade |
|---|---|---|---|---|
| HEAT01 | On ramp to I-84W from Queen St | Southington | Hartford | 1.33% |
| HEAT02 | On ramp to I-84E from Queen St | Southington | Hartford | 1.00% |
| HEAT03 | On ramp from Hwy 5 to I-9E | Berlin | Hartford | 1.67% |
| HEAT04 | SR 372 (Berlin Rd) to I-91N | Cromwell | Middlesex | 5.38% |
| HEAT05 | Buckland St. to I-84E | Manchester | Hartford | 3.94% |
| HEAT06 | SR 30 South to I-84W | Manchester | Hartford | 3.71% |
| HEAT07 | SR 140 East/West to I-91S | East Windsor | Hartford | 3.13% |
| HEAT08 | On ramp to I-91S from North Street | East Windsor | Hartford | 7.63% |
| HEAT09 | Exit 62 entrance ramp onto I-84E from Buckland Rd. | Manchester | Hartford | 4.86% |

**Exhibit 4 - Location of Sampling Sites (marked in yellow)**

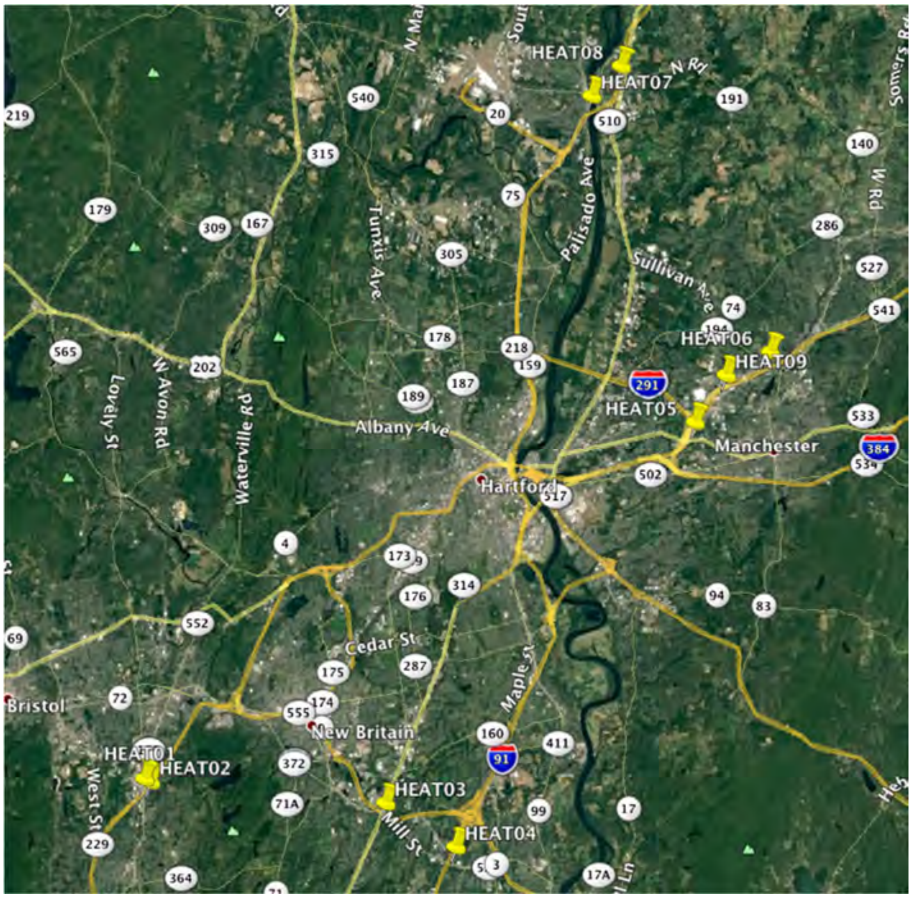



Exhibit 5 shows the measurements of each day from each EDAR unit of the two EDAR units deployed, valid emissions measurements, active collection hours, and the percentage of valid measurements that were successful.

**Exhibit 5 - Daily Measurements**

| EDAR | Date | Site | Location Description | City | County | Start Time | End time | Active Hours | Inactive Hours | Attempted Measures | Valid Emissions Read | Valid % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 8/26/16 | HEAT01 | On ramp to I-84W from Queen St | Southington | Hartford | 6:29 | 17:01 | 10.5 | 0 | 7157 | 6091 | 85.1% |
| 6 | 8/26/16 | HEAT02 | On ramp to I-84E from Queen St | Southington | Hartford | 8:28 | 20:02 | 11.6 | 0.67 | 5438 | 5273 | 97.0% |
| 4 | 8/27/16 | HEAT03 | On ramp from Hwy 5 to I-9E | Berlin | Hartford | 6:10 | 19:56 | 13.8 | 0 | 4844 | 4733 | 97.7% |
| 6 | 8/27/16 | HEAT04 | SR 372 (Berlin Rd) to I-91N | Cromwell | Middlesex | 6:00 | 16:45 | 10.7 | 0 | 1689 | 1499 | 88.8% |
| 4 | 8/29/16 | HEAT05 | Buckland St. to I-84E | Manchester | Hartford | 6:00 | 19:44 | 13.7 | 0 | 2456 | 2234 | 91.0% |
| 6 | 8/29/16 | HEAT06 | SR 30 South to I-84W | Manchester | Hartford | 9:04 | 17:17 | 8.2 | 0 | 4090 | 3594 | 87.9% |
| 4 | 8/30/16 | HEAT07 | SR 140 East/West to I-91S | East Windsor | Hartford | 5:36 | 19:09 | 13.5 | 0 | 5410 | 5114 | 94.5% |
| 6 | 8/30/16 | HEAT08 | On ramp to I-91S from North Street | East Windsor | Hartford | 5:28 | 16:51 | 11.4 | 0 | 1624 | 1400 | 86.2% |
| 4 | 8/31/16 | HEAT06 | SR 30 South to I-84W | Manchester | Hartford | 5:01 | 20:57 | 15.9 | 0 | 6052 | 5417 | 89.5% |
| 6 | 8/31/16 | HEAT09 | Exit 62 entrance ramp onto I-84E from Buckland Rd. | Manchester | Hartford | 6:27 | 20:14 | 13.8 | 0 | 4320 | 3829 | 88.6% |
| | | | | | | | **Grand Totals** | **123.1** | **0.67** | **43080** | **39184** | **91.0%** |

### 2.3.1 Weather Considerations

Inclement weather such as rain or heavy snow resulting in wet pavement prevents remote sensing devices from taking accurate reads due to the fact that water is a large absorber of infrared light. Fog, dust or humidity does not affect the measurement of the EDAR reads of gasses. The humidity during hours when sampling was performed is shown in Exhibit 7.

### Exhibit 6 - Hourly Temperature by Site

| Date | Unit | Site | Hour of the Day / Temp Degrees F | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 8/26/16 | EDAR 4 | HEAT01 | 74 | 75 | 75 | 76 | 78 | 79 | 80 | 82 | 84 | 93 | 91 | 90 | 88 |
| 8/26/16 | EDAR 6 | HEAT02 | 76 | 78 | 79 | 80 | 81 | 83 | 87 | 89 | 90 | 93 | 92 | 91 | 89 |
| 8/27/16 | EDAR 4 | HEAT03 | 71 | 73 | 75 | 76 | 78 | 83 | 87 | 87 | 91 | 94 | 89 | 85 | 78 |
| 8/27/16 | EDAR 6 | HEAT04 | 73 | 76 | 79 | 80 | 83 | 87 | 91 | 92 | 95 | 93 | 90 | 89 | 82 |
| 8/29/16 | EDAR 4 | HEAT05 | 71 | 74 | 78 | 83 | 85 | 88 | 90 | 90 | 91 | 90 | 88 | 85 | 83 |
| 8/29/16 | EDAR 6 | HEAT06 | 70 | 75 | 78 | 85 | 86 | 88 | 89 | 90 | 89 | 90 | 88 | 87 | 86 |
| 8/30/16 | EDAR 4 | HEAT07 | 68 | 70 | 72 | 75 | 73 | 77 | 79 | 80 | 80 | 81 | 82 | 83 | 78 |
| 8/30/16 | EDAR 6 | HEAT08 | 67 | 69 | 70 | 72 | 73 | 74 | 75 | 78 | 82 | 82 | 86 | 84 | 82 |
| 8/31/16 | EDAR 4 | HEAT06 | 70 | 71 | 73 | 75 | 75 | 76 | 78 | 79 | 82 | 85 | 83 | 82 | 80 |
| 8/31/16 | EDAR 6 | HEAT09 | 72 | 74 | 76 | 75 | 79 | 82 | 83 | 84 | 84 | 83 | 81 | 82 | 81 |

### Exhibit 7 - Hourly Humidity

| Date | Unit | Site | Hour of the Day /Humidity | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 8/26/16 | EDAR 4 | HEAT01 | 57 | 56 | 54 | 55 | 58 | 54 | 60 | 59 | 57 | 55 | 54 | 68 | 71 |
| 8/26/16 | EDAR 6 | HEAT02 | 76 | 75 | 74 | 68 | 71 | 70 | 66 | 62 | 59 | 58 | 56 | 48 | 42 |
| 8/27/16 | EDAR 4 | HEAT03 | 89 | 88 | 81 | 80 | 78 | 75 | 71 | 45 | 41 | 40 | 39 | 33 | 30 |
| 8/27/16 | EDAR 6 | HEAT04 | 63 | 55 | 44 | 46 | 45 | 46 | 39 | 38 | 33 | 29 | 31 | 29 | 34 |
| 8/29/16 | EDAR 4 | HEAT05 | 81 | 77 | 68 | 52 | 40 | 36 | 38 | 33 | 32 | 29 | 28 | 30 | 32 |
| 8/29/16 | EDAR 6 | HEAT06 | 62 | 55 | 56 | 50 | 48 | 46 | 38 | 37 | 35 | 33 | 32 | 29 | 31 |
| 8/30/16 | EDAR 4 | HEAT07 | 59 | 60 | 56 | 55 | 51 | 46 | 44 | 39 | 41 | 36 | 31 | 30 | 28 |
| 8/30/16 | EDAR 6 | HEAT08 | 67 | 69 | 69 | 69 | 73 | 74 | 75 | 78 | 83 | 83 | 89 | 92 | 88 |
| 8/31/16 | EDAR 4 | HEAT06 | 86 | 85 | 82 | 78 | 71 | 69 | 66 | 60 | 59 | 53 | 60 | 63 | 68 |
| 8/31/16 | EDAR 6 | HEAT09 | 70 | 65 | 65 | 66 | 63 | 51 | 50 | 48 | 49 | 48 | 49 | 48 | 50 |

## 2.4 Sources of Data and Data Collected

The EDAR unit pollutant measurements (HC, CO, CO2 and NO) and license plate were the two main sources of data used for this report. The information below demonstrates the format of the data collected in this report.

### 2.4.1 Information Collected

- HEAT units operated – EDAR 4 and EDAR 6
- Date
- Time
- License plate image
- HC, CO, $CO_2$, and NO measurements
- Speed
- Acceleration
- Temperature of the vehicle

### 2.4.2 **Data Collection Statistics**

- Unit
- Site
- Date
- Start time
- End
- Hourly temperature
- Hourly humidity

### 2.4.3 **Vehicle Registration Data**

The license plate data collected by the HEAT license plate recognition camera system was submitted to Applus and the Department of Motor Vehicles so that vehicle VIN and other vehicle data could be provided for analysis. The information provided includes:[1]

- License plate
- Vehicle Identification Number (VIN)
- Model year
- Make
- Body style
- EPA vehicle type

## 2.5 **Analysis of Collected Data**

HEAT applied the following screening checks to the measurements to ensure the data used for fleet evaluation and fleet comparisons were reasonable and consistent:

- Screening of exhaust plumes
- Screening of day-to-day variations in emissions values
- Screening for Vehicle Specific Power (VSP) range

The first two of these screening procedures are described in the following paragraphs. The VSP screening is described in section 3.2.

### 2.5.1 **Screening of Exhaust Plumes**

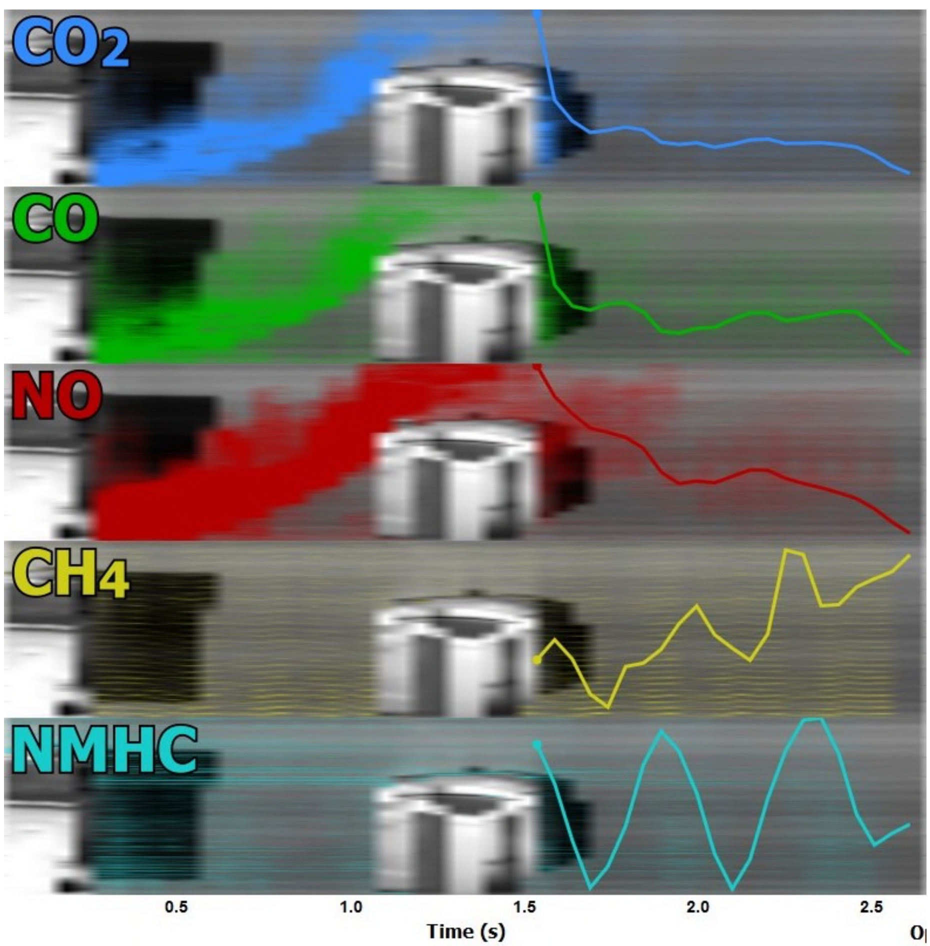
Since EDAR measures the exhaust plume with a sheet of laser light scanning across the roadway, EDAR is able to construct two-dimensional images of passing vehicles and their respective emission plumes. One axis of the image depicts the length across the road, while the other axis depicts the passage of time. EDAR can form a 2D passive infrared image of a vehicle as the vehicle moves underneath the unit. The vehicle image can show the shape of the vehicle, its lane position and the position of its tailpipe. In addition, EDAR forms an active image of a vehicle's emission plume showing the quantity of pollutant detected per unit area or optical mass. The units for optical mass are moles/m$^2$. The plume image shows the position of the plume for each pollutant as well as the dispersion rate of the plume.

[1] Only vehicle data was provided. No personal motorist information was released to HEAT or Applus Technologies

The gas record is considered valid if there is one scan where the average measurement of $CO_2$ in the scan exceeds 0.004 moles/m$^2$. Furthermore, the linear correlation coefficient or Pearson's correlation criteria (r) is applied between the CO2 measurements and the CO, NO and HC measurements. If the correlation factor is relatively high, the measurement is considered valid. This signifies that there are no interfering plumes. Interfering plumes usually have different ratios of pollutant to CO2; therefore, the linear correlation coefficient drops in value. The highest linear correlation coefficient is 1.0, whereas values near zero indicate no correlation and negative 1.0 indicates complete negative correlation. When gas readings are near zero for CO, NO and HC, then correlation values are ignored, because of the lack of presence of those gases.

In addition, the visual 2D representation of the exhaust plumes shows interfering plumes from either neighboring lanes or previous vehicles. When a prior in-lane vehicle is a high emitter, it is common for the subsequent vehicle to be "engulfed" by the large plume. Such an instance is clearly visible in the 2D image. On the other hand, when a plume enters from a neighboring lane, it is common for it to be distinct from the plume exiting the tailpipe of the target vehicle, which makes it easy to discern neighboring plumes, as shown in Exhibit 8. In other words, the EDAR technology can distinguish interfering plumes from neighboring vehicles and also any other possible interferences from prior in-lane vehicles.

**Exhibit 8 - Vehicle Driving Through the Plume of a Preceding High Emitter**



### 2.5.2 Screening of Hourly Data

HEAT's EDAR units were monitored remotely from Knoxville on an hourly basis. Parameters were set up so that HEAT's engineers would be alerted to anomalies or changes that did not meet the parameters.

### 2.5.3 Screening of Day-to-Day Variations In Emissions Values

Daily decile values were compared for the different emissions gases. The middle cluster of the decile values were averaged and plotted. The average values remained stable across the board as shown in Exhibits 9 to 11.

Due to the absolute nature of the measurement, daily variations come from different locations and scenarios. Higher NO normally derives from engines that have elevated temperature or cylinder pressures (such as when operating under high loads). Sites with steeper slopes will have slightly higher NO.

**Exhibit 9 - NO Deciles**

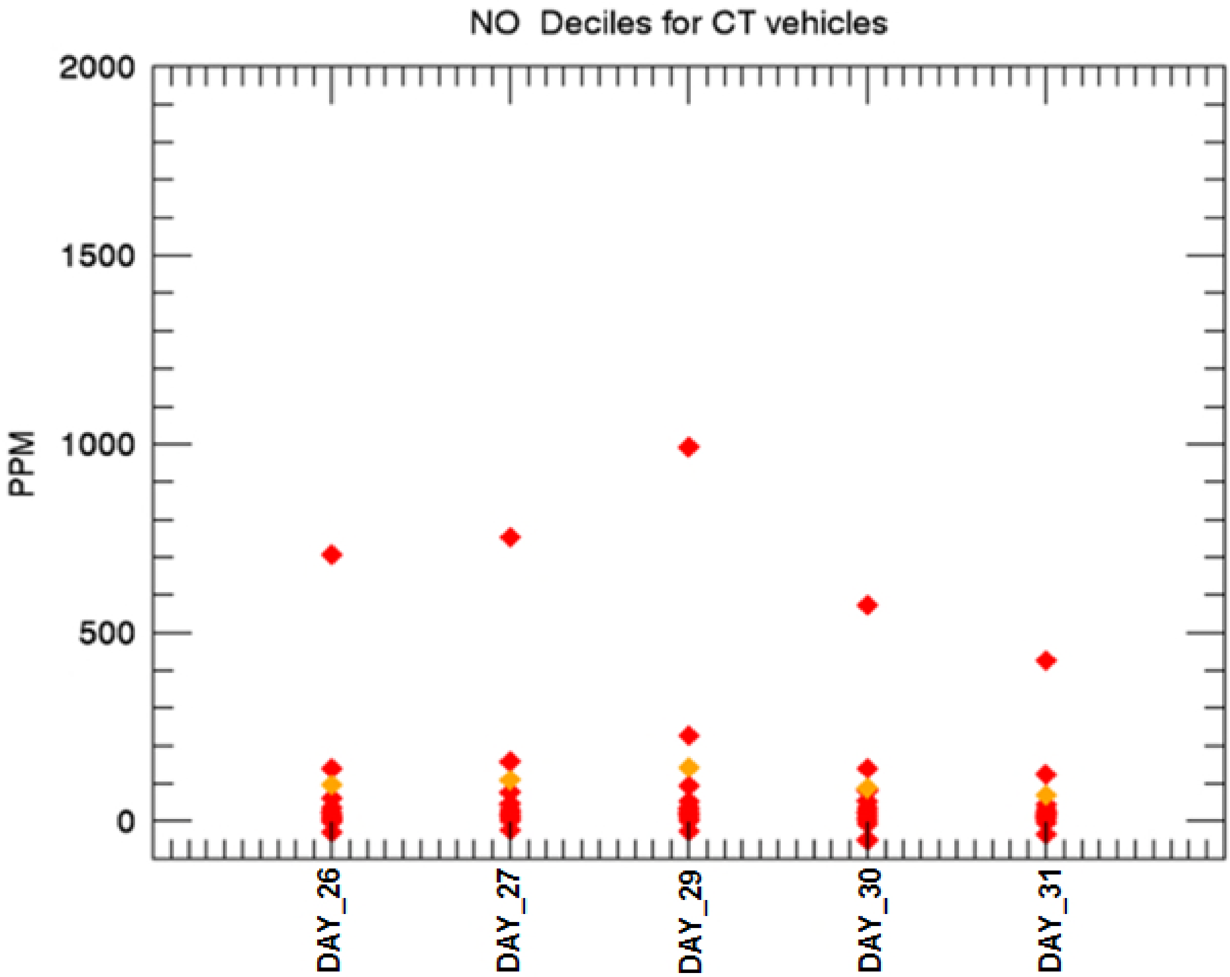


**Exhibit 10 - HC Deciles**

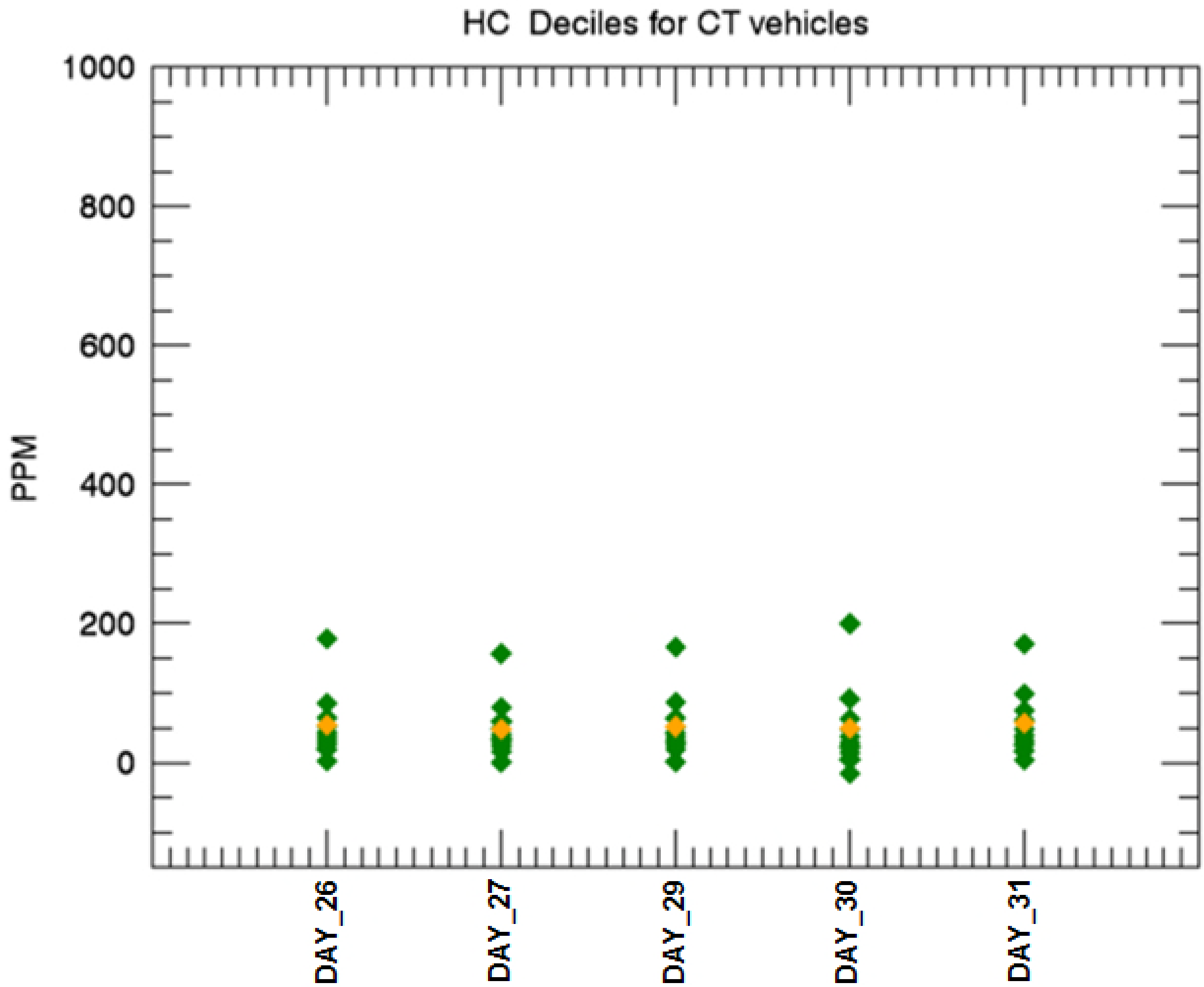
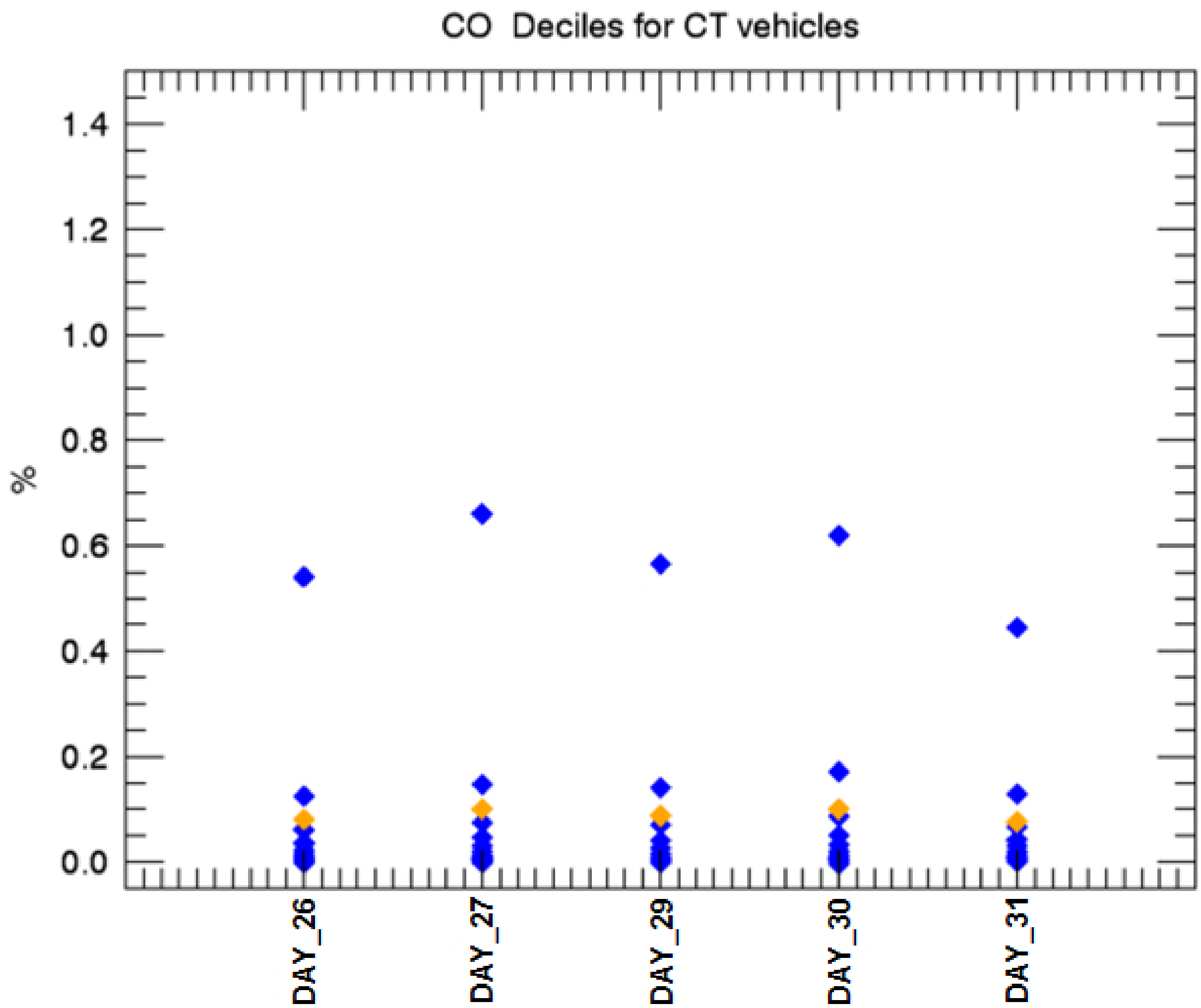


**Exhibit 11 - CO Deciles**



# 3 ANALYSIS OF DATA COLLECTED

## 3.1 General Statistics

The data was collected over 67.5 hours spanning five days in the month of August using two EDAR units (EDAR 4 and EDAR 6). A total of 43,080 attempted measures were made, of those 3,896 vehicles were excluded due to Vehicle Specific Power (VSP) resulting in a total of 39,184 vehicles with valid VSP within 3-22 kW/t. Of those vehicles, 1,239 had unreadable plates, which resulted in valid vehicles of 37,945. There were 2,322 vehicles from states other than Connecticut as well as 1,681 commercial vehicles and motorcycles from Connecticut and other states: resulting in approximately 33,942 (89.5% percent of the survey) measurements made of light duty vehicles with complete emissions information (speed, acceleration, emission measurements). The Connecticut registration data matched 18,182, out of which 1,553 were excluded due to interfering plumes resulting in a total of 16,629.

Exhibit 12 below shows the EDAR measurements made during the period of testing in Connecticut. Vehicles registered in other states comprised 6.1% of the survey, while commercial vehicles and motorcycles totaled 4.4%. The CT VIP currently does not test commercial vehicles or motorcycles, therefore these samples were excluded from the study analysis and removed from the sample as shown in Exhibit 13.

**Exhibit 12 - Number of Vehicles Measured by State of Registration or Vehicle Type**

| Vehicle Type or State | n | Fraction |
|---|---|---|
| Connecticut | 33,942 | 89.5% |
| Massachusetts | 896 | 2.4% |
| New York | 583 | 1.5% |
| New Jersey | 223 | 0.6% |
| Other | 620 | 1.6% |
| Commercial and Motorcycles | 1,681 | 4.4% |
| Total | 37,945 | 100% |

**Exhibit 13 - Data Collection and Analysis Statistics**

| Connecticut On-Road Remote Sensing Measurements Description | |
|---|---|
| EDAR Units | 2 |
| Sites | 9 |
| Cumulative hours of sampling | 67.5 |
| Data Collection Days | 5 |
| Vehicles Measured | 43,080 |
| Vehicles Excluded for Weather and VSP | 3,896 |
| Valid Measured within 3-22 kW/t VSP | 39,184 |
| Vehicles with Visible License Plate | 37,945 |
| Out of State Plates | 2,322 |
| Commercial Vehicles and Motorcycles | 1,681 |
| Vehicles with Connecticut Plates | 33,942 |
| Vehicles Matched to CT Registrations (excludes 2012 and newer MY) | 18,182 |
| Valid Measurements after Removing Measurements with Interfering Plumes | 16,629 |
| Unique Connecticut Vehicles Identified | 15,403 |
| Unique Connecticut Vehicles Identified Once | 14,304 |
| Unique Connecticut Vehicles Identified Twice | 991 |
| Unique Connecticut Vehicles Identified Three Times | 92 |
| Unique Connecticut Vehicles Identified Four or More Times | 16 |

### 3.2 **Vehicle Specific Power**

In order to make meaningful comparisons between various vehicle emissions testing methodologies, it is important to know the instantaneous loading conditions of the vehicle under test. This is particularly true for the case of remote sensing measurements, where a “snapshot” of the emissions of the vehicle under test is captured at a specific loading condition.

In 1999[2], Jimenez advanced a new metric called Vehicle Specific Power (VSP) as a development over prior load classification parameters. VSP is an estimate of the ratio of instantaneous vehicle power to vehicle mass. The main advantage of VSP is that it avoids the necessity of knowing intrinsic vehicle and engine parameters in favor of parameters that can mostly be acquired remotely, like vehicle speed/acceleration and road grade. It is also advantageous in its simplicity as being a one-dimensional parameter. Jimenez showed the effectiveness of VSP through comparative analysis and was later adopted by the EPA for use in its modeling efforts[3].

The equation for VSP incorporates various loading components acting on the vehicle under test. It includes the internal effect of “acceleration resistance,” due to the engine’s rotating components, as well as the external effects of road grade, rolling resistance, and aerodynamic drag. Jimenez developed typical values for each effect which are embedded in the following equation:

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[2] Cires.colorado.edu/jimenez/Papers/Jimenez_PhD_Thesis.pdf

[3] www.epa.gov/ttnchie1/conference/ei12/mobile/koupal.pdf

$$SP = v \cdot (1.1 \cdot a + 9.81 \cdot \sin(\alpha) + 0.132 + 0.000302 \cdot (v + v_w)^2)$$

Where:

$SP$ is specific power in $\frac{kW}{t}$, $\frac{W}{kg}$, or $\frac{m^2}{s^3}$

$v$ is vehicle speed in $\frac{m}{s}$

$a$ is vehicle acceleration in $\frac{m}{s^2}$

is roadway angle of inclination to the horizontal

$v_w$ is headwind speed in $\frac{m}{s}$

In summary, the main use of VSP in remote sensing is for screening out vehicles which could be under high load and operating open loop (not near stoichiometry and therefore are expected to have high emissions) or at very low load where the vehicle would not produce NO because the vehicle is not under load.

## 3.3 Vehicle Fleet Emission Concentrations and VSPs

### 3.3.1 Emissions Concentrations by Jurisdiction

During the course of the study, license plates from over 36 states as well as Canada and the US Government were observed. Exhibit 14 lists the average CO, HC, NO, and VSP measurements for Connecticut vehicles as well as the top three states observed which were Massachusetts, New York, and New Jersey.

The averages by jurisdiction, along with the 95% confidence intervals, shown in the black vertical bars, are plotted in Exhibits 15 through 18. The numbers of samples of measurements of out-of-state vehicles were relatively small. This explains the large confidence intervals. This means the difference in the average emissions were not statistically significant.

Exhibit 14 also lists the average emissions of 1,672 commercial vehicles that were observed, as well as 9 motorcycles from Connecticut and other states. The average NO emissions of the trucks and motorcycles were considerably higher than the passenger vehicles, plus the average CO measurements for the motorcycles surpassed all of the other CO averages.

In summary, the main use of VSP in remote sensing is for screening out vehicles which could be under high load and operating open loop (not near stoichiometry and therefore are expected to have high emissions) or at very low load where the vehicle would not produce NO because the vehicle is not under load.

**Exhibit 14 - Average Pollutant Concentrations and VSP by Jurisdictions**

| | n | CO% | HC ppm | NO ppm | VSP kW/t |
|---|---|---|---|---|---|
| **Emissions by State or Type** | | | | | |
| Connecticut | 16,629 | 0.11 | 55 | 111 | 9.1 |
| Massachusetts | 896 | 0.1 | 48 | 110 | 10.4 |
| New York | 583 | 0.08 | 48 | 101 | 10.4 |
| New Jersey | 223 | 0.1 | 44 | 85 | 9.8 |
| Other | 620 | 0.08 | 48 | 135 | 10.3 |
| Weighted Average | 18,951 | 0.11 | 54 | 111 | 9.3 |
| **Vehicles Excluded at the Request of the State** | | | | | |
| Commercial | 1,672 | 0.01 | 69 | 179 | 11.8 |
| Motorcycles | 9 | 0.15 | 208 | 163 | 13.5 |
| Plates Not Readable | 1,239 | 0.11 | 60 | 118 | 11.1 |
| Weighted Average | 2,920 | 0.05 | 66 | 153 | 11.5 |
| | | | | | |
| **Total On-Road** | **21,871** | | | | |

**Exhibit 15 - Mean HC Concentration by Jurisdiction**

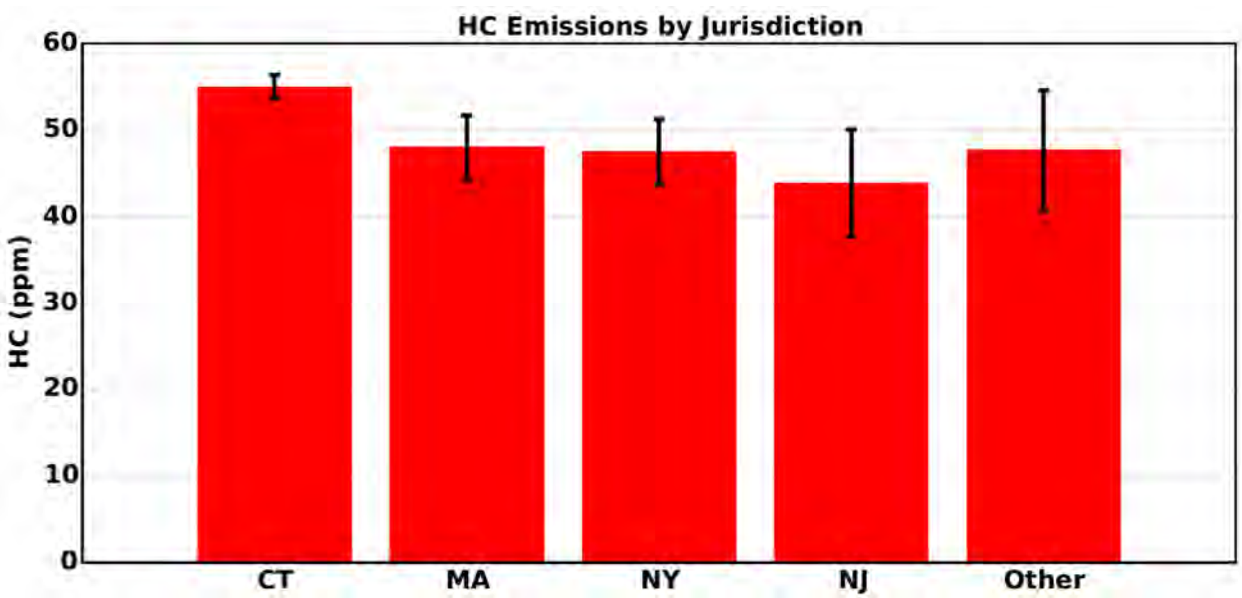



**Exhibit 16 - Mean CO Concentration by Jurisdiction**

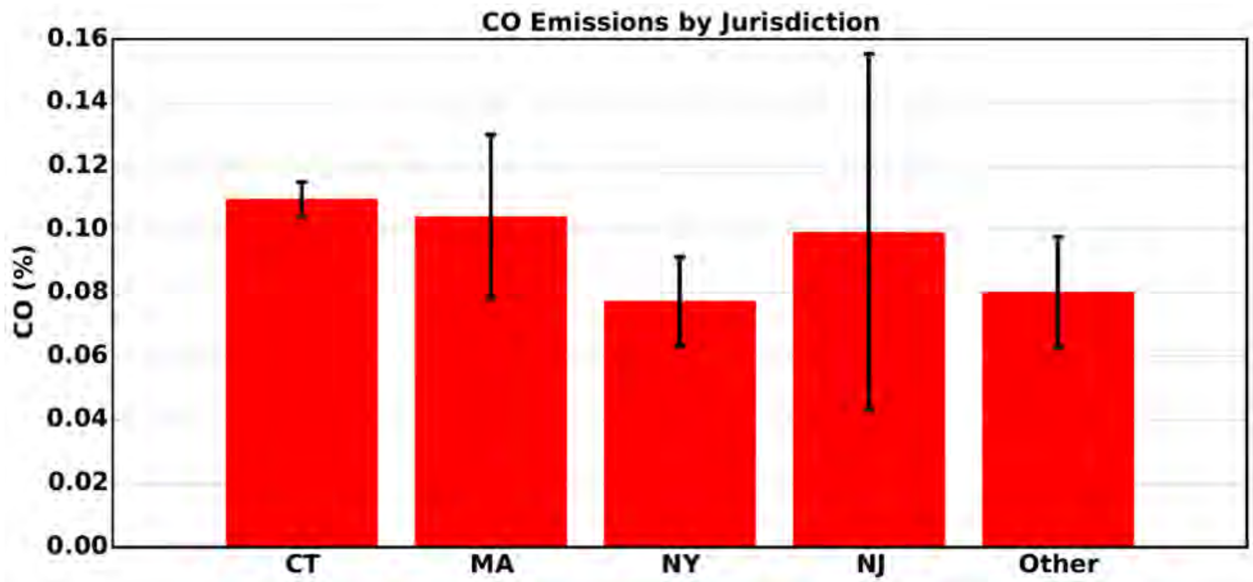



**Exhibit 17 - Mean NO Concentration by Jurisdiction**

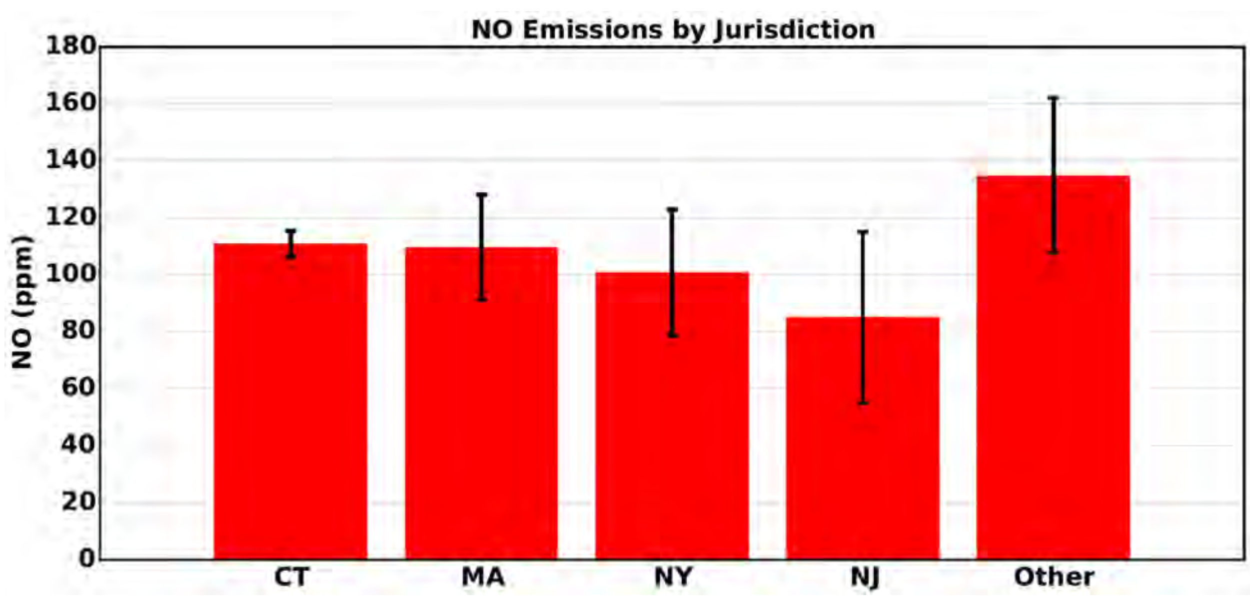
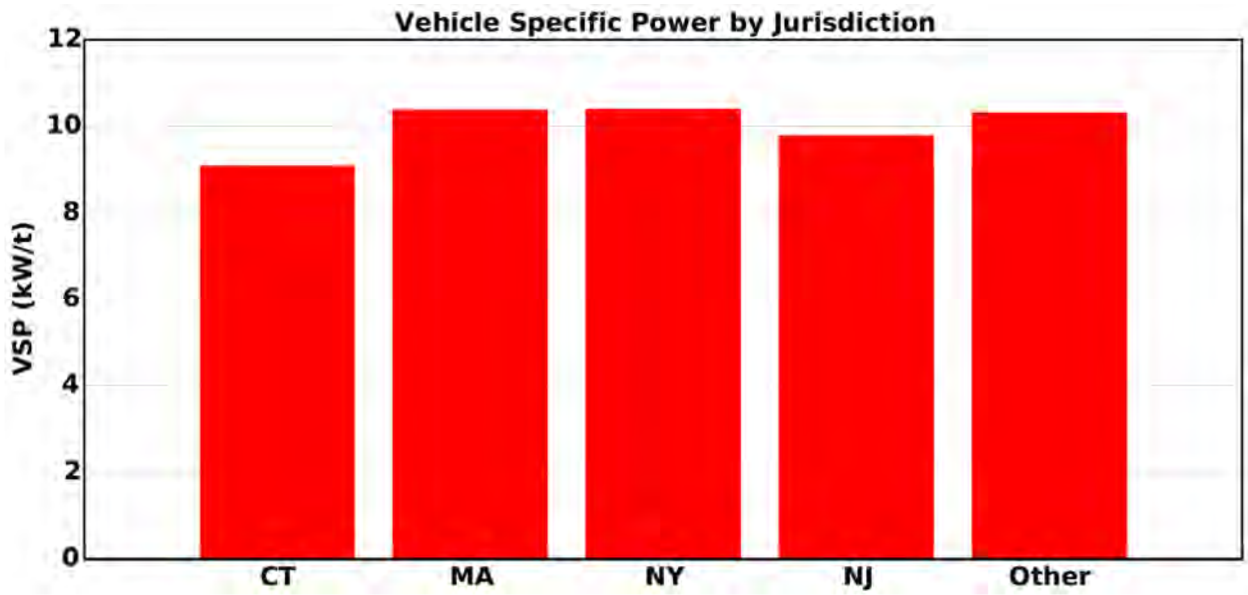



**Exhibit 18 - VSP by Jurisdiction**




### 3.3.2 Connecticut Average Emissions by Model Year

The sampled fleet population distribution and average emissions concentrations by model year are shown in Exhibits 19 to 22.

The older the model year, the more likely there will be higher emissions (the vehicles were certified to high emission rates) and greater variation in those emissions due to the aging and failure of the emission control system components. HEAT's data confirms this by showing considerable variation in the older model year averages.

The sensitivity of the EDAR system is especially demonstrated in the gradual increase of gases in model years 2007 and later. Furthermore, large variation of model years older than 22 years could be due to lack of samples. The number of samples for each year is shown in Exhibit 19.

**Exhibit 19 - Sampled Connecticut Light Duty Vehicle Distribution in the Study**

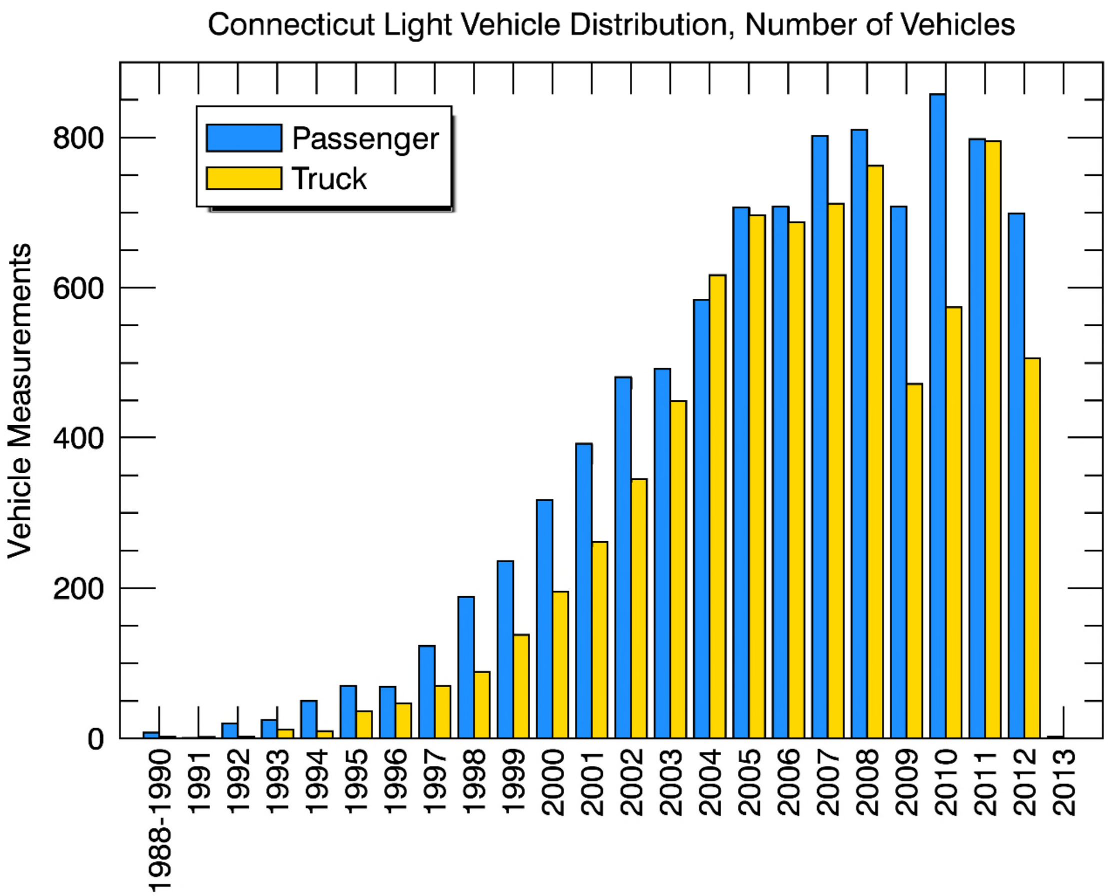


**Exhibit 20 - Average CO Emissions**

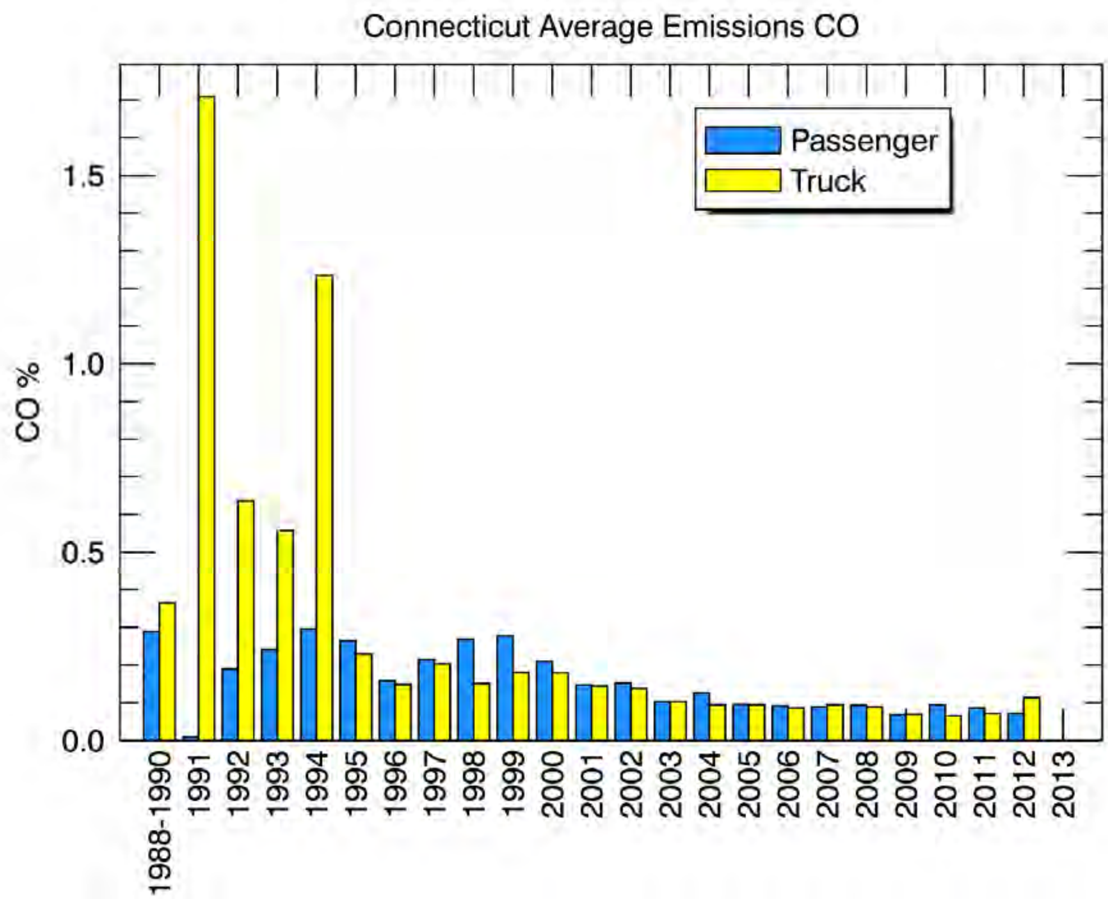


**Exhibit 21 - Average NO Emissions**

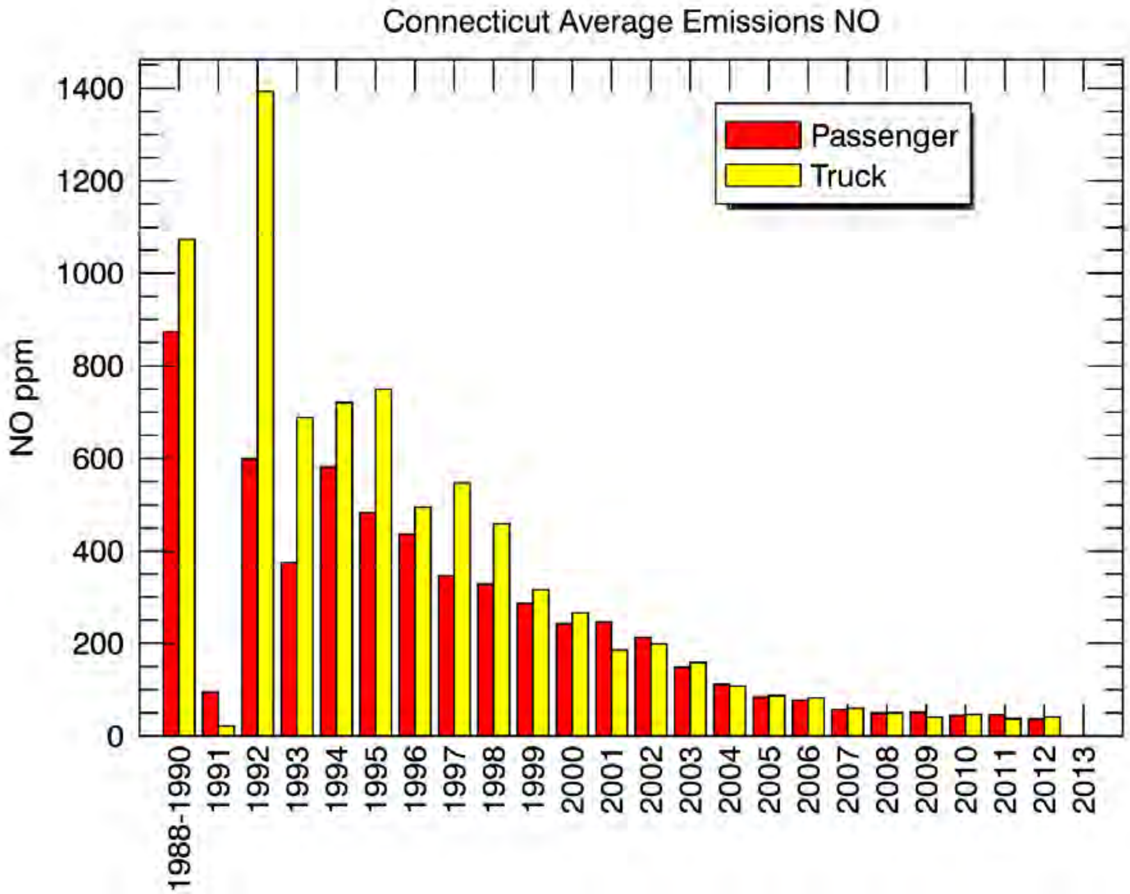
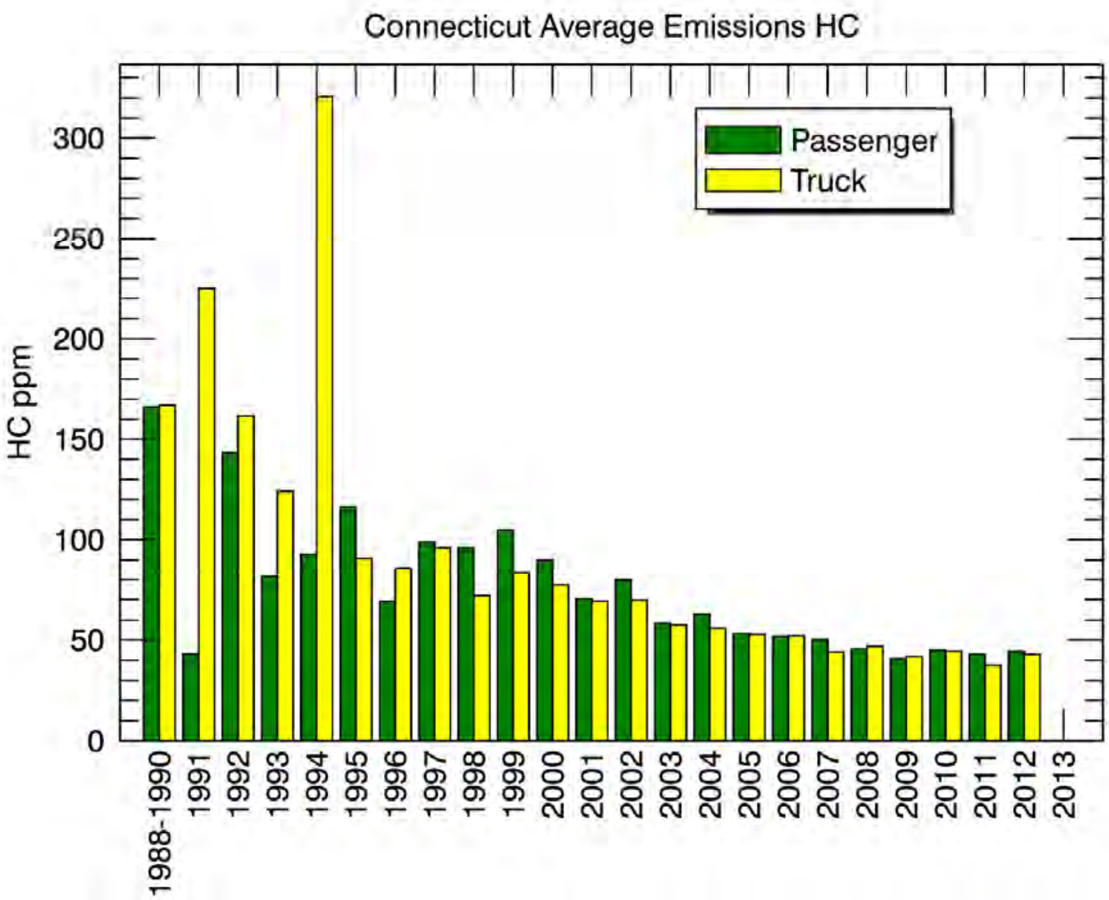


**Exhibit 22 - Average HC Emissions**




### 3.3.3 Approximate Emission Contributions by Model Year

The contributions of emissions of HC, CO, and NO for the light duty vehicles (passenger vehicles and trucks, by model year) that were observed in this study were calculated from the concentration measurements to provide a comparison to the results from previous studies. The results from this analysis are shown in Exhibits 23 through 26. The contributions are binned by model year with recent years omitted since they were not tested by the Connecticut smog stations. As an approximation, the VMT for the vehicles at all sites are considered the same. Similar to the manner in which the previous vendor performed the estimations, the VMT was assumed to be proportional to the number of vehicle measurements, which is shown in Exhibit 23 by model year and classification. To estimate the emission contributions, each measurement was converted to grams-per-fuel-gallon and divided by approximate fuel efficiency to obtain grams-per-mile. The fuel efficiency is estimated from U.S. DOT estimates by model year[4]. This will weigh the emissions from the light duty trucks as well as older vehicles toward higher emissions since they typically have lower fuel efficiency.

[4] www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html

The contributions appear to be proportional to model years for CO and HC measurements with the highest contribution from 2008. NO also shows proportionality to the model years, but has a more distinct drop after 2002. The 2009 model year dip is due to the effects of the recession on the purchase of new vehicle. New car sales dropped ~30% from 2007 to 2009.

**Exhibit 23 - VMT Contribution by Model Year**

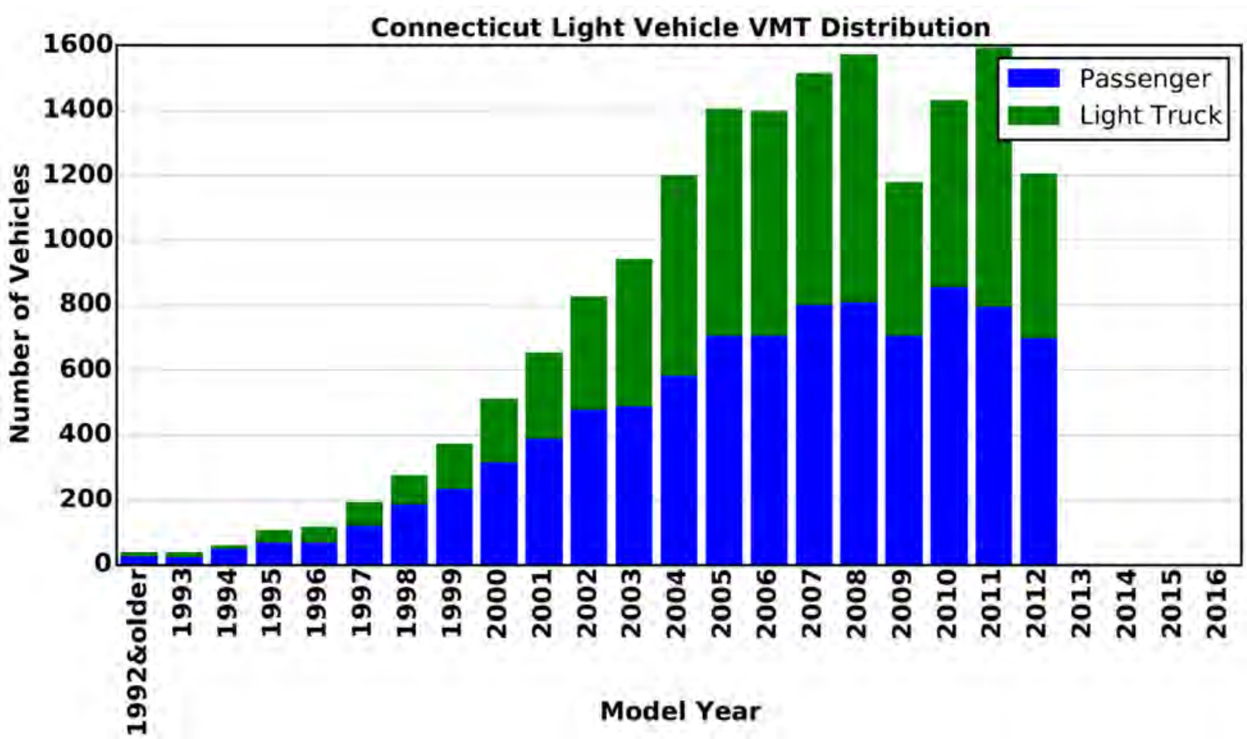


**Exhibit 24 - HC Contribution by Model Year**

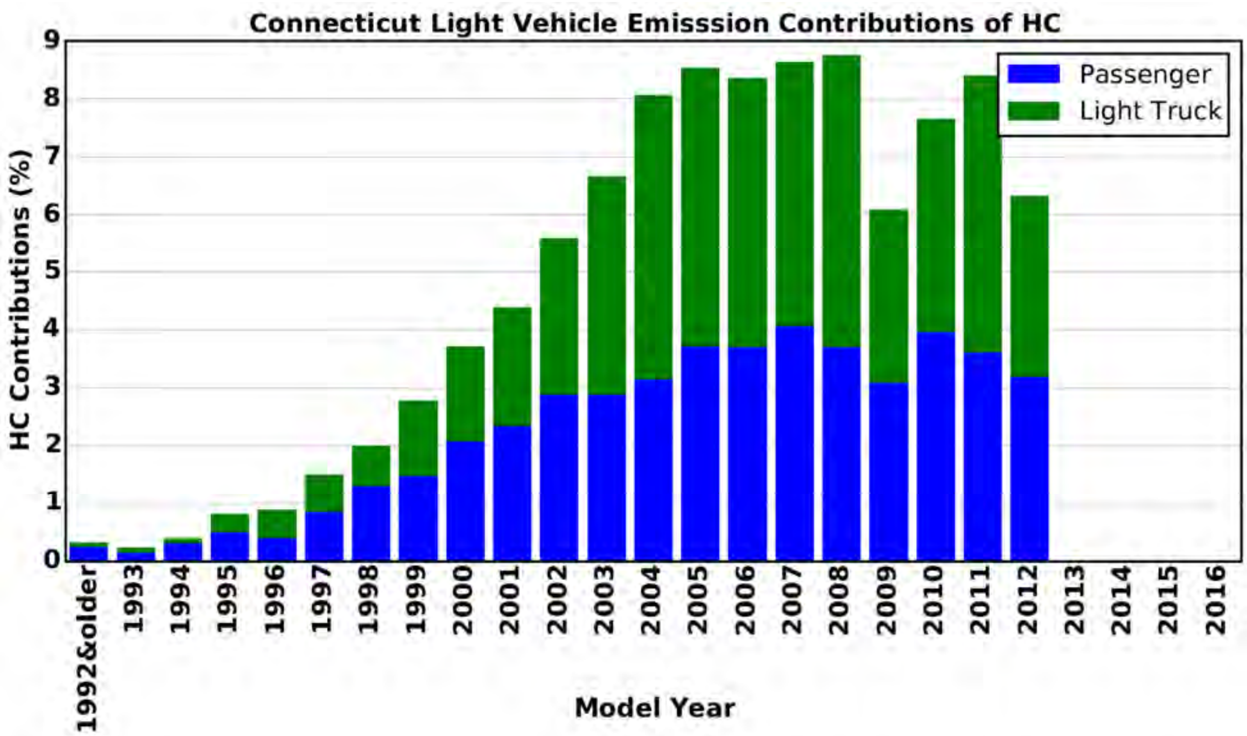



**Exhibit 25 - CO Contribution by Model Year**

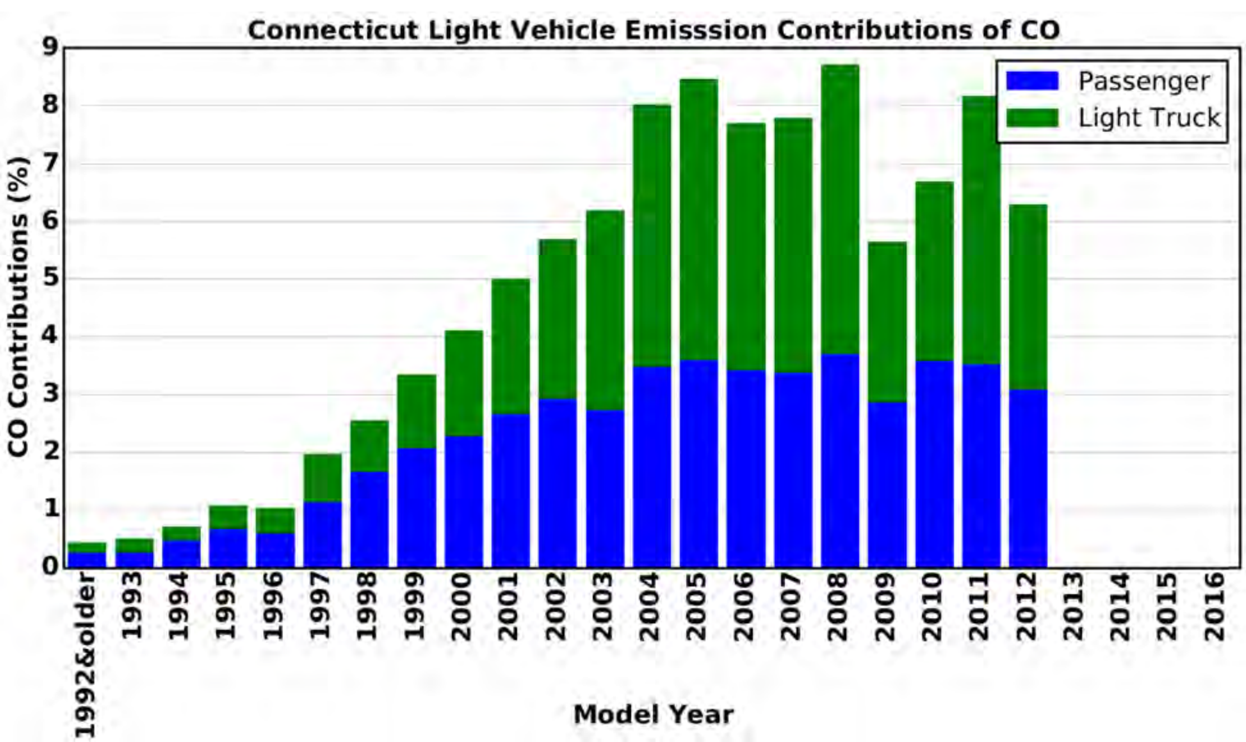
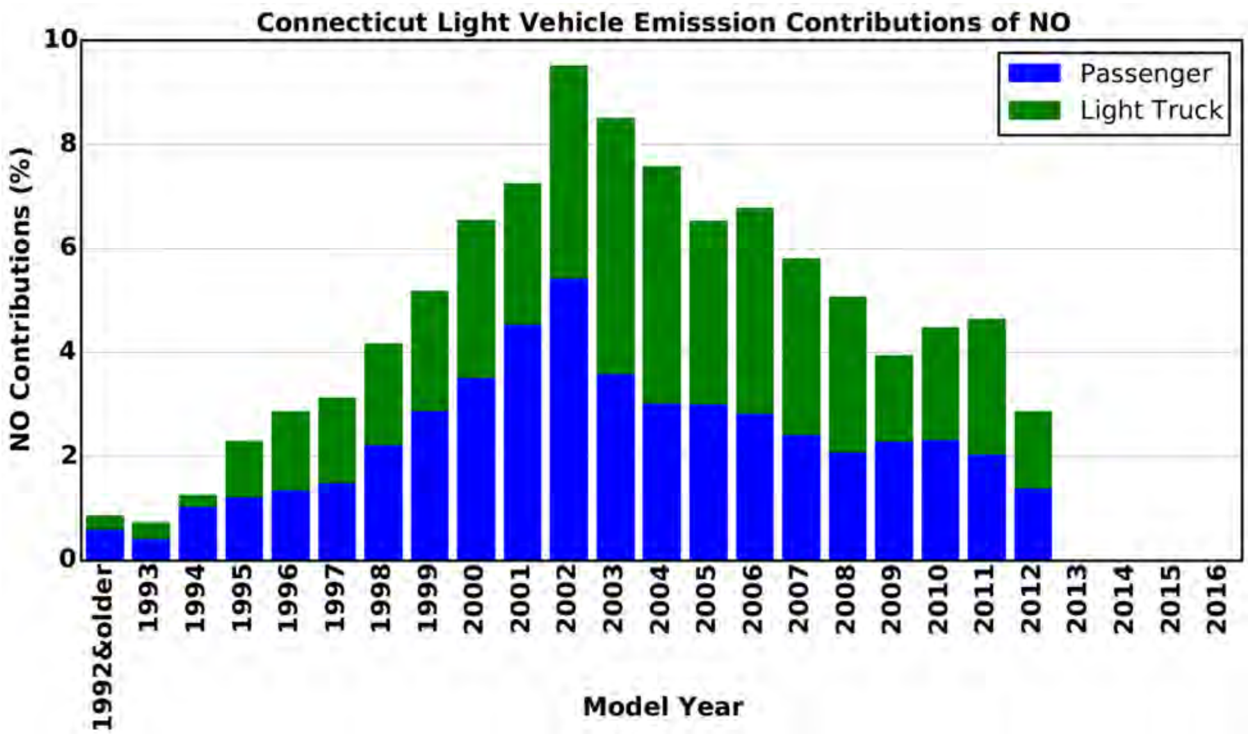


**Exhibit 26 - NO Contribution by Model Year**




## 4 HIGH EMITTERS

High Emitters were identified from 18,182 vehicle measurements that were matched to Connecticut registrations. Cut points similar to those used in previous studies of 500 ppm HC, 3% CO, 2000 ppm NO were used to identify the high emitters and allow for comparison to the previous studies.

### 4.1 High Emitters Summary

Using similar cut points as were used in previous studies, the number of high emitters for HC, CO or NO that exceeded at least one cut-point amounted to 195 vehicles or 1.2% of the identified population. The average emissions for all these vehicles were 491 ppm HC, 1.8% CO, and 1301ppm of NO. The majority of high emitters were for high NO emissions. Exhibit 27 lists the breakdown of high emitters by cut-point. Exhibit 28 lists the combination of cut-points exceeded and shows that only a handful of vehicles exceeded more than one cut-point. Review of the tailpipe versus ambient temperature data for the 195 high emitters indicates that none of these vehicles likely had high emissions due to operation in cold start mode.

**Exhibit 27 - High Emitters**

| HE Cut point | Count |
|---|---|
| Emissions cut points exceeded: | |
| HC > 500 ppm | 71 |
| CO > 3% | 55 |
| NO > 2000 ppm | 90 |
| | |
| Vehicles exceeding one or more cut points | 195 |
| Total cut points exceeded | 216 |

**Exhibit 28 - High Emitters by Pollutant Combination**

| HE Cut point Combinations | Count |
|---|---|
| Single pollutant: | |
| HC Only | 50 |
| CO Only | 35 |
| NO Only | 89 |
| | |
| Two pollutants: | |
| HC & CO Only | 20 |
| HC & NO Only | 1 |
| Co & NO Only | 0 |
| | |
| Three pollutants: | |
| HC, CO, & NO | 0 |
| Total | 195 |

## 4.2 High Emitter Numbers and Percent by Model Year

Exhibit 29 shows the percentage of high emitters for each model year. Exhibit 30 shows the number of high emitters for each model year. Vehicles with a model year above 2013 were omitted from the study.

**Exhibit 29 - Percent of High Emitters by Model Year**

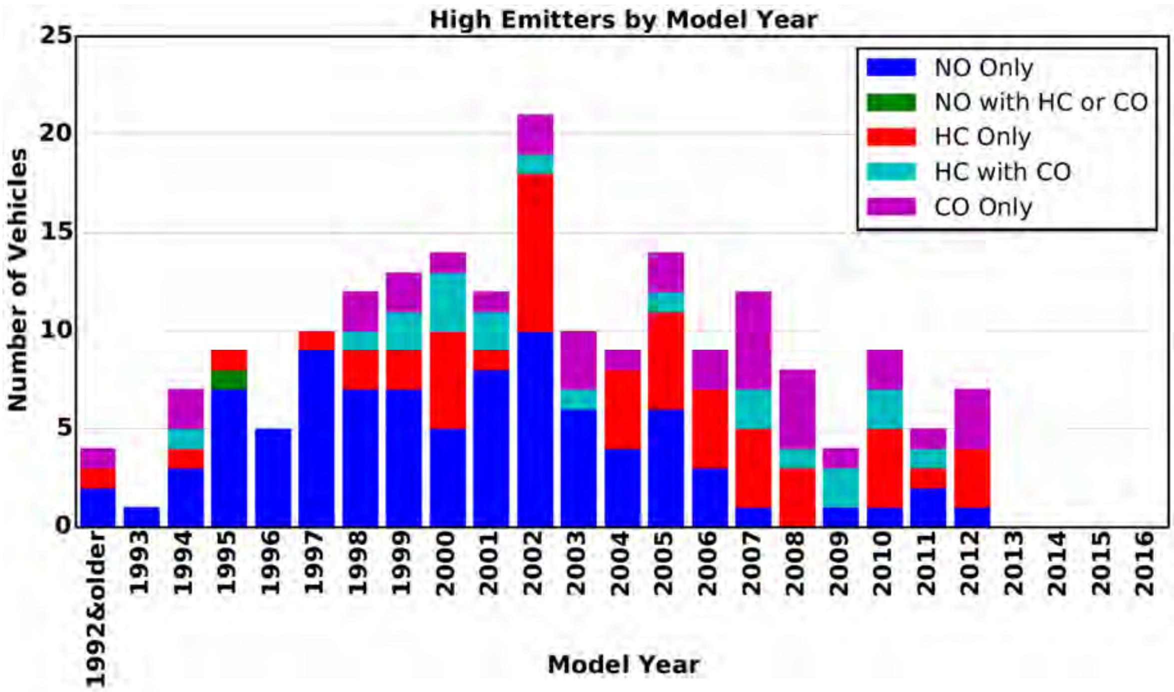
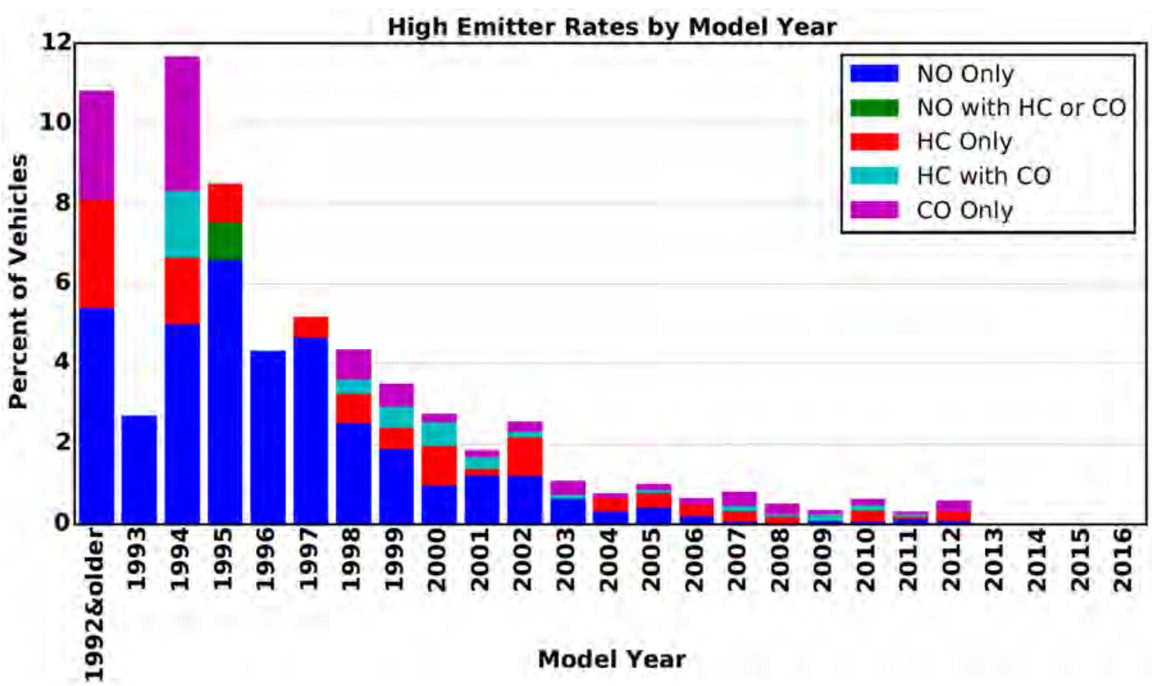



**Exhibit 30 - Number of High Emitters by Model Year**



## 4.3 Analysis of Exhaust Temperature Data

The ambient temperature and the temperature of the exhaust gases at the tailpipe were measured by the EDAR unit for each vehicle. The difference in temperature between the ambient and exhaust were used to evaluate the operation of the vehicle and to see if there were any trends in the data.

The high-emitters in this study have exhaust temperatures of an average 24.7°C above ambient. The exhaust temperatures ranged from equal to ambient, to about 268°C above ambient. These temperatures are constant with vehicle flow studies. Vehicles with tailpipe temperatures within five °C of ambient were considered to possibly be not in a warmed-up condition. These vehicles accounted for 8.2% of the on-road sample. None of the vehicles below 5°C of ambient temperature were high emitters.

# 5 FINDINGS

The on road remote sensing data were matched with the vehicle inspection data for the fleet from the prior two years. By comparing when the last passing inspection was completed for the high emitters, it can be seen that there is no indication of vehicles being falsely passed in the program. In addition, the rate of high emitters observed on road was 1.2% (as noted previously), indicating that the Connecticut Vehicle Inspection Program is effective at maintaining vehicle on road emissions.

Following are the results of the on-road emissions survey. Results are reported in concentrations to allow for comparison to the previous study, and the previous results are noted.

Average emissions

- Average emissions of Connecticut registered light vehicles were 55 ppm HC hexane, 0.11% CO and 111 ppm NO. The last study performed found average concentrations for light duty vehicles of 43 ppm HC hexane, 0.13% CO and 159 ppm NO.

- Tier 2 models, 2004 and newer, continue to have well controlled emissions.

- A small fraction of vehicles had very high emissions and contributed a substantial portion of light vehicle emissions:

    - 195 (1.2%) of vehicles had HC greater than 500 ppm or CO emissions greater than 3% or NO greater than 2000 ppm.

- Eight-nine percent of light duty vehicles measured at the survey locations were registered in Connecticut, 2.4% were from Massachusetts, 1.5% from New York, 0.6 % from New Jersey 1.6% from other states and 4.4% were commercial vehicles or motorcycles for which the state of origin was not determined.

- Comparison of Connecticut Vehicle Inspection Program results for each individual on-road high emitters measured by EDAR indicates that there is no indication of vehicles being falsely passed for emissions in the Inspection Program.

- Vehicle data will be provided to DMV and Applus to allow for motorist notification or further evaluation.

2016 On-Road Survey

195 High Emitter License Plate Review/Summary

| Plate Number | VIN | Emissions Compliant - Time of RSD (August 2016) | Currently Status | Last Emissions Test Date - Time of RSD (August 2016) | Exempt (over 10,000 LBS, 25 years or older, less than 4 years) | Comments/Notes | Registration Status |
|---|---|---|---|---|---|---|---|
| **0AMEA4** | JT2BF22KXX0179944 | NO | **Vehicle is currently not compliant** | 2/5/2016 | N/A | 1999 Toyota Camry - Failed in Feb 2016 has not returned, late the previous cycle - CIVLS lists as inactive - insurance compliance | insurance compliance Reg expired om 07/22/2016 |
| **118YRR** | 2HGFG21537H708620 | **NO** | **Vehicle is currently not compliant** | 4/22/2013 | N/A | 2007 Honda Civic SI last tested/passed in 2013 | **active - reg expires 05/06/2017** |
| **169ZWG** | JF1GG68502G814078 | NO | **Vehicle is currently not compliant** | 3/9/2015 | N/A | 2002 Subaru failed in Oct 2016, after the remote sensing but remains non-compliant | expired on 10/21/2016 |
| **254GGH** | 2T1BR12E12C555206 | NO | **Vehicle is currently not compliant** | 6/1/2015 | N/A | not in compliance - 254GGH is inactive. **New plates AH66043; remains non-compliant** seems like the same household. | **active - reg expires 9/10/2017 with new plates; vehicle test on 3/25/2017 and Failed** |
| **2AVEP7** | WBSBF9321SEH00328 | NO | **Vehicle is currently not compliant** | 5/29/2015 | N/A | 1995 BMW M3 failed - never returned | **active - reg expires 5/19/2017** |
| **2CE200** | 1FTNE24L96HA74650 | **NO** | **Vehicle is currently not compliant** | 6/12/2014 | N/A | 2006 Ford van - passed in June 2014 should've been tested in June 2016. Was and remains non-compliant | **active - reg expires 3/2/2018** |
| **308YMZ** | JT8BF28G5W5029525 | NO | **Vehicle is currently not compliant** | 6/16/2016 | N/A | 1998 Lexus - was late in 2015 but passed. Failed in June 2016 has not returned and remains non-compliant | expired on 2/22/2017 |
| **322UUP** | 3VWRF71K26M673003 | **NO** | **Vehicle is currently not compliant** | 10/12/2014 | N/A | 2006 VW Jetta was late in previous cycle was due on 9/12/2015... test failed in Oct 2016 after the remote sensing but remains non-compliant | **active - reg expires 10/12/2018** |

2016 On-Road Survey

195 High Emitter License Plate Review/Summary

| Plate Number | VIN | Emissions Compliant - Time of RSD (August 2016) | Currently Status | Last Emissions Test Date - Time of RSD (August 2016) | Exempt (over 10,000 LBS, 25 years or older, less than 4 years) | Comments/Notes | Registration Status |
|---|---|---|---|---|---|---|---|
| **396YHP** | 3VWSC29M7XM071749 | NO | **Vehicle is currently not compliant** | 11/22/2014 | N/A | 1999 VW Jetta failed on 11/22/2014 and has not returned. Registration expired in Dec 2016 | Registration expired 12/8/2016 |
| **3AATF4** | WAUDF78E17A026262 | NO | **Vehicle is currently not compliant** | 7/6/2015 | N/A | 2007 Audi failed in July 2015 and remains non-compliant | **active - reg expires 7/2/2017** |
| **3ADUA2** | JA3AY11A6YU054352 | NO | **Vehicle is currently not compliant** | 2/16/2016 | N/A | 2000 Mitsubishi - failed never returned | **active - reg expires 12/5/2017** |
| **401YHY** | 2HGEJ8644WH594013 | **NO** | **Vehicle is currently not compliant** | 10/15/2013 | N/A | vehicle had a due date of 8/18/2015; was tested on 10/06/2016 and failed and has not returned. 1998 Honda Civic | **active - reg expires 10/15/2018** |
| **410ZXH** | 1J4GW48SXYC388935 | NO | **Vehicle is currently not compliant** | 5/4/2016 | N/A | 2000 Jeep - failed in May 2016 and has not returned and remains non-compliant | inactive/junked |
| **459SZW** | 1GKEK13KXSJ748422 | NO | **Vehicle is currently not compliant** | 4/9/2016 | N/A | 1995 GMC failed twice in 2016 has not returned - tested on 4/3/2017 - failed again | **active - reg expires 3/3/2018** |
| **466ZMF** | 2T1CF28P03C602285 | **NO** | **Vehicle is currently not compliant** | 8/21/2014 | N/A | Toyota Solara is overdue should've been tested in 2015. | Registration expired 8/9/2016. |
| **4ARLB1** | 1GNDT13W9Y2219822 | **NO** | **Vehicle is currently not compliant** | 8/17/2010 | N/A | This plate is on a 2000 Chevy Blazer, failed on 8/17/2010 and never came back. Database says inactive/sold. | inactive/sold |
| **4AWJU2** | 3VWBK21C41M427250 | NO | **Vehicle is currently not compliant** | 12/29/2015 | N/A | 2001 VW Beetle failed in Dec 2015 - has not returned | **active - reg expires 7/2/2017** |

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|---|---|---|---|---|---|---|---|
| **514UDR** | 1J4GZ58SXSC762304 | YES | **Vehicle is currently not compliant** | 10/31/2015 | N/A | 1995 Jeep - was late in previous cycle. Was due on 10/31/2016. | **active - reg expires 10/25/2017** |
| **515ZNE** | 1J4GZ58S7VC521398 | YES | **Vehicle is currently not compliant** | 2/3/2015 | N/A | 1997 Jeep - **compliant** at the time but overdue | **active - reg expires 9/22/2018** |
| **534ZXA** | JTMBD33V075086879 | NO | **Vehicle is currently not compliant** | 7/15/2015 | N/A | 2007 Toyota RAV4 - failed in July 2015 has not returned and remains non-compliant | **active - reg expires 6/19/2017** |
| **549YEP** | 2HGFA1F64AH524002 | **NO** | **Vehicle is currently not compliant** | 1/25/2014 | N/A | 2010 Honda Civic due March 2016. only tested in 1/25/2014 Not in compliance | **active - reg expires 7/16/2018** |
| **592ZXM** | SAJEA01T53FM64352 | NO | **Vehicle is currently not compliant** | 5/13/2016 | N/A | 2003 Jag - failed never returned | **active - reg expires 5/23/17** |
| **5AEXS1** | YV1RS61T232277054 | NO | **Vehicle is currently not compliant** | 12/4/2014 | N/A | 5AEXS1 is inactive; vehicle has **new registration plate AG47835** and remains non-compliant 2003 Volvo S60 | **active - Reg expires 10/24/2018** |
| **5AGDT4** | 1GNEC16K4SJ415838 | NO | **Vehicle is currently not compliant** | 1/23/2014 | N/A | Chevy Suburban no data in CIVLS. Chris Z from DMV said the plates were canceled in 2015 | Canceled |
| **6052CE** | 1GCCS1449XK198151 | NO | **Vehicle is currently not compliant** | 5/10/2016 | N/A | 1999 Chevy S10 failed in May 2016 and remains noncompliant | **active - reg expires 4/8/2018** |
| **6ARRD1** | 1GNDM19W2XB117278 | NO | **Vehicle is currently not compliant** | 7/29/2015 | N/A | 1999 Chevy Astro van - vehicle failed 7/29/2015. Registration is now inactive | Registration expired. Can't be renewed unless it becomes emissions compliant. |

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| Plate Number | VIN | Emissions Compliant - Time of RSD (August 2016) | Currently Status | Last Emissions Test Date - Time of RSD (August 2016) | Exempt (over 10,000 LBS, 25 years or older, less than 4 years) | Comments/Notes | Registration Status |
|---|---|---|---|---|---|---|---|
| **732ZTE** | 4T1BE32K02U003756 | NO | **Vehicle is currently not compliant** | 10/7/2015 | N/A | 2002 Toyota Camry failed on 10/7/2015 has not returned - Registration expired in Feb 2017 still says active | Registration expired. Can't be renewed unless it becomes emissions compliant. |
| **742ZUD** | 2C4GP44R45R170742 | NO | **Vehicle is currently not compliant** | 11/30/2015 | N/A | 2005 Chrysler T&C - only test on 11/30/2015 which failed and has never returned. Database says plates were transferred | canceled |
| **753ZUH** | 3VWSC29M9XM017904 | **NO** | **Vehicle is currently not compliant** | 1/16/2014 | N/A | 1999 VW Jetta passed in January 2014; was not in compliance during the remote sensing. Sold is listed | canceled |
| **767UWG** | 2FALP74W8SX188065 | NO | **Vehicle is currently not compliant** | 4/16/2015 | N/A | 1995 Ford Crown Vic - was due in Sep 2016. Aborted in January 2017. Remains non-compliant | Registration expired. Can't be renewed unless it becomes emissions compliant. |
| **7ASTF5** | 4T1BG22K9YU640108 | NO | **Vehicle is currently not compliant** | 3/26/2015 | N/A | Vehicle was overdue by a year, should 've been tested in March 2016 - failed in Feb 2017 | inactive/sold |
| **829YRY** | JTLKT334650180046 | **NO** | **Vehicle is currently not compliant** | 5/20/2014 | N/A | 2005 Scion non-compliant | suspended/insurance compliance |
| **908WVZ** | 1HGCG66521A082423 | **NO** | **Vehicle is currently not compliant** | 6/3/2014 | N/A | 2001 Honda Passed in June 2014 - vehicle was not in compliance at the time of the remote sensing. Has not returned for a test. Registration is active but lists it as sold. | canceled / sold |

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|---|---|---|---|---|---|---|---|
| **922ZCZ** | 1N4AL2AP5AN467783 | **NO** | **Vehicle is currently not compliant** | 4/3/2014 | N/A | 2010 Nissan Altima due May 2016. only test complated on 4/3/2014. Not in compliance Reg suspended for insurance compliance issue. When insurance compliance department reinstates a registration, they don't check if it is emissions compliant or not. | **active - expires 2/27/2018** |
| **924URH** | JM1BK12F741130559 | NO | **Vehicle is currently not compliant** | 8/3/2016 | N/A | 2004 Mazda 3 failed in August 2016; has not returned and remains non-compliant The I/M date of 7/16/2016 was present when the vehicle was tested on 8/03/2016, DMV believes this was a function of the transition to CIVLS for conversion of vehicles that were non- compliant. | **active - reg expires 7/30/2017** |
| **945ZTS** | 1GKFK66837J307997 | NO | Vehicle is currently not compliant | 7/30/2015 | N/A | 2007 GMC Denali - late in the previous cycle. Was due to be tested in July 2016. Vehicle remains non-compliant | Reg expired - 3/15/2017 |
| **9AAEX9** | TRUWT28N831011121 | **NO** | **Vehicle is currently not compliant** | 1/24/2014 | N/A | 2003 Audi TT - was due for emissions in Sep 2015 & registration expired 7/18/2015. Not complaint during the remote sensing in Aug 2016. | Suspended |

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|---|---|---|---|---|---|---|---|
| **9AHFS0** | 2T1CE22P32C000829 | NO | **Vehicle is currently not compliant** | 4/9/2015 | N/A | this 2002 Toyota last passed in 2010; failed in 2015 and never returned. Not compliant at the time of the remote sensing. Currently the registration status says insurance compliance. | Suspended |
| **9AUJH4** | 1HGEJ6228VL073550 | NO | **Vehicle is currently not compliant** | 5/23/2015 | N/A | 1997 Honda Civic - Was due for test in May 2016; was not compliant during remote sensing. CIVLS lists registration as inactive | canceled |
| **AB44124** | 4T1BE30KX2U546213 | NO | **Vehicle is currently not compliant** | 11/20/2015 | N/A | 2002 Toyota Camry was not compliant at the time of the remote sensing and remains non-compliant. Vehicle failed in Nov 20, 2015 and has not returned. | Revoked |
| **39046** | N/A | Exempt Farm Plates | N/A | never tested | Yes | 1999 dodge Dakota registered with farm plates | |
| **55554** | N/A | YES | N/A | 8/5/2016 | N/A | | |
| **05CW12** | N/A | YES | N/A | 12/21/2015 | N/A | | |
| **0ANNF2** | N/A | YES | N/A | 7/26/2016 | N/A | | |
| **119UOU** | N/A | Exempt at the time | N/A | 5/30/2014 | Yes | 1990 Mercedes exempt in Aug 2016. Registration expiration is set to 6/15/2016 | |
| **127TSD** | N/A | YES | N/A | 2/17/2015 | N/A | in compliance | |
| **174CYM** | N/A | YES | N/A | 5/28/2015 | N/A | | |
| **186RNF** | N/A | Exempt at the time | N/A | N/A | Yes | 2014 Chevy Cruz | |
| **189YFF** | N/A | Exempt at the time | N/A | 1/30/2017 | N/A | 2013 Nissan | |
| **1AFME2** | N/A | YES | N/A | 10/15/2015 | N/A | | |
| **216WKX** | N/A | YES | N/A | 12/9/2015 | N/A | | |

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|---|---|---|---|---|---|---|---|
| 225UJB | N/A | YES | N/A | 7/27/2015 | N/A | | |
| 238ZXD | N/A | YES | N/A | 12/9/2015 | N/A | | |
| 248ZHK | N/A | YES | N/A | 6/3/2016 | N/A | | |
| 251YFW | N/A | YES | N/A | 8/22/2016 | N/A | | |
| 265PRO | N/A | YES | N/A | 7/5/2016 | N/A | listed as donated | |
| 270YRP | N/A | YES | N/A | 3/12/2015 | N/A | in compliance | |
| 2ADDB0 | N/A | YES | N/A | 12/10/2015 | N/A | registration is inactive but vehicle is compliant under new plates AH00598 | |
| 2AGXP5 | N/A | YES | N/A | 5/27/2016 | N/A | | |
| 2AHKK0 | N/A | YES | N/A | 9/26/2015 | N/A | | |
| 301ZH1 | N/A | YES | N/A | 2/23/2016 | N/A | | |
| 302ZCH | N/A | YES | N/A | 5/10/2016 | N/A | | |
| 308YAR | N/A | YES | N/A | 3/21/2016 | N/A | | |
| 318ZJL | N/A | YES | N/A | 6/29/2015 | N/A | | |
| 321SWJ | N/A | YES | N/A | 9/8/2015 | N/A | | |
| 337AFM | N/A | YES | N/A | 2/22/2016 | N/A | | |
| 339WYN | N/A | YES | N/A | 5/19/2015 | N/A | | |
| 33CC61 | N/A | YES | N/A | 4/6/2016 | N/A | | |
| 363COB | N/A | YES | N/A | 5/27/2016 | N/A | | |
| 36CD30 | N/A | Exempt | N/A | N/A | likely exempt - box truck with dual rear wheels | no CIVLS data | |

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|---|---|---|---|---|---|---|---|
| **379YCM** | N/A | YES | N/A | 6/10/2016 | N/A | plates transferred to 1998 Chevy Blazer, however, 2000 Daewoo was compliant | |
| **38168A** | N/A | Exempt | N/A | N/A | Yes | No CIVLS data Heavy Duty Vehicle | |
| **381PYG** | N/A | YES | N/A | 5/16/2015 | N/A | | |
| **395SVU** | N/A | YES | N/A | 5/27/2015 | N/A | | |
| **396HJE** | N/A | YES | N/A | 6/22/2016 | N/A | | |
| **397BNP** | N/A | YES | N/A | 4/27/2015 | N/A | listed as sold/inactive - was in compliance during remote sensing | inactive/sold |
| **3AAEV1** | N/A | YES | N/A | 6/8/2015 | N/A | | |
| **3ADXH3** | N/A | YES | N/A | 2/8/2016 | N/A | | |
| **3AFDT1** | N/A | YES | N/A | 10/18/2014 | N/A | registration is inactive as of Feb 2017. | |
| **3AJBF4** | N/A | YES | N/A | 3/15/2016 | N/A | | |
| **3AURW1** | N/A | YES | N/A | 8/22/2016 | N/A | | |
| **4055CX** | N/A | YES | N/A | 11/17/2015 | N/A | | |
| **417ZHE** | N/A | YES | N/A | 7/23/2016 | N/A | | |
| **422WFS** | N/A | YES | N/A | 6/9/2015 | N/A | | |
| **458DWB** | N/A | YES | N/A | 2/20/2016 | N/A | | |
| **467RUY** | N/A | Exempt at the time | N/A | N/A | N/A | 2013 Mercedes was **exempt** from testing in 2016. Never tested in 2017 and is currently late | active |
| **473VAZ** | N/A | YES | N/A | 4/11/2016 | N/A | | |
| **4AFKG4** | N/A | YES | N/A | 11/7/2015 | N/A | | |
| **4ARHX9** | N/A | YES | N/A | 7/22/2016 | N/A | | |
| **4ASTA8** | N/A | YES | N/A | 1/26/2016 | N/A | | |
| **4ATWB5** | N/A | YES | N/A | 1/14/2016 | N/A | | |
| **505TOO** | N/A | YES | N/A | 1/5/2016 | N/A | | |

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|---|---|---|---|---|---|---|---|
| **513JZW** | N/A | YES | N/A | 9/3/2015 | N/A | | |
| **513YXZ** | N/A | YES | N/A | 4/21/2016 | N/A | | |
| **525MNU** | N/A | YES | N/A | 5/9/2016 | N/A | | |
| **536JZS** | N/A | YES | N/A | 4/23/2015 | N/A | | |
| **553YNM** | N/A | YES | N/A | 4/2/2016 | N/A | | |
| **564YUZ** | N/A | YES | N/A | 8/14/2015 | N/A | | |
| **568TZL** | N/A | YES | N/A | 9/18/2015 | N/A | | |
| **589YTH** | N/A | YES | N/A | 7/23/2015 | N/A | | |
| **5AEBJ7** | N/A | YES | N/A | 9/4/2015 | N/A | | |
| **5AFDJ2** | N/A | Exempt at the time | N/A | N/A | Yes | 2015 Dodge | |
| **5AMMA2** | N/A | YES | N/A | 10/19/2015 | N/A | | |
| **5ASEG2** | N/A | YES | N/A | 11/2/2015 | N/A | | |
| **5AWMH9** | N/A | YES | N/A | 8/15/2016 | N/A | | |
| **6139CE** | N/A | Exempt at the time | N/A | 11/18/2014 | Yes | 1991 Toyota pickup - failed in Nov 2014, became exempt in 2016 | |
| **613XKB** | N/A | YES | N/A | 2/22/2016 | N/A | | |
| **618YEC** | N/A | YES | N/A | 6/4/2016 | N/A | | |
| **619ZYA** | N/A | YES | N/A | 5/25/2016 | N/A | | |
| **644ZCY** | N/A | Exempt at the time | N/A | 2/1/2017 | N/A | 2013 Nissan Sentra | |
| **64CK09** | N/A | YES | N/A | 4/25/2015 | N/A | | |
| **657ZWS** | N/A | YES | N/A | 3/23/2015 | N/A | in compliance | |
| **663ZOM** | N/A | YES | N/A | 12/19/2014 | N/A | currently in compliance | |
| **670XUN** | N/A | YES | N/A | 12/7/2016 | N/A | registration has been canceled was in compliance | |
| **673WPG** | N/A | YES | N/A | 3/26/2015 | N/A | LATE | |
| **674LEN** | N/A | YES | N/A | 10/9/2015 | N/A | | |
| **682YYV** | N/A | YES | N/A | 9/26/2015 | N/A | | |
| **693XXL** | N/A | YES | N/A | 4/1/2016 | N/A | | |
| **6AAFK5** | N/A | Exempt at the time | N/A | N/A | Yes | 2016 Subaru | |

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|---|---|---|---|---|---|---|---|
| **6AJBD9** | N/A | YES | N/A | 6/20/2016 | N/A | | |
| **6AURG7** | N/A | YES | N/A | 8/17/2015 | N/A | | |
| **6CH291** | N/A | YES | N/A | 10/24/2014 | N/A | currently in compliance | |
| **708TEU** | N/A | YES | N/A | 7/2/2015 | N/A | | |
| **715ZBD** | N/A | YES | N/A | 7/24/2015 | N/A | plates are now on a 2015 Dodge Caravan - 1997 Caravan is in compliance | |
| **73CC69** | N/A | Exempt at the time | N/A | N/A | Yes | exempted due age - never tested in CT | |
| **755PGA** | N/A | YES | N/A | 9/11/2015 | N/A | | |
| **756PCJ** | N/A | YES | N/A | 7/28/2016 | N/A | These plates were used on a Volvo during a test in March 2016. The Honda pictured was tested in July 2016 and passed. Registration since then has become inactive. | |
| **7776CZ** | N/A | YES | N/A | 10/22/2015 | N/A | registration expired after remote sensing | |
| **7855CS** | N/A | YES | N/A | 9/29/2016 | N/A | was in compliance passed in sep 2016 | |
| **797KCG** | N/A | YES | N/A | 1/9/2016 | N/A | | |
| **7ABNK7** | N/A | YES | N/A | 11/3/2015 | N/A | 2005 Toyota Camry | |
| **7AESU1** | N/A | YES | N/A | 7/6/2015 | N/A | | |
| **7AXAG0** | N/A | YES | N/A | 9/23/2015 | N/A | | |
| **7CF958** | N/A | YES | N/A | 7/17/2015 | N/A | | |
| **8130DA** | N/A | YES | N/A | 9/9/2015 | N/A | | |
| **833YJA** | N/A | YES | N/A | 11/7/2014 | N/A | currently in compliance | |
| **842RGF** | N/A | Exempt at the time | N/A | N/A | Yes | 2015 Toyota | |
| **843ZKK** | N/A | Exempt at the time | N/A | N/A | Yes | 2015 Ford Mustang | |
| **850ZKX** | N/A | YES | N/A | 8/8/2016 | N/A | | |

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|---|---|---|---|---|---|---|---|
| 854SGA | N/A | YES | N/A | 3/21/2015 | N/A | in compliance | |
| 855ZPZ | N/A | YES | N/A | 6/11/2016 | N/A | emissions is compliant but registration date has expired. | active |
| 859UPJ | N/A | YES | N/A | 6/29/2016 | N/A | | |
| 861ZGA | N/A | YES | N/A | 8/24/2015 | N/A | | |
| 86407C | N/A | YES | N/A | 6/22/2015 | N/A | | |
| 869XLZ | N/A | YES | N/A | 4/23/2015 | N/A | | |
| 8704DA | N/A | YES | N/A | 5/12/2015 | N/A | | |
| 878YCV | N/A | YES | N/A | 6/1/2016 | N/A | | |
| 882RMA | N/A | YES | N/A | 5/18/2015 | N/A | | |
| 887YYP | N/A | YES | N/A | 2/22/2016 | N/A | | |
| 8883DC | N/A | YES | N/A | 4/19/2016 | N/A | | |
| 889ZWK | N/A | YES | N/A | 6/15/2015 | N/A | | |
| 890YGM | N/A | YES | N/A | 6/27/2016 | N/A | | |
| 890ZKM | N/A | YES | N/A | 8/18/2016 | N/A | | |
| 8ABET1 | N/A | YES | N/A | 6/3/2015 | N/A | | |
| 8AKEM9 | N/A | YES | N/A | 5/11/2016 | N/A | | |
| 8ALGH4 | N/A | YES | N/A | 7/15/2016 | N/A | | |
| 900RXP | N/A | YES | N/A | 9/10/2014 | N/A | currently in compliance | |
| 900YUZ | N/A | YES | N/A | 11/17/2014 | N/A | currently in compliance | |
| 901YNH | N/A | YES | N/A | 8/29/2016 | N/A | in compliance | |
| 903XDB | N/A | YES | N/A | 3/1/2016 | N/A | 1992 Honda now exempt in 2017 | |
| 904ZEK | N/A | YES | N/A | 5/5/2016 | N/A | | |
| 906YUH | N/A | YES | N/A | 8/3/2015 | N/A | | |
| 9132CX | N/A | YES | N/A | 8/31/2015 | N/A | | |
| 915KXW | N/A | Exempt at the time | N/A | N/A | Yes | 2014 Lexus | |
| 919RXP | N/A | YES | N/A | 4/28/2016 | N/A | | |
| 920NAO | N/A | YES | N/A | 12/8/2015 | N/A | | |
| 927GHS | N/A | YES | N/A | 7/15/2016 | N/A | | |
| 927XFU | N/A | YES | N/A | 6/13/2015 | N/A | | |

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|---|---|---|---|---|---|---|---|
| **929ZCZ** | N/A | YES | N/A | 3/3/2016 | N/A | | |
| **930ENO** | N/A | YES | N/A | 8/13/2016 | N/A | | |
| **933DNP** | N/A | Exempt at the time | N/A | N/A | Yes | 2015 Nissan Rogue | |
| **960UCS** | N/A | YES | N/A | 5/24/2016 | N/A | | |
| **968LEP** | N/A | YES | N/A | 1/25/2016 | N/A | | |
| **99CX76** | N/A | YES | N/A | 10/5/2015 | N/A | | |
| **9AESP5** | N/A | YES | N/A | 10/31/2015 | N/A | | |
| **9CE646** | N/A | YES | N/A | 7/12/2016 | N/A | plates transferred to 2013 Chevy Van, however, 2006 Ford was compliant | |
| **AB60364** | N/A | YES | N/A | 5/6/2016 | N/A | | |
| **AD** | N/A | YES | N/A | 7/9/2016 | N/A | | |
| **AE69091** | N/A | YES | N/A | 6/18/2016 | N/A | | |
| **JW2563** | N/A | YES | N/A | 11/18/2014 | N/A | currently in compliance | |
| **K57392** | N/A | YES | N/A | 8/11/2016 | N/A | | |
| **RA2739** | N/A | Unknown | N/A | N/A | Unknown | Repair plate on a Jeep info is unknown | |
| **TN7128** | N/A | YES | N/A | 6/21/2016 | N/A | | |
| **WF2007** | N/A | YES | N/A | 7/18/2016 | N/A | | |
| **XD369** | N/A | Unknown | N/A | N/A | N/A | Dealer plate on fairly new Honda Fit | |
| **154FVB** | N/A | NO | Compliant | 8/28/2015 | N/A | 2001 Ford Focus - vehicle was overdue. Failed on 8/28/2015, did not return until Feb 2017 - passed | active |
| **17CX03** | N/A | **NO** | Compliant | 11/8/2013 | N/A | Overdue - only tested in 2013 listed GVWR is 9600 | active - tested passed on 3/28/2017 |

2016 On-Road Survey

195 High Emitter License Plate Review/Summary

| Plate Number | VIN | Emissions Compliant - Time of RSD (August 2016) | Currently Status | Last Emissions Test Date - Time of RSD (August 2016) | Exempt (over 10,000 LBS, 25 years or older, less than 4 years) | Comments/Notes | Registration Status |
|---|---|---|---|---|---|---|---|
| **213UYJ** | N/A | NO | Compliant | 1/7/2015 | N/A | was not compliant at the time 2002 Lexus overdue by year faild twice in january 2017 - passed in March 2017 | active |
| **234RAV** | N/A | YES | Compliant | 4/29/2015 | N/A | failed in Feb 2017; however the vehicle was compliant during remote sensing | active - tested passed on 3/30/2017 |
| **254XCP** | N/A | **NO** | Compliant | 7/31/2014 | N/A | Vehicle was overdue Was not in compliance at the time of the remote sensing but in compliance now. | active |
| **274WKK** | N/A | **NO** | Compliant | 10/11/2013 | N/A | 2007 Nissan Max - Vehicle was overdue. Was not in compliance during remote sensing - should been tested in 2015, passed in Dec 2016 in complaince for one year | active |
| **436FWA** | N/A | **NO** | Compliant | 7/30/2013 | N/A | Over a year late - 2009 Honda CRV - Should 've been tested in june 2015. Passed Sep 2016 | active |
| **444XFF** | N/A | **NO** | Compliant | 8/6/2014 | N/A | Should've been test in Aug 2015 over a year late 2000 VW Jetta passed in Nov 2016 | active |
| **831ZPS** | N/A | NO | Compliant | 4/11/2015 | N/A | Was not in compliance at the time of the remote sensing - overdue by year, but in compliance now. Tested on 2/27/2017 - Passed. | active |

# 2016 On-Road Survey

## 195 High Emitter License Plate Review/Summary

| Plate Number | VIN | Emissions Compliant - Time of RSD (August 2016) | Currently Status | Last Emissions Test Date - Time of RSD (August 2016) | Exempt (over 10,000 LBS, 25 years or older, less than 4 years) | Comments/Notes | Registration Status |
|---|---|---|---|---|---|---|---|
| **9AMTG1** | N/A | NO | Compliant | 7/28/2015 | N/A | **2003 Dodge caravan - failed in Feb 2015 and did not pass until November 2016** | active |


TOYOTA
CAMRY
Connecticut
0AM-EA4


MILE
51
CIVIC
Si


SUBARU
SUBURBAN
OUTBACK
Connecticut
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CE
254·GGH


Connecticut
2AV·EP7
Constitution State


SEWER & STORM DRAIN CLEANING
DAN'S DISCOUNT
ROOTER
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2.0T


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MIDDLETOWN NISSAN


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GMC


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