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March 9, 2015

Eyvonne Parker-Bair, Esq.
Emissions Division Chief
Department of Motor Vehicles
60 State Street
Wethersfield, CT 06161

Re: 2014 Remote Sensing Study

Dear Ms. Parker-Bair:

Enclosed please find the Connecticut 2014 On-Road Remote Emissions Testing Survey.

For the 2014 study, Applus enlisted Hager Environmental & Atmospheric Technologies ("H.E.A.T."), to perform the data and emissions collection. H.E.A.T. subcontracted with Revecorp, Inc. to analyze the data and complete the attached report. We worked closely with both vendors to complete the study and appreciate the support received from DMV with matching the license plate numbers that were not in the emissions database.

Pursuant to the CFR requirement, the EPA requires an out-of-cycle emissions test on 0.5% of the vehicle fleet tested in the Connecticut Vehicle Inspection Program (CT VIP) or 20,000 vehicles, whichever is less. To meet this requirement, historically Connecticut has used remote sensing devices instead of the more intrusive roadside pullovers. During a typical testing cycle, the CT VIP performs 2.2 million emissions tests every two years. In previous studies, the target number for collection has been 11,000 records. Due to a calculation error on our part, the 2014 study actually captured more than twice as many measurements. The enclosed report represents approximately 1.0% of the vehicle fleet in the CT VIP, instead of the required 0.5%.

In all, 37,400 emissions samples were captured during the month of October 2014, at eight different locations, throughout the state. Ultimately, a specific number of those measurements were excluded for various reasons, such as the weather, vehicle type (E.g., commercial vehicles, motorcycles, out-of-state) plume interference, and unreadable license plates. After excluding these records, 17,916 records were matched to the emissions database.

Approximately 1.7% of the 17,916 or 307 vehicles were identified as high emitters. That number was eventually reduced to 298 unique VINs, as some of these vehicles failed more than once.

In February 2015, a final analysis was performed on the vehicles flagged as high emitters. Following are some highlights of the analysis:

+ Thirty-seven percent or 110 vehicles remained either non-compliant with the emissions due date (with an expiration date prior to December 31, 2014) or in a failed status. Please note that seven of the 110 became exempt on January 1, 2015, leaving 103 vehicles that appear to be out of compliance:
    - 39 are in a failed status;
    - 48 have expiration dates that range from 2007 to 2013;
    - 55 have expiration dates in 2014.

- Another 110 are currently in compliance and scheduled to be tested in 2015; while 78 are due in 2016/2017. Twelve vehicles have been tested since the data was captured in October 2014.

We elected to perform a manual comparison of a small percentage of these vehicles and selected the vehicles with expiration dates from January 2007 through December 2012; this represented the 21 oldest overdue vehicles.

H.E.A.T. provided the images captured during the study for these 21 vehicles and the license plate numbers were confirmed in the images. Next we compared the vehicle description (make/model) from the previous test record, to the vehicle in the image provided by H.E.A.T. For reference the images are enclosed with this letter.

- Twelve of the 21 vehicles matched the images from the study and the previous test vehicle description.
    - Of those 12 vehicles, 10 remain in a fail status and two passed the test in 2009 then never returned for an emissions test thereafter.
    - One of the vehicles is a bus, and the GVWR should exclude this vehicle from emissions testing; however the license plate number was used on a different vehicle that was tested and passed in 2006.

In addition, we asked DMV to match and provide VINs for those license plates that were not in our emissions database. From this sample of 21 "outliers", seven license plate numbers were NOT in our emissions database. However, on an additional five vehicles, we were able to match previous test data (vehicle make/model) to VINs provided by DMV. The other two VINs were also matched in the emissions database; however the vehicle make/model information from the previous test did NOT match the vehicles in the images from the study.

Unfortunately, the status is unknown on eight of the 21 vehicles because the previous test vehicle information does not match the vehicle in the images from the study (the license plates are clearly on different vehicles).

My understanding is that in the past years, it has not been customary to send out notifications to motorists for an out-of-cycle emissions test; however I recommend we look further into these outliers. It's unclear whether some motorists are simply circumventing the requirement, or perhaps a policy or procedure needs review. Fifty percent of this small sample appears to be out of compliance, yet the motorists continue to operate their vehicles on Connecticut roads. Again, this was a small sample; it did not include those vehicles identified with expiration dates in 2013 or 2014.

The majority of the license plates on different vehicles, as indicated above, are most likely due to casual sales. The study was conducted in early- to mid-October and the request for DMV to match unknown license plates was in early November; this should have provided sufficient time to register the vehicle and have the DMV database sync up, However, as indicated above, two of the VINs matched to plate numbers provided by DMV were on different vehicles.

Finally, the enclosed spreadsheet includes the 298 unique VINs of the high emitters; we will plan to run these VIN numbers in early 2016 to analyze the actual failure percentage of those tested since the October 2014.

Applus Technologies, Inc.

Connecticut Emissions Program

Please feel free to contact me should you have any questions, need clarification, or would like to pursue further analysis of the remaining outliers from 2013 and 2014.

Sincerely,

Mario Daponte
Program Manager
Connecticut Vehicle Inspection Program

CC: Ms. Ellen Pierce, Connecticut Department of Energy and Environmental Protection

Enclosures (3):

2014 On-Road Remote Emissions Testing Survey
High Emitter Spreadsheet (298 vehicles)
Images (21 vehicles)

REVECORP

ENGINEERING AND DATA SOLUTIONS

Connecticut Vehicle Inspection Program

2014 On-Road Vehicle Survey

PREPARED FOR:

Applus

AND

THE STATE OF CONNECTICUT DEPARTMENT OF MOTOR VEHICLES

February 9, 2015

Connecticut Vehicle Inspection Program

2014 On-Road Vehicle Survey

Prepared for:

Darrin Greene
Applus Technologies
444 North Michigan Avenue, Suite 1110
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February 9, 2015

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With

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Connecticut Vehicle Inspection Program
2014 On-Road Vehicle Survey

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 testing at least 0.5% of the subject vehicle population, or 20,000 vehicles; whichever is less. In the case of Connecticut, 20,000 is less. The on-road emissions testing study is required to test vehicles out of their normal periodic testing cycle, for Hydrocarbons (HC), Carbon Monoxide (CO), Nitrogen Oxides (NO_x) and/or Carbon Monoxide (CO_2). The on-road emissions data collection can be accomplished through roadside pullovers or with the use of remote sensing devices. Roadside pullovers can include tailpipe, evaporative and/or on-board diagnostic (OBDII) system testing. Since roadside pullovers can be considered intrusive, Connecticut has opted to use the non-intrusive remote sensing method. 40CFR §51.371 requires notification of owners of vehicles identified during on-road emissions testing as a high emitters that had that have previously been through the normal periodic inspection and passed the final retest that the vehicles are required to pass an out-of-cycle follow-up inspection.

For the 2014 biennial reporting, Applus Technologies, the contractor for the CT VIP, has subcontracted with Hager Environmental & Atmospheric Technologies (HEAT) to perform the study using their proprietary Emissions Detecting and Reporting (EDAR) on-road remote sensing system. 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. Previously, on-road emissions measurements were performed using alternative technology for the State of Connecticut. However, EDAR has additional capabilities over the remote sensing system used in previous studies, which allowed for the determination of mass emission rates (as opposed to just measuring concentrations), 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 October. The survey was completed in 62 hours of active testing time, over a period of nine days, at eight different locations, resulting in 37,400 measurements.

Due to the rain and vehicles outside of the allowed Vehicle Specific Power (VSP) limits (3 to 22 kW/t) 8,130 measurements were excluded, resulting in a total of 29,270 qualified measurements. Of those measured vehicles, 1,707 had unreadable plates, which further reduced the valid samples to 27,563. Commercial vehicles and motorcycles from Connecticut and other states represented another 2,491 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, 1,816 vehicles were from states other than Connecticut. This reduced the valid samples of Connecticut vehicles to 23,256 with valid and complete sample information (speed, acceleration, license plate information and emission measurements).

The 23,256 samples were compared to registration data provided by the DMV and Applus. In total, 21,396 vehicles were successfully matched. Analysis of the emissions data for the 21,396 vehicles, found that 3,480 had to be excluded due to interfering plumes (emissions from vehicles in adjoining lanes also being measured, etc.) resulting in a final sample of 17,916 vehicles.

The survey identified a small percentage of the vehicles as high emitters (1.7% of the final sample). High emitting vehicles were identified as those exceeding cutpoints used in past remote sensing studies (500 ppm HC, 3% CO, 2000 ppm NO). In total, 307 vehicles exceeded at least one of these cutpoints. Vehicle data will be provided to DMV and Applus to allow for motorist notification or further evaluation. Please reference Section 4 on page 33 of this report for a detailed breakdown of high emitters.

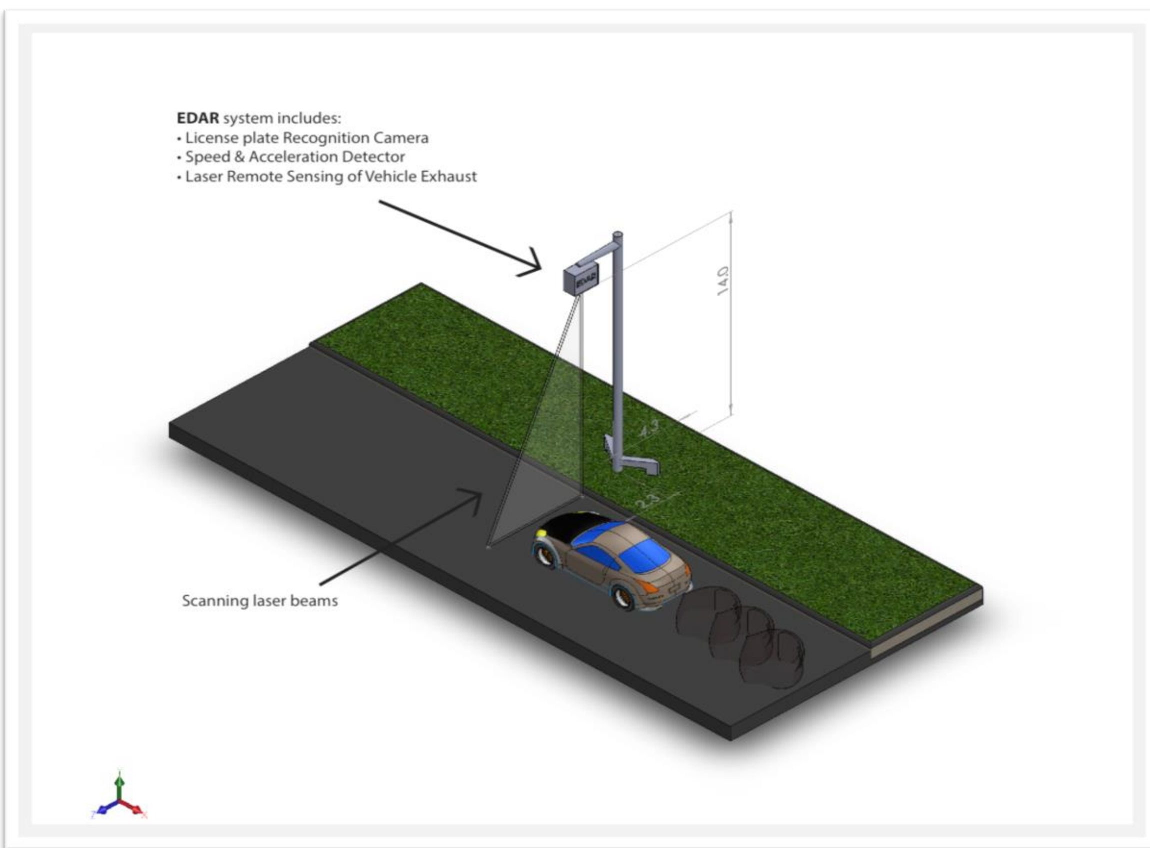
2 STUDY DESIGN

2.1 Equipment Description

The Connecticut study was performed using HEATs 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 pollutants emitted by in-use vehicles. EDAR measures the entire exhaust plume as the vehicle passes allowing for 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 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, the sensor can catch an entire exhaust plume as it exits the vehicle. Seeing the whole plume is advantageous since it allows for consistently high signal to noise ratio(SNR) 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. Whereas other technologies base their measurements on the concentration of pollutants in vehicles exhaust, EDAR can determine the emission rates of pollutants by vehicles. The calculation of emission rates in grams per mile is how vehicle emissions are measured during certification allowing for direct comparison to hot running certification emission rates. The emission rates are also useful for emissions modeling and can be combined with vehicle miles traveled (VMT) data to estimate fleet emissions. In addition, EDAR is able to take passive infrared images of the vehicles passing below the sensor, allowing the vehicles 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.

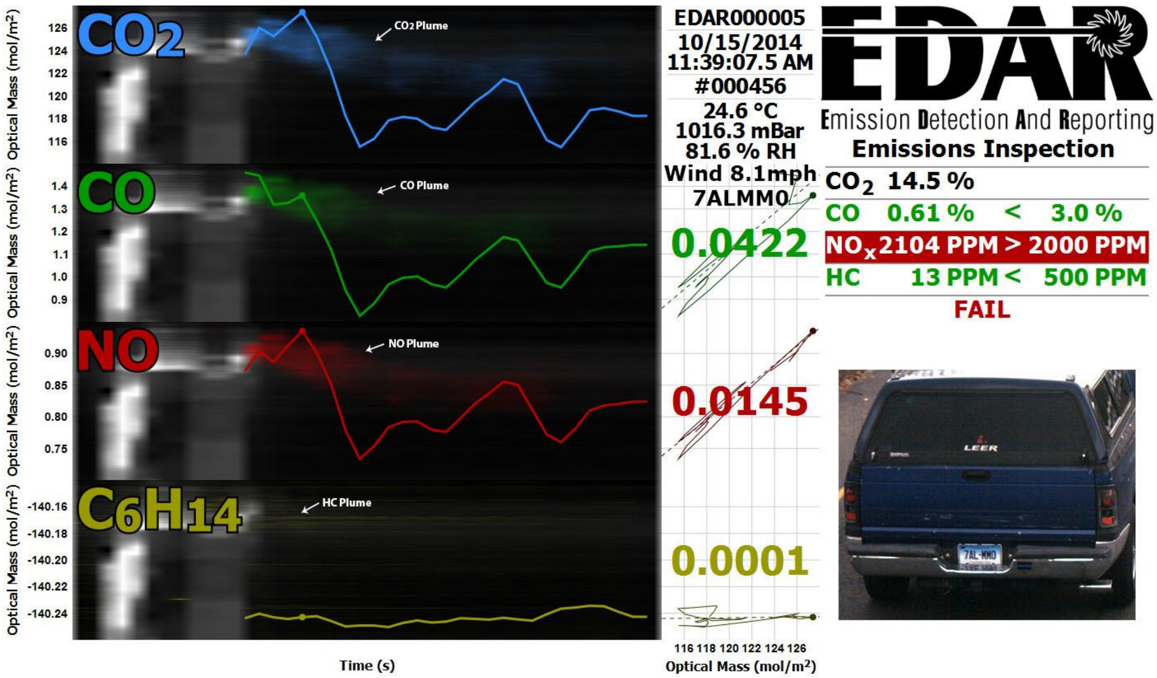
The EDAR system also gathers vehicle characteristic data necessary for analysis of the emissions results. These include:

- 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.
- 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 gasses it can detect. For each vehicle, EDAR attempts to find 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 in 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 identify these vehicles so they are not identified as false positive 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 calculates a 2D image of the vehicle and plume for the four gases as well as the speed, acceleration, license plate, date, time, temperature, barometric pressure, humidity, wind speed, a pass or fail indication, and an actual image of the vehicle itself.

Exhibit 2 - Example EDAR Report



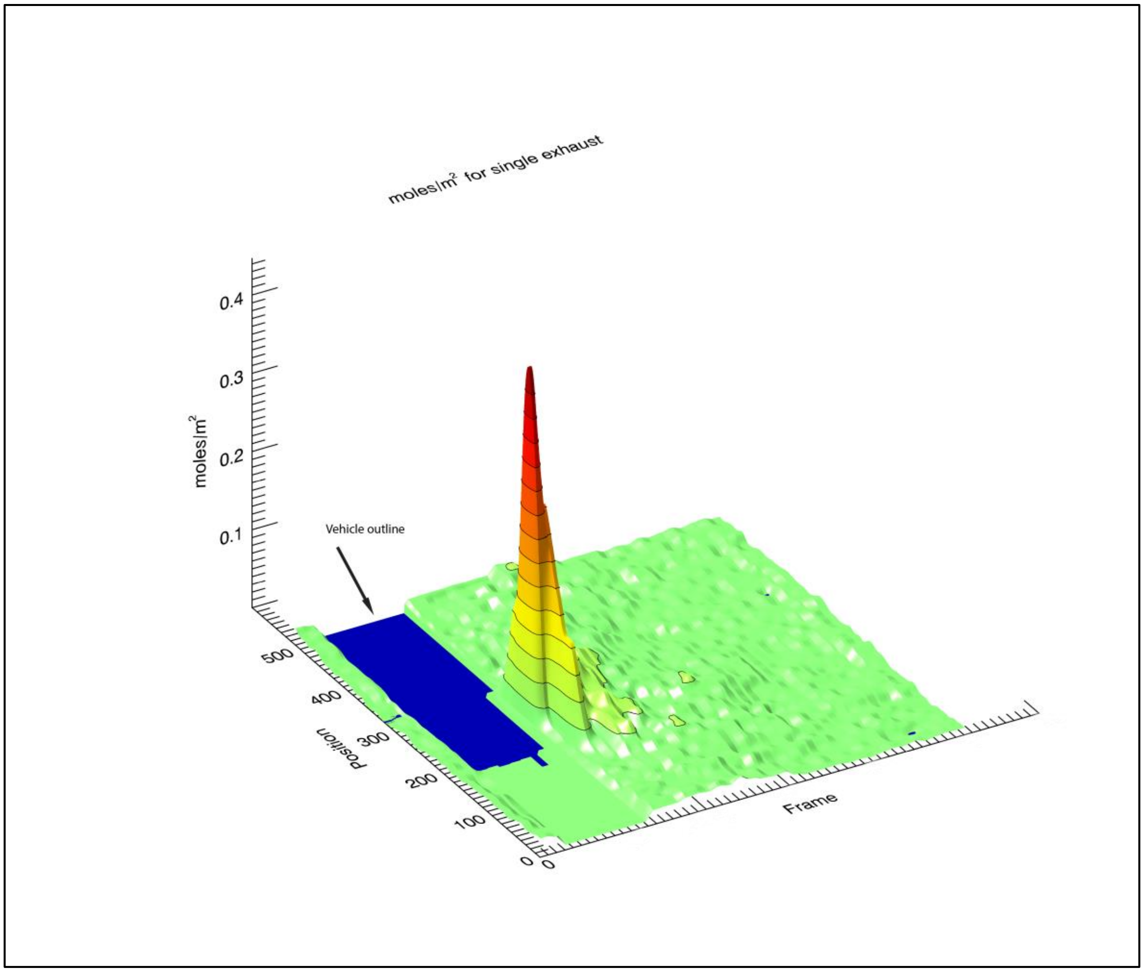
2.1.1 **Calculation of Mass Emission Rates**

The calculation of absolute emission rates (grams/mi) is possible with the EDAR system because of the geometry of the remote sensing set up. EDAR scatters laser light off of the road surface; therefore it is always looking down onto the plume. This allows EDAR to remote sense the entire plume at one time. One can use the optical mass of each measurement across the plume to calculate absolute values, the gram per mile emission rates are calculated directly.

The concentrations of the exhaust plume remain relatively consistent for the first half of a meter at the rear of the vehicle[1]. This is partly due to the relative vacuum created at the rear of a vehicle. A meter behind the vehicle the vortices and turbulent mixing drops the concentration dramatically. Example of a single exhaust system is shown in Exhibit 3.

[1] Chan, T.L., Luo, D.D., Cheung, C.S., Chan, C.K., 2008. "Large eddy simulation of flow structures and pollutant dispersion in the near-wake region of the studied ground vehicle for different driving conditions.", Atmospheric Environment, 42, 5317–5339.

Exhibit 3 - Amount and Location of CO_2 Plume Per Frame or Scan of EDAR



The gram per mile is calculated on the first few frames after the vehicle has passed while concentrations are relatively high and only in the neighborhood of the tailpipe. This mitigates any effects of interfering plumes of vehicles in the vicinity.

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 US 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 (e.g., a golf cart) 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. 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).

Specific accuracies 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, as mentioned previously, EDAR meets or exceeds current California BAR OREMS requirements.

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 installed on transportable gantries for overlooking the roadway. For this study, the HEAT deployed EDAR systems using the temporary deployments 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, the EDAR unit is attached to the gantry along with the license plate camera and the speed and acceleration 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. Once the equipment was put up and aligned, the units ran accurately for the remainder of the day.

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. 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 more 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 NO_2, and other oxides of nitrogen, which are collectively referred to as NO_x. The particular EDAR units used in this study were factory calibrated to measure NO. Since only NO is measured, to determine the total amount of NO_x 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 NO_x 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 NO_x 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 K_{NOx}. It is applied in the following manner:

$$NO_x - actual = K_{NOx} * NO_x - reference$$

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 eight 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 4 below provides the details about each site including the exact location and road grade. Sites 4 and 8 were used in the previous study. Exhibit 5 shows the locations on a map.

Exhibit 4 - Description of Sites where Sampling was Performed

Site	Description	City	County	Grade
HEAT01	Long Hill Rd., near intersection of Berkeley	Waterbury	New Haven	8%
HEAT02	Meriden Rd., near intersection of National	Waterbury	New Haven	4.6%
HEAT03	Asylum Ave., near intersection of Woodland	Hartford	Hartford	4.75%
HEAT04	SR 372 (Berlin Rd) to I-91 N	Cromwell	Middlesex	2.1%
HEAT05	Wolcott St., near intersection of South St.	Bristol	Hartford	8%
HEAT06	SR 30 South to I-84 West	Manchester	Hartford	2.3%
HEAT07	Albany Ave., near Intersection of Mark Twain	Hartford	Hartford	5%
HEAT08	Buckland St. to I-84 East	Manchester	Hartford	2.8%

Exhibit 5 - Location of Sampling Sites

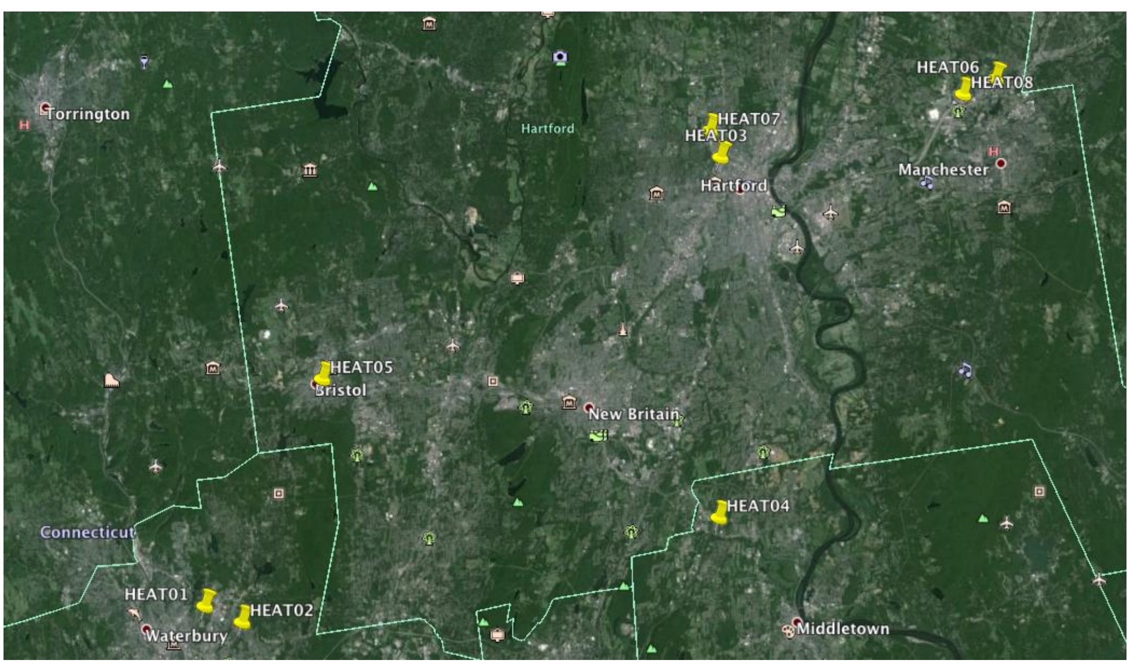


Exhibit 6 shows the measurements of each day from each EDAR unit deployed, valid emissions measurements, active collection hours, and the percentage of valid measurements that were successful.

Exhibit 6 - Daily Measurements

Date	Unit #	Site	Start	End	Active Hours	Inactive Hours	Attempted Measures	Valid Emissions Read	Valid %
10/5/14	EDAR 5	HEAT02	11:58:47	18:33:56	6.5	0	1745	1288	74%
10/6/14	EDAR 4	HEAT01	9:42:54	15:19:45	9.5	1.5	1030	739	72%
	EDAR 5	HEAT02	7:33:04	18:33:06			4338	3276	76%
10/8/14	EDAR 4	HEAT03	15:22:29	18:44:25	3.3	0	1397	1193	85%
10/9/14	EDAR 4	HEAT03	6:38:27	18:51:33	10.5	.5	5722	4657	81%
10/10/14	EDAR 4	HEAT04	7:06:20	18:16:28	10	1	4203	3418	81%
	EDAR 5	HEAT05	11:32:22	17:12:32			2348	1712	73%
10/12/14	EDAR 5	HEAT06	13:18:54	18:22:06	5	0	1854	1322	71%
10/13/14	EDAR 4	HEAT04	11:32:00	19:05:00	10.25	0	3216	2563	80%
	EDAR 5	HEAT06	8:47:01	18:47:50			3914	3169	81%
10/14/14	EDAR 4	HEAT07	10:10:10	19:18:10	7.1	2	1534	1316	86%
	EDAR 5	HEAT06	16:00:00	20:05:34			1724	1342	78%
10/15/14	EDAR 4	HEAT08	10:11:59	17:09:48	7	2	2460	1864	76%
	EDAR 5	HEAT05	10:14:57	16:54:54			1915	1411	74%
Total					**69.15**	**7**	**37400**	**29270**	**78%**

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. The hours by day listed in Exhibit 7 vary due to pop-up showers on certain days which resulted in sampling being discontinued. Fog affects the measurement of smoking vehicles and particulate matter but does not affect the EDAR reads of gasses. The humidity during hours when sampling was performed is shown in Exhibit 8.

Exhibit 7 - 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
10/5/14	EDAR 4	HEAT02					48	52	54	54	55	55	55	55	
10/6/14	EDAR 4	HEAT01			52	56	59	61	62	64	64				
10/6/14	EDAR 5	HEAT02	38	40	52	56	59	61	62	64	64	64	62	61	60
10/8/14	EDAR 4	HEAT03									71	72	72	70	67
10/9/14	EDAR 4	HEAT03	52	52	56	58	60	62	65	65	67	67	67	64	61
10/10/14	EDAR 4	HEAT04	41	44	49	55	57	60	61	62	61	62	61	60	
10/10/14	EDAR 5	HEAT05					60	60	61	61	62	61	60		
10/12/14	EDAR 5	HEAT06							58	60	60	60	60	57	
10/13/14	EDAR 4	HEAT04					51	55	60	62	63	62	62	61	60
10/13/14	EDAR 5	HEAT06		45	47	49	51	55	60	62	63	62	61	60	
10/14/14	EDAR 4	HEAT07				68	70	72	73	74	75	75	73	72	69
10/14/14	EDAR 5	HEAT06										75	73	72	69
10/15/14	EDAR 4	HEAT08				73	74	77	76	76	76	76	76		
10/15/14	EDAR 5	HEAT05				72	70	74	76	76	76	75	75		

Exhibit 8 - Hourly Humidity

Date	Unit	Site	Hour of the Day / Humidity												
			7	8	9	10	11	12	13	14	15	16	17	18	19
10/5/14	EDAR 4	HEAT02					54	44	47	47	44	44	41	44	
10/6/14	EDAR 4	HEAT01			67	63	63	59	55	56	49				
10/6/14	EDAR 5	HEAT02	87	81	67	63	63	59	55	56	49	55	51	55	67
10/8/14	EDAR 4	HEAT03									42	38	34	38	40
10/9/14	EDAR 4	HEAT03	61	63	55	47	42	39	37	36	33	31	33	38	44
10/10/14	EDAR 4	HEAT04	93	89	80	57	49	46	39	35	38	39	41	42	
10/10/14	EDAR 5	HEAT05					46	42	39	38	39	39	49		
10/12/14	EDAR 5	HEAT06							47	42	36	41	44	53	
10/13/14	EDAR 4	HEAT04					80	80	72	62	56	58	67	75	80
10/13/14	EDAR 5	HEAT06		89	75	78	80	80	72	62	56	58	67	75	
10/14/14	EDAR 4	HEAT07				84	78	71	68	64	60	57	66	68	75
10/14/14	EDAR 5	HEAT06										57	66	68	75
10/15/14	EDAR 4	HEAT08				81	79	71	71	71	71	74	73		
10/15/14	EDAR 5	HEAT05				81	90	79	71	70	71	73	73		

2.4 Sources of Data and Data Collected

The EDAR unit pollutant measurements (HC, CO, CO_2 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 –EDAR4 and EDAR 5
- Date
- Time
- License plate image
- HC, CO, CO_2, and NO measurements
- Speed
- Acceleration
- Smoke
- 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:[2]

- 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

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

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.

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.

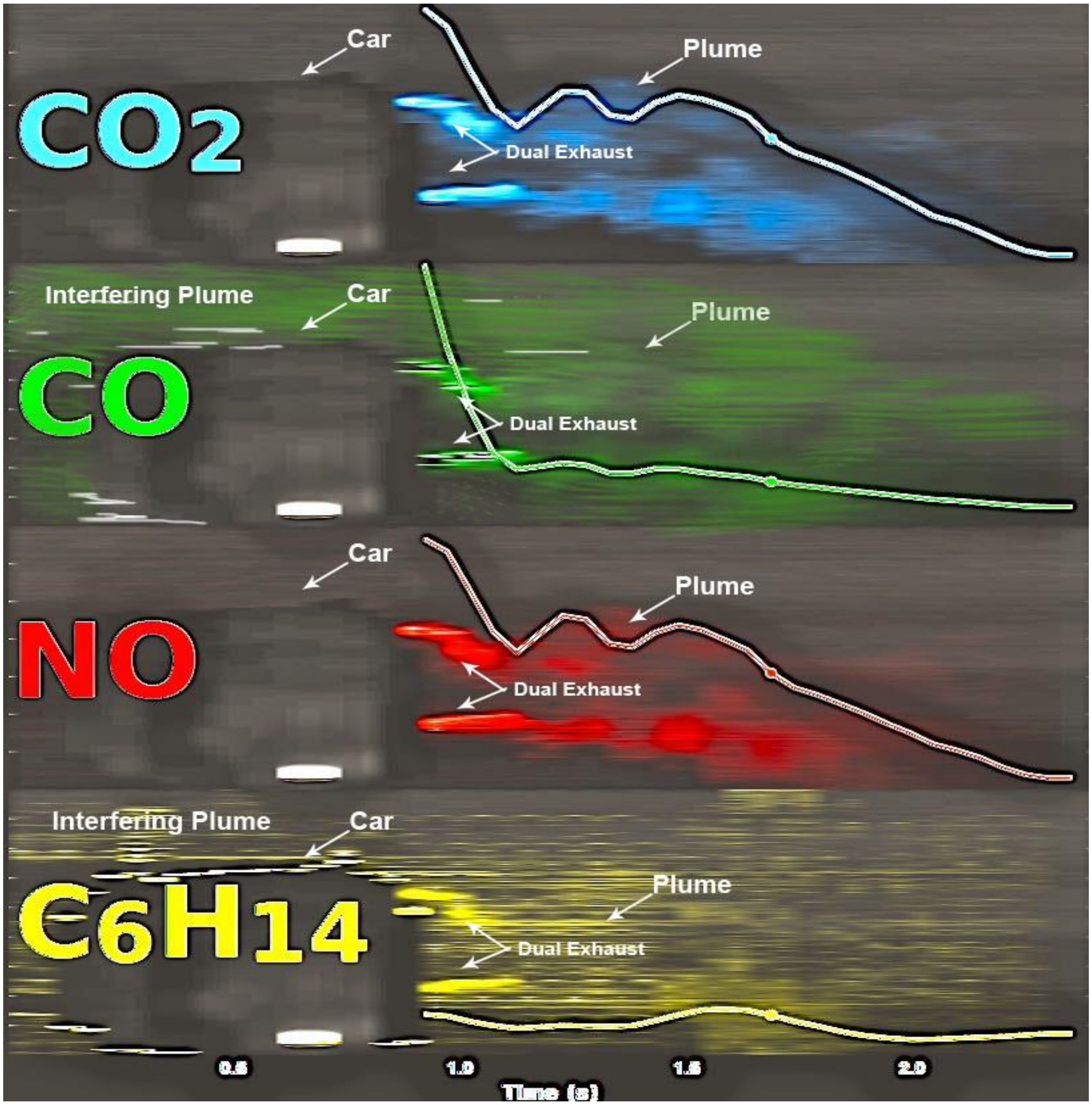
Furthermore, the linear correlation coefficient or Pearson's correlation criteria (r) is applied between the CO_2 measurements and the CO, NO and HC measurements. If the correlation factor is relatively high, the measurement is considered valid. This signifies that there are no interfering plumes. Interfering plumes usually have different ratios of pollutant to CO_2, 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 were inspected to check for 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 9.

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.

Exhibit 9 - Dual Exhaust Vehicle Driving Through the Plume of a Preceding High Emitter



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 10 to 12.

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). For example, the HEAT01 location measured on October 6th had an 8% grade which was a vertical incline of 160 feet that vehicles had to ascend in less than a quarter of a mile to pass under the EDAR unit. The data reflects higher than average NO and CO levels due the increase in power required climbing the hill.

Exhibit 10 - NO Deciles

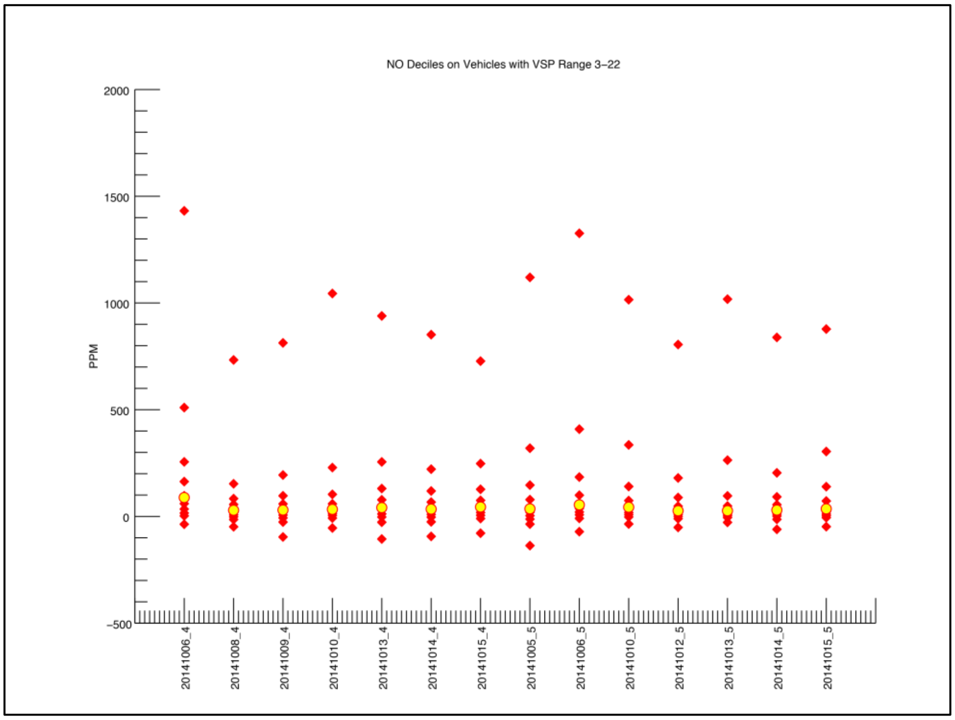


Exhibit 11 - HC Deciles

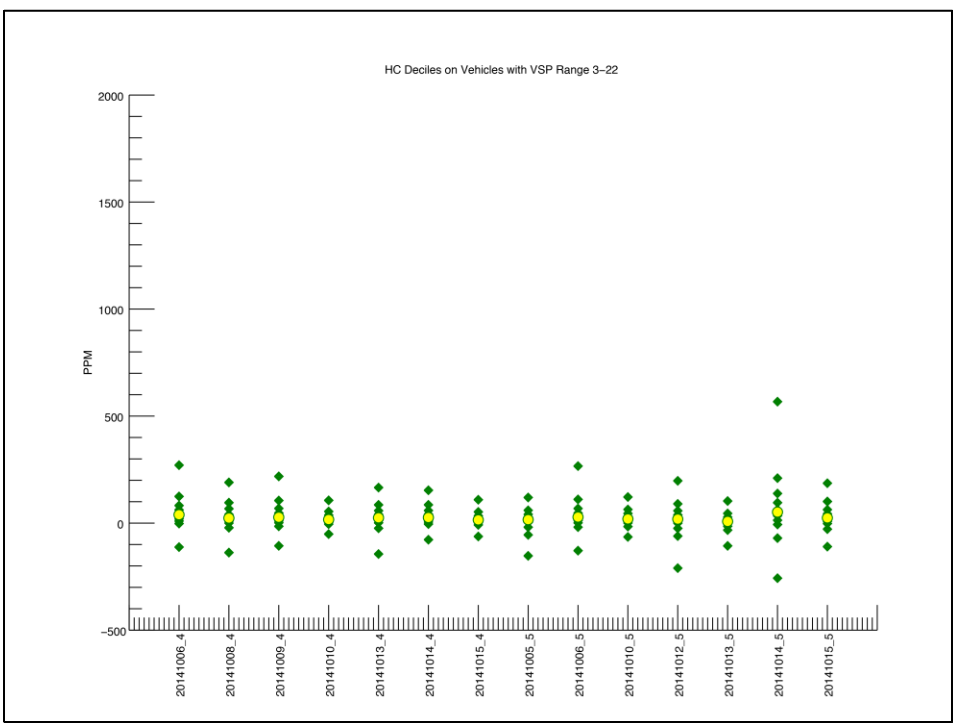
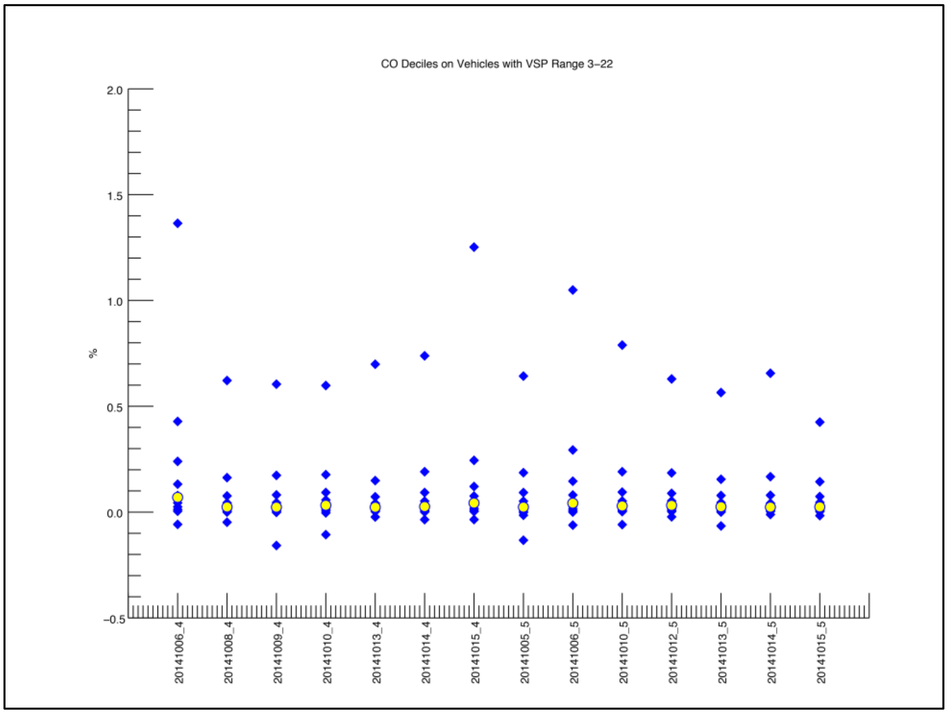


Exhibit 12 - CO Deciles



3 ANALYSIS OF DATA COLLECTED

3.1 General Statistics

The data was collected over 62 hours spanning nine days in the month of October using two EDAR units (EDAR 4 and EDAR 5).

A total of 37,400 attempted measures were made, 8,130 of those vehicles were excluded due to rain and Vehicle Specific Power (VSP) resulting in a total of 29,270 vehicles with valid VSP within 3-22 kW/t. Of those vehicles, 1,707 had unreadable plates, which resulted in valid vehicles of 27,563. There were 1,816 vehicles from states other than Connecticut as well as 2,491 commercial vehicles and motorcycles from Connecticut and other states: resulting in approximately 23,256 (84% percent of the survey) measurements made of light duty vehicles with complete emissions information (speed, acceleration, emission measurements). The Connecticut registration data matched 21,396, out of which 3,480 were excluded due to interfering plumes resulting in a total of 17,916.

Exhibit 13 below shows the EDAR measurements made during the period of testing in Connecticut. Vehicles registered in other states comprised 7% of the survey, while commercial vehicles and motorcycles totaled 9%. Seventy-five percent of the commercial vehicles were from the State of Connecticut. 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 14.

Exhibit 13 - Number of Vehicles Measured by State of Registration or Vehicle Type

Vehicle Type or State	n	Fraction
Connecticut	23,265	84%
Massachusetts	700	3%
New York	352	1.50%
New Jersey	158	0.50%
Other	606	2%
Commercial and Motorcycles	2,491	9%
Total	27,563	100%

Exhibit 14 - Data Collection and Analysis Statistics

Connecticut On-Road Remote Sensing Measurements Description	
EDAR Units	2
Sites	8
Cumulative hours of sampling	62
Data Collection Days	9
Vehicles Measured	37,400
Vehicles Excluded for Weather and VSP	8,130
Valid Measured within 3-22 kW/t VSP	29,270
Vehicles with Visible License Plate	27,563
Out of State Plates	1,816
Commercial Vehicles and Motorcycles	2,491
Vehicles with Connecticut Plates	23, 256
Vehicles Matched to CT Registrations (excludes 2012 and newer MY)	21,396
Valid Measurements after Removing Measurements with Interfering Plumes	17,916
Unique Connecticut Vehicles Identified	16,698
Unique Connecticut Vehicles Identified Once	15,591
Unique Connecticut Vehicles Identified Twice	1,020
Unique Connecticut Vehicles Identified Three Times	75
Unique Connecticut Vehicles Identified Four or More Times	12

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[3], 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[4].

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:

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

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

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

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 $\frac{m}{s^2}$

α 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 vehicle 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 40 states as well as Canada were observed. Exhibit 15 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 16 through 19. The numbers of samples of measurements of out-of-state vehicles were relatively small. This explains the large confident intervals. This means the difference in the average emissions were not statistically significant.

Exhibit 15 lists the average emissions of 2,491 heavy-duty trucks (listed as "commercial") that were observed, as well as 30 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.

Exhibit 15 - Average Pollutant Concentrations and VSP by Jurisdictions

	n	CO%	HC ppm	NO ppm	VSP kW/t
Emissions by State or Type					
Connecticut	23,256	0.12	32	156	10.4
Massachusetts	700	0.11	35	111	10.7
New York	352	0.06	53	90	10.4
New Jersey	158	0.14	24	115	10.3
Other	606	0.11	51	111	10.5
Weighted Average	25,072	0.12	33	152	10.4
Vehicles Excluded at the Request of the State					
Commercial	2,461	0.04	52	456	11.1
Motorcycles	30	1.52	93	772	14.1
Plates Not Readable	1,707	0.11	40	197	12.2
Weighted Average	4,198	0.08	47	353	11.6
Total On-Road	**29,270**				

Exhibit 16 - Mean HC Concentration by Jurisdiction

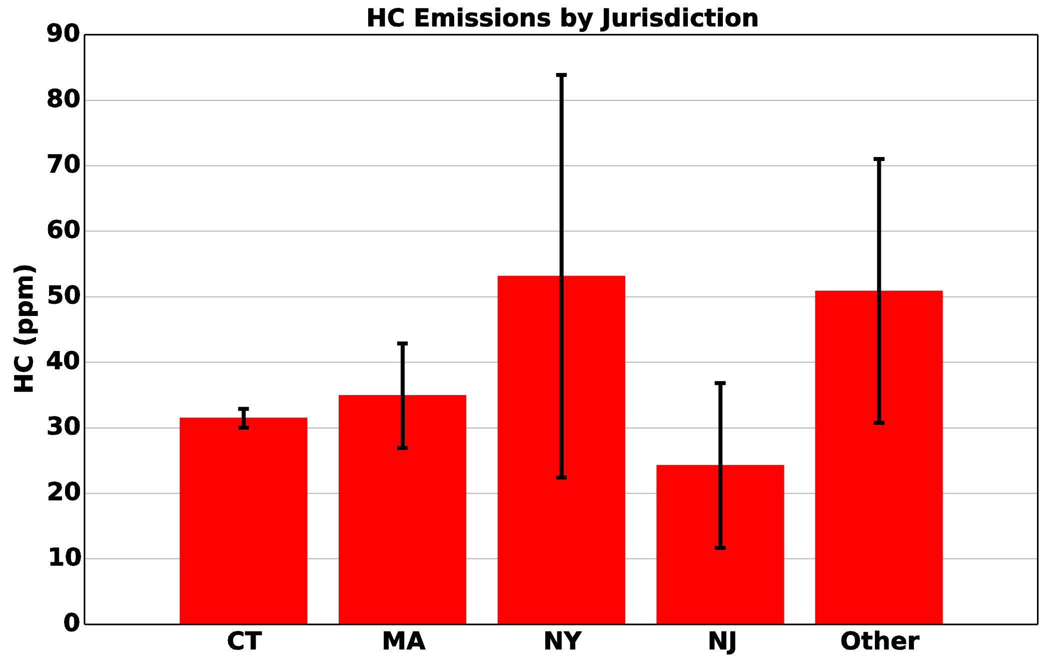


Exhibit 17 - Mean CO Concentration by Jurisdiction

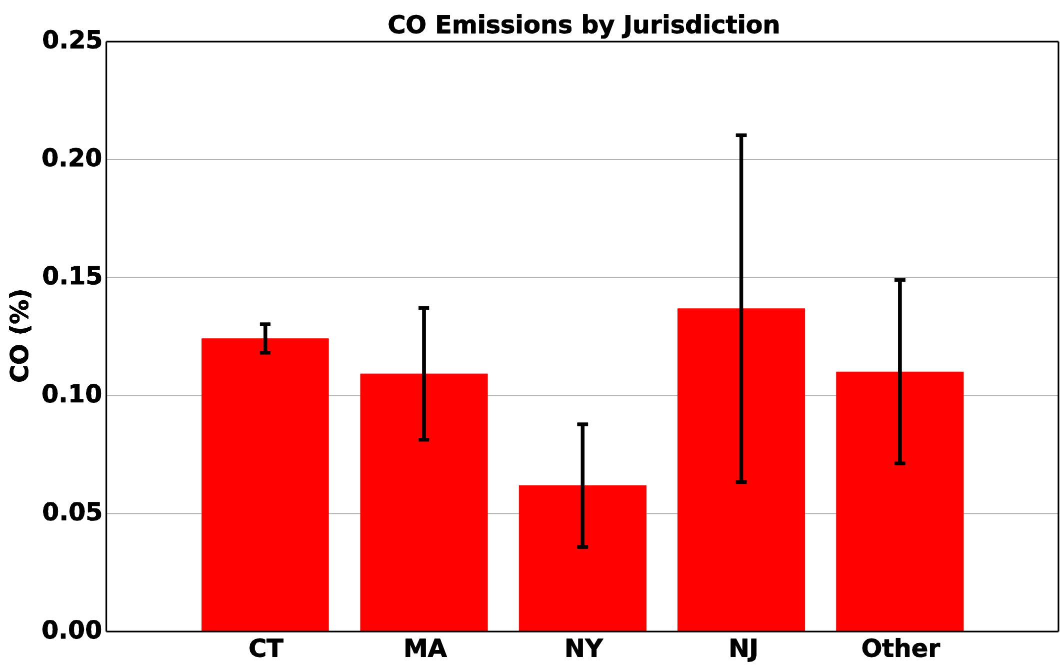


Exhibit 18 - Mean NO Concentration by Jurisdiction

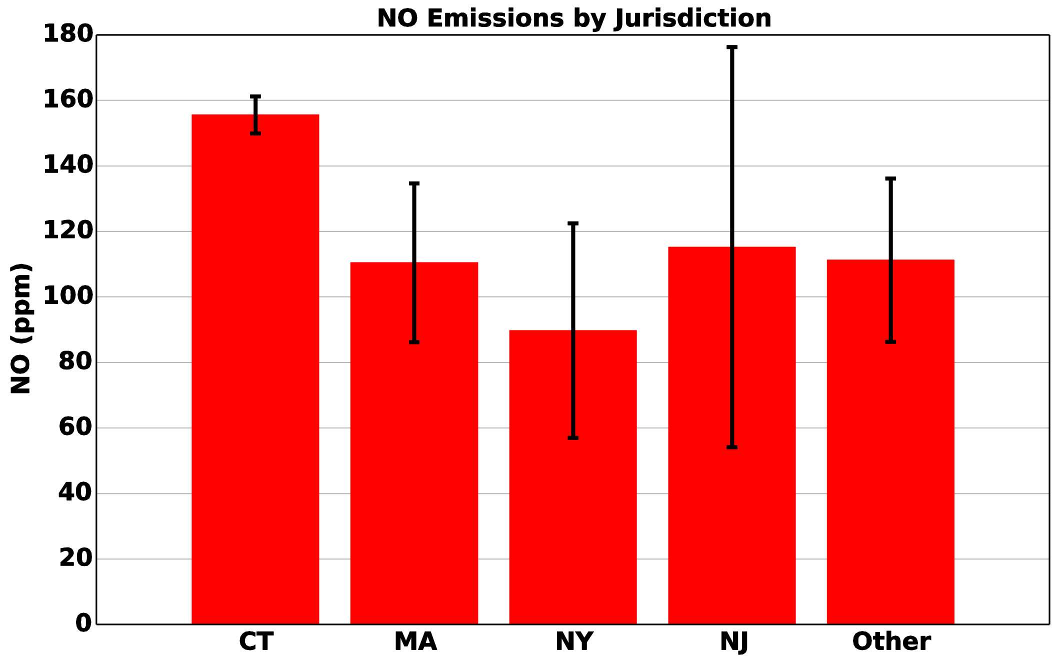
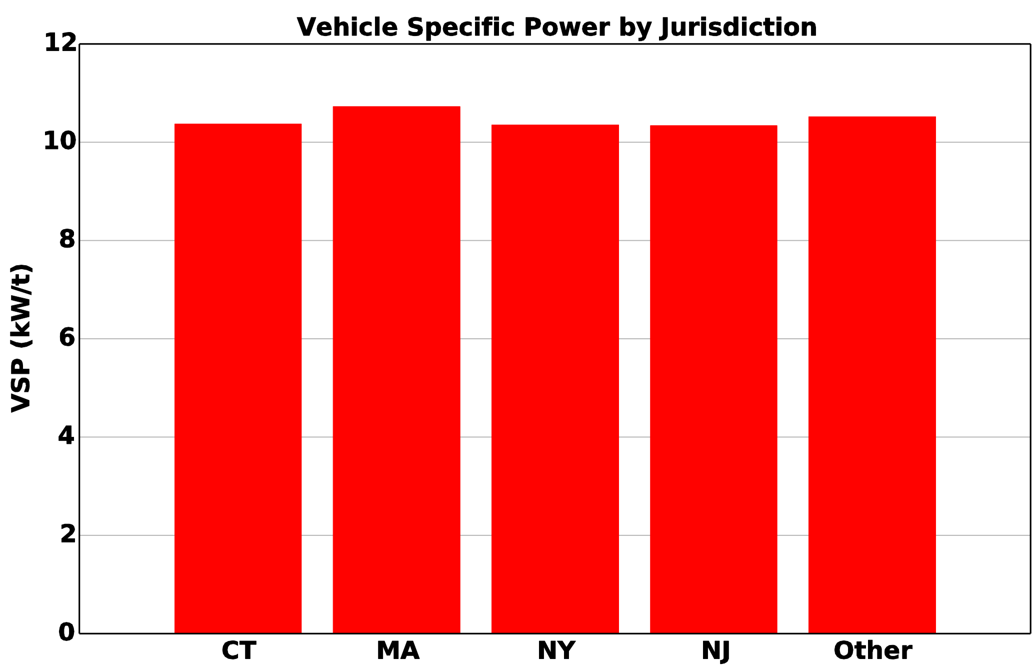


Exhibit 19 - VSP by Jurisdiction



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 20 to 23.

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 2006 and later. Furthermore, large variation of model years older than 20 years could be due to lack of samples. The number of samples for each year is shown in Exhibit 20.

Exhibit 20 - Sampled Connecticut Light Duty Vehicle Distribution in the Study

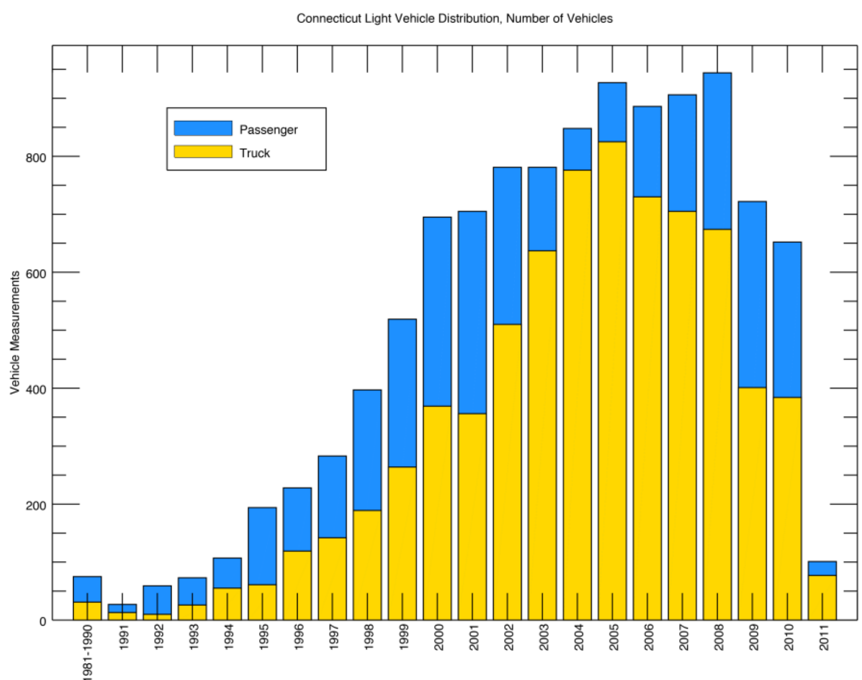


Exhibit 21 - Average CO Emissions

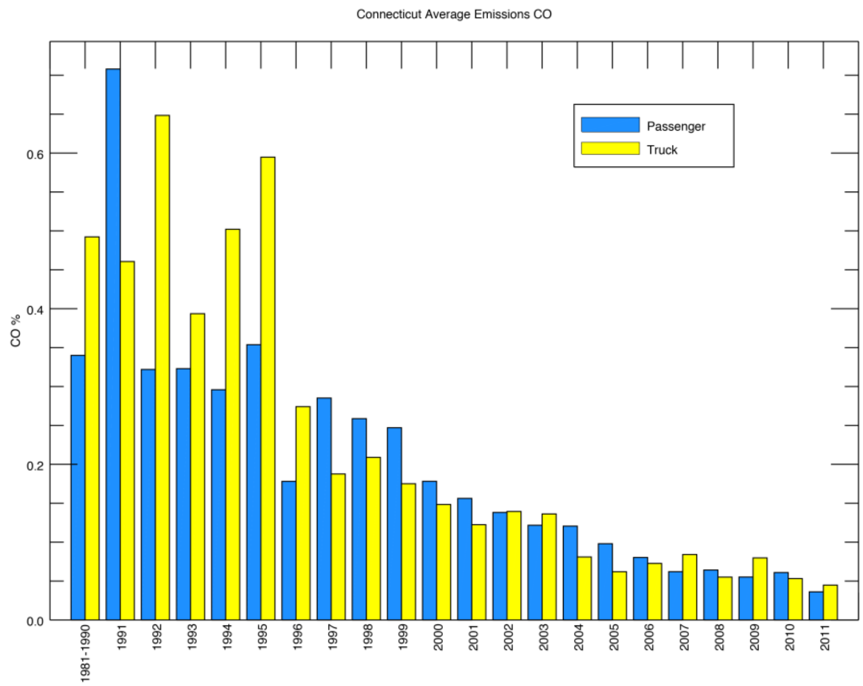


Exhibit 22 - Average NO Emissions

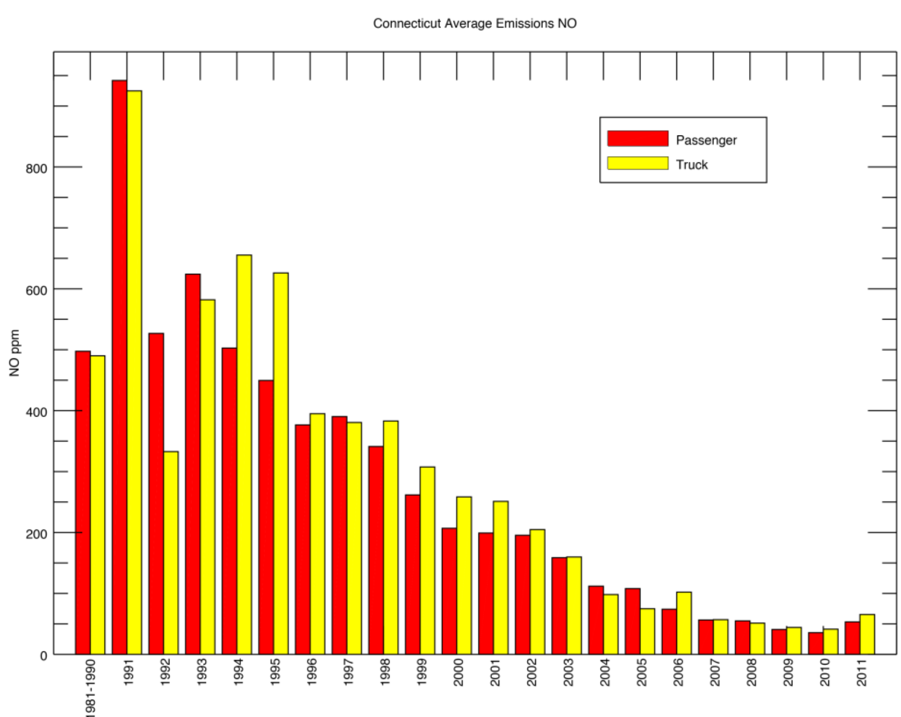
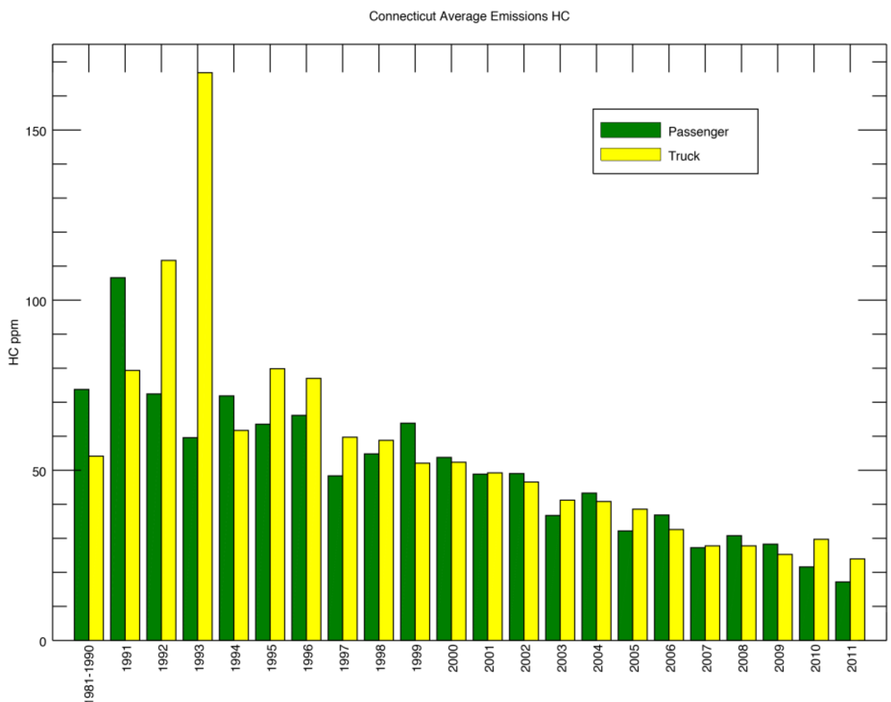


Exhibit 23 - Average HC Emissions



3.3.3 **Emissions Contributions by Model Year**

The mass emission contributions by model year and vehicle type were calculated using the method used in previous years (based on concentration data and VMT assumed to be proportional to population in the sample) and based on the use of mass emissions measurements and actual VMT. A description of and the results from the two methods are provided below.

3.3.3.1 Mass Emissions Calculated Similar Method to Past Years

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 24 through 27. 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 Figure 25 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[5]. 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.

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

Total contributions, overall, appear to be declining for model years 2002 and newer despite a strong population of newer cars. On the other hand, the light duty vehicles for 2002 and older amount to 34% of the vehicles sampled, but contributed 64% of the HC, 56% percent of the CO, and 46% of the NO. As a result, it is still important to enforce the maintenance and encourage the retirement of old vehicles to manage emissions.

All light duty trucks seen in the study amounted to 40% of the population and contributed 45% of the HC, 43% of the CO, and 45% of the NO.

Exhibit 24 - VMT Contribution by Model Year

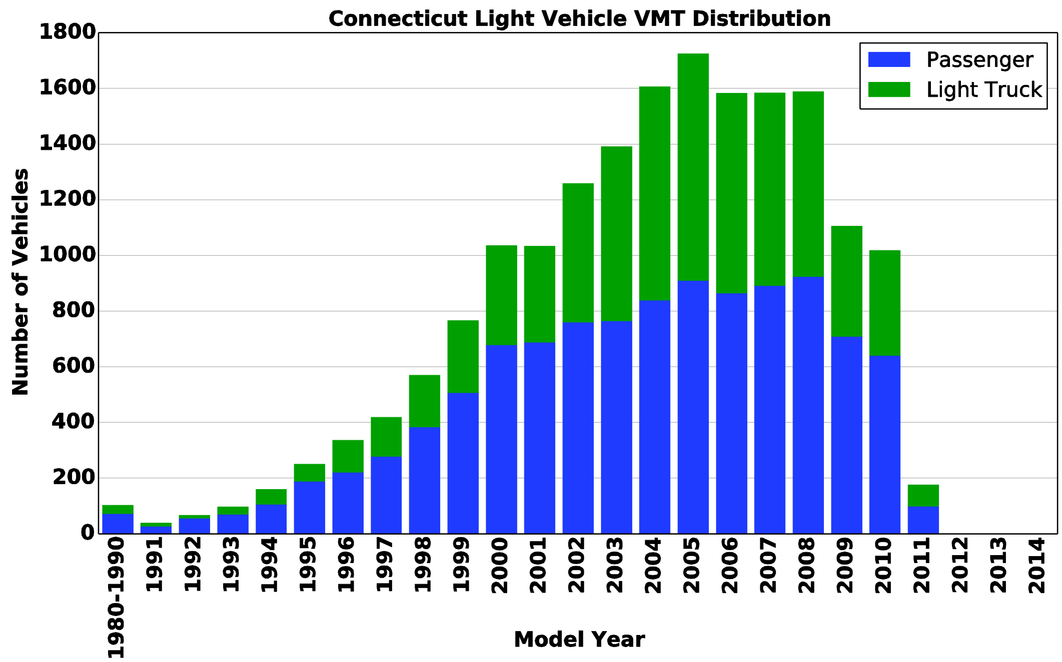


Exhibit 25 - VMT Contribution by Model Year

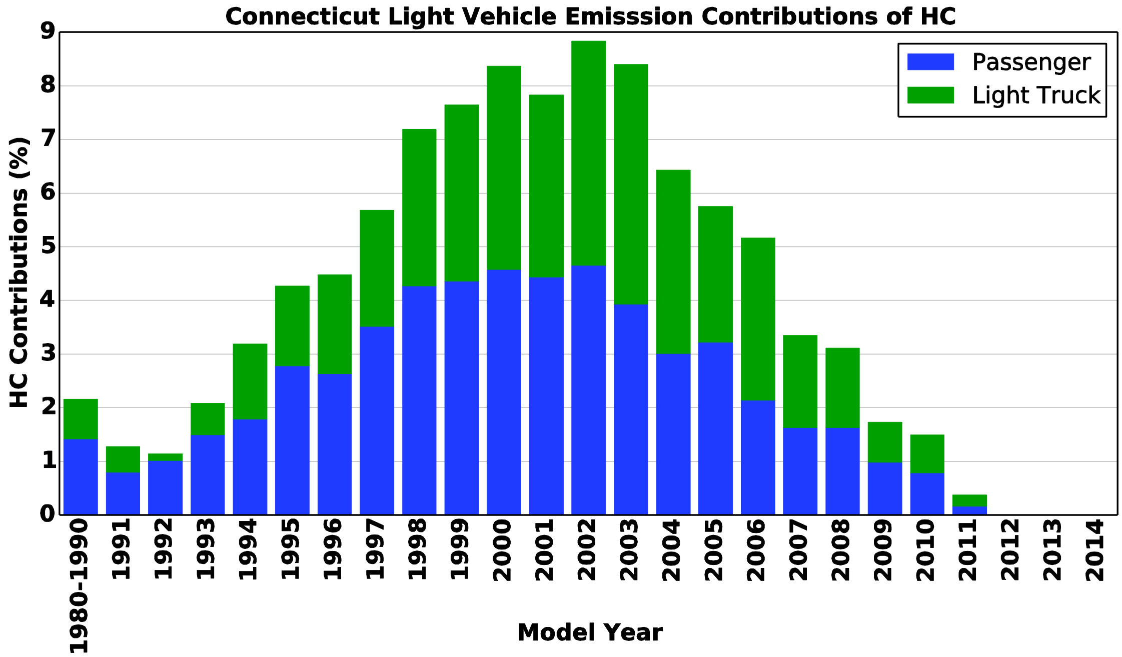


Exhibit 26 - CO Contribution by Model Year

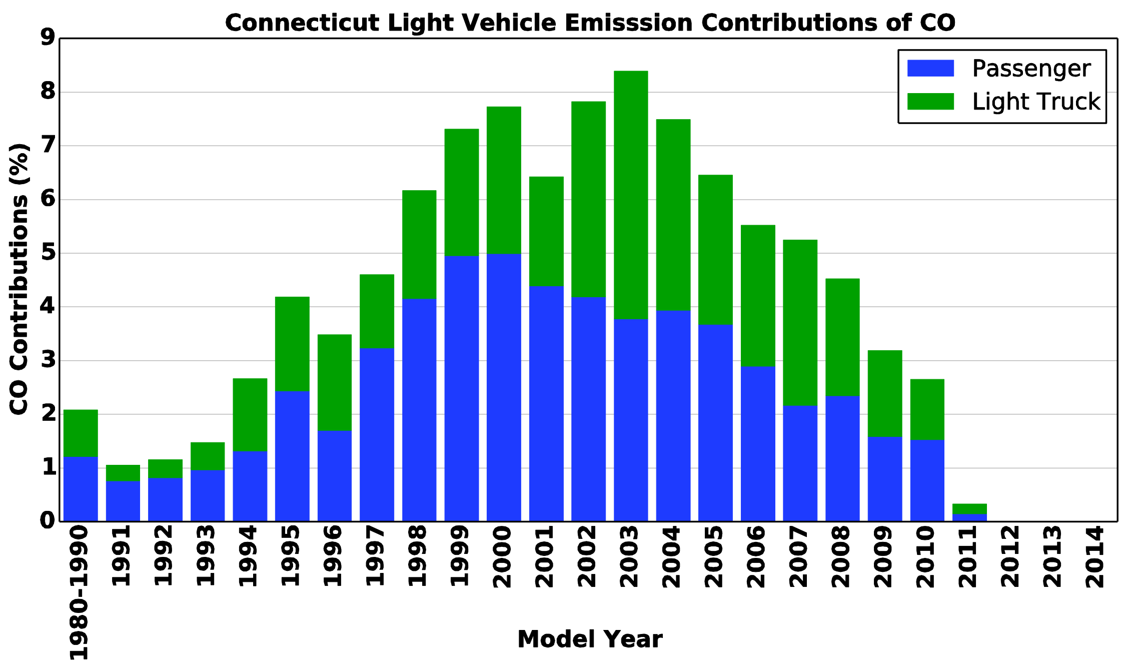
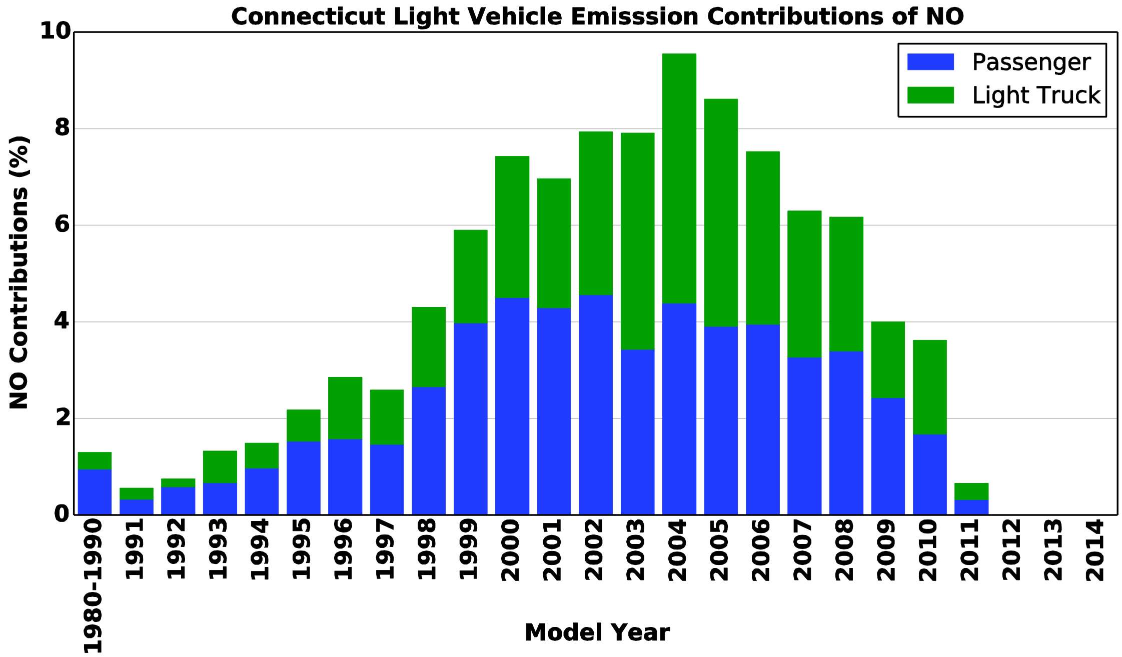


Exhibit 27 - NO Contribution by Model Year



3.3.3.2 Mass Emissions Calculated By Measured Mass Emission Rates

A major advantage to use of EDAR is its ability to directly measure mass emissions as discussed earlier. The estimated hot running mass emissions of the Connecticut Fleet participating in the Connecticut Vehicle Emissions Program was estimated using these mass emissions rates from EDAR, the population of vehicles participating in the program and the vehicle miles traveled for each model year. Each of these is explained below and the data derived for each is provided in the following tables by pollutant (HC, CO and NO), vehicle type (passenger vehicles and trucks) and by model year. As in the above analysis, the contributions are binned by model year with recent years omitted since they were not tested by the Connecticut Vehicle Emissions Program.

The calculation of hot running mass emissions rates was performed for 1989 to 201 vehicles. These were the only vehicles which had VMT, population and mass emissions rate data. The mass emissions in tons per day (TPD) were calculated for passenger cars and trucks, by model year for CO_2, CO, NO and HC. For each the formula used was:

$$\text{Mass emissions (TPD)} = \frac{\text{Population * average annual VMT * average emission rate g/mi}}{\text{365 days/year * 907,185 g/ton}}$$

The VMT values were calculated using odometer reading collected as part of the Connecticut Vehicle Emissions Program. Revecorp received inspection data covering the period January 2013 to October 2014. The data were analyzed to determine the odometer reading of the most recent inspection for each unique VIN, and then the odometer for a prior inspection which took place at least ten months prior. The annual VMT for each was calculated as follows:

$$\text{Annual VMT} = \frac{\text{(Most recent odometer reading – prior odometer reading) * 365}}{\text{Most recent inspection date – prior inspection date}}$$

The results were then grouped by passenger car or truck and by model year.

The population data were determined from the inspection data. Revecorp was provided inspection data for a 22 month period and the Connecticut Vehicle Emissions Program inspects vehicles biennially. The number of unique VINS in the inspection data were counted, and then these count were adjusted for the fact that two full inspection cycles (24 months) of data were not provided. This was done again by passenger car or truck and by model year.

The mass emissions rates for individual vehicles were determined for 12,164 of the 17,916 valid CT plated vehicle measurements (68%). Mass emissions could not be determined for some vehicles, because in order to calculate mass emissions for a vehicle, the entire plume of emissions needs to be observed, and there needs to be minimal interference with the plume from vehicles in adjoining lanes. Because the EDAR unit was mounted on a boom which could be taken down, and had to be a certain distance away from the road therefore, it was not possible to perfectly center the unit over the lane, leading to some measurements not observing the entire plume, of have interference. However, we believe that the 68% of sampled vehicles for which we could determine the mass emissions rate are representative of the overall fleet. The average mass emission rates are shown below in Exhibit 28.

Exhibit 28 - Average Mass Emission Rates (grams per mile)

Average Mass Emission Rates Measured, g/mi										
Model Year	Cars					Trucks				
	n	CO2	CO	NO	HC	n	CO2	CO	NO	HC
1982	0					1	1048	84.94	7.38	2.33
1983	0					0				
1984	0					2	1742	1.59	0.00	0.06
1985	1	2825	0.00	0.01	0.09	0				
1986	2	1376	24.70	0.01	0.24	0			0.01	
1987	5	2122	9.27	3.70	0.56	3	2660	4.29	3.22	0.14
1988	7	2575	26.83	6.39	0.46	5	1604	24.12	1.70	1.25
1989	12	2810	31.32	6.92	0.68	5	1995	25.70	6.58	0.33
1990	23	2599	16.50	7.73	0.55	2	1497	7.03	11.81	0.45
1991	16	2020	33.37	12.79	0.43	6	2050	33.38	3.30	0.58
1992	33	2634	46.45	7.81	0.71	7	1931	6.49	6.40	0.17
1993	53	2439	23.56	8.05	0.54	16	1884	22.11	5.43	1.09
1994	69	2444	21.09	7.90	2.83	32	1859	24.15	3.53	0.55
1995	122	2536	20.40	5.75	0.36	31	1643	30.90	3.74	0.53
1996	163	2581	22.58	4.96	0.54	72	1998	21.85	4.14	1.29
1997	187	2398	23.10	4.90	0.35	90	2117	19.91	4.04	0.47
1998	253	2587	20.27	5.26	0.44	129	2157	12.59	2.67	0.45
1999	342	2556	20.66	3.65	0.74	187	2105	10.79	2.29	0.44
2000	448	2628	16.82	2.53	1.21	251	2110	11.76	2.68	1.42
2001	446	2493	14.65	2.38	1.14	257	2289	10.70	2.14	0.32
2002	515	2640	11.71	2.25	0.32	372	2452	13.42	1.50	1.11
2003	511	2497	11.22	1.59	0.45	443	2428	9.38	0.91	0.25
2004	554	2641	9.94	1.48	0.35	556	2552	7.01	0.68	0.74
2005	582	2609	9.32	1.25	0.66	575	2606	6.76	1.04	0.43
2006	565	2798	9.71	0.77	1.07	519	2756	6.31	0.45	0.46
2007	581	2720	5.19	0.53	1.00	484	2717	7.29	0.26	0.26
2008	615	2553	6.50	0.39	0.26	473	2712	5.82	0.36	0.78
2009	440	2640	5.65	0.37	0.33	285	2717	7.14	0.24	0.46
2010	386	2600	5.27	0.19	0.59	303	2499	5.26	0.38	0.30
2011	68	2815	3.07	0.31	0.15	58	3081	7.51	1.15	0.18
2012	0					1	2625	2.17	0.03	0.12
Total	6999					5165				

The calculated instantaneous hot running mass emissions of the entire fleet were calculated from the mass emission rates given above for 1989 to 2010 vehicles using the population and VMT data previously discussed. The results and the populations and average annual VMT rates can be seen in Exhibit 29 below.

Exhibit 29 - Estimates Instantaneous Hot Running Fleet Mass Emissions (Tons per Day)

Estimated Instantaneous Hot Running Fleet Mass Emissions												
Model Year	Tons per day - Cars						Tons per day - Trucks					
	IM Population	VMT	CO2	CO	NO	HC	IM Population	VMT	CO2	CO	NO	HC
1989	5,639	15,003	718	8.00	1.77	0.17	4,045	9,882	241	3.10	0.79	0.04
1990	7,651	4,207	253	1.60	0.75	0.05	3,670	7,495	124	0.58	0.98	0.04
1991	9,197	4,429	248	4.10	1.57	0.05	3,733	11,050	255	4.16	0.41	0.07
1992	12,385	4,201	414	7.30	1.23	0.11	4,970	7,400	214	0.72	0.71	0.02
1993	16,453	5,361	650	6.28	2.14	0.14	8,138	8,393	389	4.56	1.12	0.22
1994	21,020	5,460	847	7.31	2.74	0.98	14,027	6,974	549	7.14	1.04	0.16
1995	31,151	5,608	1,338	10.76	3.03	0.19	19,147	5,403	513	9.65	1.17	0.17
1996	33,760	5,575	1,467	12.84	2.82	0.30	20,756	5,168	647	7.08	1.34	0.42
1997	47,748	5,951	2,058	19.82	4.20	0.30	32,093	5,472	1,123	10.56	2.14	0.25
1998	57,639	5,528	2,489	19.50	5.06	0.43	51,304	5,639	1,885	11.00	2.33	0.39
1999	69,973	6,142	3,318	26.82	4.74	0.96	49,325	5,775	1,811	9.28	1.97	0.38
2000	87,476	7,546	5,239	33.54	5.04	2.42	57,761	7,047	2,594	14.46	3.29	1.75
2001	86,848	7,285	4,764	27.99	4.55	2.18	64,509	7,465	3,328	15.57	3.12	0.47
2002	99,478	6,394	5,071	22.50	4.32	0.62	82,485	6,724	4,106	22.48	2.51	1.85
2003	97,572	8,526	6,273	28.19	3.98	1.14	85,351	8,631	5,402	20.87	2.02	0.55
2004	99,576	7,798	6,193	23.31	3.47	0.81	106,990	8,414	6,940	19.05	1.86	2.02
2005	98,580	10,094	7,840	28.01	3.75	1.97	97,349	10,633	8,146	21.14	3.24	1.36
2006	102,140	9,597	8,283	28.74	2.28	3.17	95,593	10,357	8,239	18.87	1.35	1.38
2007	105,456	12,213	10,578	20.20	2.05	3.89	86,377	12,686	8,993	24.11	0.86	0.87
2008	105,289	11,314	9,186	23.39	1.40	0.93	90,046	12,363	9,118	19.57	1.20	2.63
2009	79,569	13,603	8,629	18.46	1.21	1.08	52,129	13,697	5,860	15.40	0.52	1.00
2010	67,451	13,012	6,892	13.98	0.50	1.56	53,489	14,258	5,757	12.11	0.88	0.69
Total	1,342,051	11,759,785,897	92,749	392.63	62.59	23.47	1,083,288	10,063,117,117	76,233	271.47	34.86	16.73

Note that the Total VMT values is the sum of the population times the annual average VMT by model year, for all model years (i.e., there were an estimated 11.7 billion miles driven by cars in Connecticut in 2013). The contributions to overall emissions by each vehicle type and model year, for each pollutant can be seen in Exhibits 30 to 33 based on the instantaneous measurements and are not representative of all conditions.

Exhibit 30 - CO_2 Emissions (Tons per Day) By Vehicle Type and Model Year

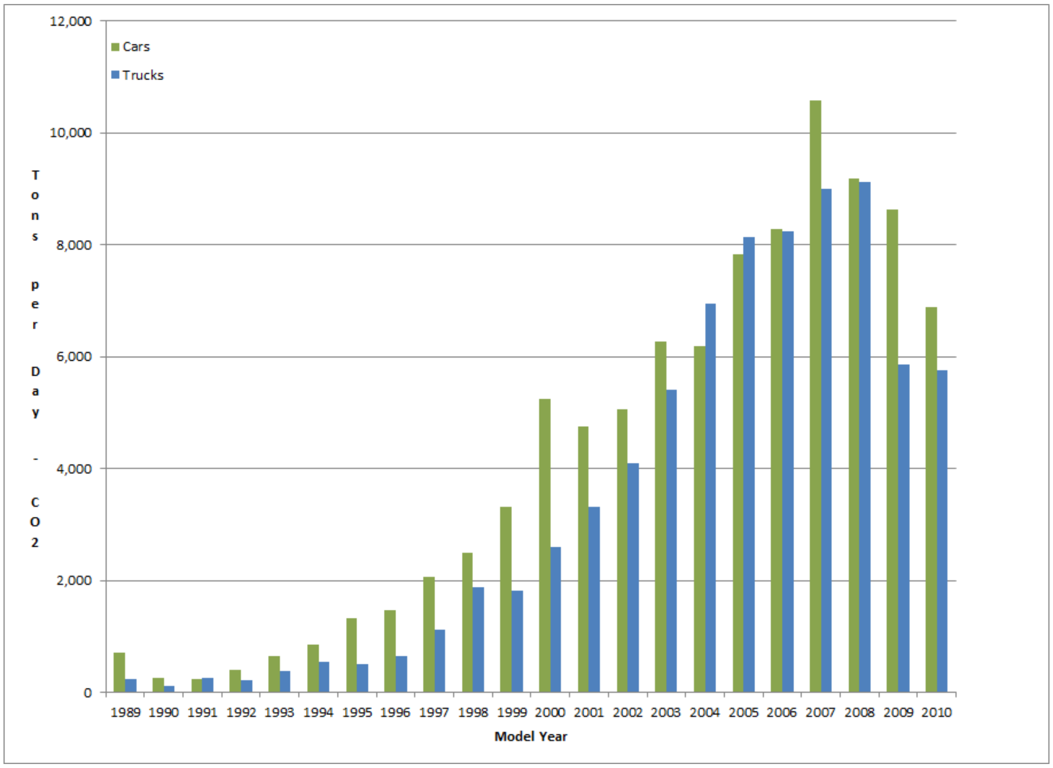


Exhibit 31 - CO Emissions (Tons per Day) By Vehicle Type and Model Year

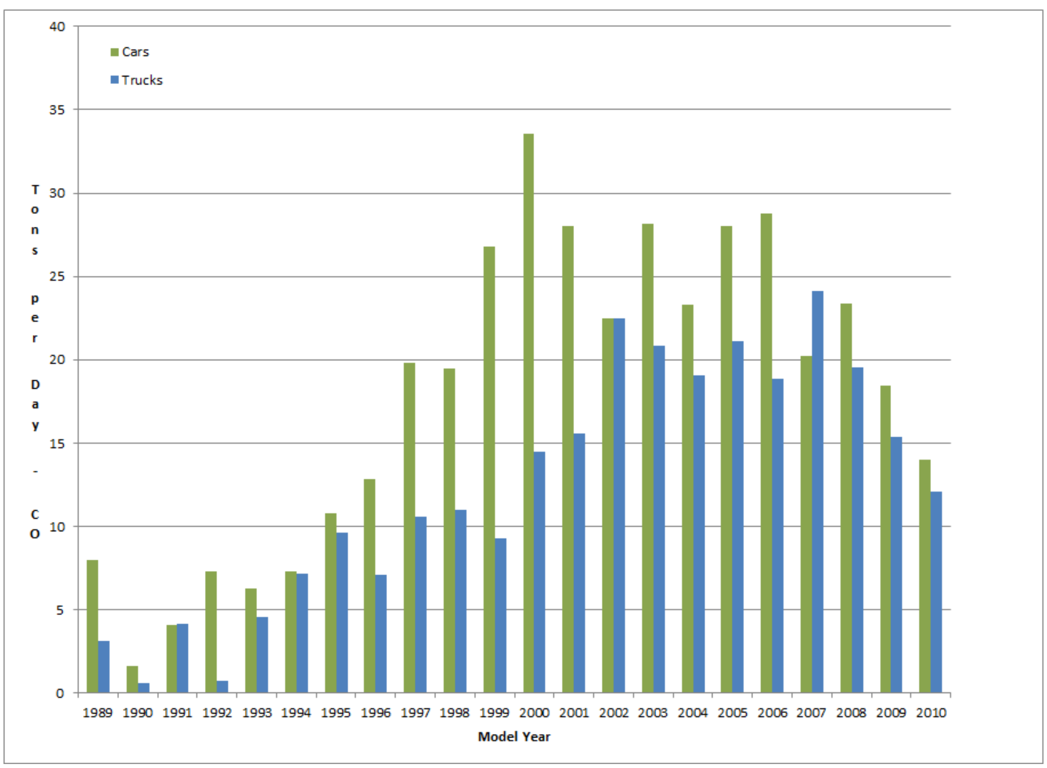


Exhibit 32 - NO Emissions (Tons per Day) By Vehicle Type and Model Year

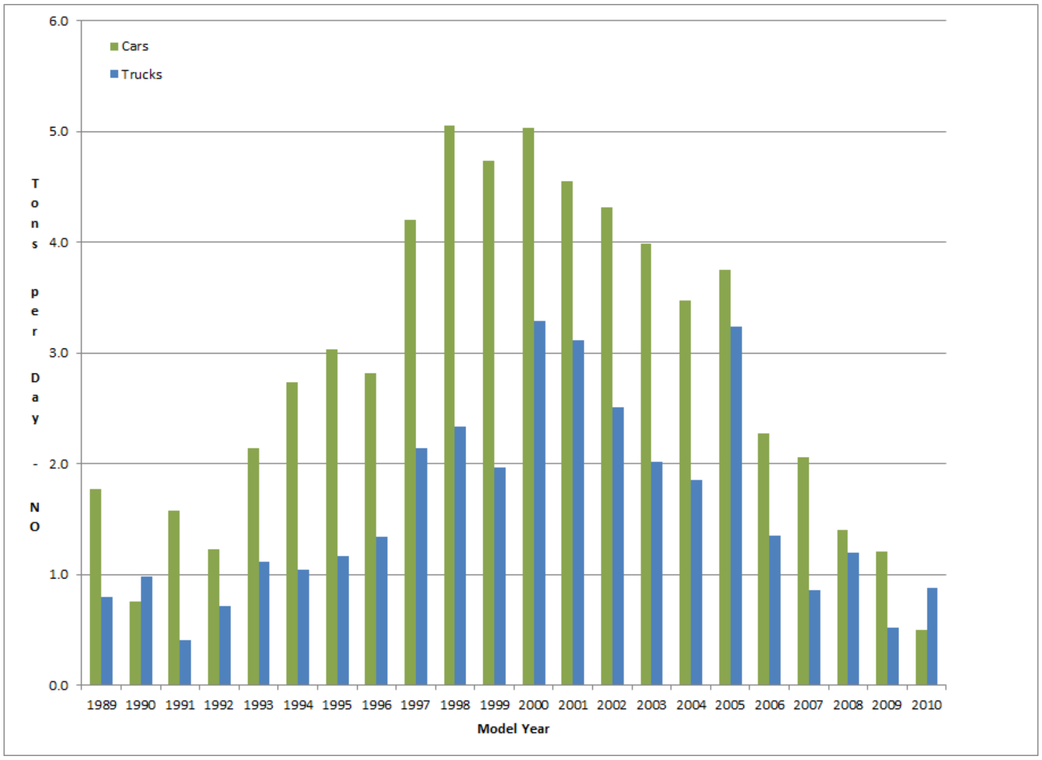
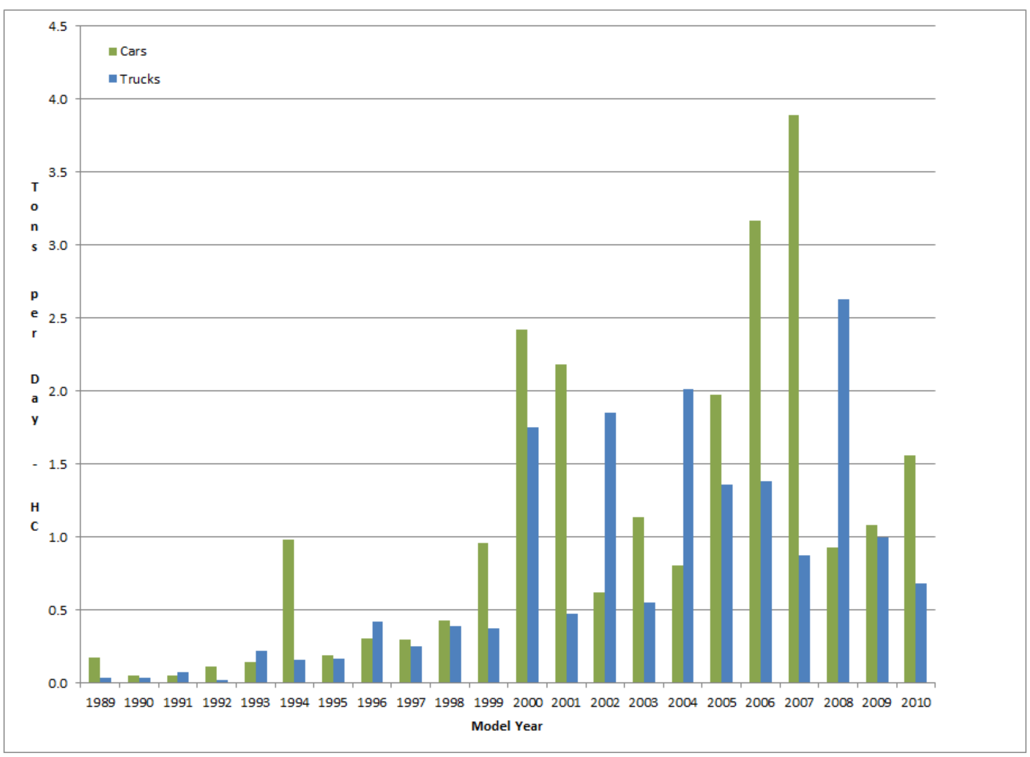


Exhibit 33 - HC Emissions (Tons per Day) By Vehicle Type and Model Year



The Exhibits show that the bulk of CO_2 emissions are coming from newer vehicles. Emissions of CO are spread more evenly across model years 2002 and newer model year vehicles. The maximum contribution to NO emissions for cars was centered around 1998 model year vehicles, while for trucks the maximum was centered around 2001 model year vehicles. The fleet emissions of HCs was fairly noisy, however the bulk of the hydrocarbon emissions was generated by newer vehicles with some newer cars have very high emission contributions.

3.3.4 **Emissions Contributions by Fleet Fraction and Pollutant**

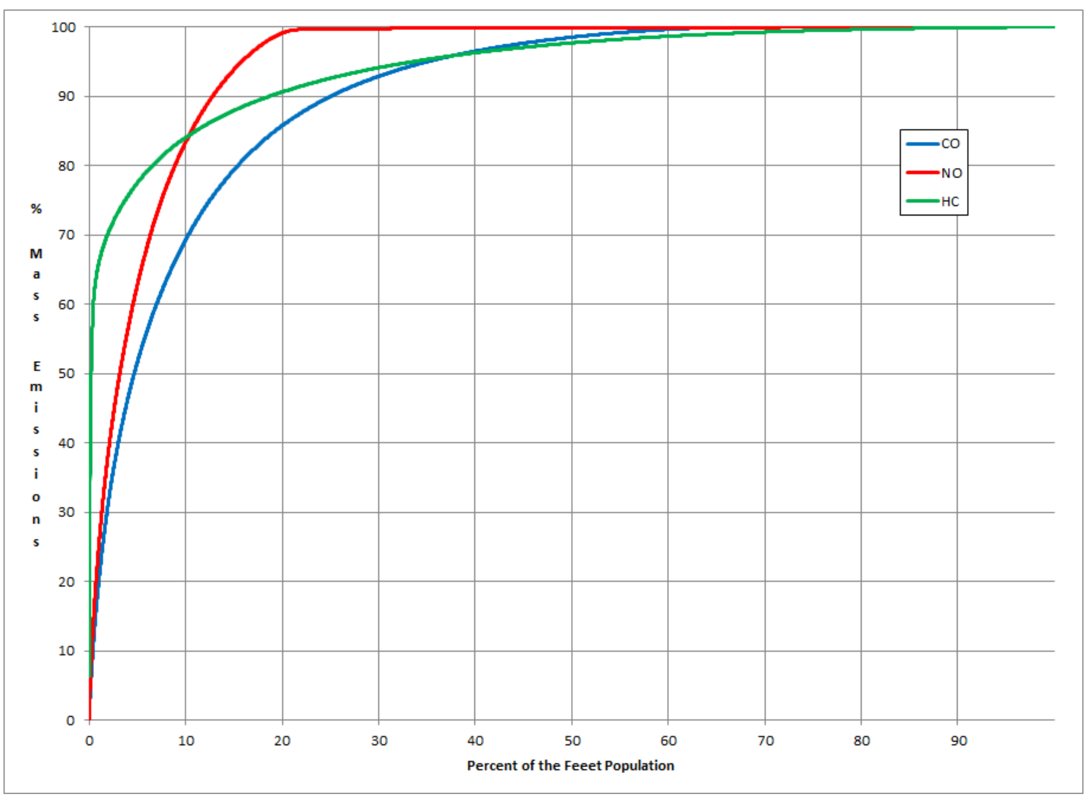
Because the EDAR unit allows for the determination of mass emission rates, these can be combined with the estimated average annual VMT to calculate the contributions of each individual vehicle to overall fleet emissions. The results of the individual calculated mass emission rates can then be ordered from highest contribution to lowest, and plotted by fraction of the fleet. This allows for determination of emissions contribution of different fractions of the fleet. The results are shown in Exhibit 34 below.

In summary the contributions of the 10% dirtiest fraction of the fleet were:

- CO – 69.3%
- NO – 83.4%
- HC – 84.1%

These results are in line with other remote sensing studies of contributions of emitters by fleet fractions.

Exhibit 34 - Percent Emissions Contributions (CO, NO and HC) by Fleet Fraction



4 HIGH EMITTERS

High Emitters were identified from 17,916 vehicle measurements that were matched to Connecticut registrations. Cutpoints 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 cutpoints as were used in previous studies, the number of high emitters for HC, CO or NO that exceeded at least one cutpoint amounted to 307 vehicles or 1.7% of the identified population. The average emissions for these vehicles were 238 ppm HC, 1.5% CO, and 1628 ppm NO. The majority of high emitters were for high NO emissions. Exhibit 35 lists the breakdown of high emitters by cutpoint. Exhibit 36 lists the combination of cutpoints exceeded and shows that only a handful of vehicles exceeded more than one cutpoint. Review of the tailpipe versus ambient temperature data for the 307 high emitters indicates that none of these vehicles likely had high emissions due to operation in cold start mode.

The mass emissions contributions of the high emitters was calculated and it was found that although they only represent 1.73% of the fleet measured on-road, they represent 1.35% of the CO_2, 2.05% of the CO, 2.80% of the NO and 1.52% of the HC for the hot running fleet tailpipe emissions.

Exhibit 35 - High Emitters

HE Cutpoint	Count
Emissions cutpoints exceeded:	
HC > 500 ppm	71
CO > 3%	72
NO > 2000 ppm	174
Smoke	2
Vehicles exceeding one or more cutpoints	307
Total cutpoints exceeded	317

Exhibit 36 - High Emitters by Pollutant Combination

HE Cutpoint Combinations	Count
Single pollutant:	
HC Only	61
CO Only	64
NO Only	172
Smoke Only	2
Two Pollutants:	
HC & CO Only	8
HC & NO Only	2
CO & NO Only	0
Three Pollutants:	
HC, CO & NO	0
All pollutants:	
HC, CO, NO & Smoke	
Total	309

4.2 High Emitter Numbers and Percent by Model Year

Exhibit 37 shows the percentage of high emitters for each model year. Exhibit 38 shows the number of high emitters for each model year. Vehicles with a model year above 2011 were omitted from the study.

Exhibit 37 - Percent of High Emitters by Model Year

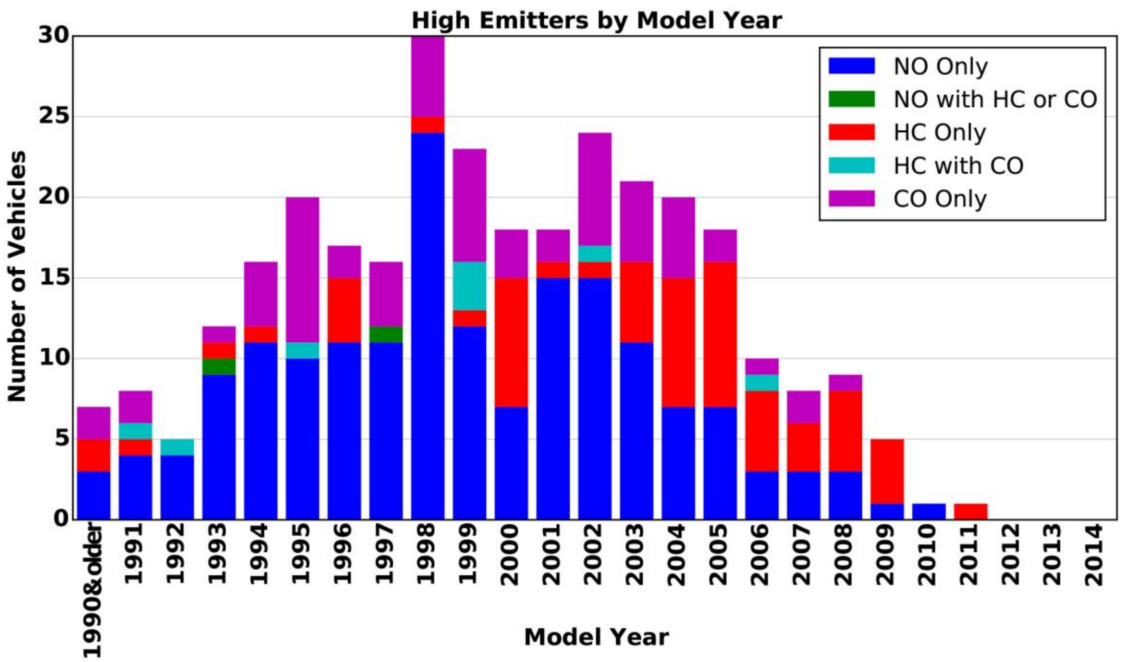
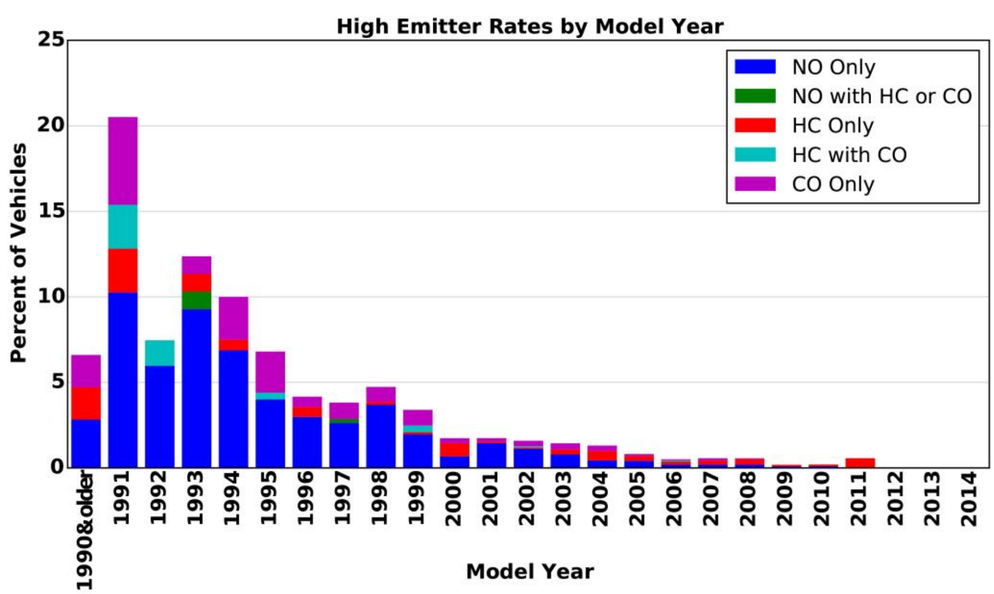


Exhibit 38 - Number of High Emitters by Model Year



4.3 Fleet Emissions

The EDAR unit allows for the determination of the mass emission rates of the vehicles observed on the road. These measurements only include the "hot running" portion of the emissions, not "cold start" or "hot start" emissions since they are measured on vehicles expected to be warmed up while operating on road under load. These hot running mass emission rates were combined with the vehicle miles traveled to calculate the overall mass emissions impact in tons per day (TPD) of the feet by vehicle type (car and truck). These measurements can be compared from one biennial study to the next to determine the overall changes in fleet average emissions. Exhibit 39 below provides a summary of these emissions and is based on the calculation methods given in Section 3.3.3.2 and are also provided by model year in Exhibit 29. The vehicle pollution data and the VMT were determined from station based Connecticut Vehicle Inspection Program data provided by Applus.

Exhibit 39 - Vehicle Population, VMT, and Hot Running Emissions (TPD) by Vehicle Type and Total

	IM Population	VMT	CO2	CO	NO	HC
Cars	1,342,051	11,759,785,897	92,749	392.63	62.59	23.47
Trucks	1,083,288	10,063,117,117	76,233	271.47	34.86	16.73
Total	2,425,339	21,822,903,015	168,981	664.10	97.46	40.19

The results by model year indicate that newer model year vehicles are the largest contributors to CO_2 emissions, CO was dominated almost evenly by model year 2000 and newer vehicles, NO was dominated by 1998 to 2001 model year vehicles and hydrocarbons were dominated by 2000 and newer model year vehicles.

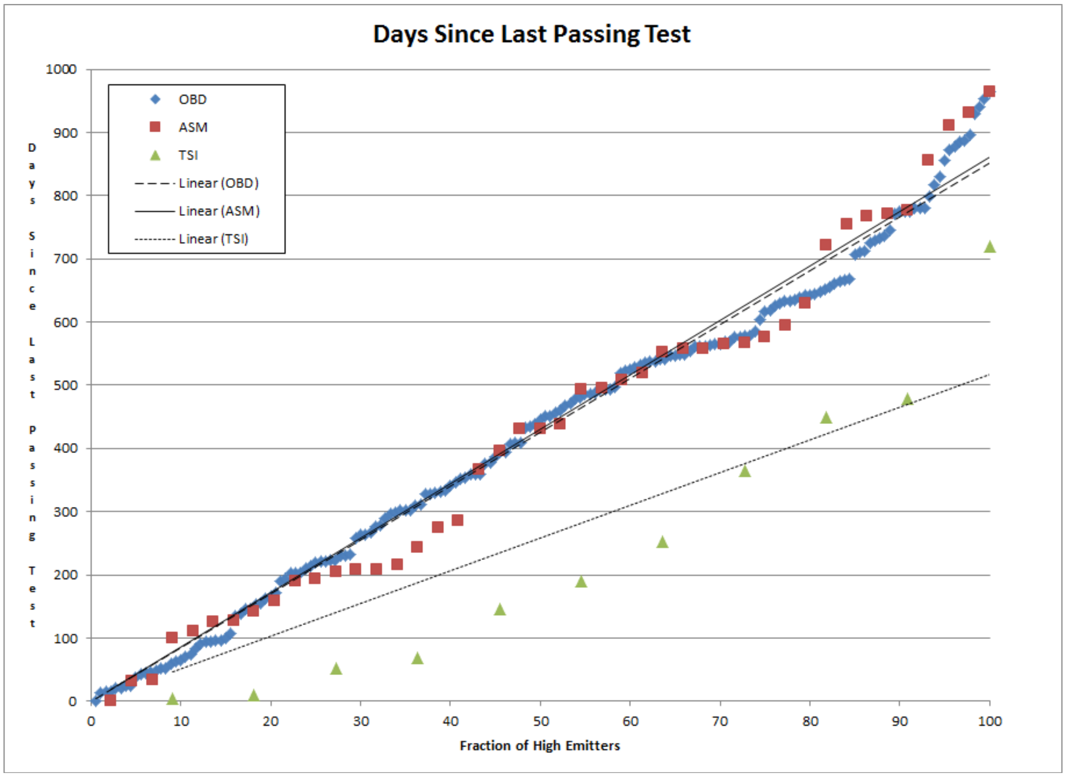
The contributions to total on-road hot running exhaust emission of the 10% dirtiest fraction of the fleet were found to be 84% for HC, 69% for CO and 83% for NO.

4.4 Analysis of High Emitter Vehicle Histories

A key reason for performing on road emissions measurements is to determine the on-road high emitter rate, to determine the contribution to overall excess pollution these vehicles are generating and to determine if there is systemic fraudulent testing in the program. Because the number of high emitters observed on road was very low (1.7% of the sample), the potential level of fraudulent testing, if present would be small.

An indication of potential fraud would be observing vehicles on road with high emissions, immediately after passing a station based inspection. This is commonly referred to as "clean for a day". One way to determine if this is occurring, is to look at the observed on road failures as a function of when they passed their last Connecticut Vehicle Emissions Program station based inspection. This was done by looking up the date of each vehicle observed on road as a high emitter, and then determining the time since passing the last Connecticut Vehicle Emissions Program station based inspection from the inspection data. If vehicles were being falsely passed, the fraction of high emitters observed on road immediately after passing an inspection would be high – that is, there would be a large number of vehicles in the first 10% of the high emitting fleet. As can be seen in Exhibit 40, the days since passing an inspection and then being observed on road with high emissions is fairly linear and there is no increase right after inspection. This indicates that the Connecticut Vehicle Emissions Program has a high compliance rate and there is no indication of fraud based on analysis of the study data.

Exhibit 40 - Days Since Last Passing Inspection for High Emitting Vehicles Observed On-Road



The results of the last emissions inspection for the high emitting vehicles were also analyzed to see if there was a correlation between high emissions and failing the last inspection (previous inspection data could not be located for 30 vehicles and two vehicles were diesels which also had no previous inspection data). In Exhibit 41 below, the failure rates at the last Connecticut Vehicle Emissions Program inspection of vehicles (by test type – Any, OBDII, ASM or TSI) are given by the results observed by the EDAR unit on road. The table shows clearly that the EDAR unit does an excellent job of identifying vehicles which fail their station based emissions inspections. While only 3.3% of vehicles which were not high emitters fail the inspection, 14.9% of the vehicles identified by EDAR as high emitting failed their most recent inspection. This makes it clear that the EDAR unit can identify vehicles on road which are high emitting and in need of repairs.

Exhibit 41 - Last Inspection Result by Test Type versus On Road Passing and High Emitting Vehicles

Failure Rates by Test Type				
On-Road	Overall	OBD	ASM	TSI
Not High Emitting	3.3%	3.3%	4.1%	0.3%
High Emitter	14.9%	16.2%	12.8%	0.0%

It should be noted that the cutpoints used were designed only to capture high emitters, not just vehicles which may be failing inspection standards. If cutpoints closer to the in use emissions standards were applied, the capture rate on road of vehicles failing their emissions inspection would have been higher than the 14.9% identified above.

An additional reason for some vehicles which passed their inspection but were identified as high emitters can be seen in the sample which received a TSI test at their last inspection. There were 11 vehicles which were identified as high emitters and had passed the TSI (two speed idle) test. However, the TSI test only measures the pollutants HC and CO. Analysis of the EDAR data for these vehicles found that 7 of these vehicles had high emissions of NO, and therefore would not have been expected to be identified or failed but the TSI test. This shows an advantage of using EDAR on road, to identify high emitters which cannot be identified by the inspection program.

Failures of the OBDII test can be more difficult for on-road emissions measurements to correlate to, however Exhibit 41 above indicates that there was good correlation between the EDAR high emissions identification and vehicles having failed their last OBDII inspection. It can be expected that there will be vehicles which fail the OBDII test and will not be identified by EDAR because they have a problem which is not causing high emissions (such as a sensor failure). However, these vehicles also are not causing high on road emissions, therefore they are not a concern from a pollution aspect. Only actual high emitting vehicles are identified by EDAR.

Vehicles with high on road emissions also had a higher number of average tests per inspection cycle (from last passing test to the current passing test) than vehicles which had lower on road emissions (1.23 versus 1.08 inspections per inspection cycle). This indicates that vehicles which do have a failure of an inspection at some point in their lifetime are more likely to again exhibit failures. The EDAR sampling observed this phenomenon.

4.5 **Analysis of Mass Emission Contributions of High Emitting Vehicles**

The mass emissions contributions of the high emitting vehicles to the overall fleet were calculated using the same formula provided in Section 3.3.3.2 above. The results are giving in Exhibit 42. In this exhibit, on the bottom row is the relative contribution of emissions from the high emitters is compared to the overall sampled fleet. For cars, the high emitters were 1.87% of the fleet, however their mass emissions of CO and NO were 2.13% and 2.76%, indicating that these vehicles were significant contributors to excess pollution. For trucks, a similar trend is observed. The high emitters were 1.47% of the fleet, however their mass emissions of CO and NO were 1.90% and 3.12%, indicating that these vehicles were also significant contributors to excess pollution.

Exhibit 42 - Estimates Instantaneous Hot Running High Emitter Mass Emissions (Tons per Day)

Estimated Instantaneous Hot Running Mass Emissions - On-Road High Emitters												
Model	Tons per day - Cars						Tons per day - Trucks					
Year	Fails	VMT	CO2	CO	NO	HC	Fails	VMT	CO2	CO	NO	HC
1989	1	15,003	0.1273	0.001419	0.000314	0.000031	1	9,882	0.0595	0.000767	0.000051	0.000010
1990	2	4,207	0.0660	0.000419	0.000196	0.000014	1	7,495	0.0339	0.000159	0.000149	0.000010
1991	4	4,429	0.1081	0.001785	0.000684	0.000023	4	11,050	0.2736	0.004456	0.001577	0.000078
1992	3	4,201	0.1002	0.001768	0.000297	0.000027	2	7,400	0.0863	0.000290	0.000147	0.000008
1993	8	5,361	0.3158	0.003051	0.001043	0.000069	3	8,393	0.1432	0.001681	0.000486	0.000083
1994	8	5,460	0.3224	0.002782	0.001042	0.000373	9	6,974	0.3524	0.004578	0.001029	0.000104
1995	10	5,608	0.4295	0.003454	0.000973	0.000062	7	5,403	0.1876	0.003529	0.000403	0.000061
1996	11	5,575	0.4781	0.004183	0.000918	0.000099	7	5,168	0.2183	0.002387	0.000408	0.000141
1997	13	5,951	0.5603	0.005397	0.001145	0.000081	4	5,472	0.1400	0.001316	0.000274	0.000031
1998	19	5,528	0.8205	0.006429	0.001667	0.000141	11	5,639	0.4041	0.002359	0.000757	0.000084
1999	20	6,142	0.9485	0.007666	0.001354	0.000275	7	5,775	0.2570	0.001317	0.000326	0.000053
2000	16	7,546	0.9582	0.006135	0.000921	0.000443	4	7,047	0.1796	0.001001	0.000195	0.000121
2001	12	7,285	0.6583	0.003867	0.000629	0.000301	7	7,465	0.3611	0.001689	0.000423	0.000051
2002	14	6,394	0.7137	0.003167	0.000607	0.000087	10	6,724	0.4978	0.002725	0.000435	0.000225
2003	12	8,526	0.7715	0.003466	0.000490	0.000140	8	8,631	0.5063	0.001956	0.000312	0.000052
2004	13	7,798	0.8086	0.003044	0.000453	0.000106	8	8,414	0.5189	0.001425	0.000185	0.000151
2005	11	10,094	0.8748	0.003125	0.000418	0.000220	5	10,633	0.4184	0.001086	0.000110	0.000070
2006	5	9,597	0.4055	0.001407	0.000111	0.000155	2	10,357	0.1724	0.000395	0.000065	0.000029
2007	6	12,213	0.6018	0.001149	0.000117	0.000221	3	12,686	0.3123	0.000837	0.000052	0.000030
2008	5	11,314	0.4362	0.001111	0.000066	0.000044	4	12,363	0.4050	0.000869	0.000039	0.000117
2009	1	13,603	0.1084	0.000232	0.000015	0.000014	1	13,697	0.1124	0.000295	0.000015	0.000019
2010	2	13,012	0.2044	0.000414	0.000015	0.000046	1	14,258	0.1076	0.000226	0.000010	0.000013
Total	196	1,392,811	10.8181	0.0655	0.0135	0.0030	109	836,050	5.7479	0.0353	0.0074	0.0015
% Overall	1.87%	1.52%	1.49%	2.13%	2.76%	1.62%	1.47%	1.21%	1.10%	1.90%	3.12%	1.34%

4.6 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 majority of high-emitters in this study have exhaust temperatures of approximately 25 ^{0}C above ambient and an average 30.4 ^{0}C above ambient. The temperatures ranged from equal to ambient, to about 120 ^{0}C above ambient. These temperatures are constant with vehicle flow studies. Vehicles with tailpipe temperatures within five ^{0}C of ambient were considered to possibly be not in a warmed up condition. These vehicles accounted for 14.1% of the on-road sample. This indicates that some of the sites chosen may not be ideal for eliminating the measurement of vehicles potentially operating in cold start mode. Because the sites chosen were also used in previous on-road measurements studies, this may call into question the identification of high some high HC and CO emitters in the previous study due to cold start operation. Of the 307 high emitters identified in the current study, only 9 (2.9%) had temperature differentials (exhaust to ambient) of less than 5 ^{0}C, however none had both high HC and CO emissions also indicative of cold start open loop operation. In fact, six of the nine vehicles had high NO_x emissions, even though they had cooler tailpipe temperatures. The other three which had high emissions had only high CO emissions.

In the group of 307 high emissions vehicles, 2 of the 3 vehicles which had exhaust temperatures over 100 ^{0}C higher than ambient had high NO emissions. In fact, those vehicles which had high NO emissions had average tailpipe temperatures of 31.7 ^{0}C higher than the overall sample.

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 1.73% (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. However, because EDAR allows for the direct measurement of mass emission rates, this report calculated actual hot running mass emission rates which were combined with vehicle mile traveled data derived from Connecticut Vehicle Inspection Program Data.

- Average emissions of Connecticut registered light vehicles were 43 ppm HC hexane, 0.13% CO and 159 ppm NO. The last study performed found average concentrations for light duty vehicles of 13 ppm HC hexane, 0.10% CO and 127 ppm NO.
- Tier 2 models, 2004 and newer, continue to have well controlled emissions.
- Contributions of on-road emissions were skewed towards the older vehicles. Among Connecticut registered light vehicles based on analysis of odometer data from vehicle inspections, 2002 and older models accounted for 30% of on-road activity and for up to 28%, 42%, 49% and 75% of the CO_2, HC, CO and NO <u>mass</u> emissions respectively. In the previous study, it was estimated that 2002 and older vehicles represented 27% of on-road activity and for up to 70%, 56% and 77% of the HC, CO and NO mass emissions respectively, CO_2 was not reported.
- A small fraction of vehicles had very high emissions and contributed a substantial portion of light vehicle emissions:
  - 307 (1.7%) of vehicles had HC greater than 500 ppm or CO emissions greater than 3% or NO greater than 2000 ppm.
  - These high emitting vehicles had average mass emission rates 51% higher for CO, 112% higher for NO and 12% higher for HC.
- The contributions to total on-road hot running exhaust emission of the 10% dirtiest fraction of the fleet were found to be 84% for HC, 69% for CO and 83% for NO, similar to trends historically found in other remote sensing studies where a small fraction of the fleet makes up the majority of the emissions.
- Eight-four percent of light duty vehicles measured at the survey locations were registered in Connecticut, 3% were from Massachusetts, 1.5% from New York, 0.5 % from New Jersey 2% from other states and 9% 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.

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	5864	2001	2B5WB35Z81K517407	T	RAM 3500 PASSENGER VAN	7/13/2006	11/21/2007
1	0	0	1	481YHA	1998	1FMPU18LXWLA19200	T	EXPEDITION	8/30/2014	5/14/2009
0	1	0	1	443YHC	1997	3VWFB81HXVM098916	P	GOLF	11/15/2008	3/11/2010
1	0	0	1	841ZRB	1997	JN1CA21D6VT201076	P	MAXIMA	4/22/2013	4/17/2010
0	0	1	1	9ALBF0	1996	1HGCD5657TA160507	P	ACCORD	5/26/2010	6/4/2010
0	0	1	1	309RHX	1993	1GKDT13W0P2535086	T	T15 JIMMY	10/17/2008	10/18/2010
0	0	1	1	310VAR	1996	1B4GP44R5TB156373	T	CARAVAN	8/27/2009	3/31/2011
0	1	0	1	422ZZS	1997	1GNDT13W9V2193279	T	BLAZER	7/30/2014	5/20/2011
0	1	0	1	138UFR	1994	JH4CC2563RC005541	P	VIGOR	7/23/2009	6/23/2011
0	1	0	1	252ZWG	1997	1J4GZ58S1VC727395	T	GRAND CHEROKEE	8/8/2009	9/20/2011
0	1	0	1	299YGL	1998	1YVGF22C8W5775880	P	626	10/8/2010	10/8/2011
0	1	0	1	3AKBH9	2001	2C4GP44G51R194038	T	TOWN & COUNTRY 2WD	12/5/2009	12/5/2011
0	1	0	1	188MDH	2002	2B4GP44302R546535	T	CARAVAN 2WD	8/22/2014	1/7/2012
0	0	1	1	240PHZ	2004	KMHWF25S64A950812	P	SONATA	2/4/2010	2/19/2012
0	1	0	1	8ABLD7	1997	1G2HX52K3VH243650	P	BVS	1/3/2012	3/3/2012
0	1	0	1	UROK	1994	1GCCS1441RK152896	T	S10 PICKUP	3/10/2010	3/16/2012
0	1	0	1	6AELM9	2004	YV1RS61T442323176	P	S60	4/8/2014	7/29/2012
0	1	0	1	229RRB	2004	4A3AE45G84E051822	P	ECLIPSE	6/20/2012	8/19/2012
0	0	1	1	294ZYA	2000	1HGCG2250YA035710	P	ACCORD V6 COUPE	8/26/2010	8/26/2012
0	0	1	1	455THR	2004	WVWVD63B04E224694	P	PASSAT 4MOTION	9/30/2010	9/29/2012
0	1	0	1	603XZM	1997	1HGCD5632VA260418	P	ACCORD	6/11/2011	10/23/2012
0	1	0	1	702ZZR	1995	JHMCD5659SC007806	P	ACCORD	1/22/2015	4/1/2013
1	0	0	1	9594CS	1996	1GCGK24R7TZ181661	T	2500	7/7/2011	4/13/2013
0	1	0	1	980ZGL	2003	1N4AL11E53C350213	P	ALTIMA	4/11/2011	4/23/2013
0	0	1	1	TFFIII	2007	JTMBD33V975093135	T	RAV4 2WD	3/12/2011	4/27/2013
0	1	0	1	333XHL	2000	1G8ZH5288YZ147104	P	SL	3/1/2013	4/30/2013
0	1	0	1	171YTE	1997	1HGCD5604VA142988	P	ACCORD	5/19/2012	5/19/2013
0	1	0	1	1AMEH1	2001	1GTFG25M011905329	T	G2500 SAVANA	3/22/2013	5/21/2013
0	1	0	1	798MGY	2001	1HGCG66591A062993	P	ACCORD SEDAN	3/27/2013	5/26/2013
1	0	0	1	222ZWA	2004	1N4BA41E84C889597	P	MAXIMA SE/SL	4/18/2013	6/17/2013
0	1	0	1	339XEM	1993	1G6CD53B3P4257381	P	DEVILLE	8/15/2013	6/30/2013
0	1	0	1	663ZWG	1999	4A3AA46G4XE028360	P	GALANT	5/23/2013	7/22/2013

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	406XTL	1995	1GNEK13K4SJ360735	T	K1500 TAHOE	6/20/2013	8/19/2013
0	1	0	1	420VSF	1998	4TANL42N4WZ136225	T	TACOMA 2WD	8/23/2012	8/23/2013
0	1	0	1	L7794L	1999	2FAFP74W4XX142494	P	CROWN VICTORIA	8/24/2012	8/24/2013
1	0	0	1	947VAZ	1994	SAJHX1744RC695951	P	XJ6	8/27/2012	8/27/2013
0	1	0	1	75C290	1996	1B7HC16ZXTS708755	T	RAM 1500	7/1/2013	8/30/2013
0	1	0	1	8AAKB5	1995	2FALP74W2SX201134	P	CROWN VICTORIA	7/2/2013	8/31/2013
1	0	0	1	6AHGD0	1995	1FASP15J3SW326408	P	ESCORT	8/4/2011	9/2/2013
1	0	0	1	120SLL	2002	5TDBT48A52S112605	T	SEQUOIA 4WD	7/5/2013	9/3/2013
0	1	0	1	5094CP	1995	2GCEK19Z9S1255826	T	K1500 PICKUP	9/5/2012	9/5/2013
0	1	0	1	2AKBF3	2002	WVWSK61J42W456127	P	JETTA	9/19/2012	9/19/2013
0	1	0	1	6ABNK6	1997	4T1BG22K3VU139520	P	CAMRY	8/2/2013	10/1/2013
0	1	0	1	895XSX	2000	JN1CA31D5YT554029	P	MAXIMA	8/7/2013	10/6/2013
0	0	1	1	H80193	1996	1FTJE34F6THA10205	T	ECONOLIN	10/11/2011	10/19/2013
0	1	0	1	2864CO	2005	1FTSX21585EA50360	T	F250	6/29/2012	12/1/2013
0	1	0	1	907EYV	2001	1FMDU74E01ZA44058	T	EXPLORER 4DR	12/22/2012	12/22/2013
0	1	0	1	672YNB	2001	JF1SF63521H746508	P	FORESTER AWD	11/12/2011	12/28/2013
0	1	0	1	2378CY	1999	2B7HB11X1XK500272	T	B1500	11/7/2013	1/6/2014
1	0	1	1	957ZUK	2006	1D4GP25B76B606900	T	CARAVAN SE	2/24/2012	2/10/2014
0	1	0	1	8109CV	1994	1GCEK19HXRE113288	T	K1500 PICKUP	2/18/2012	2/23/2014
1	0	0	1	559ZAU	2004	1N4BA41E84C879524	P	MAXIMA	2/13/2012	2/23/2014
0	1	0	1	794XWK	2003	1G6KY54983U274179	P	SEVILLE	11/18/2014	3/1/2014
0	0	1	1	169ZAP	2000	4T1BF28B4YU024892	P	AVALON	1/2/2014	3/3/2014
0	1	0	1	972ZBZ	2005	19UUA66275A054196	P	TL	3/7/2012	3/7/2014
0	1	0	1	100ZDA	1996	4T1BG12K7TU656763	P	CAMRY	1/8/2014	3/9/2014
0	0	1	1	720YKC	2004	19UUA66224A004756	P	TL	1/16/2014	3/17/2014
0	1	0	1	810SJB	1996	2HGEJ632XTH120294	P	CIVIC	4/11/2013	4/11/2014
0	1	0	1	2AGED0	1997	1YVGE22CXV5656679	P	626	2/18/2014	4/19/2014
0	1	0	1	809YAW	1996	JN1CA21D5TT181545	P	MAXIMA GLE/GXE/SE	4/26/2012	4/26/2014
0	1	0	1	5AJRK4	2005	1B3ES56C95D257237	P	NEON	3/4/2014	5/3/2014
1	0	0	1	4ADFX3	1998	1GNFK16R0WJ323619	T	K1500	6/1/2012	5/5/2014
0	1	0	1	237YSJ	2001	9BWGD21JX14024795	P	GOLF	5/5/2012	5/5/2014
0	1	0	1	244XEJ	2004	YS3FH46Y341047362	P	2-Sep	4/5/2013	5/5/2014

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	8AKDW8	1997	1G2WJ52K7VF358305	P	GRAND PRIX	7/3/2014	5/6/2014
0	1	0	1	409ZXY	1996	4T1BF12B7TU103601	P	AVALON	8/20/2012	5/6/2014
0	1	0	1	5ADKP2	1998	KNAFB1213W5716268	P	SEPHIA	5/10/2012	5/10/2014
0	1	0	1	0aapa4	2002	SAJEA51D82XC47637	P	X-TYPE	3/11/2014	5/10/2014
1	0	0	1	1AFJS8	2005	1FMDU62E25UB48745	P	EXPLORER XLS/XLS SPORT	5/19/2012	5/19/2014
1	0	0	1	96254	2004	2T2HA31U24C025332	T	RX330 4WD	1/21/2013	5/25/2014
0	1	0	1	758WVE	2008	JM3ER29LX80185391	T	CX7	4/5/2014	6/4/2014
1	0	0	1	0AAEK3	1995	4T1GK13E1SU106115	P	CAMRY	6/6/2013	6/6/2014
1	0	0	1	8CL761	2004	1FTPX14524NB65739	T	F150 4WD	7/6/2012	7/6/2014
0	1	0	1	3AHVG6	1999	WVWGC31J2XW499504	P	GOLF	5/10/2014	7/9/2014
0	1	0	1	984ZVG	1992	1HGCB765XNA231039	P	ACCORD	3/26/2013	7/14/2014
0	1	0	1	815XYN	1998	YV1LS5535W1447041	P	S70	5/19/2014	7/18/2014
0	1	0	1	793XSF	2005	4S3BL676854224646	P	LEGACY	5/22/2014	7/21/2014
1	0	0	1	168VAU	1999	JT8BD68S2X0049408	P	GS300	7/18/2012	7/21/2014
0	1	0	1	393UJT	2002	1G4HP54K024122159	P	LESABRE	7/27/2012	8/4/2014
0	1	0	1	818WDE	2000	19UUA5669YA020617	P	3.2TL	1/8/2013	8/26/2014
0	0	1	1	707YER	2005	JNKCV54EX5M412135	P	G35	4/26/2013	8/27/2014
0	1	1	1	7AEMM8	1993	2P4GH25K3RR577312	T	VOYAGER	8/28/2012	8/28/2014
1	0	0	1	975SJB	1997	6MMAP37P4VT010613	P	DIAMANTE	8/15/2012	9/1/2014
0	1	0	1	221WMM	2003	JA3AH86F93U122679	P	LANCER EVOLUTION	8/24/2012	9/1/2014
0	0	1	1	915XBH	2008	2B3KA43G18H265752	P	CHARGER	8/22/2012	9/4/2014
0	1	0	1	273ZUV	1994	4T1GK13E3RU002641	P	CAMRY	7/10/2014	9/8/2014
0	1	0	1	902FAN	1993	4T1SK11E2PU202565	P	CAMRY	9/11/2013	9/11/2014
0	1	0	1	390ZHY	1998	1J4GZ78S8WC306674	T	GRAND CHEROKEE	1/4/2013	9/20/2014
0	1	0	1	105UXH	2004	KMHDN46D34U824993	P	ELANTRA GLS/GT	10/3/2012	10/3/2014
1	0	0	1	8834CN	1994	1FTHF36H2RNB29258	T	F350	7/16/2013	10/8/2014
0	1	0	1	3AFSS9	1998	WBAGJ8325WDM09259	P	7-SERIES	10/13/2012	10/13/2014
0	0	1	1	6ADNV0	2002	WMWRE33482TD53855	P	MINI COOPER	10/9/2012	10/15/2014
0	1	0	1	421YZF	1996	2T1BA02E2TC110265	P	COROLLA	10/19/2013	10/19/2014
0	0	1	1	525MYW	2000	3FAKP1139YR116298	P	ESCORT ZX2 2.OL L4	8/27/2014	10/26/2014
1	0	0	1	308RZV	2002	1J4GW48S72C328649	T	GRAND CHEROKEE 4WD	4/19/2013	10/28/2014
1	0	1	1	353UDC	2002	2C4GT54LX2R652060	T	TOWN & COUNTRY AWD	10/28/2013	10/28/2014

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	584WXL	1998	1MEFM10P6WW625041	P	TRACER GS/TRIO	10/29/2012	10/29/2014
1	0	0	1	881ZPT	2001	1N4DL01D71C117896	P	ALTIMA	9/5/2014	11/4/2014
1	0	0	1	6697CV	1995	1B7KF26Z8SS126252	T	RAM 2500	11/13/2013	11/13/2014
0	0	1	1	6073CZ	1991	1FTEF14YXMNA45580	T	F150 PICKUP	10/12/2012	11/16/2014
0	1	0	1	701PWR	1993	1G4AG55N6P6441202	P	CENTURY	9/20/2014	11/19/2014
0	0	1	1	365XZF	2002	1G1JC524427216588	P	CAVALIER	12/13/2012	12/3/2014
0	1	0	1	887ZNB	2001	JHLRD18631C014830	T	CR-V	10/7/2014	12/6/2014
1	0	0	1	2AAPG1	1993	JHMEG8555PS047543	P	CIVIC	1/2/2014	1/2/2015
0	1	0	1	677ZTL	1999	1Y1SK5282XZ403269	P	PRIZM/LSI	1/3/2013	1/3/2015
1	0	0	1	274YJH	2001	3N1CB51D41L447380	P	SENTRA	1/8/2014	1/8/2015
0	1	0	1	986YME	1998	1HGEJ6523WL019621	P	CIVIC	12/12/2012	1/11/2015
0	1	0	1	659YTA	1998	1J4GZ78Y9WC107184	T	GRAND CHEROKEE	11/13/2014	1/12/2015
0	1	0	1	667ZSY	1998	JN1CA21D4WT610484	P	MAXIMA GLE/GXE/SE	1/18/2013	1/18/2015
1	0	1	1	964PZY	1999	4T1BF18B9XU293642	P	AVALON	8/5/2013	1/19/2015
0	0	1	1	0AATU0	2000	JTDDR32T5Y0026797	P	CELICA	1/7/2013	1/22/2015
0	1	0	1	GLH586	1995	1GNDT13W4S2244649	T	BLAZER	7/31/2013	1/25/2015
0	1	0	1	4CK166	1994	1FTJE34H7RHB67137	T	E350 ECONOLINE	10/10/2013	2/6/2015
0	1	0	1	577DVO	2002	1G2NE52F82C184793	P	GRAND AM	2/13/2013	2/10/2015
0	1	0	1	500ZDB	1997	2HGEJ634XVH121398	P	CIVIC	2/17/2014	2/17/2015
0	0	1	1	3AIKW9	2001	1C4GJ25331B251269	T	VOYAGER	9/5/2013	2/22/2015
0	0	1	1	739YXJ	1996	JM1BB1417T0332906	P	PROTEGE	2/25/2014	2/25/2015
1	0	0	1	944PMP	1996	JACDJ58V4T7902284	T	TROOPER	3/27/2013	3/2/2015
0	1	0	1	798XKB	1996	1HGEJ6523TL058592	P	CIVIC	5/1/2013	3/4/2015
0	0	1	1	931YXJ	2004	5N1ED28YX4C626493	T	XTERRA 4WD	3/5/2014	3/5/2015
0	1	0	1	470WBV	1995	JT2AE04B8S0116821	P	COROLLA	3/14/2013	3/5/2015
0	1	0	1	958RGB	1993	1G3AG55NXP6447654	P	CUTLASS CIERA	3/7/2014	3/7/2015
1	0	0	1	156ZWK	2007	2A8GM68X47R239650	T	PACIFICA TOURING	3/13/2013	3/8/2015
1	0	0	1	710RZH	2003	1D4GP24313B153220	T	GRAND CARAVAN	1/8/2015	3/9/2015
0	0	1	1	3726CF	2002	1GCEK14T02Z236558	T	K1500	3/15/2013	3/9/2015
0	0	1	1	873RKK	2003	2G4WS52J031270728	P	CENTURY	3/8/2013	3/13/2015
1	0	0	1	9AFPP7	1998	JF1GM4351WH401543	P	IMPREZA	3/13/2014	3/13/2015
0	1	0	1	6774CS	1998	1FTZR15X4WTA14029	T	RANGER SUPER CAB 2DR	1/13/2015	3/14/2015

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
1	0	0	1	0ALKH5	1995	3FALP67L3SM127293	P	CONTOUR	3/18/2013	3/18/2015
0	1	0	1	100ZWS	1999	3VWCB61E8XM817046	P	CABRIO	3/18/2013	3/18/2015
1	0	0	1	731ZTF	2000	1J4FF48S9YL234485	T	CHEROKEE 4WD	4/22/2013	3/25/2015
0	1	0	1	294SCM	1994	1G8ZJ5571RZ229491	P	SL	3/16/2013	3/26/2015
0	1	0	1	679XAO	1996	1N4BU31D0TC193114	P	ALTIMA	2/26/2013	3/26/2015
0	0	1	1	2617CW	2005	5TELU42N55Z056833	T	TACOMA 4WD	3/21/2013	3/29/2015
0	1	0	1	832SGM	2003	KNDUP131736378521	T	SEDONA	3/30/2013	3/31/2015
0	1	0	1	335XXH	2000	9BWGA21J0Y4030298	P	GOLF	3/23/2013	4/3/2015
0	1	0	1	422RPH	2002	1GNEK13Z02R250070	T	TAHOE	4/6/2013	4/4/2015
0	1	0	1	8AKET2	2003	WAUVC68E93A165945	P	A4	5/1/2013	4/4/2015
1	0	0	1	L10729	2000	1FTNE2422YHA46618	T	E250	4/7/2014	4/7/2015
0	1	0	1	8992CN	1999	3B7HF12Y9XG238056	T	RAM 1500 4WD	2/6/2015	4/7/2015
0	1	0	1	565SGR	2000	JTDDY38T2Y0020188	P	CELICA	3/22/2013	4/8/2015
0	1	0	1	404XLJ	2003	2C4GP443X3R319356	T	TOWN & COUNTRY	10/18/2013	4/10/2015
1	0	0	1	507ZVJ	1998	1FAFP13P7WW211647	P	ESCORT	3/6/2013	4/13/2015
0	1	0	1	780UMN	1998	1HGCG5550WA141620	P	ACCORD COUPE	4/25/2013	4/13/2015
1	0	1	1	576X0A	1995	1MELM6534SK653475	P	MYSTIQUE	4/3/2013	4/15/2015
0	1	0	1	2AFMW6	1999	1HGCG6679XA109515	P	ACCORD	4/6/2013	4/20/2015
0	1	0	1	5AHME3	1999	4A3AA46L0XE013044	P	GALANT	4/24/2014	4/24/2015
0	0	1	1	351XWA	1999	4T1BG22K7XU518684	P	CAMRY	4/20/2013	4/30/2015
1	0	1	1	919XBC	1999	KMHVD14N4XU447841	P	ACCENT	4/30/2014	4/30/2015
0	1	0	1	825ZTR	1995	2T1AE09B8SC118817	P	COROLLA	3/29/2013	5/1/2015
0	0	1	1	294ZTL	2002	1GCDM19X12B129982	T	ASTRO 2WD	3/15/2013	5/2/2015
0	1	0	1	977ZZR	2006	JF1GD79636G503238	P	IMPREZA	8/23/2013	5/4/2015
0	0	1	1	2381CS	2005	1FTYR15E55PA52354	T	RANGER 4WD	4/29/2013	5/5/2015
0	1	0	1	1658CX	1999	3B7KF26Z5XM531369	T	DURANGO 4WD	5/13/2014	5/13/2015
1	0	0	1	343ZWT	1997	2T1BB02E8VC198867	P	COROLLA	4/3/2013	5/14/2015
0	0	1	1	950YXY	2000	1Y1SK5288YZ431885	P	PRIZM	3/26/2013	5/16/2015
0	0	1	1	650ZDN	2000	YV1LS56DXY2659938	P	S70	7/17/2013	5/16/2015
0	0	1	1	782ZBX	2005	2HKYF18715H556773	T	PILOT 4WD	11/12/2013	5/25/2015
1	0	0	1	980WUS	1998	WBAGF8321WDL55024	P	7-SERIES	5/28/2013	5/25/2015
0	0	1	1	9ADWD7	2007	4A3AB36F87E074966	P	GALANT	6/11/2013	6/11/2015

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1	0	0	1	TY66	2006	1MEHM43186G616644	P	MONTEGO	6/3/2013	6/15/2015
1	0	0	1	3CH832	1991	1GCCT14Z7M2313964	T	S10 PICKUP	5/2/2013	6/18/2015
0	1	0	1	735UME	2005	YV1MS390352108098	P	S40	6/28/2013	6/18/2015
0	1	0	1	759WYP	1994	1G8ZK5574RZ204095	P	SL	6/6/2013	6/20/2015
1	0	0	1	478GXX	1998	JT2BG22K0W0191404	P	CAMRY	5/4/2013	6/20/2015
1	0	0	1	346RSA	1999	1GNCT18W3XK234397	T	BLAZER 4WD	6/20/2013	6/24/2015
0	1	0	1	7AAPB8	1999	JM1BJ2224X0111970	P	PROTEGE	6/20/2013	6/26/2015
0	0	1	1	SEABBB	1994	2FALP74W9RX174928	P	CROWN VICTORIA	5/14/2013	6/27/2015
0	1	0	1	7209CN	1994	1B7HF16Y1RS570935	T	RAM 1500	7/1/2014	7/1/2015
0	1	0	1	392WHG	1998	1J4GZ58S1WC300137	T	GRAND CHEROKEE	7/9/2013	7/9/2015
0	0	1	1	5AARN7	2007	JTNBE46K773093341	P	CAMRY CE/LE/XLE/SE	7/9/2013	7/9/2015
0	1	0	1	2AHDS7	2007	1HGCM56167A102391	P	ACCORD	6/6/2013	7/13/2015
0	1	0	1	4AKML1	2000	3VWBC21CXYM413618	P	NEW BEETLE	7/14/2014	7/14/2015
0	1	0	1	837YHP	2003	4S3BH665X37646214	P	OUTBACK	5/29/2013	7/21/2015
0	0	1	1	706YWP	2003	2T1LR32E23C053399	P	MATRIX	7/10/2013	7/26/2015
0	1	0	1	776YWA	1991	JT2AE94KXM3485377	P	COROLLA	7/27/2013	7/27/2015
0	1	0	1	577YVU	1992	JT2EL45F1N0080524	P	PASEO	3/17/2014	7/28/2015
1	0	0	1	7CN104	2003	1FTRW08L13KA13434	T	F150 4WD	1/8/2014	8/2/2015
0	0	1	1	206YKE	2003	2HKRL18573H504847	T	ODYSSEY	7/30/2013	8/4/2015
0	0	1	1	413NRK	2000	JF1SF6555YG710549	T	FORESTER AWD	7/17/2013	8/5/2015
0	1	0	1	5ALKP9	2002	1N4BL11D52C117894	P	ALTIMA	8/14/2014	8/14/2015
0	1	0	1	464SPP	1992	YS3AK45E7N2013648	P	900	8/5/2013	8/14/2015
0	0	1	1	9AHTT8	2004	WBAEU33414PM61955	P	3-SERIES	8/22/2013	8/22/2015
0	1	0	1	158TKG	1996	1J4GZ78Y4TC297410	T	GRAND CHEROKEE	8/22/2014	8/28/2015
0	1	0	1	903MVY	1998	1J4FJ68SXWL178970	T	CHEROKEE	8/28/2013	9/6/2015
0	0	1	1	963ZJG	2005	1N4AL11D85C232473	P	ALTIMA	7/24/2013	9/15/2015
0	0	1	1	834AHY	2004	YV1TH59H641373310	P	S80	9/13/2013	9/17/2015
1	0	0	1	598UDX	1999	4T1BG22K5XU481103	P	CAMRY	9/6/2013	9/21/2015
0	1	0	1	309PBH	2001	9BWGT61JX14042403	P	GOLF	11/15/2013	10/1/2015
1	0	0	1	1ADTS7	1999	2FMDA5341XBA00992	T	WINDSTAR	9/27/2013	10/3/2015
0	0	1	1	726UBM	1997	1J4GZ78Y3VC687398	T	GRAND CHEROKEE	10/29/2013	10/4/2015
1	0	0	1	7169CA	1994	1GCCS1441RK131627	T	S10 PICKUP	4/8/2014	10/5/2015

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0	1	0	1	1ADMX6	2009	5TDBK22C29S023246	P	SIENNA	10/2/2013	10/5/2015
0	1	0	1	3AEFG4	1993	1HGCB764XPA162458	P	ACCORD	10/7/2013	10/7/2015
1	0	1	1	6622CZ	1992	1GCCS19Z6N2159258	T	S10 PICKUP	10/8/2014	10/8/2015
0	1	0	1	4AHXW0	1993	4T1SK12E1PU228704	P	CAMRY	6/7/2014	10/11/2015
0	1	1	1	871ZHY	1997	1HGEJ6628VL001340	P	CIVIC	10/17/2014	10/17/2015
1	0	0	1	915ZGD	2003	3N1AB51D23L720858	P	SENTRA	10/14/2013	10/23/2015
0	1	0	1	9AMUD3	2002	1B4HS58N42F160681	T	DURANGO 4WD	8/27/2014	11/3/2015
1	0	0	1	535XTV	2002	2T1BR12E12C573852	P	COROLLA	10/17/2013	11/3/2015
0	0	1	1	115ZUL	1996	1MELM66L1TK643387	P	MYSTIQUE	11/9/2013	11/9/2015
0	0	1	1	PAER	2004	5GZCZ63464S819057	T	VUE AWD	11/13/2014	11/13/2015
1	0	0	1	222JRY	2005	2HGES16315H510157	P	CIVIC	12/6/2013	12/2/2015
0	1	0	1	542ZWU	2001	4T1BG22K71U833136	P	CAMRY	10/18/2013	12/2/2015
0	1	0	1	608ZLB	2001	1G2NF52T21M529179	P	GRAND AM	12/13/2013	12/6/2015
0	1	0	1	301ZGY	1998	1HGCG5647WA110483	P	ACCORD	12/6/2013	12/8/2015
1	0	1	1	330ZCE	1999	2T1BR12E7XC195608	P	COROLLA	8/20/2014	12/17/2015
0	1	0	1	5283CE	1997	1GCGK24R4VZ130685	T	K2500	9/25/2014	12/22/2015
1	0	0	1	432YGO	2007	5TDBK22CX7S004831	T	SIENNA	11/6/2013	12/23/2015
0	1	0	1	272XMH	2003	JNKCV54E33M204627	P	G35	12/23/2013	12/23/2015
1	0	0	1	7031CX	2003	2D6WB11Z53K522966	T	RAM VAN 1500	4/3/2014	12/27/2015
1	0	0	1	1ANRD2	2001	19UUA56771A007721	P	3.2TL	9/10/2014	12/30/2015
0	1	0	1	105NHP	1998	2T1BR18E4WC095701	P	COROLLA	12/11/2013	12/30/2015
0	1	0	1	721	2006	JF1GD67656H505967	P	IMPREZA	12/2/2013	1/8/2016
0	1	0	1	510RVO	2010	WBAPK5C58AA599963	P	BMW	1/14/2014	1/12/2016
0	0	1	1	472VBD	2009	1FAHP35N99W201089	P	FOCUS	1/18/2014	1/18/2016
0	1	0	1	5AEXR2	1991	1HGCB7169MA069970	P	ACCORD	12/28/2013	1/21/2016
0	1	0	1	K60517	1998	1FTNS24L8WHB31042	T	E250 SUPER VAN	1/28/2014	1/24/2016
0	1	0	1	D7361A	2003	YS3FB49SX31061864	P	2-Sep	1/24/2014	1/24/2016
1	0	0	1	155HMW	1997	4T1BG22K7VU103703	P	CAMRY	1/23/2014	1/26/2016
0	1	0	1	537YJY	2005	JF1GD296X5G515548	P	IMPREZA	3/3/2014	1/31/2016
0	1	0	1	8118CM	1993	2FTDF15Y1PCA03271	T	F150 REG CAB LONG	4/4/2014	2/2/2016
1	0	0	1	612FFE	1999	4F4YR12C9XTM41275	T	B2500	1/23/2014	2/11/2016
0	0	1	1	DH4042	1996	1HGCD5635TA213784	P	ACCORD	3/26/2014	2/15/2016

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	906XFS	2003	3VWSE69M83M177025	P	JETTA	10/31/2014	2/19/2016
1	0	0	1	906NOG	1999	4T1BG22K6XU584370	P	CAMRY	3/18/2014	2/19/2016
1	0	0	1	910ZJG	2003	1HGCM72663A031541	P	ACCORD COUPE	9/15/2014	2/27/2016
1	0	0	1	776ZEO	1998	JT8BD68S9W0002598	P	GS300	2/26/2014	2/28/2016
0	1	0	1	3AHFJ8	1998	JHMBB6146WC000291	P	PRELUDE	3/1/2014	3/1/2016
0	1	0	1	872CNR	1999	1B7GL22X3XS233736	T	DAKOTA 2WD	3/20/2014	3/6/2016
1	0	0	1	645ZWS	1995	JT2SK12E1S0333790	P	CAMRY	3/14/2014	3/17/2016
1	0	0	1	2AKDR7	1995	JHMRA1866SC008056	T	ODYSSEY LX/EX	3/18/2014	3/18/2016
0	1	0	1	7AHFX3	2001	1G8JU52F81Y555251	P	L200	3/25/2014	3/25/2016
1	0	1	1	872TUP	1991	1G1LT53T7ME172647	P	CORSICA	2/12/2014	3/31/2016
0	1	0	1	706XFO	2003	JN8AZ08W73W214315	T	MURANO	2/14/2014	4/1/2016
0	1	0	1	9AHGG3	2000	JTDDR32T8Y0012604	P	CELICA	5/2/2014	4/2/2016
0	0	1	1	6AHTS7	2005	1HGES16345L008567	P	CIVIC	4/22/2014	4/22/2016
1	0	0	1	846T6	1994	1GCEK19K3RE282578	T	K1500 PICKUP	12/27/2014	4/23/2016
0	1	0	1	802ZEA	2008	WBANV93508CZ62129	P	5-SERIES	3/17/2014	4/23/2016
0	1	0	1	6142CS	1991	2GCEK19K2M1138966	T	K1500 PICKUP	5/1/2014	5/2/2016
1	0	0	1	236SDV	2002	2T1BR12E12C543170	P	COROLLA	5/17/2014	5/3/2016
0	1	0	1	149YSJ	2010	JF1GH7G65AG822169	P	IMPREZA	5/14/2014	5/13/2016
0	1	0	1	582NPA	2002	4T1BE32KX2U058618	P	CAMRY	5/15/2014	5/15/2016
0	1	0	1	3480CX	1992	1FTCR10A4NTA74769	T	RANGER REG CAB SHORT	5/23/2014	5/23/2016
0	0	1	1	777YBK	2004	JF1SG65624H748380	T	FORESTER AWD	6/28/2014	5/25/2016
0	1	0	1	5602CB	1994	1GCCS14W5R8153340	T	S10 PICKUP	6/2/2014	6/29/2016
0	0	1	1	8AFTA0	2010	1NXBU4EE1AZ376740	P	COROLLA	6/27/2014	6/30/2016
0	0	1	1	576XOA	2000	2T1BR12E1YC310916	P	COROLLA	7/3/2014	7/3/2016
0	1	0	1	772XNH	2008	JTDBT923581280872	P	YARIS	7/9/2014	7/3/2016
0	0	1	1	180ZTK	2008	WBANU53558CT04253	P	528I	6/2/2014	7/6/2016
0	0	1	1	64C168	2000	1GCGK24U4YE200752	T	K2500	8/5/2014	7/7/2016
0	0	1	1	WS2939	2006	KMHDN46D16U336208	P	ELANTRA	7/26/2014	7/8/2016
0	1	0	1	468Z	1993	1MELM554XPG648018	P	SABLE	6/17/2014	7/10/2016
0	1	0	1	7ALMM0	1996	1B7HC16Z8TJ124828	T	RAM 1500	7/15/2014	7/15/2016
0	1	0	1	821YLU	1998	3VWBB61C9WM001889	P	NEW BEETLE	8/5/2014	7/15/2016
0	1	0	1	8826CY	2004	1FTNX21P44ED87248	T	F250	6/3/2014	7/24/2016

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	1	0	1	6386CN	1993	1FTCR10UXPTA28554	T	RANGER REG CAB LONG	10/22/2014	7/29/2016
1	0	0	1	244SNS	2000	JT2BG22K5Y0445322	P	CAMRY	7/23/2014	8/3/2016
0	1	0	1	506ZUL	2000	1G8ZH5288YZ259319	P	SL	7/1/2014	8/11/2016
0	1	0	1	D514A	2002	YV1RS61R722180399	P	S60 FWD	7/11/2014	8/17/2016
1	0	0	1	750YEK	1999	1G4CU5215X4639526	P	PARK AVENUE	8/12/2014	8/19/2016
1	0	0	1	419YFZ	1991	4S3BC6326M9619414	P	LEGACY	8/18/2014	8/24/2016
0	0	1	1	676WWG	2008	1N4BA41E98C802635	P	MAXIMA	9/10/2014	9/11/2016
0	0	1	1	493NOX	2004	SHSRD778X4U245162	T	CR-V	8/29/2014	9/11/2016
0	1	0	1	802WMJ	1995	1GCCS1447SK175847	T	S10 PICKUP	9/10/2014	9/15/2016
0	0	1	1	6288DA	2011	1FMCU9DG4BKC66847	T	ESCAPE XLT	9/18/2014	9/18/2016
0	1	0	1	749YJC	2002	JF1GG68502G816591	P	OUTBACK IMPREZA AWD	11/3/2014	9/18/2016
0	0	1	1	7ALKN8	2003	SHSRD78873U148708	T	CR-V	9/19/2014	9/19/2016
0	1	0	1	750ZMC	1998	1B4GP45G7WB702186	T	CARAVAN	8/19/2014	9/20/2016
0	1	0	1	5APAF2	2007	WVWEV71K37W273618	P	GTI	9/26/2014	9/22/2016
0	1	0	1	5ABKR5	2002	1FMYU041X2KA96510	T	ESCAPE	8/15/2014	9/24/2016
1	0	0	1	919THU	2004	KMHDN46D44U912256	P	ELANTRA	12/2/2014	9/24/2016
0	1	0	1	4225DB	1998	1FTSE34L8WHA41454	T	ECONOLINE E350	10/7/2014	10/7/2016
0	1	0	1	723USU	2006	5GZCZ33D36S803349	T	VUE FWD	10/29/2014	10/12/2016
0	0	1	1	6AGRW4	2008	JTMBK33V785041901	T	RAV4 4WD	10/17/2014	10/18/2016
0	1	0	1	749YFF	2002	4S3BE635627208821	P	LEGACY	10/13/2014	10/19/2016
0	1	0	1	255BYA	1991	1J4FJ58S7ML615122	T	CHEROKEE	9/2/2014	10/21/2016
0	1	0	1	121ZDB	2001	JN1CA31D51T615904	P	MAXIMA	10/27/2014	10/27/2016
1	0	0	1	6AMGS8	1999	1N4DL01D1XC221955	P	ALTIMA	9/29/2014	11/13/2016
0	1	0	1	867UGB	1995	1J4GZ78S8SC591435	T	GRAND CHEROKEE	10/23/2014	11/28/2016
0	0	1	1	363SOA	2008	1FMEU73E18UA28903	T	EXPLORER 4WD	11/26/2014	11/30/2016
0	1	0	1	841ZJR	1999	2T1BR12E2XC130682	P	COROLLA	12/26/2014	12/26/2016
1	0	0	1	701XFT	2008	JTEBU17R38K022464	T	4RUNNER	12/30/2014	12/30/2016
0	1	0	1	5221CP	2004	3GNEK12T34G332908	T	AVALANCHE 4WD	12/6/2014	12/31/2016
1	0	0	1	789ZMW	2005	KMHHM65D85U163836	P	TIBURON	1/2/2015	1/8/2017
0	0	1	1	8AJLF7	1998	JT2BG22K6W0241058	P	CAMRY	12/15/2014	1/14/2017
0	1	0	1	506YZG	2004	JH4DC53064S013393	P	RSX TYPE-S	1/15/2015	1/17/2017
1	0	0	1	191ZDN	1999	2G4WS52MXX1617904	P	CENTURY	1/20/2015	1/21/2017

CO_fail	NO_fail	HC_fail	fail	Plate	Year	VIN	Vehicle Type	Vehicle Model	Last Test Date	Last Expiration Date
0	0	1	1	8ADVR4	2006	2G4WD582361314672	P	LACROSSE	1/30/2015	1/30/2017
0	1	0	1	448TUC	1995	JHMEH9696SS015228	P	CIVIC	2/3/2015	2/5/2017
0	0	1	1	365UZG	2007	4T1BE46K17U122682	P	CAMRY	1/17/2015	3/1/2017


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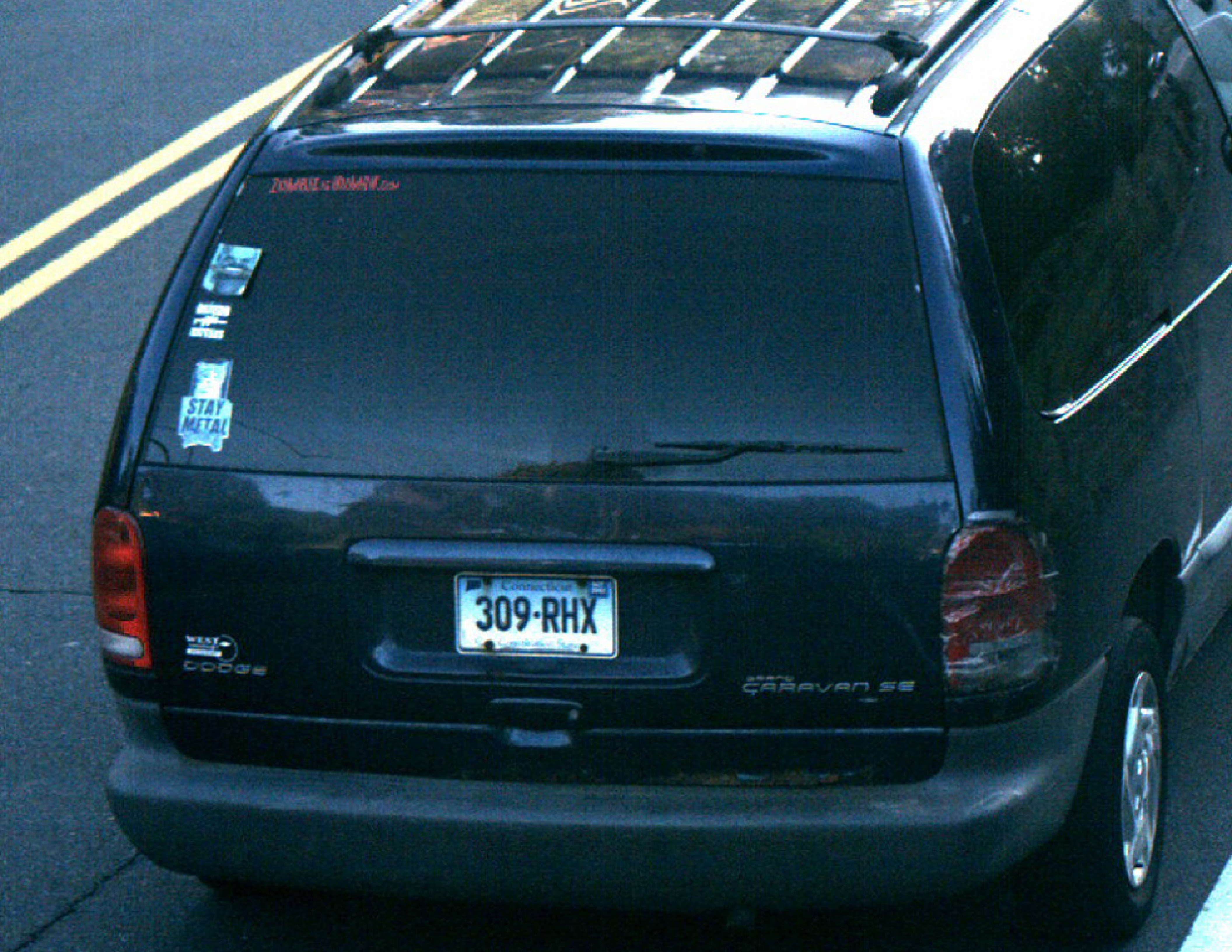
455·THR


603·XZM


443·YHC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METAL
309·RHX
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CONNECTICUT
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VETERAN
AWD
MONTESI


294·ZYA


8ABLD7


299·YGL


481·YHA


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McGEE
229·RRB


VOLVO
6AELM9


841·7RB


KC
NO PROBLEM
252·ZWG
Jeep


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138-UFR


9AL-BFO


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