Attachment C:

Emissions Estimation Methodology for Off-Highway Recreational Vehicles

May 2013

California Air Resources Board

Planning and Technical Support Division

(Page intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. EXECUTIVE SUMMARY

Off-highway OHRVs (OHRVs) are integrated into a single regulatory category including off-road motorcycles (OMC), all-terrain vehicles (ATV), off-road sport vehicles, off-road utility vehicles, sand cars, and golf carts, as defined in Cal. Code Regs., tit. 13,§ 2411(a). The California Air Resources Board (ARB) has developed a regulation to control evaporative emissions from gasoline-powered OHRVs in order to satisfy the 2007 State Implementation Plan (SIP) commitment to reduce ROG emissions from OHRVs.

To support the proposed rule, ARB staff has developed an emissions inventory model, RV2013, to estimate emissions generated by OHRVs in each region of the State. This inventory revision builds on previous ARB assessments, and contains updates to vehicle population, activity (hours/year or miles/year), annual vehicle sales, emission factors, technology change from carbureted (CARB) to fuel injected (FI) engines, as well as the change in the population split between two and four stroke engines. These factors were adjusted to account for the effects of the economic recession that began in December 2007 as well as the expected recovery of California's economy over the next twenty years.

Table I-1 provides a summary of the statewide OHRV emissions inventory for three critical air quality attainment deadlines in California: 2020, 2023, and 2035. Based on the emissions estimate from RV2013, the baseline statewide summer ROG emissions from OHRV operating in California in 2020, 2023, and 2035 are 17.35 tons per day (TPD), 17.38 TPD, and 19.08 TPD, respectively. Taking into account the benefits of the proposed rule, the statewide summer ROG from OHRV in 2020, 2023, and 2035 is estimated to be 16.01 TPD, 14.03 TPD, and 9.17 TPD, respectively.

Because of the relatively long useful life of OHRVs and the near-term downturn in sales of new OHRVs related to the recession, emissions benefits from this proposed rule will increase further into the future as a larger fraction of the existing OHRV population operating in California turns over to newer vehicles that meet the more stringent emissions requirements. Staff estimates that with the proposed ARB regulation on evaporative controls, the emission benefits will be 1.34, 3.35, and 9.91 TPD by 2020, 2023, and 2035, respectively.

Table I-1. Statewide Summer ROG Emissions Benefits (tons/day)

	2020			2023			2035		
	Exhaust	Evap	Total	Exhaust	Evap	Total	Exhaust	Evap	Total
RV 2013	4.85	12.50	17.35	4.38	13.0	17.38	3.96	15.12	19.08
RV 2013 with Proposed Rule	4.85	11.16	16.01	4.38	9.65	14.03	3.96	5.21	9.17
Benefits	0	1.34	1.34	0	3.35	3.35	0	9.91	9.91

II. BACKGROUND

OHRVs are a significant source of ROG, which is an important precursor to ozone formation in the atmosphere. To reduce ozone levels and comply with ambient air quality standards, ROG reductions are necessary. The proposed new evaporative emissions standards for OHRVs will help reduce ambient ozone levels.

Previously, OFFROAD2007 was ARB's off-road emissions inventory model used to estimate emissions from different off-road sources such as OHRVs, lawn and garden equipment, pleasure craft, construction equipment, and other types of off-road equipment. As part of this rulemaking, staff has replaced OFFROAD2007 with a stand-alone Microsoft Access-based model, RV2013, to estimate the OHRV emissions inventory. RV2013 has grouped these OHRVs into five categories: off-road motorcycles (OMC), all-terrain vehicles (ATV), mini bikes, snowmobiles, and golf carts/specialty vehicles. Staff has included updated information on OHRVs' population, activity, growth projections, and emission factors.

A. PURPOSE AND OVERVIEW

This document describes the new data, methodologies, and assumptions that were applied in RV2013 as well as the steps taken to estimate the emission benefit for the proposed rule. The following presents a brief overview of the new data and methodologies used to develop the revised OHRV inventory:

- Base Vehicle Population and Model Year Distribution (2000 to 2010)

  Updated California Department of Motor Vehicle (DMV) registration data provide detailed information on the total population and model year distribution of that population for each calendar year between 2000 and 2010. The database also allows us to estimate vehicles that are actively used (active vehicles) as well as vehicles that may be stored at households but not used (inactive vehicles).

- Forecasting Vehicle Populations and Age Distributions (2010 to 2035)

  Staff used DMV registration data to reevaluate the projected lifecycle of each vehicle type, and to estimate the expected total life, half-life (or useful life), and year-to-year survival rate by vehicle type.

- Forecasting New Vehicle Sales

  Staff developed a new method to forecast new vehicle sales by vehicle type as a function of near-term forecasted economic trends and long term demographic trends.

- Technology Shifts

  Staff used the DMV database to decode the vehicle identification number (VIN) to determine the engine type for each registered vehicle. The technology associated for both two-stroke and four-stroke engines was then forecast into the future.

- Activity

  In 2009, ARB-funded a California State University Sacramento (CSUS) phone survey of over 1,127 respondents (CSUS, 2009). Staff corroborated the results of the survey with other data sources to develop estimates for OHRV use by age and vehicle type.

- Emission Factors

  Staff updated and simplified emission factors based on certification data, vehicle testing, and other testing and analysis. Updates include:

  - Updated evaporative emission factors based on new evaporative test data for diurnal, resting, and hot soak emissions.
  - Updated snowmobile exhaust emission factors based on in-use test data.
  - A weathering correction to account for decreasing fuel volatility in inactive vehicles assumed to experience a full year of diurnal/resting emissions without use or refueling.

- Spatial Allocation

  Exhaust and evaporative emissions that occur during vehicle operation (running loss and hot soak) were allocated to area of operation (based on the 2009 CSUS survey). Other evaporative emissions (diurnal and resting loss) were allocated to area of storage (based on DMV registration data).

- Red and Green Sticker Program

  Staff estimated the emission benefits from the Red and Green Sticker Program using a simplified approach that assumes that about 50% of red sticker vehicles will not operate in nonattainment areas during the summer ozone season.

- Correction Factors
  - Temperature/Reid Vapor Pressure (RVP) correction is used to scale down the one-day diurnal and resting loss evaporative emissions from the laboratory testing conditions of 65ºF to 105ºF to temperature conditions more representative of what OHRVs experience under real-world storage and operating conditions in different parts of California. The revised temperature/RVP correction is based on normalized calculation of vapor generation and permeation.
  - Relative humidity correction for oxides of nitrogen (NO_x) is based on the 24-hourly average of humidity.
  - Exhaust temperature correction is based on the hourly average of ambient temperatures measured between 9 a.m. to 4 p.m. to better reflect the temperatures the vehicles are experiencing during their peak operating hours.

III. EMISSIONS CALCULATION METHODOLOGY

In this section, staff describe the data sources, methodology, assumptions, and algorithms used in developing the emissions inventory. Topics that required more detailed explanation are included in the appendices in Section VI.

A. METHODOLOGY

1. Exhaust Emissions

Exhaust emissions are a function of the number of vehicles operating in a given area, the amount of activity assumed by vehicle type and age, and region-specific emission factors. Exhaust emissions generated by OMCs and ATVs are calculated as follows:

$$P_{i,y,r} = \sum Pop_{i,v,r} * EF_{i,v,r} * Miles_{i,v}$$

Snowmobiles, golfcarts, and specialty vehicle exhaust emissions are calculated as follows:

$$P_{y,r} = \sum Pop_{v,r} * EF_{v,r} * Hrs_{i,v} * Avg\ Hp_i * Load\ Factor_i$$

Where,

P	= pollutant (ROG, TOG, CO, NO_X, PM, CO_2)
Pop	= equipment population
EF	= emission factor
Miles	= annual average mileage
Avg. Hp	= average horsepower
Load factor	= load factor
Hrs	= annual average use hours
y	= scenario year (1990-2035)
i	= equipment type
v	= vintage (age of equipment)
r	= region and season

2. Evaporative Emissions

The evaporative emissions inventory is separated into four distinct processes: diurnal, resting loss, hot soak, and running loss. Evaporative emissions generally occur through the permeation of fuel through plastic and rubber components of the engine and fuel delivery system of a vehicle. Note that the definition of diurnal in a regulatory context represents the sum of the diurnal and resting loss processes.

a. <u>Diurnal emissions occur in equipment that is not being used, when rising ambient temperature causes fuel evaporation from engines and gas tanks throughout the day.</u>

b. <u>Resting loss emissions occur while the equipment is not being used, and are generated when the ambient temperature is either stable or declining during the day and evening.</u>

c. <u>Hot soak emissions occur after an engine is shut off, as the temperature of equipment and fuel delivery systems gradually return to ambient temperatures.</u>

d. <u>Running loss emissions occur while the equipment is operating and the temperature of the equipment and fuel delivery systems is above ambient temperature.</u>

The basic equations for estimating evaporative emissions are provided below:

$$\text{Diurnal/Resting} = \text{Population} * EF_{\text{Diurnal/Resting}} * \text{Temp/RVP Correction}$$

$$\text{Hot Soak} = \text{Population} * EF_{\text{Hot Soak}} * \text{RVP Correction}$$

$$\text{Running Loss} = \text{Population} * EF_{\text{Running Loss}} * \text{Activity} * \text{RVP Correction}$$

Where,

$EF_{\text{Diurnal/Resting}}$	= gram per day for diurnal and resting losses
$EF_{\text{Hot Soak}}$	= gram per event of hot soak
$EF_{\text{Running Loss}}$	= grams per hour of running loss
Activity	= usage in hours per year
RVP Correction	= Reid vapor pressure correction factor (region specific)
Temp/RVP Correction	= Temperature and RVP correction factor (region specific)

B. EMISSIONS INVENTORY INPUTS

1. Active and Inactive Population

Staff used 2000 to 2010 calendar year DMV registration data to update the OHRV population. As shown in Table III-1, DMV has designated different codes to reflect the current usage of the vehicle. Based on the DMV's definition, staff has divided the OHRV population into two groups: "active" and "inactive." For active vehicles, both exhaust and some evaporative emissions (hot soak and running loss) occur where the vehicles are operated such as state parks. All vehicles, whether active or inactive, generate evaporative diurnal and resting emissions where they are stored, which is assumed to be each vehicle's registered address.

Generally speaking, about 80% of all vehicles appearing in the DMV database are currently registered or in the process of being registered. For this assessment, we assume vehicles with a DMV code of N, P, or R in the registration database are still present at their registered address, but are not going to be used during the year. We call these “inactive” vehicles.

Table III-1. Definition of Active and Inactive Status

DMV code	Definition	Status
C	Currently registered	Active
E	Evidence of use	Active
S	Pending	Active
N	Not currently registered	Inactive
P	Planned non-operational	Inactive
R	Prior history	inactive

2. *Lifespan by Vehicle Type*

We define the total life of a vehicle type from the time a population of vehicles is manufactured in a given year to the time all of those vehicles have been scrapped. We define the useful life as the time a population of vehicles is manufactured to the time half of all vehicles in that population would be scrapped. This assessment is conducted on a vehicle type-specific basis, based on DMV registration data for active and inactive vehicles. We assume vehicle lifespans as derived from DMV registration data also represent the total life of each engine in each vehicle. As a result, we do not assume engines are rebuilt or replaced during a vehicle’s life span.

In RV2013, the total life of each vehicle type is estimated directly from DMV raw data. Figure III-1 shows that OMCs operating in California have a total life of about 40 years but that the age distribution is strongly skewed towards vehicles that are 10 years and younger. This reflects OMCs being scrapped as they age and is consistent with age distributions seen in other vehicle classes including on-road vehicles. Also of note is the spike in vehicles around 20 years of age, likely reflecting a surge in new OMC sales in the mid-1980s. Finally, the series of curves shown here reflect show the age distribution for a cohort of vehicles changes with time due to scrappage and other factors.

Similarly, for other OHRV categories, staff used the age distribution of the raw DMV data and estimated their total life. Table III-2 provides a summary of the total life estimated from the DMV data. For ATVs, OMCs, snowmobiles and mini bikes, the total life is 40 years. For golf carts and specialty vehicles, the total life is 50 years.

Figure III-1. OMC Population Data from DMV

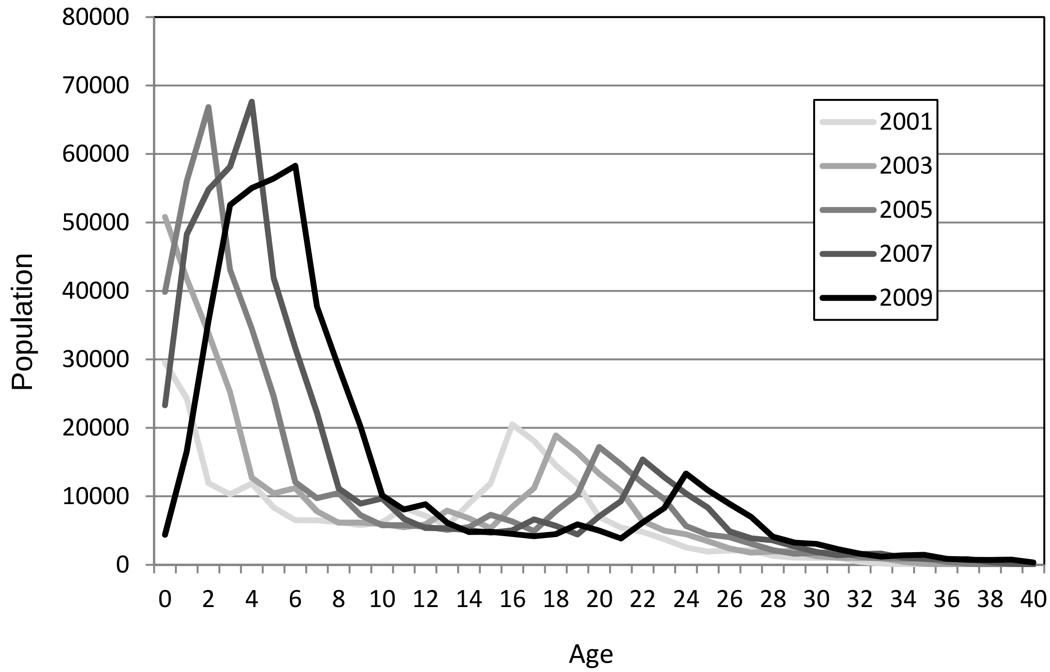


Table III-2. Total Life of OHRVs

Vehicle Type	Total Life (year)
OMC	40
ATV	40
Mini Bike	40
Snowmobile	40
Golf Cart & Specialty Vehicle	50

3. *Survival Rate*

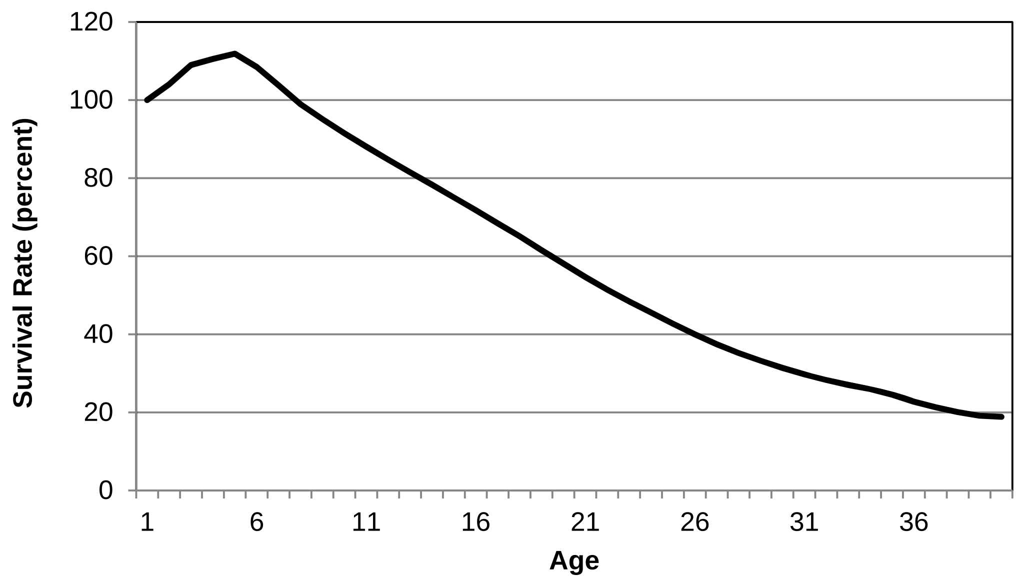
A survival rate, or survival curve, is used to model the rate at which a population is scrapped over time. To determine a survival rate by vehicle type, staff evaluated year-to-year changes in 10 years of DMV registration data. In particular, by tracking a specific population through two calendar years, staff were able to estimate a survival ratio on a year-to-year basis. For example, there are significantly fewer 6 year old OMCs in the 2009 calendar year DMV database than there were 4 year old OMCs in the 2007 calendar year DMV database, reflecting scrappage of vehicles (or vehicles moving out of state) between those two calendar years (as shown in Figure III-1).

In theory, the survival ratio should decline starting from the first year the vehicle is sold. However in practice we sometimes see trends where the vehicle population initially increases before it begins to decrease due to attrition. In the case of OHRVs, we believe, based on analysis of 10 years of DMV registration data, newly manufactured vehicles are sold over the course of several years rather than just in the year manufactured. This trend is reflected in our survival rate estimates.

Appendix A provides our detailed calculation process for estimating the survival rate as well as a summary of survival rates for all OHRV categories.

Figure III-2 presents the survival rate for OMCs to illustrate the typical trend we observed for OHRV survival rates in the DMV registration data. As discussed earlier, the OMC survival rate actually increases until about age 5, and then decreases.

Figure III-2. Survival Rate of OMCs



4. Forecasting OHRV Populations by Age

OHRV population growth is determined from two factors: incoming population as estimated by annual sales and the scrapped population as estimated by the survival rate. This is shown in the equation below.

New Population = Old Population + New Vehicle Sales – Scrapped Population (for each age)

In the following example, we discuss the method we used to estimate the growth of annual OMC sales. Estimating future annual sales of OHRVs is a challenging task, as no direct forecasts for OMCs are available. To estimate future sales, we found that robust OHRV purchases generally correlate well with favorable economic conditions. Specifically, staff found there is a good correlation between historical annual vehicle sales data in California (based on 2000 to 2010 DMV data) with historical nationwide new housing starts over the same period. As shown in Figure III-3, there is a good correlation between annual sales of OMCs and the nationwide new housing starts. We used forecasted nationwide new housing starts as a surrogate to forecast the future annual sales of OMCs.

Nationwide housing start data and forecasts were obtained from the 2012 UCLA economic forecast, and used to forecast to 2017, when the economy is assumed to have fully recovered from the 2009 to 2010 economic recession (UCLA, 2012). From 2011 to 2017, OMC annual sales were estimated using the new housing starts as surrogates as shown in Figure III-4. For 2018 and beyond, the OMC annual sales were estimated using the historical California human population growth of 1.2%. As shown in Figure III-4, we expect that as California's economy recovers and individuals have more disposable income, OHRV sales will begin to recover from the lows seen in 2010. By 2017, we estimate that annual sales will be comparable to what was seen around 2000.

To check if the back-cast annual sales growth was reasonable, staff obtained annual OMC sales data from Motorcycle Industry Council (MIC) to compare with the output from RV2013. Past annual sales OMC sales from 1999 to 1999 to 2000 is back-casted from 2000 DMV data and estimated survival rate. Generally speaking, the back-casted data are in good agreement with the MIC annual sales data.

Figure III-3. OMC California Annual Sales and Nationwide New Housing Starts

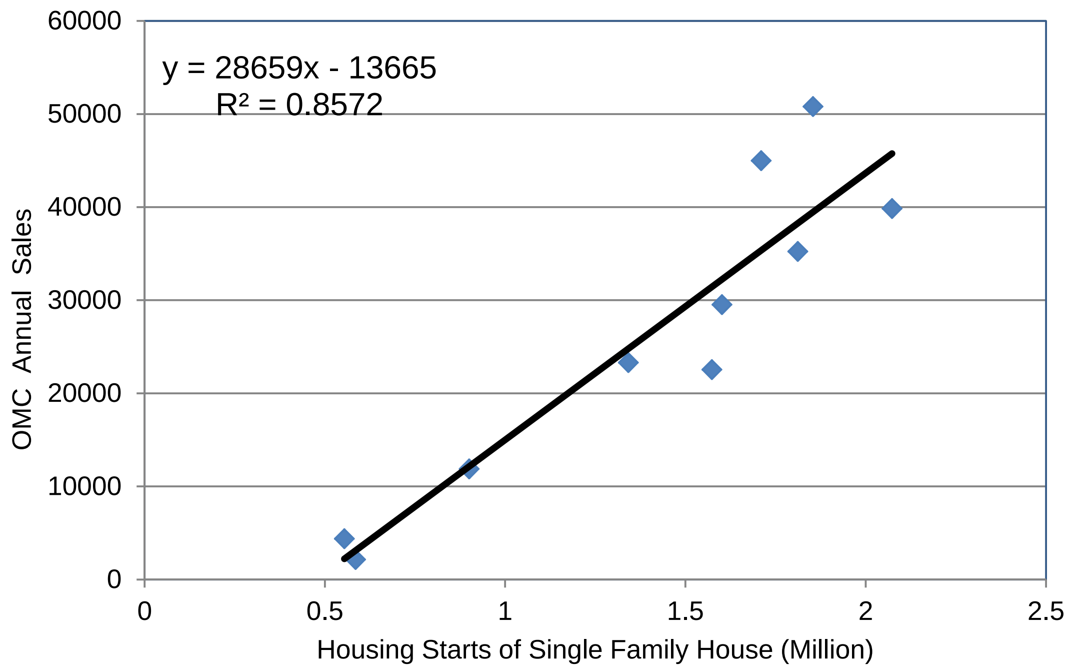


Figure III-4. Comparison of OMC Annual Sales between RV2013 and MIC

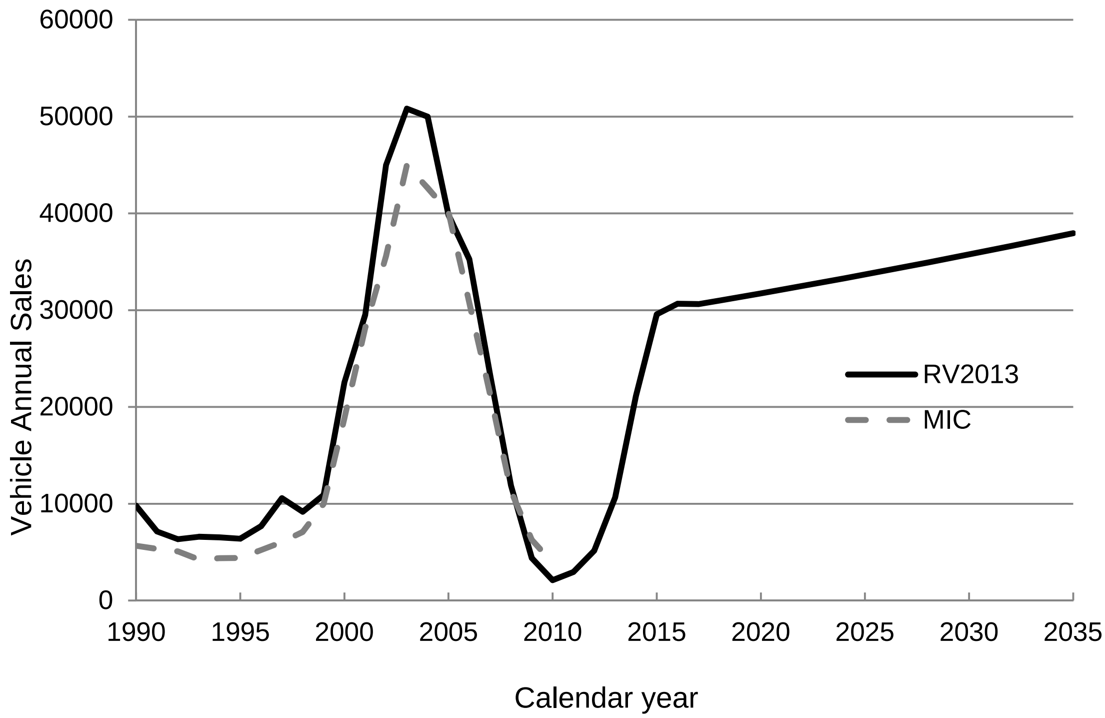
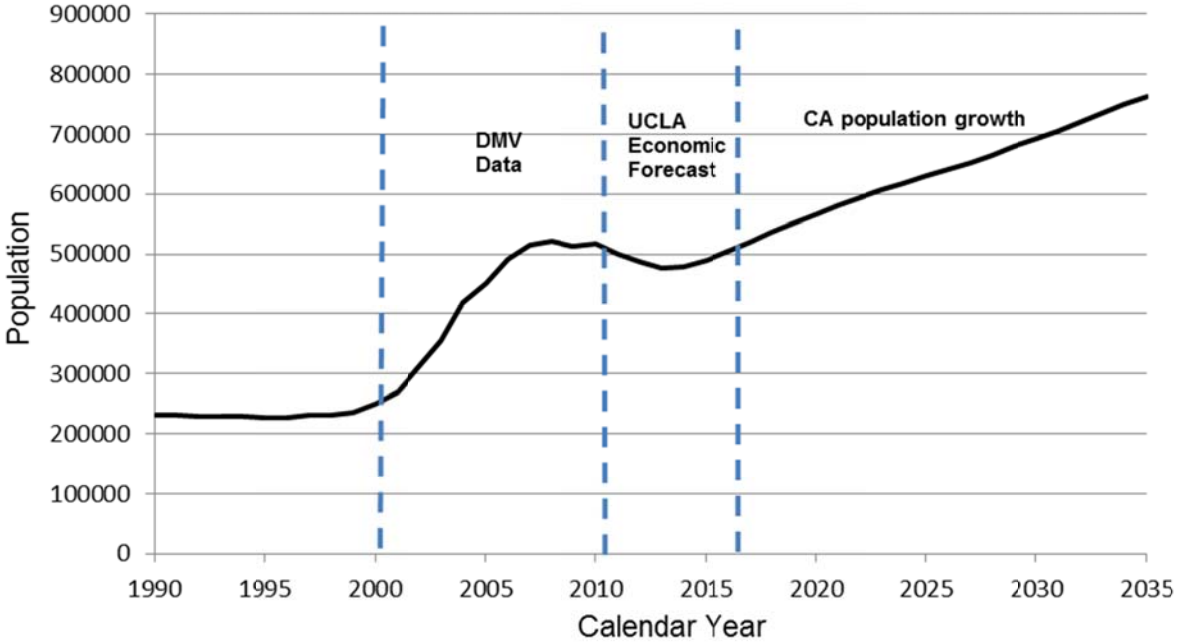


Figure III-5 shows the historic, as well as projected, trend in the overall OMC population in California between 1990 and 2035, taking into account actual and estimated future vehicle sales, assumptions about OMC survival rate, and forecasts of California's future economic and human population growth. Note that the OMC population from 2000 to 2010 is based on actual DMV registration data while the OMC population for calendar years 1999 to 1990 is back-casted from 2000 using assumed survival rates. As shown in Figure III-5, the OMC population started to decline in 2008 with the economic recession. This reduction was caused by a massive decline in new vehicle sales coupled with on-going fleet attrition as vehicles aged and were scrapped. By 2014, we estimate the total population of OMCs operating in California will start to grow again as new vehicle sales driven by a recovering economy and human population growth outpace fleet attrition.

Figure III-5. Population Growth of OMC



5. Load Factors

Engine load is the average operational level of an engine in a given application as a fraction or percentage of the engine manufacturer's maximum rated horsepower. Since emissions are directly proportional to engine horsepower, load factors are used in the inventory calculations to adjust the maximum rated horsepower to the horsepower levels typically observed during normal operation.

Because exhaust emissions from OMCs, ATVs, and mini bikes are based on certification testing results conducted on the Urban Dynamometer Driving Schedule (UDDS) test cycle and reported in grams per mile, a load factor is not used for calculating emissions from these vehicles. Staff did not conduct any studies on the load factors of OHRVs such as snowmobiles, golf carts, and specialty vehicles. The load factors used in RV2013 were based on data provided by Power System Research (PSR) in 1996 and are shown in Table III-3. These load factors are consistent with what was used in OFFROAD2007.

Table III-3. Load Factor

Vehicle Type	Load Factor	Data Source
Snowmobiles	0.34	PSR
Golf Carts and Specialty Vehicles	0.46	PSR

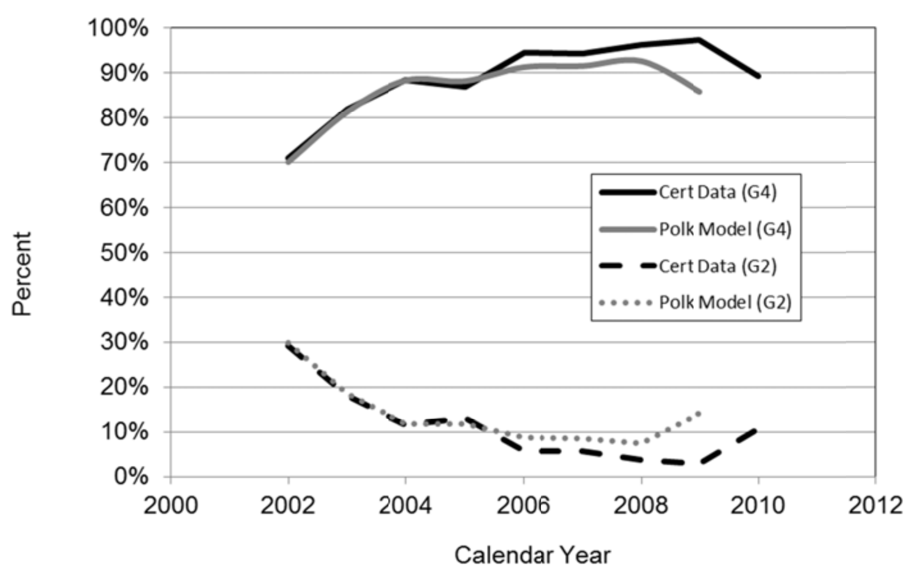
6. *Technology and Horsepower Split*

Engine technology definitely has an impact on exhaust and evaporative emissions. For instance, a two-stroke gasoline engine (G2) produces more hydrocarbon (HC) exhaust compared to a four-stroke gasoline engine (G4). In RV2013, all vehicles are categorized as either two-stroke gasoline (G2) or four-stroke gasoline (G4) engines. Because of a lack of data on what fraction of engines are fuel-injected, staff assumed that for both G2 or G4 technology types, 50% of engines are carbureted and 50% are fuel-injected.

Staff applied the Polk Model (Polk VINtelligence) to estimate the G2/G4 split by decoding the vehicle identification number that is provided for each OHRV in the DMV registration data (POLK, 2013). As DMV data are available only for calendar years 2000 to 2010, staff assumed that for calendar year 2000 and earlier, the G2/G4 split was the same as for calendar year 2000. Likewise, the G2/G4 split for calendar year 2010 and later is assumed to be same as for calendar year 2010.

Staff compared the calendar year-specific G2/G4 split obtained from applying the Polk Model to the DMV registration data with the G2/G4 split obtained from analysis of certification data provided to ARB. As shown in Figure III-6, the G2/G4 trend from the certification data and Polk Model are in good agreement with the fraction of G2 engines found in OHRV operating in California declining from about 30% of the total in 2002 to about 10% in 2010.

Figure III-6. G2/G4 Trend from Certification Data and Polk Model



As shown in Table III-4, the RV2013 model bins OHRVs into different calendar year, technology and horsepower groups for the purpose of assigning emission factors. Due to the limited availability of emissions test data and certification data, carbureted and fuel injected engines may be assigned the same emission factors within a given technology group such as G2 or G4.

Generally speaking, in RV2013, emission factors are assumed to be the same regardless of different horsepower groups. However, horsepower is subdivided into five groups in order that each horsepower group may have a different emission factor when more test data are available in future.

Table III-4. Summary of Calendar Year, Technology, and Horsepower Split Bins

Calendar Year	Technology	Horsepower (hp)
1999 and before	2-Stroke Carbureted (G2 CARB)	0 to 5
2000 to 2010	2-Stroke Fuel Injected (G2 FI)	5 to 15
2010 and later	4-stroke Carbureted (G4 CARB)	16 to 25
	4-Stroke Fuel Injected (G4 FI)	26 to 50
		51 to 120

7. *Exhaust Emission Factors*

Exhaust emission factors used in RV2013 are consistent with OFFROAD2007 and based on certification data and adopted exhaust emissions standards. As OMCs and ATVs were tested on the Urban Dynamometer Driving Schedule (UDDS), which was designed primarily for passenger vehicles and light duty trucks, these exhaust emission factors do not represent the typical trail driving conditions experienced by OMCs and ATVs. One study, conducted by CE-CERT at the University of California at Riverside, focused on real-world driving conditions for OMCs, ATVs, and mini bikes (Durbin et al.,2004). The study provided the average speed, miles driven per day, hours of operation per day, and fuel economy reported by a group of OMC and ATV users. After analyzing the results of the CE-CERT study, staff determined that the average fuel use reported in the CE-CERT study was about three times higher than fuel use measured for comparable vehicles tested on the UDDS. Staff applied an external adjustment factor to revise the baseline CO_2 emission factors, but did not apply such an adjustment to criteria pollutants. The impact of real-world driving conditions on OMCs and other OHRVs is an issue that requires further study; ARB is currently developing test plans to better understand this impact. Table III-5 presents a summary of exhaust emission factors currently used in RV2013.

Table III-5. Exhaust Emission Factors for RV2013

Vehicle Type	Tech Group	HP	Model Year	HC	CO	NOX	PM	CO2
OHMC (g/mile)	G2	All	All	34.2	54.1	0.01	0.42	79.58
	G4	All	1997 and before	3.59	39.1	0.49	0.06	79.58
			1998 and later	0.68	19.8	0.64	0.06	79.58
ATV (g/mile)	G2	All	All	34.2	54.1	0.01	0.42	109.63
	G4	All	1997 and before	3.59	39.1	0.64	0.06	109.63
			1998 and later	0.68	19.8	0.49	0.06	109.63
Mini Bike (g/mile)	G2	All	All	34.2	54.1	0.01	0.42	79.58
	G4	All	1994 and before	24.25	488.1	2.03	0.71	79.58
			1995-1998	8.68	300	2.8	0.75	79.58
			1999 and later	0.47	100	2.7	0.25	79.58
Snowmobile (g/bhp-hr)	G2	All	2005 and before	140.7	385.1	0.54	2.3	615
			2006	89.75	246.1	0.54	2.3	615
			2007-2009	74.5	205	0.54	2.23	615
			2010 and later	55.9	205	0.54	1.57	615
	G4	All	All	3.5	59.3	6.57	0.2	615
Golf Cart & Specialty Vehicle (g/bhp-hr)	G2	0 - 5	All	92	145.5	0.03	1.13	446.2
		>5	All	63.27	100.09	0.02	0.78	446.2
	G4	0 - 5	1997 and before	14.6	159.1	2.6	0.24	446.2
			1998 and later	2.77	80.59	1.99	0.24	446.2
		>5	1997 and before	6.64	72.33	1.18	0.11	446.2
			1998 and later	1.26	36.63	0.91	0.11	446.2

Note that CARB and FI are included in both G2 and G4

8. *Evaporative Emission Factors*

ARB has been active in collecting evaporative emissions data from OHRVs. In 2003, ARB contracted with Automotive Testing Laboratory (ATL) for testing of evaporative emissions from OHRVs using a Sealed Housing for Evaporative Determination (SHED). In addition, ARB began testing OHRVs in ARB's SHED in El Monte, California to support development of this proposed regulation. The goal of the testing was to determine baseline evaporative emissions for a wide range of OHRV equipment and blends of gasoline with different ethanol fuel contents.

For each vehicle tested, the evaporative emissions were measured for hot soak, running loss, diurnal, and resting loss processes. Staff analyzed the results of the ATL and ARB in-house testing to develop the evaporative emission factors by model year group shown in Table III-6. The detailed calculation process is described in Section VI. B.

While analyzing the data from evaporative tests including hot soak, diurnal and resting, and running loss, staff also recognized some sources of uncertainty in estimating the evaporative emission factors, listed as follows:

a. CARB and FI engines used in OHRV applications are assumed to have the same evaporative emission rates due to the lack of emissions data currently available for FI vehicles. From a practical perspective, FI engines should have lower evaporative emission rates than CARB engines because FI systems are sealed whereas carbureted engines have an air intake open to the atmosphere.

b. Evaporative testing is generally more difficult to conduct than exhaust testing as vehicle fuel systems can have many sources for hydrocarbon emissions including the fuel system hoses, hose fittings, fuel tank, carburetor opening, and even liquid leaks. Subsequently, there is typically higher test to test variability when measuring evaporative emissions compared to exhaust emissions.

c. It is reasonable to assume, based on observations of on-road passenger vehicles, that a small percentage of the OHRV population have leaks in their fuel systems (so-called “liquid leakers”); This results in in a disproportionate fraction of the overall evaporative emissions coming from those few vehicles. RV2013 assumes there are no “liquid leakers” in the OHRV fleet in California as there are currently no data on the “liquid leaker” fraction in the population. More importantly, all emissions tests were done on ATVs and OMCs that were in good operating condition such that there was no information available on the contribution of “liquid leakers” to the overall OHRV emissions inventory.

Table III-6. Evaporative Emission Factors for RV2013

Vehicle Type	MY Group	Hot Start (g/event)	Diurnal (g/day)	Resting (g/day)	Running Loss (g/mile)
OMC	2007 and before	3.12	12.23	6.59	1.07
	2008 and after	2.37	9.29	5.01	0.81
ATV	2007 and before	1.28	6.93	3.73	1.08
	2008 and after	0.97	5.26	2.83	0.82
Mini Bike	2007 and before	3.12	12.23	6.59	1.07
	2008 and after	2.37	9.29	5.01	0.81
Snowmobile	2007 and before	1.28	6.93	3.73	1.08
	2008 and after	0.97	5.26	2.83	0.82
Golf Cart & Specialty Vehicle	2005 and before	1.23	5.93	3.33	1.71*
	2006 and after	1.23	1.26	0.71	0.34*

* Running loss measured in g/hour

9. Activity

Assumptions about vehicle activity or usage (e.g. miles driven per year, hours used per year) are a critical component in estimating the OHRV emissions inventory. Previously, in OFFROAD2007, the activity of OHRVs was assumed to remain constant throughout the entire engine life span. To support the development of

RV2013, ARB contracted with CSUS to conduct a phone survey in 2009 of California OHRV owners who were randomly selected from DMV registration data. A total of 1,123 complete responses were received. While the focus of this survey was on OMC and ATV owners, a small sample (less than 2 %) of respondents reported they were owners of mini bikes, golf carts, and specialty vehicles. As the survey was conducted during the depth of the last recession (2009), it is not clear to what extent the reported usage was biased low because of owners using their vehicles less than in normal economic times.

To supplement the activity data, staff also conducted Internet research. By analyzing sales information for secondhand OHRVs, specifically the reported mileage or hours of use reported for different model year used OHRV, staff was able to estimate the annual activity for snowmobiles, golf cart, and specialty vehicles. Appendix C provides a detailed analysis showing how the activity was estimated for each vehicle type.

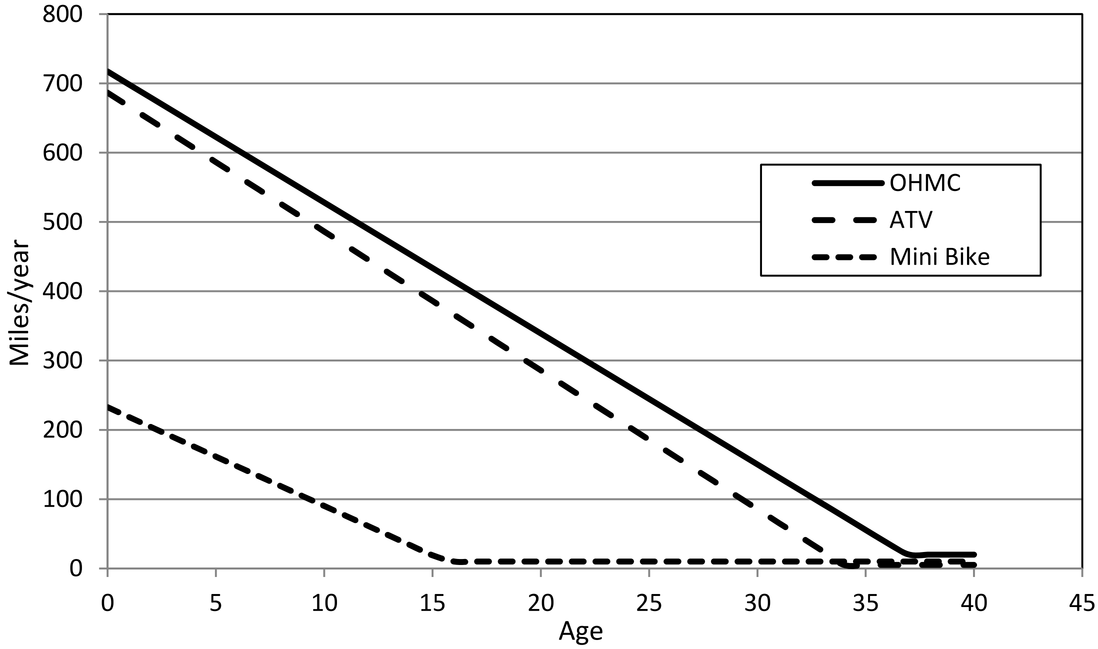
The results of the CSUS survey show that the activity of OHRVs declines with respect to age. Table III-7 summarizes the range of activity for different type of OHRVs. All vehicles show a higher activity during initial years when the vehicles are used more heavily. Based on the CSUS survey, the annual average usage for OMCs, ATVs, and mini bikes is 350 miles/year, 303 miles/year, and 56 miles/year, respectively. In addition, the annual average usage for snowmobiles and golf carts and specialty vehicles is 26 hours/year and 61 hours/year, respectively.

Table III-7. Annual Activity for OHRVs

Vehicle Type	Activity Range	Average
OMCs (miles/year)	717 to 20	350
ATVs (miles/year)	687 to 5	303
Mini Bikes (miles/year)	233 to 10	56
Snowmobiles (hours/year)	120 to 11	26
Golf Carts & Specialty Vehicles (hours/year)	540 to 10	61

Figure III-7 shows how the annual activity of OMCs, ATVs, and mini bikes changes with vehicle age. Not surprisingly, newer, more reliable vehicles are used the most, with usage declining as vehicles age. A similar trend is seen for on-road vehicles where newer vehicles are typically used more than older vehicles. For OMCs, the CSUS survey reported annual activity ranging from 717 miles/year for new motorcycles to 20 miles/year for 38 year old motorcycles. For ATVs, the survey reported annual activity ranging from 687 mile/year for new ATVs to 5 miles/year for 35 year old ATVs. Mini bikes, which are used sparingly, have reported usage ranging from 233 miles/year when new to about 10 miles/year at age 17. Since the CSUS survey did not provide results for the very oldest OHRV (40 or 50 years old), it was assumed that these very old vehicles had the same usage level as the oldest vehicle reported in the survey.

Figure III-7. Activity by Age for OMCs, ATVs, and Mini Bikes



10. Correction Factors

Evaporative emissions testing is conducted under controlled temperature and humidity conditions. However, OHRVs may experience different temperature and humidity conditions depending on where the vehicle is actually operated and stored. For the purpose of emissions inventory modeling, corrections are developed and applied to the baseline emission factors, which reflect controlled laboratory conditions, to better account for the emissions produced under real-world operating conditions.

For political and regulatory purposes, California is divided into 58 counties, 35 local air districts, and 15 air basins. The boundary of each air basin or air district does not necessarily coincide with the boundary of multiple counties. To estimate emissions for each unique combination of air basin, local air district, and county, emissions are developed for a smaller unit of area called a geographic area of interest (GAI). A total of 69 GAIs were developed and formed the basis for spatially allocating the statewide OHRV emissions inventory. The OHRV emissions inventory for a specific county, air district, and air basin combination (or GAI) was corrected to account for the unique ambient temperature and humidity characteristics, as well as fuel requirements of that GAI.

The following section will discuss the correction factors applied in RV2013 to reflect the local temperature and humidity conditions that OHRVs experience during operation and storage in different regions of California.

a. <u>Temperature/RVP Correction for Evaporative Emissions</u>

(1) Temperature/RVP Correction (Diurnal and Resting Loss)

Temperature/RVP correction factors are primarily used to correct the diurnal and resting loss emissions measurements made under laboratory conditions of 65ºF to 105ºF and standard RVP of 7 pounds per square inch (psi) to local ambient temperature and dispensed fuel properties that OHRVs actually experience under real-world conditions. Previously, ARB applied the Temperature/RVP correction based on a laboratory study in which evaporative emissions from lawn mowers were measured with a combination of different temperature profiles and fuel RVP blends. After reviewing ARB's previous methodology, the Eastern Research Group recommended a new approach using vapor generation and permeation as the basis for the Temperature/RVP correction (ERG, 2013).

The work to model the amount of vapor generated from the evaporation of gasoline was first undertaken by Wade in the 1960s, who established equations relating vapor generation to fuel temperature rise and several fuel properties, including RVP, distillation properties, density and molecular weight (Wade, 1967). These equations have been used by the United States Environmental Protection Agency (U.S. EPA) for earlier versions of their on-road emissions model (MOBILE), as well as their off-road emissions model (NONROAD). In the 1980s, Reddy developed a simplified model for vapor generation based only on fuel temperature rise and RVP, and published model coefficients reflecting variations in altitude (sea level, Denver) and ethanol level (E0, E10) (Reddy, 1989).

The Temperature/RVP correction was estimated based on two main processes which are described in more detail below: vapor generation (uncontrolled system) and permeation.

<u>Vapor Generation</u>

For this analysis, we used the Reddy equation for estimating grams of gasoline vapor generated per gallon of fuel tank vapor space, using coefficients for sea level and E10, as these are most reflective of California conditions:

Vapor generated (g/gal vapor space) = $A^* \, e^{B^*(RVP)} \, (e^{C^*T2} - e^{C^*T1})$
Where,
RVP, starting temperature (T1) and ending temperature (T2) are inputs, and A, B and C are coefficients for E10 and sea level (A=0.00875, B = 0.2056, C=0.0430).

Vapor generated (grams) = Vapor (g/gallon vapor space) * Fuel Capacity (gal) * (1- Fill %)

<u>Permeation</u>

The permeation process is assumed to include both tank permeation and hose permeation. The base permeation emission factors are 10.7 g/m^2 /day for tanks, and 222 g/m^2 /day for hoses based on the U.S. EPA NONROAD model (E10 fuel). Generally speaking, temperature corrections for permeation in NONROAD are based on the rule of thumb that permeation emissions double with every increase of 18ºF (10ºC) from its reference temperature. As a result, a temperature adjustment is applied to the reference temperature when estimating the permeation emission factor at a different temperature.

Hose Permeation Temperature Adjustment

Temperature adjustment is applied to the hose permeation calculation. The hose permeation doubles with each 18ºF increase from the reference temperature of 73°F.

TCF = 0.06013899*exp(0.03850818*T)

Tank Permeation Temperature Adjustment

Temperature adjustment is applied to the tank permeation calculation. The tank permeation doubles with each 18ºF increase from the temperature of 85°F.

TCF = 0.03788519*exp(0.03850818*T)

Diurnal = Vapor Generation + 0.5*(Tank Permeation + Hose Permeation)
Resting Loss = 0.5*(Tank Permeation + Hose Permeation)

By calculating the absolute values of diurnal and resting loss at 65ºF to 105ºF and other local temperature conditions and fuel RVP, staff is able to normalize all calculated values, based on the value from 65ºF to 105ºF as 100%. These normalized values are used as the Temperature/RVP correction to adjust diurnal and resting loss emission factors to the local temperature and fuel RVP conditions. The tank size or hose diameter that is assumed represents the typical fleet average and is not important in the final calculation as staff is only interested in the normalized values from different temperature and RVP conditions. Appendix D provides a sample calculation of how the Temperature/RVP correction can be applied to diurnal and resting loss emissions conducted at different temperature profiles and fuel RVP.

(2) RVP Correction (Hot Soak and Running Loss)

The RVP correction is applied to the hot soak and running loss of the evaporative emissions that are conducted with fuel RVP of 7 psi. When the winter fuel with RVP of 9 psi is used, the following formula is used:

$$CF_{RVP} = 0.3*RVP-1.1$$

Applying RVP = 9 psi, the above equation becomes 0.3*9-1.1 = 1.6 which is used for all GAI when winter fuel is used. For summer fuel (RVP is at 7 psi), there is no correction for RVP, which indicates that CF_{RVP} is 1.

b. Fuel Correction Factor for Exhaust Emissions

The fuel correction factors (FCFs) are dimensionless multipliers applied to the basic exhaust emissions rates that account for differences in the properties of certification fuels compared to those of commercially dispensed fuels. California went through three phases of reformulated gasoline in the past two decades: California Reformulated Phase 1 Fuel (1992 to 1995), California Reformulated Phase 2 Fuel (1996 to 2003), and California Reformulated Phase 3 Fuel (2004+) including 6% ethanol gasoline (E6) and 10% ethanol gasoline (E10). In those instances where engines or vehicles are not required to certify, the FCFs intends to reflect the impact of changes in dispensed fuel over time as refiners respond to changes in fuel specific regulations compared to the fuel used to obtain the test data.

E10 is the reference fuel assumed in RV2013 for estimating the future emissions inventory because most OHRV are tested on E10 and it is the current commercially available gasoline. As a result, staff renormalized previous FCFs in OFFROAD2007 to E10 fuel (Sicat, 2007).

c. Temperature and Humidity Correction

The temperature and humidity correction for exhaust emissions were developed as follows:

(1) Temperature Correction

For hydrocarbons and NO_x, the temperature correction is

$$CF_{Temp} = 10^{(T-75)a}$$

Where,

T = ambient temperature (°F)

a = coefficient which depends on engine type and whether the ambient temperature is above or below 75°F as shown in Table III-8

Table III-8. Coefficients for Temperature Correction

Pollutants	Low Temp (<75F)		High Temp(>75F)	
	G2	G4	G2	G4
CO	0	0	0.01494	-0.0146
HC	0	0	0.00484	-0.0113
NOx	0	0	0	-0.0059

To simplify the calculation methods used in developing the OHRV emissions inventory, we have applied the temperature correction on a daily basis to the average daily temperature. Using this approach captures the general trend of the correction factor without requiring calculations on an hourly basis.

(2) Humidity Correction

For humidity correction for NOx, the correction factor is

$$CF_{Humd} = 1 - 0.0038 \times (A - 75)$$

Where *A* is the absolute humidity.

The absolute humidity is derived from the relative humidity and ambient temperature based on the following equation:

$$ABH = RH \times (-0.09132 + 0.01594 \times T - 0.00029 \times T^2 + 0.00000437 \times T^3)$$

Where,
ABH = scenario humidity (grains/pound)
T = scenario temperature (F)
RH = relative humidity (%)

However, this equation is bounded to use ambient temperatures between 40ºF and 120ºF, and to predict absolute humidity values not greater than 200 grains/pound.

If the ambient temperature is less than 40ºF, then 40ºF is used for the calculation. Similarly, if the ambient temperature is higher than 120ºF, then 120ºF is used for calculation. Finally, if the calculated absolute humidity is greater than 200 grains/pound, then only 200 grains/pound is used.

d. Correction Factor for ROG, TOG, and CH_4

(1) ROG and TOG Correction

This correction factor refers to the conversion of THC to TOG, ROG, and other pollutants. The conversion factor varies by calendar year (due to phase-in schedule of reformulated gasoline), engine type and emission process such as evaporative and exhaust. The conversion coefficients are listed in Table III-9.

Table III-9. Conversion Factors for THC, TOG and ROG

Calendar Year	Engine	Process	TOG	ROG
Pre-1996	Gasoline Engine	Exhaust (G2)	THC*1.01	THC*0.92
		Exhaust (G4)	THC*1.04	THC*0.89
		Evaporative (All)	THC*1.04	THC*1.04
1996 - 2003	Gasoline Engine	Exhaust (All)	THC*1.09	THC*1.00
		Evaporative (All)	THC*1.12	THC*1.12
2004+	Gasoline Engine	Exhaust (All)	THC*1.10	THC*1.01
		Evaporative (All)	THC*1.14	THC*1.14

(2) Methane (CH_4)

CH_4 is derived as a fraction of TOG. The formula is: CH_4=TOG*Coefs. The coefficients are shown in Table III-10.

Table III-10. Coefficients Used for CH4 Conversion from TOG

Fuel Type	CY	Coefficients
G2	Pre-1996	0.0774
	1996 - 2003	0.0558
	2004+	0.0572
G4	Pre-1996	0.1132
	1996 - 2003	0.0558
	2004+	0.0572

e. <u>Fuel Consumption and SO_2 Calculation</u>

(1) Fuel Consumption

The fuel consumption correction factor is derived from mass balance using CO, CO_2 and with TOG or ROG. The formulas are shown below and the fuel consumption coefficients are shown in Table III-11:

For hydrocarbon reported in ROG, fuel consumption =

[12.011/(12.011+Alpha*1.008))*TOG/ROGadj+0.429*CO+0.273*CO2]/(0.854*453.59237*Fuel Density)

For hydrocarbon reported in TOG, fuel consumption =

[(12.011/(12.011+alpha*1.008))*TOG+0.429*CO+0.273*CO2]/(0.854*453.59237*Fuel Density)

Table III-11. Coefficients Used for Fuel Consumption Calculation

<table>
<tr><th>Fuel Type</th><th>CY</th><th>Alpha</th><th>TOGAdj</th><th>ROGAdj</th><th>Fuel Density (lb./gallon)</th></tr>
<tr><td rowspan="3">G2</td><td>Pre-1996</td><td>0.54</td><td>1.0155</td><td>0.9079</td><td rowspan="6">6.17</td></tr>
<tr><td>1996-2003</td><td>0.54</td><td>1.0949</td><td>0.9219</td></tr>
<tr><td>2004+</td><td>0.54</td><td>1.1004</td><td>0.9198</td></tr>
<tr><td rowspan="3">G4</td><td>Pre-1996</td><td>0.54</td><td>1.0379</td><td>0.8648</td></tr>
<tr><td>1996-2003</td><td>0.54</td><td>1.0949</td><td>0.9219</td></tr>
<tr><td>2004+</td><td>0.54</td><td>1.1004</td><td>0.9198</td></tr>
</table>

(2) Sulfur Dioxide (SO_2)

The SO_2 correction factor is calculated based on sulfur content in the fuel and will differ by fuel type.

The formula is:

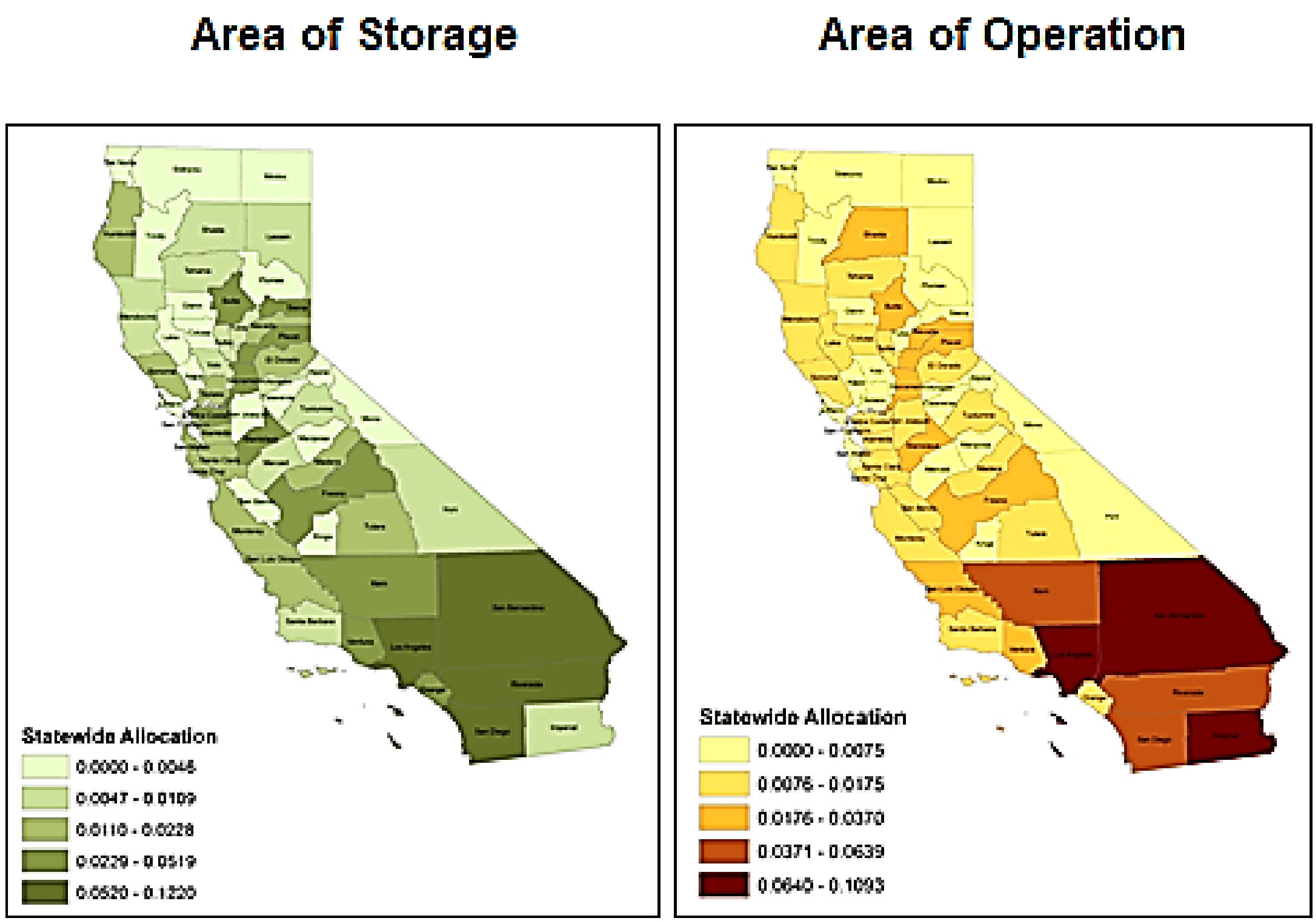
SO_2 (g/hp-hr)=(ppm /10^6) * 2 *BSFC * 453.5

Where,
ppm is S content in the fuel (weight basis)
BSFC is the brake-specific fuel consumption (lb/hp-hr)
Conversion factor from pound to gram is 453.5

11. Spatial Allocation

Allocating emissions spatially is an important part of an emissions inventory. In the case of OHRVs, the spatial allocation of emissions associated with vehicle operation and storage are different because of differing emission processes and environmental conditions (e.g. temperature and humidity) for different locations. Using OMCs as an example, as shown in Figure III-8, during operation only the exhaust and hot soak and running loss of the evaporative emissions are allocated to the area of operation such as state parks. On the other hand, when OMCs are being stored in a garage, only the diurnal and resting portion of the evaporative emissions are allocated to that location. Figure III-8 shows how the spatial allocation of storage and operating emissions differs for OHRVs in California. Table III-12 summarizes the surrogates used in the RV2013 model for allocating evaporative emissions associated with OHRV operation and storage related emissions. DMV registration data was primarily used to estimate the allocation factor for storage allocation for all five types of vehicles. CSUS survey data were used to estimate the operation allocation factor for OMCs and ATVs. For mini bikes, golf carts, and specialty vehicles, staff assumed the area of operation is close to where vehicles are registered. For snowmobiles, the areas above 5000 feet during winter are used as a surrogate for the operation allocation factor.

Figure III-8. Spatial Allocation for OMCs*



* Note this chart shows the percentage of vehicles stored in each county on the left, and the percent of total vehicle operation on the right. Exhaust and running loss emissions are allocated to areas of operation, while diurnal and resting evaporative emissions are allocated to storage areas.

Table III-12. Summary of Spatial Allocation for Recreation Vehicles

Vehicle Type	Operation	Storage
OMCs	CSUS survey	DMV Registration
ATVs	CSUS survey	DMV Registration
Mini Bikes	DMV Registration	DMV Registration
Snowmobiles	Area above 5000 ft (winter)	DMV Registration
Golf Carts & Specialty Vehicles	DMV Registration	DMV Registration

a. <u>Operation</u>

For OMCs and ATVs, staff developed the spatial allocation for vehicle operation based on the CSUS survey data which provides information on those counties where survey respondents used their OMCs or ATVs.

The allocation factor was derived using the CSUS survey data as shown in the following formula by taking into account the actual activities reported on the survey:

$$AF_{OP,i} = \frac{\sum_j D_j \times H_j \times PT_{i,j}}{\sum_i \sum_j D_j \times H_j \times PT_{i,j}}$$

Where,
$AF_{OP,I}$ = the operation allocation factor for county i
D_j = the number of days of vehicle riding for respondent *j* per year
H_j = the hours of riding per day for respondent *j*
$PT_{i,j}$ = the percentage of time for respondent *j* spent riding in county *i*

As mini bikes are small in size and have a limited range of operation, staff assumed they are operated near the addresses where the end users are registered. For snowmobiles, staff assumed that the operation will take place at areas above 5000 feet during the winter season. Finally, since most golf carts and specialty vehicles are used in places such as golf courses, parking lots, or school campuses, staff assumed these vehicles would also be operated near the addresses where they are registered.

b. <u>Storage</u>

As the DMV registration data includes the county code, staff was able to assign individual OHRV to their county of registration. The statewide total OHRV storage emissions were then allocated to the local county level based on the percent ownership of vehicles for each county.

12. Benefit of Red and Green Sticker Program

The Red and Green Sticker Program was adopted by ARB with the intent of protecting air quality in ozone non-attainment areas by limiting the use of OHRVs such as OMCs and ATVs that do not meet emission standards applicable for California OHRV riding areas. After the regulations were established, ARB and DMV worked together to develop criteria for identifying non-complying OHRVs.

Generally speaking, OHRVs with green stickers are allowed to operate on public land all year around. Vehicles with the red sticker, which is for 2003 and later model year OHRV that do not meet the emission standards established by ARB, are not allowed to operate during certain times of the year when ozone attainment is more challenging (such as summer months).

Since the implementation of the Red and Green Sticker Program, more consumers are buying the OMC and ATV with green stickers. Consequently, there is a huge incentive for OHRV manufacturers to produce more engines that meet the green sticker requirement. Though OHRV have 4 stroke engines, as observed in the recent DMV data, there are still some ATVs and OMCs with 2 stroke engines. Appendix E provides a more detailed description regarding the estimate of emission benefit from the Red and Green Sticker Program.

13. *Seasonality*

To model seasonal variability in OHRV usage in California, staff analyzed the activity survey data collected by CSUS in 2009. Questionable survey responses were filtered out and not used for subsequent analysis based on the following criteria:

- Daily usage of OMC greater than 10 hours.
- More than 365 days of usage reported in a year.

For each valid response, the total hours of use per year was calculated by multiplying the reported days of use per year by the reported hours of use per day.

The monthly usage was developed for each of the four seasons: winter (December to February), spring (March to May), summer (June to August), and fall (September to November). The monthly usage was calculated using the following equation:

$$MUF_i = \frac{THU \times UF_i}{3}$$

MUF_i is the monthly usage frequency for season i,THU is the total hours of usage per year, and UF_i is the usage frequency for season i.

Since the seasonal definition in the RV2013 model is different from what was defined in the survey, the seasonal usage frequency is calculated by summing the monthly usage frequency over the specified season. In the model, the summer season refers to the six months from May to October while the winter season refers to the remaining six months from November to April.

$$SUF_i = \sum_j MUF_{j,i}$$

SUF_i is the seasonal usage frequency for a given season *i*, $MUF_{j,I}$ is the *j* month usage frequency within a given season *i*. The RV2013 model assumes summer months to include May through October and winter months to include November through April.

Therefore, the seasonality adjustment will be:

$$SA_i = \frac{SUF_i}{\sum SUF_i}$$

Where,
SA_i is the seasonal adjustment factor for season i.

Using the methodology described above, the seasonality adjustment factor for OHRV is 0.97 for summer months and 1.03 for winter months.

14. Garage Temperature Correction

Since temperature has such a significant effect on evaporative emissions from OHRVs, especially the diurnal and resting loss processes, it is critical that the emissions modeling reflects the temperatures actually experienced by OHRVs under real-world storage conditions. With this in mind, staff corrected the ambient temperature profiles assumed in the modeling to better reflect the temperatures OHRVs experience when stored inside a garage in California.

Specifically, vehicles stored inside the garage would experience less fluctuation of temperature when compared to the ambient temperature. When the ambient temperature is corrected with a garage temperature correction, the overall net effect is about a 5 % reduction in baseline evaporative emissions. Appendix F provides a more detailed description of the methodology developed for garage temperature correction using data provided by Sierra Research and also independently collected by ARB.

15. Long Term Weathering Correction for Inactive Vehicles

Evaporative emissions (diurnal and resting loss) are based on the assumption the emission rate remains constant throughout all 365 days of the year for inactive vehicles. This assumes the liquid-phase composition of the tank fuel is constant (no depletion of volatile components over time). While such assumptions may be reasonable for active vehicles, as they are refueled more frequently throughout the year, it may not be applicable for inactive vehicles, as they are more likely to sit many months without activity or refueling. Staff developed an “adjustment factor” to reduce the evaporative emissions from those inactive vehicles due to weathering of the fuel as described in Appendix G.

16. Methods and Data Used for Estimating the Rule Inventory

In developing the proposed evaporative emission standards for OHRV, ARB staff worked closely with the OHRV manufacturers and their representatives to ensure the proposed standards are technically feasible. Specifically, ARB conducted in-house evaporative testing on ATVs and OMCs equipped with the proposed control technologies to ascertain whether the proposed evaporative emissions standards can be met. To model the emissions benefits of the proposed rule, staff assumed that the appropriate model years of new OMCs, ATVs, mini bikes, and specialty vehicles meet the proposed evaporative standards. Note that snowmobiles and golf carts are excluded from the proposed rule, as snowmobiles are currently only subject to federal regulation and gasoline-fueled golf carts are regulated under ARB's existing small off-road engine regulation (SORE). The proposed evaporative emission diurnal standard is shown in Table III-13.

Table III-13. Proposed Evaporative Controls for OHRV

Model Year	Required Test	Test Standard
2018 and later model years	Diurnal	1 g TOG/day

The phase-in schedule for the proposed standards lasts for four calendar years from 2018 to 2021 with average phase-in of 75% per compliant vehicles manufactured in each calendar year during the phase in. For all estimates made during the phase in period, it is assumed that a manufacturer would phase in emission standards at a rate of 50% in model year 2018, 75% for both 2019 and 2020, and 100% for 2021. Small volume manufacturers have the option of certifying OHRVs to a design-based standard. However, in estimating the rule inventory, staff assumed all new OHRV will meet the proposed diurnal emission standard of 1.0 g TOG/ day.

All emission factors are based on total hydrocarbon (THC), therefore all emission standards reported as total organic gas (TOG) must be converted to THC for use in the inventory model. The proposed 1 g TOG/day diurnal emissions standard is converted to THC by dividing by 1.1248, resulting in a THC equivalent standard of 0.89 g/day.

The proposed rule does not set a measured standard for hot soak or running loss emissions. Instead, hot soak and running loss are included as vehicle preconditioning tests, and are expected to be controlled by the stringent diurnal standard. To determine the hot soak and running loss emission factors, staff used the average test results for a prototype controlled OHRV, reported as THC, from controlled ATV and OMC.

Since hot soak is defined as a 45-minute event, the 1.5 hour hot soak test result is adjusted to 45 minutes by multiplying by a factor of 0.65 (see Appendix B). The average hot soak from controlled ATVs and OMCs is 0.33 g per 1.5 hour event. After the adjustment, the hot soak emission factor is 0.21 g per 45 minute event associated with the proposed controls for OHRV.

The average running loss for controlled ATVs and OMCs is 0.13 g per 7.45 miles. Thus, the running loss emission factor is 0.018 g/mile associated with the proposed controls for OHRV. The evaporative emission factors based on the proposed standard and controlled emission tests are shown in Table III-14.

Table III-14. Emission Factors Based on the Proposed Rule

Evaporative Process	New Standard	Proposed Emission Factor (THC)	Unit
Diurnal and Resting Loss	1.0 g TOG	0.89	g/day
Hot Soak	NA	0.21	g/event
Running Loss	NA	0.018	g/mi

Note that THC=TOG/1.1248

IV. RV2013 MODEL

The RV2013 emissions inventory model uses the Microsoft Access™ platform to perform all calculations. Input information such as population, activity, emission factors, correction factors, and spatial allocation are stored as tables. During the calculation process, queries are used to combine variables from different tables and carry out the calculation process.

A. CALCULATION PROCESS

The population input table includes five categories; namely, OMCs, ATVs, mini bikes, snowmobiles, and golf carts and specialty vehicles. Each category includes active or inactive status, calendar year, model year, horsepower group, and technology. The technology group is subcategorized into 2-stroke-gasoline-carbureted (G2-CARB), 2-stroke-gasoline-fuel injected (G2-FI), 4-stroke-gasoline-carbureted (G4-CARB) and 4-stroke-gasoline-fuel injected (G4-FI). The activity input table provides the annual activity with respect to age while the emission factor input tables include exhaust and evaporative emission factors grouped by calendar year group or technology.

The top-down calculation process starts with multiplying the population input tables with activity table and emission factor tables, resulting in the statewide uncorrected emissions. The statewide uncorrected emissions are then allocated to the local GAI and adjusted with different correction factors to reflect the local conditions (e.g., Temperature/RVP, garage temperature effect, ambient temperature and humidity correction, etc.)

The model output provides emissions with and without the proposed rule at the statewide, air district, and air basin levels, as well as by season and calendar year. End users may also specify the vehicle type, vehicle status (active or inactive), technology, and horsepower prior to getting the emissions summary. Finally, the model is capable to provide outputs by model year for a given calendar year.

B. MODEL INSTALLATION AND USER GUIDE

The RV2013 model can be downloaded from ARB website as follows:
http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles

The RV2013 model runs as an Access database file. The model was developed in Microsoft Access 2010 and previous versions of Access may not support all the model functionality. The computer needs to have sufficient memory to store and run the model (these requirements are fairly small). Unzipped, the file will be about 1.2 GB. When running the model, the file size can grow to up to 2.0 GB. Model runtime varies depending on the processing power of the computer. Estimates are provided in the user interface. Details on the model installation and user guide can be found in Appendix I. Finally, the source code of RV2013 is provided in Appendix J.

V. EMISSION RESULTS

A. BENEFITS OF PROPOSED RULE

The emission benefits from the proposed rule are summarized in Table V-I, which provides ROG emission reductions through evaporative controls. The proposed rule phases in between 2018 and 2021, requiring increasing control levels for vehicles manufactured in these calendar years. A small statewide benefit of 1.34 TPD is observed starting in 2020. In 2023, the benefit increases to 3.35 TPD, as more vehicles will be subject to the proposed rule. By 2035, about 70% of the OHRV population will be subject to the proposed evaporative controls, the statewide summer ROG benefit increases to 9.91 TPD.

For the Bay Area Air Quality Management District (AQMD), the ROG benefits are 0.16 TPD, 0.40 TPD, and 1.20 TPD for 2020, 2023, and 2035, respectively. For the San Joaquin Valley (SJV) Unified Air Pollution Control District (APCD), the ROG benefits are 0.22, 0.55, and 1.61 TPD ROG for 2020, 2023, and 2035, respectively. For the South Coast AQMD, ROG benefits are 0.38, 0.97, and 2.99 TPD for 2020, 2023, and 2035, respectively.

Table V-1. Benefits of the Proposed Rule for Summer Emissions (tons/day)

2020	Baseline		Proposed Rule		Benefit	
	ROG	NOx	ROG	NOx	ROG	NOx
Statewide	17.35	0.83	16.01	0.83	1.34	0.00
Bay Area AQMD	2.04	0.10	1.88	0.10	0.16	0.00
SJV Unified APCD	2.88	0.15	2.66	0.15	0.22	0.00
South Coast AQMD	4.33	0.08	3.95	0.08	0.38	0.00

2023	Baseline		Proposed Rule		Benefit	
	ROG	NOx	ROG	NOx	ROG	NOx
Statewide	17.38	0.91	14.03	0.91	3.35	0.00
Bay Area AQMD	2.04	0.11	1.64	0.11	0.40	0.00
SJV Unified APCD	2.86	0.16	2.31	0.16	0.55	0.00
South Coast AQMD	4.46	0.09	3.49	0.09	0.97	0.00

2035	Baseline		Proposed Rule		Benefit	
	ROG	NOx	ROG	NOx	ROG	NOx
Statewide	19.08	1.13	9.17	1.13	9.91	0.00
Bay Area AQMD	2.25	0.14	1.05	0.14	1.20	0.00
SJV Unified APCD	3.08	0.20	1.47	0.20	1.61	0.00
South Coast AQMD	5.12	0.11	2.13	0.11	2.99	0.00

Appendix H provides a detailed breakdown of the evaporative emissions. For 2020 and 2023, the emission benefits are small as majority of the population is not covered by this rule. By 2035, about 70% of the population is subjected to the proposed rule, there are more emission benefits coming from the diurnal and resting process when comparing to running loss and hot soak.

VI. REFERENCES

CSUS, 2009. Final Analysis of the 2008 California Survey of Registered Off-Highway Vehicle Owners: Usage and Storage. Final Report. California State University, Sacramento. June 2009.

Durbin, T.D., Smith, M.R., Wilson, R., Rhee, S. (2004). In-Use Activity Measurements For Off-Road Motorcycles and All-Terrain Vehicles. Transportation Research Part D 9. (2004) 209–219. 2004. **http://cichlid.cert.ucr.edu/research/pubs/durbin-9.pdf**

ERG, 2013. Eastern Research Group, Analysis Of Off-Road Emission Correction Factors. 2013.

EPA, 2012. 2008 Ground-Level Ozone Standards — Region 9 Final Designations, April 2012. **www.epa.gov/ozonedesignations/2008standards/final/region9f.htm**

PARKS, 2007. Red Sticker Open Riding Schedule. California Air Resources Board (CARB) Non-Compliant OHV (Red Sticker) Riding Season Schedule. **http://ohv.parks.ca.gov/?page_id=21928**

POLK, 2013. Polk Vintelligence™ (Vehicle Identification Number Analysis). **https://vintelligence.polk.com**

Reddy, S. Raguma. Prediction of Fuel Vapor Generation From a Vehicle Fuel Tank as a Function of Fuel RVP and Temperature. SAE Technical Paper 1989-09-01. 1989. **DOI:** 10.4271/892089.

SICAT, 2007. Sicat, T. OFFROAD Modeling Change Technical Memo. F-Road Exhaust Emissions Inventory Fuel Correction Factors. 7/25/05. **http://www.arb.ca.gov/msei/offroad/techmemo/arb_offroad_fuels.pdf**

UCLA, 2012. The UCLA Anderson Forecast for the Nation and California (2012).

Wade, D., Factors Influencing Vehicle Evaporative Emissions. SAE Technical Paper 670126, 1967. DOI:10.4271/670126.

VII. APPENDICES

APPENDIX A. ESTIMATE OF SURVIVAL RATE

All engines will follow a natural attrition with a certain fraction of vehicles scrapped every year as they age. To model OHRV population growth, it is critical to have a good understanding how the engine population survives through time. As the 2000 to 2009 calendar year DMV OHRV registration data includes the model year of the vehicle registered, staff was able to analyze and develop a survival trend for a cohort of vehicles over that 10 year period.

To explain how the survival rate was estimated, staff used the DMV registered OMC as an example. Note that 2004 DMV data were not used due to limitations in that particular calendar year of data. Staff first calculated the survival ratio of a population for two consecutive calendar years at different ages. As shown in Table VI-1, the population of Age 10 in calendar year 2007 is 9674 while the population of Age 11 in calendar year 2008 is 9270. Therefore, the survival ratio of ($Pop_{Age\ 11,\ 2008}$ /$Pop_{Age\ 10,\ 2007}$) is 0.96 as listed in Table VI-2. In other words, only 96% of the population at age 10 of calendar year 2007 survived at age 11 of calendar year 2008.

Generally speaking, the survival ratio should decline starting the first year. However, unlike passenger cars, OHRVs are discretionary items, consumers are likely to purchase new OHRVs that are already a couple years old, which explained why the survival ratio actually increases in the beginning years.

After the survival ratios are calculated between calendar years 2000 and 2009, the average survival ratio was then calculated. As the average survival ratio starts to fluctuate after age 5, staff uses the moving average to minimize the fluctuation and come up with a smooth survival rate. As illustrated in Table VI-2, the refined survival ratio at age 6 (0.96) is the average of the survival ratio at age 5 (0.97) and age 6 (0.94).

Finally, the survival rate is calculated using the refined survival ratios. A reference population of 100 was used to multiply the refined survival ratios. Likewise, for other vehicle types such as ATVs, mini bikes, snowmobiles, and golf carts/specialty vehicles, staff used the similar approach in estimating their survival rates. Finally, Table VI-3 presents the survival rates of OHRVs used in RV2013.

Table VII-1. OMC Population from DMV

Age	2000	2001	2002	2003	2004*	2005	2006	2007	2008	2009
0	22564	29531	45004	50817		39847	35245	23302	11888	4387
1	11345	24294	32942	41791		56045	53282	48261	32821	16572
2	9985	11932	24934	33809		66852	57948	54788	52225	35594
3	11698	10286	12391	25210		43089	67467	58151	54953	52568
4	8599	11850	10587	12716		34473	43469	67643	58239	55045
5	6939	8387	11591	10429		24639	33637	41934	63695	56406
6	6767	6511	8024	11204		12069	23119	31637	39580	58291
7	6518	6478	6307	7823		9727	11693	22224	30536	37746
8	6026	6222	6311	6140		10485	9315	11164	21093	28850
9	6524	5787	6113	6153		7250	10084	8927	10686	20240
10	8621	6216	5608	5944		5768	7030	9674	8477	10161
11	7575	8302	6049	5482		5780	5618	6717	9270	8064
12	5916	7152	8078	5898		5565	5546	5359	6403	8851
13	9581	5663	7026	7909		5115	5337	5325	5094	6124
14	12404	8957	5494	6797		5503	4897	5047	5053	4772
15	22461	11874	8770	5340		7302	5301	4689	4809	4802
16	19279	20486	11466	8481		6320	6938	5040	4388	4493
17	16439	18096	19848	11201		4927	6070	6632	4789	4166
18	12677	14518	16990	18893		7842	4653	5685	6272	4483
19	8015	11865	14210	16390		10306	7497	4427	5394	5912
20	5824	7001	11200	13279		17211	9731	7061	4116	4994
21	5300	5442	6904	10780		14693	16444	9286	6663	3855
22	4013	4815	5182	6396		11922	13574	15371	8720	6190
23	2850	3741	4696	4987		9589	11417	12779	14496	8282
24	2088	2540	3593	4445		5660	8817	10408	11617	13330
25	2217	1924	2490	3453		4417	5396	8350	9853	10890
26	2215	2066	1827	2366		4024	4088	4871	7572	8888
27	1358	2114	2042	1773		3082	3827	3871	4617	7010
28	1093	1308	2058	1941		2142	2865	3567	3505	4106
29	1021	1055	1280	1997		1596	2047	2675	3365	3229
30	1033	998	1031	1261		1746	1486	1894	2435	3048
31	437	1010	973	1010		1830	1667	1394	1785	2276
32	167	427	995	956		1157	1719	1568	1290	1625
33	10	172	439	976		930	1092	1626	1504	1191
34	9	7	168	428		878	878	1041	1526	1387
35	0	9	7	161		904	820	846	953	1429
36	0	0	9	7		409	857	782	772	887
37	0	0	0	11		165	404	829	711	723
38	0	0	0	0		5	157	383	786	683
39	0	0	0	0		11	6	155	364	736
40	0	0	0	0		0	9	6	151	349
41	0	0	0	0		0	0	14	9	139
42	0	0	0	0		0	0	0	10	5
43	0	0	0	0		0	0	0	0	9
Total	249568	269036	312637	354654		451275	491447	515403	522485	512788

*Note that the 2004 population was not used due DMV registration errors

Table VII-2. Survival Ratios Estimated from DMV Data

Age	2001	2002	2003	2006	2007	2008	2009	Average Survival Ratio	Refined Survival Ratio	Survival Rate
0	1	1	1	1	1	1	1	1	1	100
1	1.08	1.12	0.93	1.34	1.37	1.41	1.39	1.04	1.04	104
2	1.05	1.03	1.03	1.03	1.03	1.08	1.08	1.05	1.05	109
3	1.03	1.04	1.01	1.01	1.00	1.00	1.01	1.01	1.01	111
4	1.01	1.03	1.03	1.01	1.00	1.00	1.00	1.01	1.01	112
5	0.98	0.98	0.99	0.98	0.96	0.94	0.97	0.97	0.97	109
6	0.94	0.96	0.97	0.94	0.94	0.94	0.92	0.94	0.96	104
7	0.96	0.97	0.97	0.97	0.96	0.97	0.95	0.96	0.95	99
8	0.95	0.97	0.97	0.96	0.95	0.95	0.94	0.96	0.96	95
9	0.96	0.98	0.97	0.96	0.96	0.96	0.96	0.96	0.96	91
10	0.95	0.97	0.97	0.97	0.96	0.95	0.95	0.96	0.96	88
11	0.96	0.97	0.98	0.97	0.96	0.96	0.95	0.96	0.96	85
12	0.94	0.97	0.98	0.96	0.95	0.95	0.95	0.96	0.96	82
13	0.96	0.98	0.98	0.96	0.96	0.95	0.96	0.96	0.96	78
14	0.93	0.97	0.97	0.96	0.95	0.95	0.94	0.95	0.96	75
15	0.96	0.98	0.97	0.96	0.96	0.95	0.95	0.96	0.96	72
16	0.91	0.97	0.97	0.95	0.95	0.94	0.93	0.95	0.95	68
17	0.94	0.97	0.98	0.96	0.96	0.95	0.95	0.96	0.95	65
18	0.88	0.94	0.95	0.94	0.94	0.95	0.94	0.93	0.95	62
19	0.94	0.98	0.96	0.96	0.95	0.95	0.94	0.95	0.94	58
20	0.87	0.94	0.93	0.94	0.94	0.93	0.93	0.93	0.94	55
21	0.93	0.99	0.96	0.96	0.95	0.94	0.94	0.95	0.94	51
22	0.91	0.95	0.93	0.92	0.93	0.94	0.93	0.93	0.94	48
23	0.93	0.98	0.96	0.96	0.94	0.94	0.95	0.95	0.94	46
24	0.89	0.96	0.95	0.92	0.91	0.91	0.92	0.92	0.94	43
25	0.92	0.98	0.96	0.95	0.95	0.95	0.94	0.95	0.94	40
26	0.93	0.95	0.95	0.93	0.90	0.91	0.90	0.92	0.94	37
27	0.95	0.99	0.97	0.95	0.95	0.95	0.93	0.95	0.94	35
28	0.96	0.97	0.95	0.93	0.93	0.91	0.89	0.93	0.94	33
29	0.97	0.98	0.97	0.96	0.93	0.94	0.92	0.95	0.94	31
30	0.98	0.98	0.99	0.93	0.93	0.91	0.91	0.94	0.95	30
31	0.98	0.97	0.98	0.95	0.94	0.94	0.93	0.96	0.95	28
32	0.98	0.99	0.98	0.94	0.94	0.93	0.91	0.95	0.95	27
33	1.03	1.03	0.98	0.94	0.95	0.96	0.92	0.97	0.96	26
34	0.70	0.98	0.97	0.94	0.95	0.94	0.92	0.92	0.94	25
35	0.70	0.98	0.96	0.93	0.96	0.92	0.94	0.94	0.93	23
36	0.70	0.98	0.96	0.95	0.95	0.91	0.93	0.94	0.94	21
37	0.70	0.98	0.96	0.99	0.97	0.91	0.94	0.95	0.94	20
38	0.70	0.98	0.96	0.95	0.95	0.95	0.96	0.95	0.95	19
39	0.70	0.98	0.96	1.20	0.99	0.95	0.94	1.02	0.99	19
40	0.70	0.98	0.96	0.82	1	0.97	0.96	0.94	0.98	18

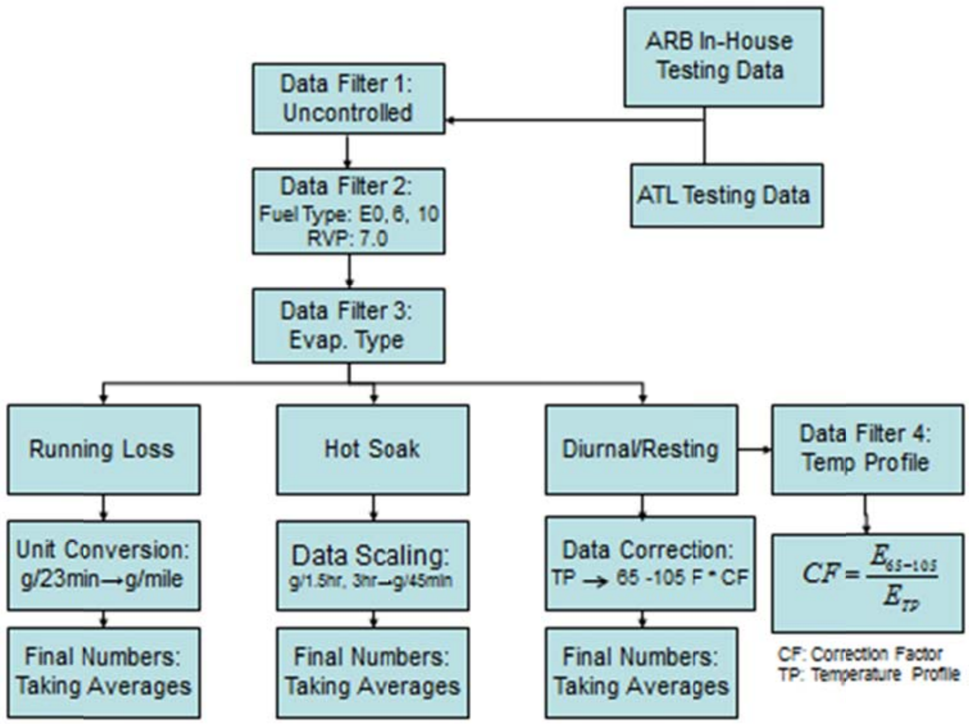
Table VII-3. Survival Rate (Percent) of OHRVs

Age	OMC	ATV	Snowmobile	Mini Bike	Golf Cart and Specialty Vehicle
0	100	100	100	100	100
1	104	105	135	125	220
2	109	107	147	121	206
3	111	108	153	116	196
4	112	107	157	112	183
5	109	103	158	107	167
6	104	99	156	103	152
7	99	95	153	98	137
8	95	91	150	94	125
9	91	88	146	88	116
10	88	84	143	82	107
11	85	81	139	75	99
12	82	78	134	69	92
13	78	75	131	63	84
14	75	72	128	61	79
15	72	69	124	59	74
16	68	66	120	57	69
17	65	63	116	55	64
18	62	61	112	53	59
19	58	59	107	51	55
20	55	56	102	49	51
21	51	54	96	47	46
22	48	52	89	45	44
23	46	49	84	43	42
24	43	46	78	41	39
25	40	43	71	39	36
26	37	41	65	37	33
27	35	38	60	35	30
28	33	35	55	33	28
29	31	32	50	32	27
30	30	30	45	29	25
31	28	28	40	26	23
32	27	27	36	23	21
33	26	25	31	20	20
34	25	24	28	17	18
35	23	22	24	15	18
36	21	21	21	12	17
37	20	19	19	9	16
38	19	18	17	6	14
39	19	16	15	3	13
40	18	15	0	0	13
41	0	0			12
42					11
43					9
44					8
45					8
46					7
47					6
48					6
49					3
50					0

APPENDIX B. EVAPORATIVE EMISSION FACTOR CALCULATION PROCESS

The following describes the process of deriving the baseline evaporative emission factors for OHRVs based on laboratory testing data. A diagram of this process is shown as in Figure VII-1. Calculation Process for Evaporative Emission Rates

Figure VII-1. Calculation Process for Evaporative Emission Rates



There are two sources of data for deriving emission factors for OHRVs; ARB in-house test data and Automotive Test Laboratory (ATL) test data. These two sources of data were combined together first. To develop uncontrolled emission factors, data were used from those tests without any controlled technology. The fuels used in the tests included gasoline with MTBE (E0), gasoline with 6% ethanol (E6), and gasoline with 10% ethanol (E10) with an RVP of 7.0 psi. The data were then further separated by testing procedures and purposes including diurnal and resting loss, running loss, and hot soak.

For running loss, the model reports the value in units of g/mile, while the testing data was reported as g/23 min. Thus, the g/23 min data had to be converted to g/mile data. The conversion is done using the total running loss during the entire test divided by the total travel distance. For ARB in-house data, since the UDDS driving cycle was used for the running loss testing, a total travel distance of 7.45 miles was used for the calculation.

Hot soak emissions are calculated over a 45 minute period. Hot soak emissions tests were conducted for 1.5 to 3 hours. Staff evaluated minute by minute emissions data for tests where those data were available to quantify emissions over the initial 45 minute period. Staff developed an average scaling factor to estimate 45 minute hot soak test results and applied this to tests where minute by minute data were not available. The average fraction of emissions by test is shown in Table VII-4 and Table VII-5.

Table VII-4. Percentage of Hot Soak Emissions by Duration (ARB)

Test #	45min	60min
1	0.63	0.76
2	0.64	0.77
3	0.64	0.84
4	0.67	0.8
5	0.65	0.78
Mean	0.65	0.79

Table VII-5. Percentage of Hot Soak Emissions by Duration (ATL)

Vehicle	45 min	60 min	90 min	180 min
ATV1	0.89	0.94	1	1.11
ATV2	0.82	0.83	1	1.13
ATV3	0.92	0.99	1	1.05
ATV4	0.6	0.75	1	1.65
ATV Average	0.81	0.88	1	1.24
OMC1	0.61	0.76	1	1.53
OMC2	0.77	0.85	1	1.41
OMC3	0.59	0.74	1	1.64
OMC4	0.63	0.77	1	1.48
OMC Average	0.65	0.78	1	1.52

Diurnal and resting loss tests were conducted on several temperature profiles including 65º-82ºF, and 65º-105ºF. In order to evaluate test data staff converted all data to be consistent with a 65º-105ºF test schedule. To convert 65º-82ºF test data, staff evaluated vehicle tests where both schedules were tested, and developed an emissions ratio for 65º-82ºF relative to 65º-105ºF. This ratio was then applied to 65º-82ºF tests to estimate what emissions would have been like under a 65º-105ºF test.

APPENDIX C. ACTIVITY ANALYSIS

Developing an updated estimate of vehicle activity was a critical portion of this emissions inventory update. In previous OHRV inventories, annual activity estimates (miles drive per year or hours operated per year) were assumed to remain constant over a vehicle's lifetime. In 2009, ARB contracted with the California State University in Sacramento (CSUS) to conduct a survey of OHRV usage and related information. Only registered vehicles were selected for sampling. The survey collected 1,126 respondents by telephone. The main information used in calculating the annual activity estimates were (1) the age of equipment at time of interview, (2) number of operating days used in the last year, (3) typical miles per day when used, and (4) typical hours per day when used.

As not all respondents answered or remembered specific information asked by each question, staff used two different approaches to estimate the annual activity.

- First Approach:

  Annual activity = number of operating day per year x miles per day

- Second Approach (if miles per day is not provided by respondent):

Annual activity = number of operating days per year x hours/day x assumed mph

We assumed the average speed for ATVs is 8 mph and the average speed for OMCs or mini bikes is 15 mph. From these two approaches, staff was able to estimate the annual activity for the OHRVs. Some of the vehicle owners indicated that they did not operate their vehicles though they were registered. Staff included these vehicles with zero activity in the analysis of annual activity.

It is important to note that as with all mobile sources, average activity per vehicle is variable and dependent on the owner and specific use. In general, activity estimates by age are developed by fitting a regression through what is a highly variable data set. This is also true with OHRVs.

ATV Activity

The survey activity data reported for ATVs is shown in Figure VII-1. Results show highly variable equipment usage that generally decreases with age. The decrease in activity with vehicle age is commonly observed in mobile sources. Generally new vehicles are used more than older vehicles due to novelty of the equipment, equipment deterioration, and other factors. Staff also reviewed the activity data versus age provided by MIC including the survey from nationwide warranty data for ATVs (n= 51,335) and nationwide telephone survey of ATV users (n =611). The warranty data for ATVs is for the first two and half years. Staff analyzed the warranty data and found them to be skewed toward the first year (about 47,160 first year warranty data out of 51,335 total samples). Figure VII-2 compares the estimated annual activity from CSUS survey and the averages from the MIC warranty data and averages from MIC telephone surveys. The results are consistent.

Figure VII-1. ATV Activity from CSUS Survey

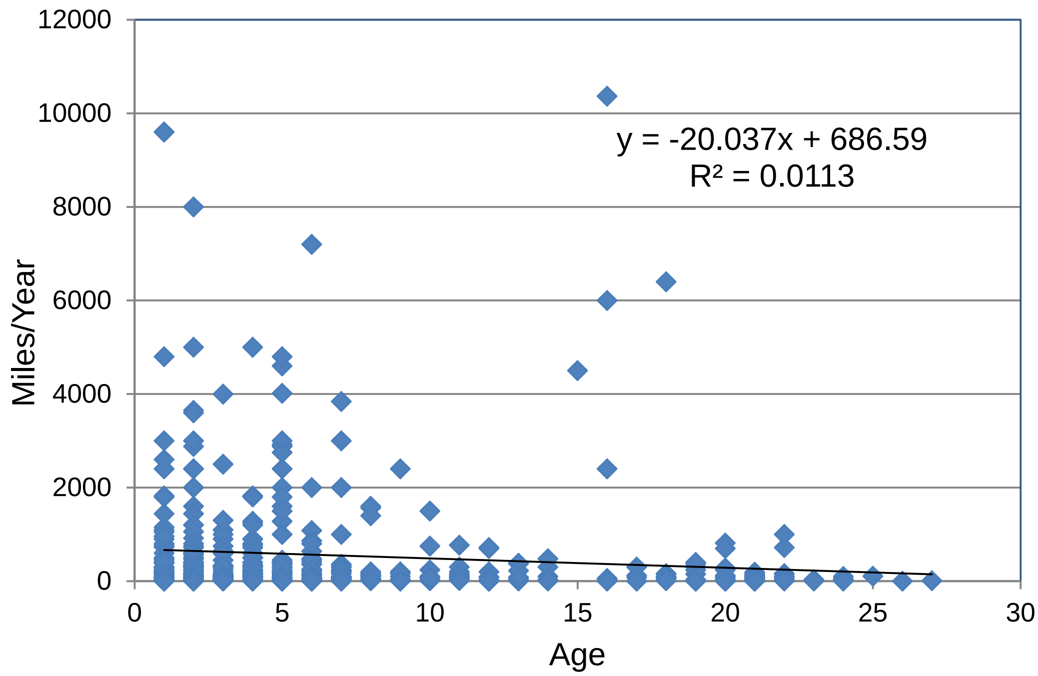
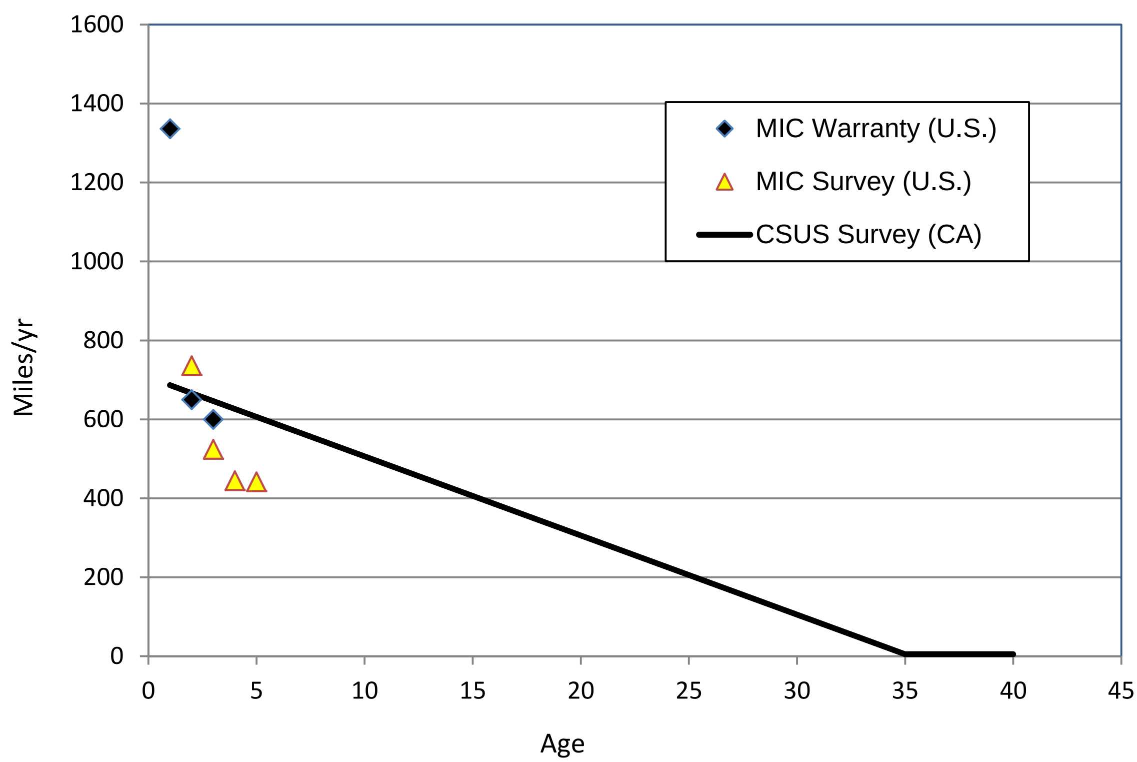


Figure VII-2. Comparison of ATV Activity from Survey and Warranty Data



OMC Activity

Similar to the estimate approach for ATVs, the activity by age was also estimated for OMCs. The scattered data points of age by activity (miles/year) were charted as shown in Figure VII-3 for OMCs.

Figure VII-3. OMC Activity from CSUS Survey

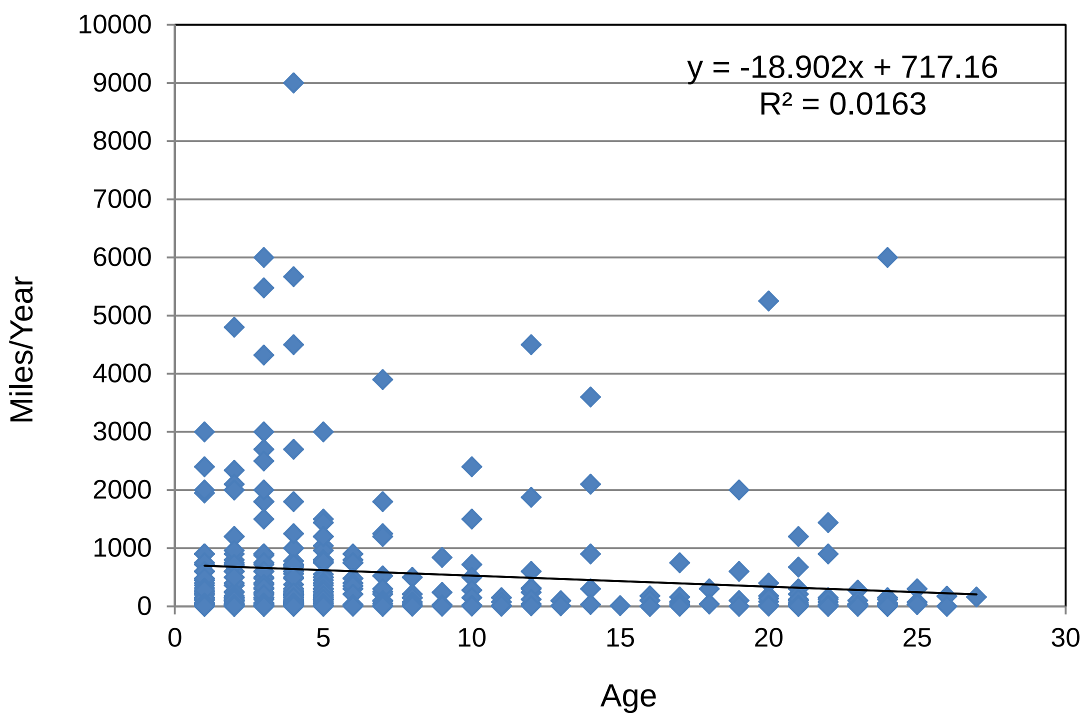
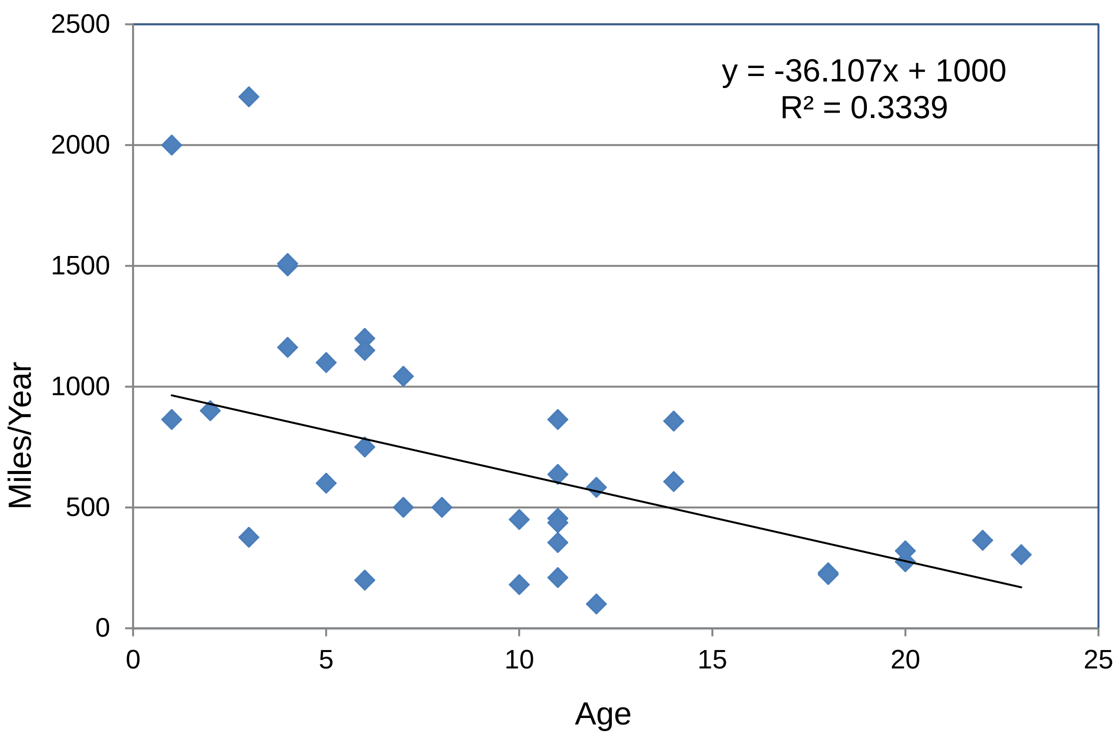


Figure VII-4 provided data on mileage and model year of the snowmobiles to be sold (snowmobileforum.com and snowmobilefanatics.com). Based on the information posed on these two websites, staff estimated the annual mileage. Staff assumed an average speed of 8 mph to convert the annual average in the final annual activity (hours/year).

Staff recognized that this activity estimate for snowmobiles may be high as the sales information is based on nationwide sales data and not only. Moreover, people participated in these two websites appear to be active user of snowmobiles. In the absence of activity data for snowmobiles, staff recommended using the web-based activity estimate until a more detailed survey can be done for California specific snowmobiles activity in future.

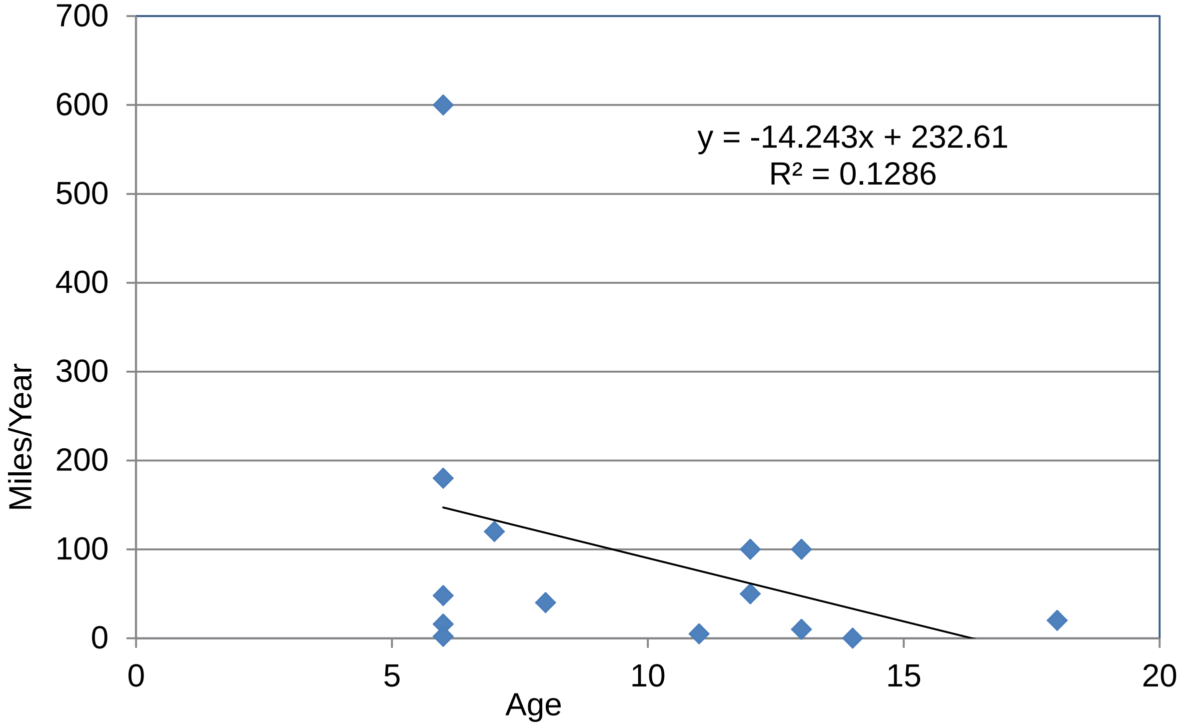
Figure VII-4. Snowmobile Activity from Internet Sales Data



Mini Bike Activity

The annual activity for mini bikes was also estimated using the similar approach like ATV and OMC. The CSUS survey included a small sample size (n=16) of mini bikes, making the analysis less robust than if a larger sample size was available. However, there is still a pattern showing more activity for newer mini bike as compared to older mini bike. As seen in Figure VI-6, a log linear regression was used to estimate the activity with respect to age. To prevent the annual activity from becoming negative, staff assumed the annual mileage will remain at 10 miles per year after age 16.

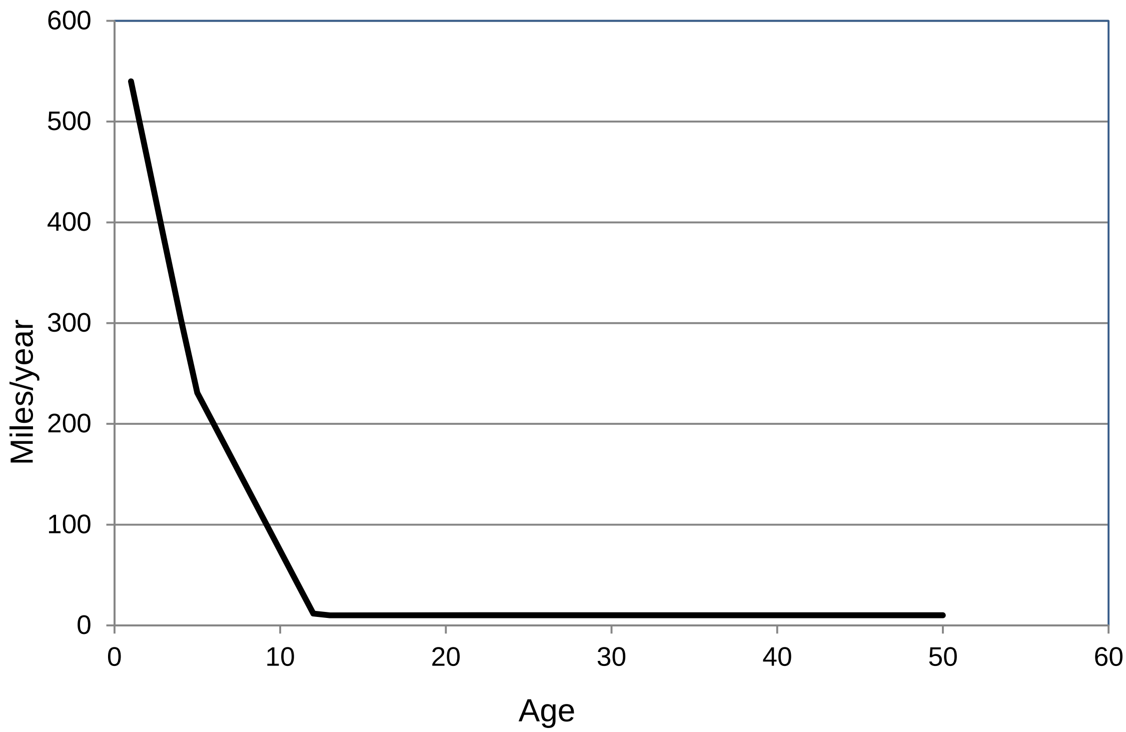
Figure VII-5. Mini Bike Activity from CSUS Survey



Golf Cart and Specialty Vehicle Activity

Gasoline powered golf carts are primarily used on golf courses, while specialty vehicles including sand cars and dune buddies distribution varies widely by activity. For example, golf cart is used more than special vehicle such as sand car. Activity information for the golf cart and specialty vehicle category was estimated based on internet data. Dune buggy activity was estimated from limited data from CSUS survey. Staff average these two activity estimates. Figure VI-6 shows the final activity by age for the golf carts and specialty vehicles.

Figure VII-6. Golf Cart and Specialty Vehicle Activity



The final activity by age for each type of OHRV is listed in Table VI-6. As shown in the table, the activity declines with respect to age. Since the CSUS survey focused primarily on OMC and ATV, there are limited survey data on golf cart and specialty vehicle and no data on snowmobile. There is definitely a need to have future activity for these types of vehicle. Moreover, there is a need to correlate activity with economic conditions which can only be done through multiple periodic surveys.

Table VII-6. Activity by Age for OHRVs

Age	OMC	ATV	Mini Bike	Snowmobile	Golf Cart and Specialty Vehicle
	Miles/year			Hours/year	
1	717	687	233	120	540
2	698	667	218	121	461
3	679	647	204	75	383
4	660	626	190	55	304
5	642	606	176	45	231
6	623	586	161	39	200
7	604	566	147	35	168
8	585	546	133	31	137
9	566	526	119	29	106
10	547	506	104	27	74
11	528	486	90	25	43
12	509	466	76	24	12
13	490	446	62	23	10
14	471	426	47	21	10
15	453	406	33	20	10
16	434	386	19	20	10
17	415	366	10	19	10
18	396	346	10	18	10
19	377	326	10	18	10
20	358	306	10	17	10
21	339	286	10	17	10
22	320	266	10	16	10
23	301	246	10	16	10
24	282	226	10	15	10
25	264	206	10	15	10
26	245	186	10	14	10
27	226	166	10	14	10
28	207	146	10	14	10
29	188	126	10	14	10
30	169	106	10	13	10
31	150	85	10	13	10
32	131	65	10	13	10
33	112	45	10	12	10
34	93	25	10	12	10
35	74	5	10	12	10
36	56	5	10	12	10
37	37	5	10	12	10
38	20	5	10	11	10
39	20	5	10	11	10
40	20	5	10	11	10
41 to 50					10
Average	350	303	56	26	61

APPENDIX D. TEMPERATURE/RVP CORRECTION

The following illustrates an example showing how the Temperature/RVP correction is used to adjust the test data conducted from 65º to 105ºF to a local ambient temperature. The following illustrates an example of correcting the test data from 65º F to 105ºF to different local temperature and fuel RVP conditions.

Vapor Generation

	Input	Units
Tmin	65	F
Tmax	105	F
RVP	7	psi
Tank Size	3	gallons
Fill	0.50	
Vapor generation	2.77	g/gal
Vapor per day	4.15	g/day

Reddy Coefficients

A	B	C	
0.00875	0.2056	0.043	(10% ethanol, sea level)

Vapor generated (g/gal vapor space) = $A * e^{B(RVP)} (e^{CT2} - e^{CT1})$

Vapor generated (grams) = Vapor (g/gallon vapor space) * Fuel Capacity (gal) * (1- Fill %)

Tank Permeation

Base EF	10.70	g/m2/day
Temp Correction at Tmin	0.46	F
Temp Correction at Tmax	2.16	F
Ave Temp Correction	1.31	F
Adjusted EF	14.03	g/m2/day
Tank Surface Area	0.34	m2
Final Emissions	4.82	g/day

Temp Correction = 0.03788519*EXP(0.03850818*T) relative to 85 F

Hose Permeation

Base EF	222.00	g/m2/day
Temp Correction at Tmin	0.73	F
Temp Correction at Tmax	3.43	F
Ave Temp Correction	2.08	F
Adjusted EF	462.19	g/m2/day
Hose Length	0.31	m
Hose Diameter	0.01	m
Hose Surface Area	0.01	m2
Final Emissions	2.81	g/day

Temp Correction = 0.06013899*EXP(0.03850818*T) relative to 73 F

Total Emission	11.79	g/day
"Diurnal"	7.97	g/day
"Resting"	3.82	g/day

Local Temp and Fuel RVP			Final Output (g/day)						Temp/RVP Correction	
RVP	T min	T max	Vapor Generation	Tank Permeation	Hose Permeation	Total	Diurnal	Resting Loss	Diurnal	Resting Loss
7	65	105	4.15	4.82	2.81	11.79	7.97	3.82	1.00	1.00
7.8	73.7	86.7	1.16	3.15	1.84	6.16	3.66	2.50	0.46	0.65
7.8	53.8	70.2	0.68	1.59	0.93	3.20	1.94	1.26	0.24	0.33
7.8	72.1	90.7	1.77	3.41	1.99	7.17	4.47	2.70	0.56	0.71
7.8	77	92.4	1.68	3.80	2.21	7.69	4.69	3.01	0.59	0.79
7.8	71.4	89.7	1.68	3.29	1.92	6.90	4.29	2.61	0.54	0.68
7.8	75.7	93.4	1.93	3.83	2.23	7.99	4.96	3.03	0.62	0.79

APPENDIX E. BENEFIT OF RED AND GREEN STICKER PROGRAM

Since 1972, the California Vehicle Code has required the registration of OHRVs with DMV. Registration is necessary for OHRVs to operate legally on California's public lands that are designated for OHRV use. Beginning with the 2003 model year, only OHRVs that meet California's exhaust emission standards are eligible for green sticker registration. OMCs and ATVs that are not certified to comply with California's exhaust emission standards remain eligible for OHRV registration, but they are issued a red sticker instead. The majority of these noncomplying OHRVs are powered by two-stroke engines, though there is a small percentage (less than 10%) of noncomplying four-stroke OHRVs as well.

In ozone nonattainment areas, OHRVs with red sticker registration are subject to a usage restriction. Specifically, this usage restriction prevents these noncomplying OHRVs from operating when ambient ozone levels exceed the federal 8-hour ozone standards. Such exceedances typically occur during the period between May and October.

To simply the calculation process, staff assumed the OHRVs subject to the Red and Green Sticker Program include OMCs and ATVs only as they comprise the majority of the population. In addition, staff assumed the following:

Only ozone nonattainment areas will be impacted by the Red and Green Sticker Program.

- Table VII-7 shows the ozone nonattainment areas based on federal 8-hour ozone standards (EPA, 2012).
- All 2002 and previous model year OHRVs have green stickers.
- All 2003 and newer model year OHRVs with two-stroke engines have red stickers.
- In ozone nonattainment areas, two-thirds of OHRVs with red sticker registration do not operate when ambient ozone standards are exceeded.
- 10% of 2003 and newer 4-stroke engines have red stickers.
- There are about 44 OHRV parks located in the nonattainment areas (PARKS, 2007). About 9 out of these 44 OHRV parks are open all year round for red stickered OHRV to ride.
- 50% of red sticker vehicles that would have otherwise operated in a non-attainment area during the summer will not operate.

Table VII-7. California Nonattainment Area Based on Federal 8-hour Ozone Standards

Area	County
Calaveras County	Calaveras
Chico (Butte County)	Butte
Imperial County	Imperial
Kern County (Eastern Kern)	Kern (p)
Los Angeles-San Bernardino Counties (West Mojave Desert)	Los Angeles (p)
	San Bernardino (p)
Los Angeles-South Coast Air Basin	Los Angeles (p)
	Orange
	Riverside (p)
	San Bernardino (p)
Mariposa County	Mariposa
Nevada County (Western part)	Nevada (p)
Riverside County (Coachella Valley)	Riverside (p)
Sacramento Metro	El Dorado (p)
	Placer (p)
	Sacramento
	Solano (p)
	Sutter (p)
	Yolo
San Diego County	San Diego
San Francisco Bay Area	Alameda
	Contra Costa
	Marin
	Napa
	San Francisco
	San Mateo
	Santa Clara
	Solano (p)
	Sonoma (p)
San Joaquin Valley	Fresno
	Kern (p)
	Kings
	Madera
	Merced
	San Joaquin
	Stanislaus
	Tulare
San Luis Obispo (Eastern San Luis Obispo)	San Luis Obispo (p)
Tuscan Buttes	Tehama (p)
Ventura County	Ventura (p)
Morongo Areas of Indian Country (Morongo Band of Mission Indians)	Areas of Indian Country
Pechanga Areas of Indian Country (Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation)	Areas of Indian Country
Rest of state is unclassifiable/attainment	

(p) = partial county

APPENDIX F. GARAGE TEMPERATURE CORRECTION

OHRVs are assumed to be stored inside a garage when not in use. The model adjusts for this assumption by applying a garage temperature correction factor to adjust it from standard testing conditions (65º to 105ºF) ambient temperature profiles that would be experienced in a garage in each appropriate region. Table VII-8 lists the 13 garages that were recorded for internal garage temperature and the respective ambient temperature outside the garage from the Sierra Research study. An additional dataset from ARB's garage study is listed in Table VII-9.

Table VII-8. Sierra Research Study of 13 Garage Temperature Profiles

Garage No.	Start Date	Time	End Date	Time	Garage Temperatures			Ambient Temperatures		
					Min.	Max.	Diff.	Min.	Max.	Diff.
1	9-Jul-10	18:00	16-Jul-10	20:35	68.9	101.3	32.4	57.9	102	44.1
2	9-Jul-10	18:00	16-Jul-10	20:35	74.3	103.1	28.8	57.9	102	44.1
3	2-Jul-10	18:00	9-Jul-10	13:00	75.2	97.7	22.5	55	98.1	43.1
4	2-Jul-10	18:00	9-Jul-10	9:00	63.5	88.7	25.2	55	98.1	43.1
5	25-Jun-10	18:01	2-Jul-10	20:36	64.4	86.9	22.5	52	101	49
6	25-Jun-10	18:01	2-Jul-10	9:36	71.6	96.8	25.2	55	102.9	47.9
7	26-Jun-10	0:56	2-Jul-10	9:46	68	93.2	25.2	55	102.9	47.9
8	7-May-10	11:42	14-May-10	11:27	68.9	84.2	15.3	40.1	89.6	49.5
9	18-Jun-10	18:01	25-Jun-10	9:51	63.5	88.7	25.2	45	91	46
10	3-Jun-10	4:01	10-Jun-10	6:36	72.5	87.8	15.3	51.8	89.6	37.8
11	18-Jun-10	18:00	25-Jun-10	9:30	61.7	90.5	28.8	45	91	46
12	7-May-10	11:40	14-May-10	9:00	57.2	86	28.8	36.5	90.5	54
13	18-Jun-10	18:01	25-Jun-10	10:01	68	95.9	27.9	45	91	46

Table VII-9. ARB Garage Temperature Study

Season	Garage Temperature			Ambient Temperature		
	Min.	Max.	Diff.	Min.	Max.	Diff.
Average garage profile during winter (n=4)	41	52	11	39	57	18
Average garage profile during summer (n=4)	76	93	17	63	94	31

From the data listed in Table VII-8 and Table VII-9, the average minimum, maximum, and difference were calculated for ambient and garage temperatures. From these averages, a garage/ambient ratios were developed as shown in Table VII-10

Table VII-10. Summary of Ratios of Garage Temperature to Ambient Temperature

Data Source	Garage/Ambient Ratio	Garage/Ambient Ratio	Garage/Ambient Ratio
	Min Temp	Max Temp	Difference
Sierra Research 95° to 105° F Data	1.253	0.944	0.57
Sierra Research 85° to 90° F Data	1.487	0.982	0.506
ARB garage data (summer)	1.206	0.989	0.548
ARB garage data (winter)	1.051	0.912	0.611

The combined data that contained different temperature profiles were further segregated into different ambient temperature ranges. The temperature ranges were 0º to 70ºF, 71º to 95ºF, and 95º+ F. The maximum ambient temperature determined the corresponding garage/ambient ratio to use to calculate the garage temperature. Table VII-11 lists the maximum ambient temperature criteria and the corresponding ratios. The garage maximum temperature ratio estimates the highest garage temperature inside the garage. The garage temperature difference ratio estimates the range of temperature inside in the garage as compared the range of ambient temperature outside the garage.

Table VII-11. Final Criteria and Ratio Used in Estimating Garage Temperature

Max Ambient Temperature Criteria	Garage Max Temp Ratio	Garage Temp Difference Ratio	Data Source
0° - 70°F	0.91	0.61	ARB
71° - 95°F	0.97	0.52	Sierra Research and ARB
95°+ F	0.94	0.57	Sierra Research

The following steps were used to estimate the garage temperature range (using the information listed in Table VII-10) with a known ambient temperature range.

- For a given GAI, ambient minimum temperature, ambient maximum temperature, and ambient temperature differences are known.
- Calculate garage max temperature using criteria and corresponding Garage Maximum Temperature Ratio.
- Calculate garage temperature difference using criteria and corresponding Garage Temperature Difference Ratio.
- Find garage minimum temperature from calculated garage temperature difference and garage max temperature.
- With known garage temperatures, garage correction factor can be calculated from test temperature profile using Temperature/RVP Correction as described in Appendix D.

For example:
Ambient temperature = 65º to 82º F

Garage maximum temperature = 82º F x 0.97 = 79.5º F
Garage temperature difference = (82º - 65º F) x 0.52 = 8.8º F
Garage minimum temperature = 79.5º F - 8.8º F = 70.7º F
Estimated garage temperature = 70.7º to 79.5º F

APPENDIX G. ADJUSTMENT OF EMISSIONS FROM INACTIVE VEHICLES

Historically, our evaporative emissions assessments for diurnal and resting loss have been based on the assumption that the liquid phase fuel composition remains constant over the course of the year. This assumption is reasonable when vehicles are regularly operated and refueled; however, in this assessment we are modeling diurnal and resting emissions from vehicles that are stored but not operated or refueled during the year. When evaporative emissions occur over months to year long periods, it is reasonable to expect, depending on tank size, that the effective vapor pressure of the fuel in the vehicle tank will decrease over time as volatile components of the fuel are evaporated. This process is called fuel weathering.

Based on the principle of vapor-liquid equilibrium (VLE) partition of gasoline, staff estimated the daily loss of emissions in an uncontrolled fuel tank, where the gasoline vapor has no restriction to enter or leave the fuel tank. Instead of including all gasoline species in the vapor-liquid mass balance, staff simplified the mass balance by selecting 12 major components in the gasoline. With this method, the vapors expelled from the tank are assumed to be saturated (in equilibrium with the liquid). The volatilized components are deducted from the liquid phase and a new vapor-liquid equilibrium is established the next day.

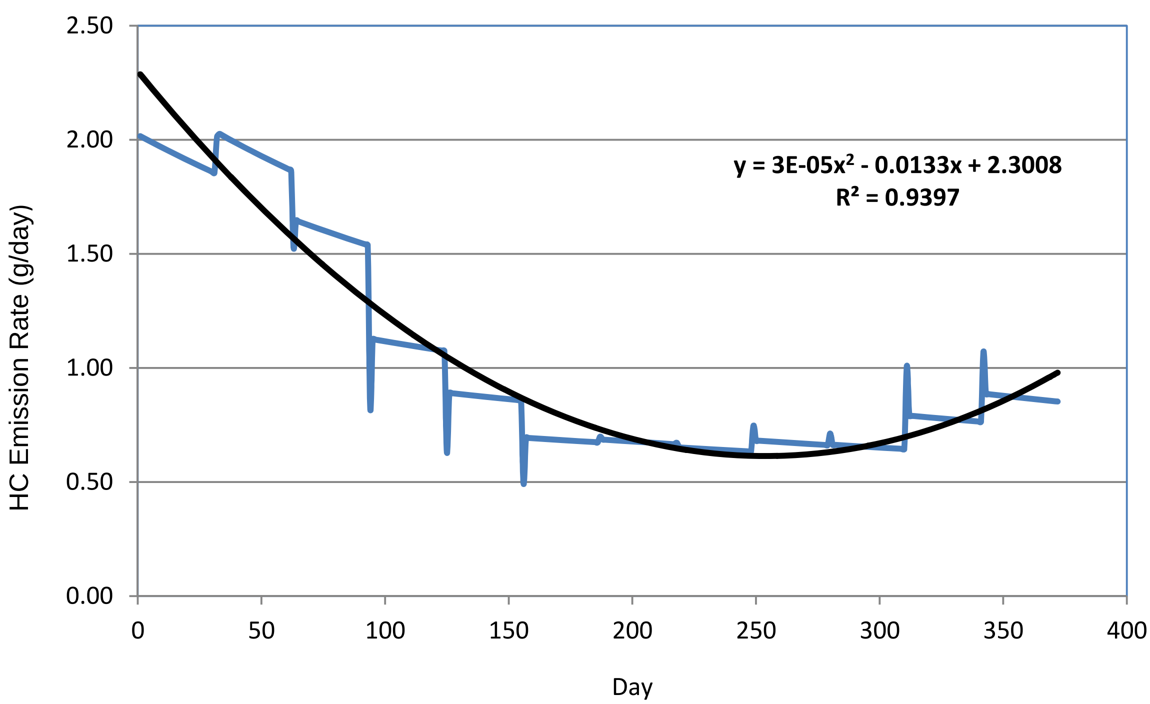
Our analysis started by assuming an OMC tank that was 50% full with Phase-II reformulated gasoline. We assumed gasoline density of 6.2 lbs/gallon with a 7 psi relative vapor pressure. We calculated emissions over a 12 month period using Los Angeles County meteorological conditions shown in Table VII-12. To model the depletion of volatile species, staff applied the VLE mass balance method. As a result of daily rise of temperature, the light ends of the gasoline (largely butane), which have a lower boiling point than other gasoline constituents, will evaporate first.

As seen in Figure VII-7, the average emission rate is higher during summer, lower during winter, and rises again during spring. A regression equation was also developed to help estimate the annual emissions from the calculated emissions rates using the liquid-vapor equilibrium approach.

Table VII-12. Temperature Range in Los Angeles County

Month	Min. Temp (F)	Max. Temp (F)
Jan	49.1	65
Feb	49.6	65.1
Mar	51.2	66.9
Apr	52.4	67.7
May	57.1	72.8
Jun	60.7	76.6
Jul	64.8	82
Aug	64.6	82.9
Sep	63.2	80.8
Oct	58.6	74.8
Nov	53.6	69.8
Dec	48.8	64.6

Figure VII-7. Estimated Monthly HC Emission Rate from Vapor-Liquid Equilibrium



Staff compared the weathered effect on two temperature profiles:

Los Angeles County 12-month Temperature Profile

Based on the VLE (weathered) mass balance over 12 months of Los Angeles County temperature profiles, the annual emissions is 385 g/year as daily evaporation rate is a small fraction of the liquid gasoline in the fuel tank. The annual emissions from “un-weathered” rate are 737 g/year (assuming 2.03 g/day *365 day/year).

Thus, the annual emissions calculated from VLE mass balance is about 53% of that calculated from the “un-weathered” calculation. The adjustment factor for this weathering and temperature profile scenario is 0.53.

65º to 105º F Temperature Profile

Based on the VLE (weathered) mass balance over 365 days of temperature profile at 65º to 105º F, the annual emissions are 1870 g/year. However, the annual emissions from “un-weathered” rate are 2900 g/year (assuming 7.94 g/day* 365 days/year). The adjustment factor for this weathering and temperature profile is 0.64.

These results are summarized in Table VII-13. In this assessment, to reflect fuel weathering, inactive vehicle diurnal and resting emissions are reduced by 47% (1-0.53).

Table VII-13. Emissions Estimated from Weathered and Un-weathered Conditions

Temp Profile	Method	gram/yr.	gal/yr.	% of 5 gal tank	Adjustment Factor
LA County (12 months)	Weathered (VLE mass balance)	385	0.14	2.7%	0.53
	Un-weathered	737	0.26	5.2%	
65º -105º F	Weathered (VLE mass balance)	1870	0.66	13.0%	0.64
	Un-weathered	2900	1.03	20.6%	

APPENDIX H. DETAILED BREAKDOWN OF EVAPORATIVE EMISSION BENEFITS

Figure VII-8. Detailed ROG and NOx Emission Benefits for State and Local Districts (TPD)

2020				2023				2035			
State	Baseline	Proposed Rule	Benefit	State	Baseline	Proposed Rule	Benefit	State	Baseline	Proposed Rule	Benefit
Hot Soak	0.69	0.61	0.08	Hot Soak	0.72	0.53	0.19	Hot Soak	0.83	0.29	0.54
Running Loss	1.59	1.42	0.17	Running Loss	1.65	1.23	0.42	Running Loss	1.92	0.66	1.26
Diurnal	10.22	9.13	1.09	Diurnal	10.63	7.89	2.74	Diurnal	12.37	4.26	8.11
Evap (Subtotal)	12.50	11.16	1.34	Evap (Subtotal)	13.00	9.65	3.35	Evap (Subtotal)	15.12	5.21	9.91
Exhaust (Subtotal)	4.85	4.85	0.00	Exhaust (Subtotal)	4.38	4.38	0.00	Exhaust (Subtotal)	3.96	3.96	0.00
ROG (total)	17.35	16.01	1.34	ROG (total)	17.38	14.03	3.35	ROG (total)	19.08	9.17	9.91
NOx	0.83	0.83	0.00	NOx	0.91	0.91	0.00	NOx	1.13	1.13	0.00
Bay Area AQMD	Baseline	Proposed Rule	Benefit	Bay Area AQMD	Baseline	Proposed Rule	Benefit	Bay Area AQMD	Baseline	Proposed Rule	Benefit
Hot Soak	0.08	0.07	0.01	Hot Soak	0.08	0.06	0.02	Hot Soak	0.10	0.03	0.07
Running Loss	0.19	0.17	0.02	Running Loss	0.19	0.14	0.05	Running Loss	0.23	0.07	0.16
Diurnal	1.20	1.07	0.13	Diurnal	1.25	0.92	0.33	Diurnal	1.45	0.48	0.97
Evap (Subtotal)	1.47	1.31	0.16	Evap (Subtotal)	1.52	1.12	0.40	Evap (Subtotal)	1.78	0.58	1.20
Exhaust (Subtotal)	0.57	0.57	0.00	Exhaust (Subtotal)	0.52	0.52	0.00	Exhaust (Subtotal)	0.47	0.47	0.00
ROG (total)	2.04	1.88	0.16	ROG (total)	2.04	1.64	0.40	ROG (total)	2.25	1.05	1.20
NOx	0.10	0.10	0.00	NOx	0.11	0.11	0.00	NOx	0.14	0.14	0.00
SJV APCD	Baseline	Proposed Rule	Benefit	SJV APCD	Baseline	Proposed Rule	Benefit	SJV APCD	Baseline	Proposed Rule	Benefit
Hot Soak	0.11	0.10	0.01	Hot Soak	0.12	0.09	0.03	Hot Soak	0.14	0.05	0.09
Running Loss	0.26	0.23	0.03	Running Loss	0.27	0.20	0.07	Running Loss	0.31	0.11	0.20
Diurnal	1.66	1.48	0.18	Diurnal	1.73	1.28	0.45	Diurnal	2.01	0.69	1.32
Evap (Subtotal)	2.03	1.81	0.22	Evap (Subtotal)	2.12	1.57	0.55	Evap (Subtotal)	2.46	0.85	1.61
Exhaust (Subtotal)	0.85	0.85	0.00	Exhaust (Subtotal)	0.74	0.74	0.00	Exhaust (Subtotal)	0.62	0.62	0.00
ROG (total)	2.88	2.66	0.22	ROG (total)	2.86	2.31	0.55	ROG (total)	3.08	1.47	1.61
NOx	0.15	0.15	0.00	NOx	0.16	0.16	0.00	NOx	0.20	0.20	0.00
SCAQMD	Baseline	Proposed Rule	Benefit	SCAQMD	Baseline	Proposed Rule	Benefit	SCAQMD	Baseline	Proposed Rule	Benefit
Hot Soak	0.21	0.19	0.02	Hot Soak	0.22	0.17	0.05	Hot Soak	0.26	0.09	0.17
Running Loss	0.49	0.44	0.05	Running Loss	0.51	0.39	0.12	Running Loss	0.60	0.22	0.38
Diurnal	3.16	2.85	0.31	Diurnal	3.29	2.49	0.80	Diurnal	3.84	1.40	2.44
Evap (Subtotal)	3.86	3.48	0.38	Evap (Subtotal)	4.02	3.05	0.97	Evap (Subtotal)	4.70	1.71	2.99
Exhaust (Subtotal)	0.47	0.47	0.00	Exhaust (Subtotal)	0.44	0.44	0.00	Exhaust (Subtotal)	0.42	0.42	0.00
ROG (total)	4.33	3.95	0.38	ROG (total)	4.46	3.49	0.97	ROG (total)	5.12	2.13	2.99
NOx	0.08	0.08	0.00	NOx	0.09	0.09	0.00	NOx	0.11	0.11	0.00

APPENDIX I. INSTALLATION AND USER GUIDE

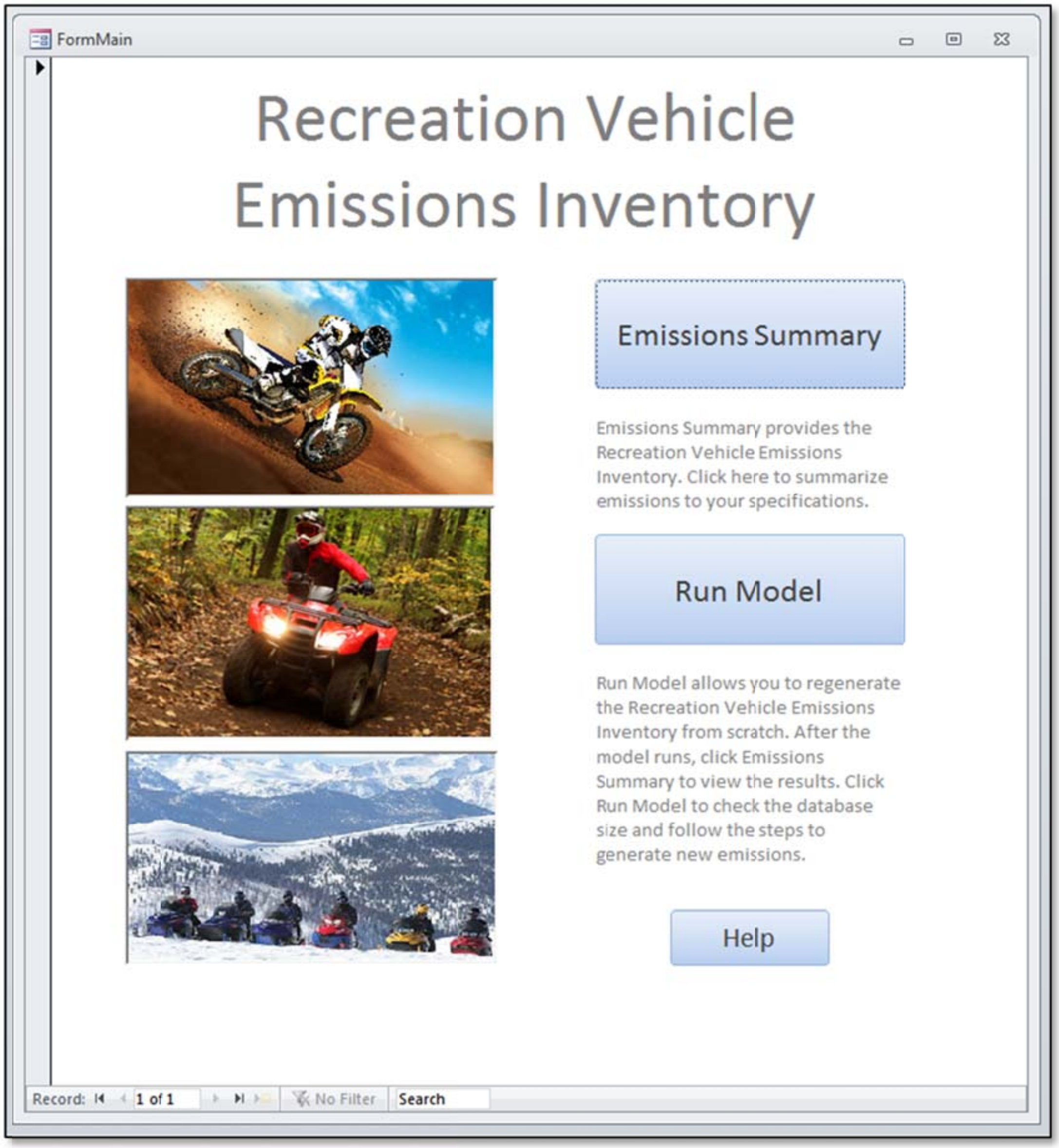
Download Instruction and Computer Specification:

- Zip - Use any zipping utility to unzip the file. Most operating systems like Windows come with a utility like 'WinZip'. Others can be downloaded off the internet along with their user guides.
- Computer Requirements: Your computer needs to have sufficient memory to store and run the model (these requirements are fairly small). Unzipped the file will be about 1.2GB. When running the model it can grow up to 2.0GB. Model runtimes can vary depending on the processing power of the computer, estimates are provided in the user interface.
- Microsoft Access: The Recreation Vehicle Emissions Inventory model runs as an Access database file. The model was developed in Microsoft Access 2010 previous versions of Access may not support all the model functionality.
- **Download Warnings:** When the database is first loaded onto the computer, Access will warn the user of possible unsafe code in the program. It is important to allow the program to open without any restrictions. **This means selecting options when Access opens that ENABLE the program content** (if prompted with a warning such as 'Do you want to allow Access to open with these unsafe expressions' **CLICK YES, OPEN, or ENABLE**).
    - Microsoft Access allows a user to define security restrictions that will apply to every file on a user's computer. If security restrictions have been set too restrictively, Access will not allow the Emissions Inventory model to open or run properly. The user might need to change the settings in the 'trust center', information about having the proper settings for Microsoft Access are available on Microsoft's website (one common setting is having the macro setting that does not inform the user when content has been blocked, in this case the question above will not come up).
- ***Note: allow a couple minutes for the model to compact itself when closing Access, this is an important step in managing space. If the model becomes unstable (errors or warnings), close the form then close Access and reopen. If problems persist, the model might be corrupt and a new version can be downloaded from the ARB website.**

Model Functionality (instructions also available within the model):

1. *Main User Interface*

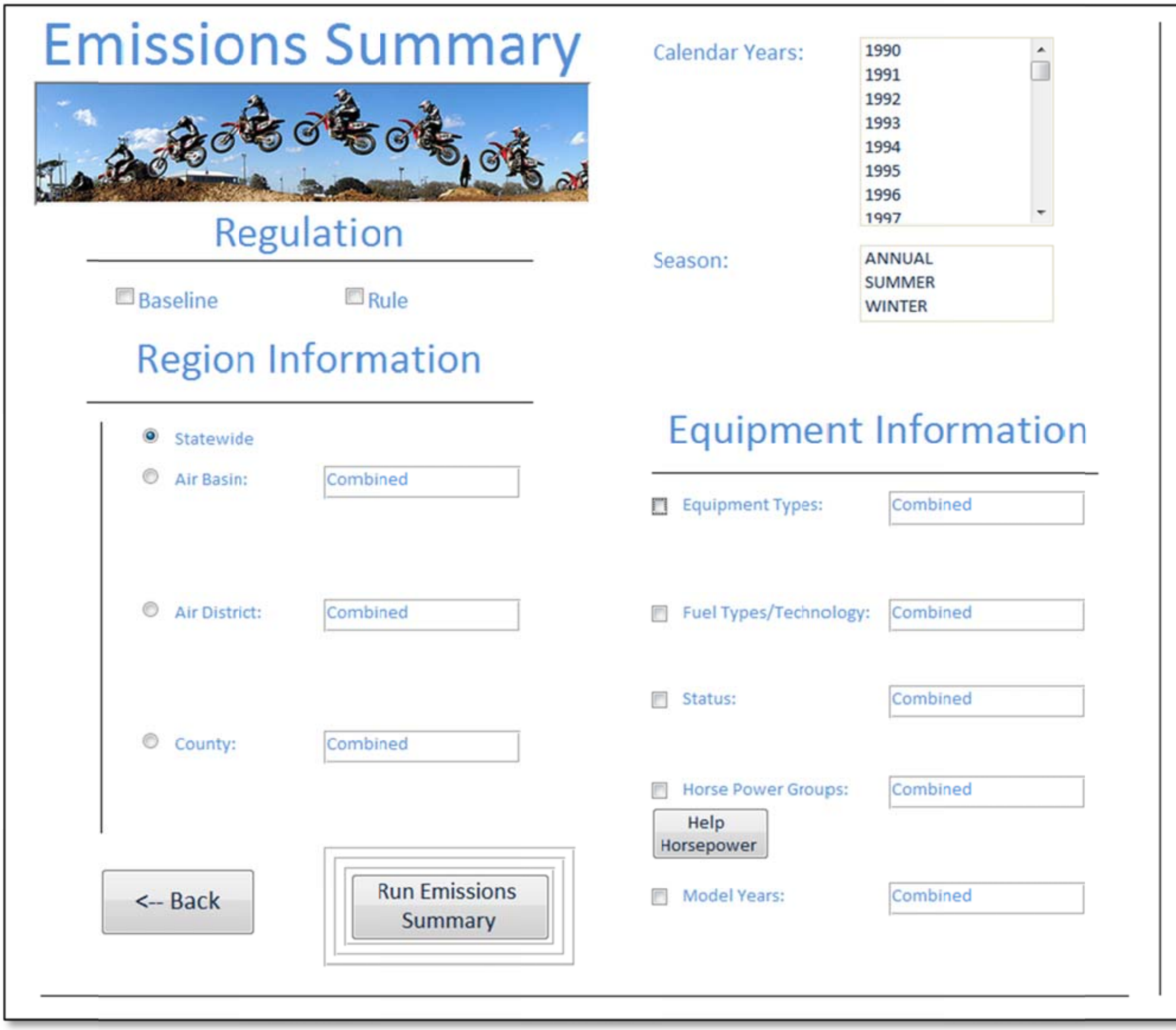
When the Model is opened, the Main user interface opens (below). From here the user can choose to use two parts of the model: Emissions Summary or Run Model. Also available is a help button that has some important information.



2. *Emissions Summary*

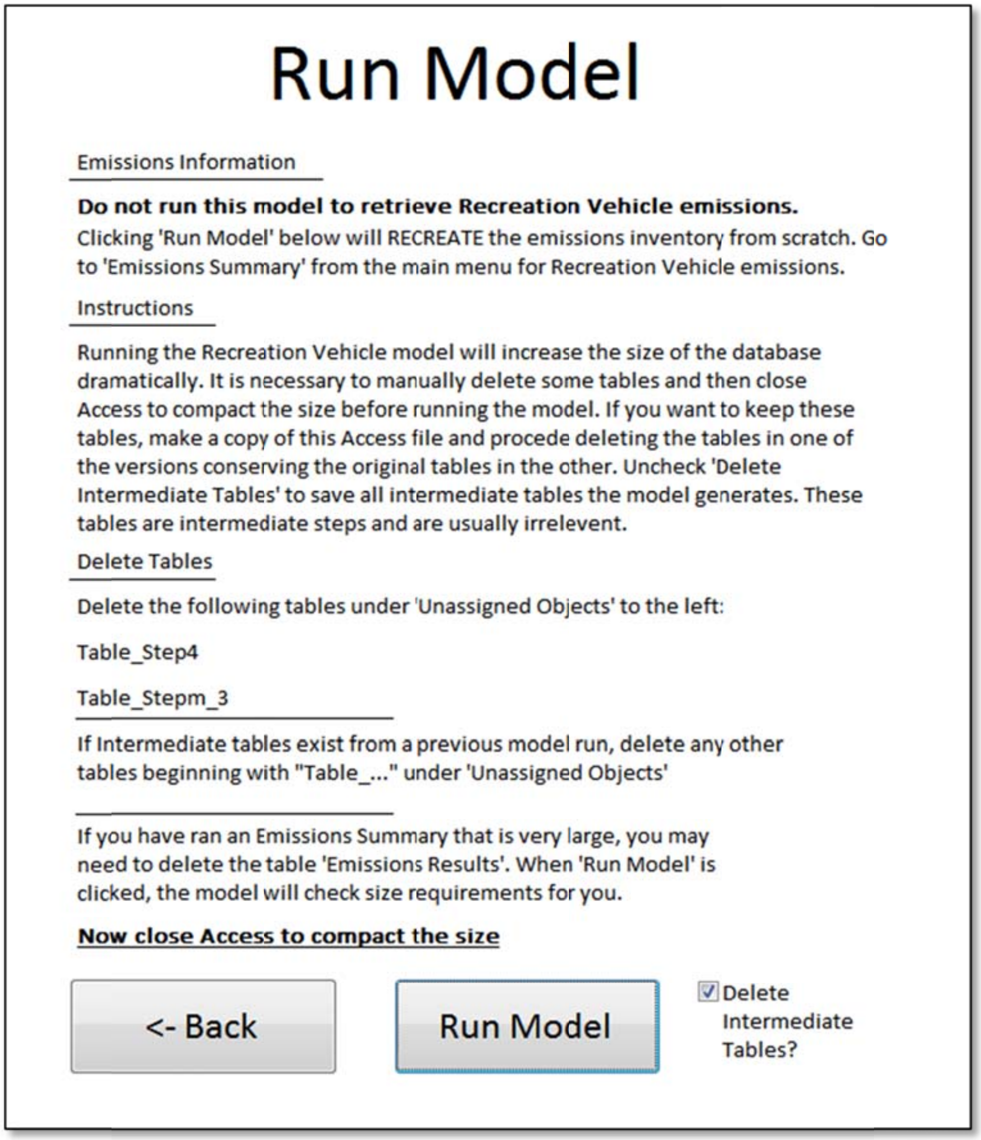
Clicking this button navigates to the Emissions Summary page (below) Estimate California Recreation Vehicle emissions for any combination of equipment type, fuel type, status, horsepower, model year, calendar year, season, and/or region for baseline or rule emissions.

Running the Emissions Summary by model year dramatically increases the runtime and restricts the user to selecting one region at a time. Equipment and fuel types must be selected with model year requests.



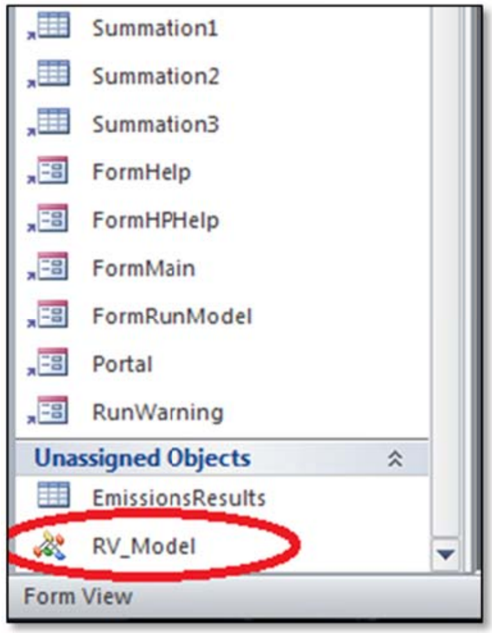
3. Run Model

The ‘Run Model’ window is only used to run a simulation of the model (below). READ ALL THE INSTRUCTIONS ON THIS PAGE BEFORE USING THE RUN MODEL PROGRAM. This portion of the model is not for viewing the emissions inventory. Running the model recreates emissions from scratch. This is not necessary as the model comes with emissions already loaded and available through the Emissions Summary window.



4. Model Code

The code for running the simulation of the model is available in the left pane under ‘Unassigned Objects’. Double-clicking Either ‘RV_Model’ will open the Visual Basic Editor for Access. For questions about navigating Visual Basic Editor use Microsoft’s ‘Help’ or online advice.



Please read all instructions provided in the model including this user guide. If there is still any confusion, feel free to contact the Mobile Source Analysis Branch at msei@arb.ca.gov.

APPENDIX J. SOURCE CODE OF RV2013

The following code is found in the Recreation Vehicle Model. There are other modules which control the user interface but the module below creates the official Recreation Vehicle Inventory.

Function RunModel()

'Methodology

'The purpose of the comments throughout the code is to help understand how the inventory methodology has been implemented.

'For an understanding of inventory methodology download the associated Recreation Vehicle Reports. Trying to understand the overall methodology is best accomplished using these other resources.

'Model Speficifications

'The Recreation Vehicle Emissions Inventory estimates emissions for OHRVs in California

'using the SQL code below developed in Visual Basic for Access. Each line of code (DoCmd...etc) accomplishes a step

'using the SQL syntax for running queries in Access. The logic can be seen below in SQL code format or can be viewed

'as a query by cutting and pasting the SQL code into an Access query while the query is in 'SQL' view.

'For information about how to use Access or VBA this way seek out Microsoft's help books, online tutorials,

'or application HELP tools

'Comments

'The comments throughout the code are to explain how the model logically accomplishes a piece of the methodology.

'There are 4 major sections of code. They each have an explanation of their significance before them:

'Beginning Calculations, Red and Green Sticker Program adjustment, Model Year Percentages, Additional Pollutants

'Model Year Percentages and Red and Green Sticker Program

'In order to fit the Recreation Vehicle Inventory into Microsoft Access many of the model steps are to store

'information efficiently. For example, the Model Year Percentages section does not alter the final emissions, 'it simply calculates a model distribution from a previous step and stores it efficiently. Also, the

'Red and Green Sticker Program section is methodologically extremely simple (multiply emissions by a adjustment value).

'However, the many steps under this section accomplish this multiplication with a derived coefficient so that

'it doesn't need to be done at the model year level. As mentioned above in 'Methodology', understanding inventory

'methodology is better accomplished with the associated write-ups, not by reading this code.

'Procedures

'The other modules under 'Microsoft Access Class Objects' control the user interface. The code below creates the

'inventory emissions but these other modules can be explored if a full understanding is necessary. Some methodological

'steps are copied from below into these other modules for model year requests.

'However, no new or unique methodology is found there

DoCmd.SetWarnings False

'Beginning Calculations

'First emissions are calculated for the regions around California (Air Basins, Air Districts, and Counties).

'Emissions are calculated by model year without regions and then are collapsed without model year.

'Once they are expanded to regions, they still need to be adjusted by the Red and Green Sticker Program.

'This is accomplished by the following section 'Red and Green Sticker Program adjustment'

'''

'Step01

'INTO Table_Step1

'Split population by HP group and Fuel technology

```
'Pop = Pop * HP_Split * FuelTech_Split

'Activity = Activity * HP_Split * FuelTech_Split

DoCmd.RunSQL "SELECT POP.CATEGORY, POP.STATUS, POP.CY, POP.MY,
POP.AGE, [STRK-FUEL-TECH].[STRK-FUEL-TECH], [STRK-FUEL-TECH].HPGRP,
[POP]![POP]*[STRK-FUEL-TECH]![STRK-FUEL--TECH-SPLT]*[STRK-FUEL-
TECH]![HPGRP-SPLT] AS POP2, [POP]![POP]*[STRK-FUEL-TECH]![STRK-FUEL--
TECH-SPLT]*[STRK-FUEL-TECH]![HPGRP-SPLT]*[ACT]![ANNUAL_USE] AS [Act-Anl]
INTO Table_Step1 FROM (((POP INNER JOIN [STRK-FUEL-TECH] ON (POP.MY =
[STRK-FUEL-TECH].MY) AND (POP.CATEGORY = [STRK-FUEL-
TECH].CATEGORY)) INNER JOIN ACT ON (ACT.CATEGORY = POP.CATEGORY)
AND (POP.AGE = ACT.AGE) AND (POP.STATUS = ACT.STATUS)) INNER JOIN
EQUIP ON (EQUIP.STATUS = ACT.STATUS) AND (EQUIP.CATEGORY = [STRK-
FUEL-TECH].CATEGORY) AND ([STRK-FUEL-TECH].[STRK-FUEL-TECH] =
EQUIP.[STRK-FUEL-TECH]) AND ([STRK-FUEL-TECH].HPGRP = EQUIP.HPGRP))
INNER JOIN LOAD ON (LOAD.CATEGORY = EQUIP.CATEGORY) AND
(EQUIP.HPGRP = LOAD.HPGRP) AND (EQUIP.[STRK-FUEL-TECH] = LOAD.[STRK-
FUEL-TECH]);"



'Step02

'INTO Table_Step2

'Calculate Emissions (Not seasonally or spatially adjusted yet. Emissions: tons / day

'Pollutant = Activity * [ ZeroHour + ( CummulativeUse * DetriorationRate ) ] * AvgHP *
Load / ( 365 * 454 * 2000 )

'See SOx, CO2, and Hydrocarbon loss emission calculations

DoCmd.RunSQL "SELECT Table_Step1.*, [Table_Step1]![Act-Anl]*([EF]![HC-
ZH]+([ACT]![CUMULATIVE_USE]*[EF]![HC-DR]))*IIf([EF]![HC-
Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS HC,
[Table_Step1]![Act-Anl]*([EF]![CO-ZH]+([ACT]![CUMULATIVE_USE]*[EF]![CO-
DR]))*IIf([EF]![CO-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000
AS CO, [Table_Step1]![Act-Anl]*([EF]![NOX-
ZH]+([ACT]![CUMULATIVE_USE]*[EF]![NOX-DR]))*IIf([EF]![NOX-
Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS NOX,
[Table_Step1]![Act-Anl]*([EF]![PM-ZH]+([ACT]![CUMULATIVE_USE]*[EF]![PM-
DR]))*IIf([EF]![PM-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000
AS PM, [Table_Step1]![Act-Anl]*([EF]![SOX-
ZH]+([ACT]![CUMULATIVE_USE]*[EF]![SOX-DR]))*IIf([EF]![SOX-
Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS SOX,
[Table_Step1]![Act-Anl]*([EF]![CO2-EF])*IIf([EF]![CO2-Units]='G/MI',1,[EQUIP]![AVG-
HP]*[EQUIP]![LOAD])*[LOAD]![CF-CO2]/365/454/2000 AS CO2, " & _
```

"[Table_Step1]![POP2]*[EQUIP]![STARTS]*([EF]![HC-HS]+[Table_Step1]![AGE]*[EF]![HC-HS-DR])/365/454/2000 AS [HC-HotSoak], [Table_Step1]![POP2]*([EF]![HC-DIU]+[Table_Step1]![AGE]*[EF]![HC-DIU-DR])/454/2000 AS [HC-DIURNAL], [Table_Step1]![POP2]*([EF]![HC-REST]+[Table_Step1]![AGE]*[EF]![HC-REST-DR])/454/2000 AS [HC-RESTING], [Table_Step1]![Act-Anl]*([EF]![HC-RUN]+[Table_Step1]![AGE]*[EF]![HC-RUN-DR])/365/454/2000 AS [HC-RL], [Table_Step1]![Act-Anl]*([EF_Scenario]![HC-ZH]+([ACT]![CUMULATIVE_USE]*[EF_Scenario]![HC-DR]))*IIf([EF_Scenario]![HC-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS HC_Scenario, [Table_Step1]![Act-Anl]*([EF_Scenario]![CO-ZH]+([ACT]![CUMULATIVE_USE]*[EF_Scenario]![CO-DR]))*IIf([EF_Scenario]![CO-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS CO_Scenario, [Table_Step1]![Act-Anl]*([EF_Scenario]![NOX-ZH]+([ACT]![CUMULATIVE_USE]*[EF_Scenario]![NOX-DR]))*IIf([EF_Scenario]![NOX-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS NOX_Scenario, " & _

"[Table_Step1]![Act-Anl]*([EF_Scenario]![PM-ZH]+([ACT]![CUMULATIVE_USE]*[EF_Scenario]![PM-DR]))*IIf([EF_Scenario]![PM-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS PM_Scenario, [Table_Step1]![Act-Anl]*([EF_Scenario]![SOX-ZH]+([ACT]![CUMULATIVE_USE]*[EF_Scenario]![SOX-DR]))*IIf([EF_Scenario]![SOX-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])/365/454/2000 AS SOX_Scenario, [Table_Step1]![Act-Anl]*([EF_Scenario]![CO2-EF])*IIf([EF_Scenario]![CO2-Units]='G/MI',1,[EQUIP]![AVG-HP]*[EQUIP]![LOAD])*[LOAD]![CF-CO2]/365/454/2000 AS CO2_Scenario, [Table_Step1]![POP2]*[EQUIP]![STARTS]*([EF_Scenario]![HC-HS]+[Table_Step1]![AGE]*[EF_Scenario]![HC-HS-DR])/365/454/2000 AS [HC-HotSoak_Scenario], [Table_Step1]![POP2]*([EF_Scenario]![HC-DIU]+[Table_Step1]![AGE]*[EF_Scenario]![HC-DIU-DR])/454/2000 AS [HC-DIURNAL_Scenario], [Table_Step1]![POP2]*([EF_Scenario]![HC-REST]+[Table_Step1]![AGE]*[EF_Scenario]![HC-REST-DR])/454/2000 AS [HC-RESTING_Scenario], " & _

"[Table_Step1]![Act-Anl]*([EF_Scenario]![HC-RUN]+[Table_Step1]![AGE]*[EF_Scenario]![HC-RUN-DR])/365/454/2000 AS [HC-RL_Scenario] INTO Table_Step2 FROM EF_Scenario INNER JOIN ((EQUIP INNER JOIN (ACT INNER JOIN ((Table_Step1 INNER JOIN EF ON (Table_Step1.CATEGORY = EF.CATEGORY) AND (Table_Step1.[STRK-FUEL-TECH] = EF.[STRK-FUEL-TECH]) AND (Table_Step1.HPGRP = EF.HPGRP) AND (Table_Step1.MY = EF.MY)) " & _

"INNER JOIN FRACTIONS ON (Table_Step1.CATEGORY = FRACTIONS.CATEGORY) AND (Table_Step1.[STRK-FUEL-TECH] = FRACTIONS.[STRK-FUEL-TECH]) AND (Table_Step1.CY = FRACTIONS.CY)) ON (ACT.CATEGORY = Table_Step1.CATEGORY) AND (ACT.STATUS = Table_Step1.STATUS) AND (ACT.AGE = Table_Step1.AGE)) ON (EQUIP.CATEGORY = Table_Step1.CATEGORY) AND (EQUIP.STATUS = Table_Step1.STATUS) AND (EQUIP.[STRK-FUEL-TECH] = Table_Step1.[STRK-FUEL-TECH]) AND (EQUIP.HPGRP = Table_Step1.HPGRP)) INNER JOIN LOAD ON

```
(Table_Step1.CATEGORY = LOAD.CATEGORY) AND (Table_Step1.[STRK-FUEL-TECH] = LOAD.[STRK-FUEL-TECH]) AND (Table_Step1.HPGRP = LOAD.HPGRP)) ON (EF_Scenario.CATEGORY = Table_Step1.CATEGORY) AND (EF_Scenario.HPGRP = Table_Step1.HPGRP) AND (EF_Scenario.[STRK-FUEL-TECH] = Table_Step1.[STRK-FUEL-TECH]) AND (EF_Scenario.MY = Table_Step1.MY);"


    'Step03

    'INTO Table_Step3

    'Sum without Model Years for spatial allocation

    DoCmd.RunSQL "SELECT Table_Step2.CATEGORY, Table_Step2.STATUS, Table_Step2.CY, Table_Step2.[STRK-FUEL-TECH], Table_Step2.HPGRP, Sum(Table_Step2.POP2) AS SumOfPOP2, Sum(Table_Step2.[Act-Anl]) AS [SumOfAct-Anl], Sum(Table_Step2.HC) AS SumOfHC, Sum(Table_Step2.CO) AS SumOfCO, Sum(Table_Step2.NOX) AS SumOfNOX, Sum(Table_Step2.PM) AS SumOfPM, Sum(Table_Step2.SOX) AS SumOfSOX, Sum(Table_Step2.CO2) AS SumOfCO2, Sum(Table_Step2.[HC-HotSoak]) AS [SumOfHC-HotSoak], Sum(Table_Step2.[HC-DIURNAL]) AS [SumOfHC-DIURNAL], Sum(Table_Step2.[HC-RESTING]) AS [SumOfHC-RESTING], Sum(Table_Step2.[HC-RL]) AS [SumOfHC-RL], Sum(Table_Step2.HC_Scenario) AS SumOfHC_Scenario, Sum(Table_Step2.CO_Scenario) AS SumOfCO_Scenario, Sum(Table_Step2.NOX_Scenario) AS SumOfNOX_Scenario, Sum(Table_Step2.PM_Scenario) AS SumOfPM_Scenario, Sum(Table_Step2.SOX_Scenario) AS SumOfSOX_Scenario, Sum(Table_Step2.CO2_Scenario) AS SumOfCO2_Scenario, Sum(Table_Step2.[HC-HotSoak_Scenario]) AS [SumOfHC-HotSoak_Scenario], " & _

    "Sum(Table_Step2.[HC-DIURNAL_Scenario]) AS [SumOfHC-DIURNAL_Scenario], Sum(Table_Step2.[HC-RESTING_Scenario]) AS [SumOfHC-RESTING_Scenario], Sum(Table_Step2.[HC-RL_Scenario]) AS [SumOfHC-RL_Scenario] INTO Table_Step3 FROM Table_Step2 GROUP BY Table_Step2.CATEGORY, Table_Step2.STATUS, Table_Step2.CY, Table_Step2.[STRK-FUEL-TECH], Table_Step2.HPGRP;"


    'Step04

    'INTO Table_Step4

    'Allocate to GAI, GAI adjustment factors, Seasonality adjustment factors

    'Pollutant = Pollutant * (GAI correction factors) * seasonality adjustments

    DoCmd.RunSQL "SELECT CInt(1) AS GR_ID, Table_Step3.CATEGORY, Table_Step3.STATUS, Table_Step3.CY, Table_Step3.[STRK-FUEL-TECH],
```

Table_Step3.HPGRP, SA.GAI, GAI.AirBasinID, GAI.DistrictID, GAI.CountyID, CRCTN.SEASON, [Table_Step3]![SumOfPOP2]*[SA]![SA-OPER] AS [POP-Alloc], [Table_Step3]![SumOfPOP2]*[SA]![SA-STORAGE] AS [POP-Stored], [Table_Step3]![SumOfAct-Anl]*[SA]![SA-OPER] AS [Act-Anl], [Table_Step3]![SumOfHC]*[SA]![SA-OPER]*[CRCTN]![CF-T-HC]*[CRCTN]![CF-H-HC]*[CRCTN]![CF-F-HC]*[SEASON]![SEASONALITY] AS [HC-Exhaust], [Table_Step3]![SumOfCO]*[SA]![SA-OPER]*[CRCTN]![CF-T-CO]*[CRCTN]![CF-H-CO]*[CRCTN]![CF-F-CO]*[SEASON]![SEASONALITY] AS [CO-Exhaust], [Table_Step3]![SumOfNOX]*[SA]![SA-OPER]*[CRCTN]![CF-T-NOX]*[CRCTN]![CF-H-NOX]*[CRCTN]![CF-F-NOX]*[SEASON]![SEASONALITY] AS [NOX-Exhaust], [Table_Step3]![SumOfPM]*[SA]![SA-OPER]*[CRCTN]![CF-T-PM]*[CRCTN]![CF-H-PM]*[CRCTN]![CF-F-PM]*[SEASON]![SEASONALITY] AS [PM-Exhaust], " & _

"[Table_Step3]![SumOfSOX]*[SA]![SA-OPER]*[CRCTN]![CF-T-SOX]*[CRCTN]![CF-H-SOX]*[CRCTN]![CF-F-SOX]*[SEASON]![SEASONALITY] AS [SOX-Exhaust], [Table_Step3]![SumOfCO2]*[SA]![SA-OPER]*[CRCTN]![CF-T-CO2]*[CRCTN]![CF-H-CO2]*[CRCTN]![CF-F-CO2]*[SEASON]![SEASONALITY] AS [CO2-Exhaust], [Table_Step3]![SumOfHC-HotSoak]*[SA]![SA-OPER]*[CRCTN]![CF-HS-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-HOTSOAK], [Table_Step3]![SumOfHC-DIURNAL]*[SA]![SA-STORAGE]*[CRCTN]![CF-DIU-GARAGE-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-DIURNAL], [Table_Step3]![SumOfHC-RESTING]*[SA]![SA-STORAGE]*[CRCTN]![CF-REST-GARAGE-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-RESTING], [Table_Step3]![SumOfHC-RL]*[SA]![SA-OPER]*[CRCTN]![CF-RL-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-RUNNINGLOSS], CDbl(0) AS [THC-TOTAL], CDbl(0) AS [TOG-EXH], CDbl(0) AS [TOG-EVAP], CDbl(0) AS [TOG-TOTAL], CDbl(0) AS [ROG-EXH], CDbl(0) AS [ROG-EVAP], CDbl(0) AS [ROG-TOTAL], CDbl(0) AS PM10, CDbl(0) AS PM25, CDbl(0) AS FUELCONSUMPTION_EXH, " & _

"CDbl(0) AS FUELCONSUMPTION_EVAP, CDbl(0) AS FUELCONSUMPTION_TOTAL, CDbl(0) AS NH3, [Table_Step3]![SumOfHC_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-HC]*[CRCTN]![CF-H-HC]*[CRCTN]![CF-F-HC]*[SEASON]![SEASONALITY] AS [HC-Exhaust_Scenario], [Table_Step3]![SumOfCO_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-CO]*[CRCTN]![CF-H-CO]*[CRCTN]![CF-F-CO]*[SEASON]![SEASONALITY] AS [CO-Exhaust_Scenario], [Table_Step3]![SumOfNOX_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-NOX]*[CRCTN]![CF-H-NOX]*[CRCTN]![CF-F-NOX]*[SEASON]![SEASONALITY] AS [NOX-Exhaust_Scenario], [Table_Step3]![SumOfPM_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-PM]*[CRCTN]![CF-H-PM]*[CRCTN]![CF-F-PM]*[SEASON]![SEASONALITY] AS [PM-Exhaust_Scenario], [Table_Step3]![SumOfSOX_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-SOX]*[CRCTN]![CF-H-SOX]*[CRCTN]![CF-F-SOX]*[SEASON]![SEASONALITY] AS [SOX-Exhaust_Scenario], " & _

"[Table_Step3]![SumOfCO2_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-T-CO2]*[CRCTN]![CF-H-CO2]*[CRCTN]![CF-F-CO2]*[SEASON]![SEASONALITY] AS [CO2-Exhaust_Scenario], [Table_Step3]![SumOfHC-HotSoak_Scenario]*[SA]![SA-

OPER]*[CRCTN]![CF-HS-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-HOTSOAK_Scenario], [Table_Step3]![SumOfHC-DIURNAL_Scenario]*[SA]![SA-STORAGE]*[CRCTN]![CF-DIU-GARAGE-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-DIURNAL_Scenario], [Table_Step3]![SumOfHC-RESTING_Scenario]*[SA]![SA-STORAGE]*[CRCTN]![CF-REST-GARAGE-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-RESTING_Scenario], [Table_Step3]![SumOfHC-RL_Scenario]*[SA]![SA-OPER]*[CRCTN]![CF-RL-HC]*[SEASON]![SEASONALITY] AS [HC-EVAP-RUNNINGLOSS_Scenario], CDbl(0) AS [THC-TOTAL_Scenario], " & _

"CDbl(0) AS [TOG-EXH_Scenario], CDbl(0) AS [TOG-EVAP_Scenario], CDbl(0) AS [TOG-TOTAL_Scenario], CDbl(0) AS [ROG-EXH_Scenario], CDbl(0) AS [ROG-EVAP_Scenario], CDbl(0) AS [ROG-TOTAL_Scenario], CDbl(0) AS PM10_Scenario, CDbl(0) AS PM25_Scenario, CDbl(0) AS FUELCONSUMPTION_EXH_Scenario, CDbl(0) AS FUELCONSUMPTION_EVAP_Scenario, CDbl(0) AS FUELCONSUMPTION_TOTAL_Scenario, CDbl(0) AS NH3_Scenario INTO Table_Step4 FROM (CRCTN INNER JOIN ((Table_Step3 INNER JOIN SA ON Table_Step3.CATEGORY = SA.CATEGORY) INNER JOIN GAI ON SA.GAI = GAI.GAI) ON (CRCTN.CY = Table_Step3.CY) AND (CRCTN.[STRK-FUEL-TECH] = Table_Step3.[STRK-FUEL-TECH]) AND (CRCTN.CATEGORY = Table_Step3.CATEGORY) AND (CRCTN.GAI = GAI.GAI)) INNER JOIN SEASON ON (Table_Step3.CATEGORY = SEASON.CATEGORY) AND (CRCTN.SEASON = SEASON.SEASON);"

'Step04a

'UPDATE Table_Step4

'population-running = 0; activity = 0 for inactive equipment

DoCmd.RunSQL "UPDATE Table_Step4 SET Table_Step4.[POP-Alloc] = 0, Table_Step4.[Act-Anl] = 0 WHERE (((Table_Step4.STATUS)=2));"

'Step04b

'UPDATE Table_Step4

'Apply weathering adjustment to Diurnal and Resting HC emissions

'HC_Process = HC_Process * WeatheringAdjustment

DoCmd.RunSQL "UPDATE Table_Step4 INNER JOIN Weathering ON (Weathering.STATUS = Table_Step4.STATUS) AND (Table_Step4.SEASON = Weathering.SEASON) SET Table_Step4.[HC-EVAP-DIURNAL] = [Table_Step4]![HC-EVAP-DIURNAL]*[Weathering]![WeatheringFactor], Table_Step4.[HC-EVAP-RESTING] = [Table_Step4]![HC-EVAP-RESTING]*[Weathering]![WeatheringFactor], Table_Step4.[HC-EVAP-DIURNAL_Scenario] = [Table_Step4]![HC-EVAP-DIURNAL_Scenario]*[Weathering]![WeatheringFactor], Table_Step4.[HC-EVAP-

RESTING_Scenario] = [Table_Step4]![HC-EVAP-RESTING_Scenario]*[Weathering]![WeatheringFactor];"

'Red and Green Sticker Program adjustment

'Pollutant = Pollutant * G-R-Adjustment

'Because of the memory limitations of Microsoft Access, this one step multiplication

'must be accomplished over steps 05-10. Percentage adjustments must be calculated instead

'of applying G-R-Adjustments directly

''

'Step05_GR

'INTO Table_Step8_ATV1 FROM Table_Step2

'Select equipment subject to Red and Green Sticker Program

'Active ATVs and OHMC that are 2-stroke engines

'Select MY

'Also, add Green-Red ID for model years that fall under adjustment 'R' (>=2003) and 'G' (<2003): "GR_Cutoff"

DoCmd.RunSQL "SELECT Table_Step2.CATEGORY, Table_Step2.STATUS, Table_Step2.CY, Table_Step2.MY, IIf([Table_Step2]![MY]>=2003,'R','G') AS GR_Cutoff, Table_Step2.[STRK-FUEL-TECH], Table_Step2.HPGRP, Table_Step2.[POP2], Table_Step2.[Act-Anl], Table_Step2.HC, Table_Step2.CO, Table_Step2.NOX, Table_Step2.PM, Table_Step2.SOX, Table_Step2.CO2, Table_Step2.[HC-HotSoak], Table_Step2.[HC-DIURNAL], Table_Step2.[HC-RESTING], Table_Step2.[HC-RL], Table_Step2.HC_Scenario, Table_Step2.CO_Scenario, Table_Step2.NOX_Scenario, Table_Step2.PM_Scenario, Table_Step2.SOX_Scenario, Table_Step2.CO2_Scenario, Table_Step2.[HC-HotSoak_Scenario], Table_Step2.[HC-DIURNAL_Scenario], Table_Step2.[HC-RESTING_Scenario], Table_Step2.[HC-RL_Scenario] INTO Table_Step8_ATV1 FROM Table_Step2 WHERE (((Table_Step2.CATEGORY)=1 Or (Table_Step2.CATEGORY)=4) AND ((Table_Step2.STATUS)=1) AND ((Table_Step2.[STRK-FUEL-TECH])=1 Or (Table_Step2.[STRK-FUEL-TECH])=2));"

'Step06_GR

'INTO Table_Step8_ATV4 FROM Table_Step8_ATV1

```
'Sum Emissions without model year
    'Group by "GR_Cutoff"
DoCmd.RunSQL "SELECT Table_Step8_ATV1.CATEGORY, Table_Step8_ATV1.STATUS, Table_Step8_ATV1.CY, Table_Step8_ATV1.GR_Cutoff, Table_Step8_ATV1.[STRK-FUEL-TECH], Table_Step8_ATV1.HPGRP, Sum(Table_Step8_ATV1.[POP2]) AS [SumOfPOP2], Sum(Table_Step8_ATV1.[Act-Anl]) AS [SumOfAct-Anl], Sum(Table_Step8_ATV1.HC) AS SumOfHC, Sum(Table_Step8_ATV1.CO) AS SumOfCO, Sum(Table_Step8_ATV1.NOX) AS SumOfNOX, Sum(Table_Step8_ATV1.PM) AS SumOfPM, Sum(Table_Step8_ATV1.SOX) AS SumOfSOX, Sum(Table_Step8_ATV1.CO2) AS SumOfCO2, Sum(Table_Step8_ATV1.[HC-HotSoak]) AS [SumOfHC-HotSoak], Sum(Table_Step8_ATV1.[HC-DIURNAL]) AS [SumOfHC-DIURNAL], Sum(Table_Step8_ATV1.[HC-RESTING]) AS [SumOfHC-RESTING], Sum(Table_Step8_ATV1.[HC-RL]) AS [SumOfHC-RL], Sum(Table_Step8_ATV1.HC_Scenario) AS SumOfHC_Scenario, Sum(Table_Step8_ATV1.CO_Scenario) AS SumOfCO_Scenario, Sum(Table_Step8_ATV1.NOX_Scenario) AS SumOfNOX_Scenario, Sum(Table_Step8_ATV1.PM_Scenario) AS SumOfPM_Scenario, Sum(Table_Step8_ATV1.SOX_Scenario) AS SumOfSOX_Scenario, " & _
"Sum(Table_Step8_ATV1.CO2_Scenario) As SumOfCO2_Scenario, Sum(Table_Step8_ATV1.[HC-HotSoak_Scenario]) AS [SumOfHC-HotSoak_Scenario], Sum(Table_Step8_ATV1.[HC-DIURNAL_Scenario]) AS [SumOfHC-DIURNAL_Scenario], Sum(Table_Step8_ATV1.[HC-RESTING_Scenario]) AS [SumOfHC-RESTING_Scenario], Sum(Table_Step8_ATV1.[HC-RL_Scenario]) AS [SumOfHC-RL_Scenario] INTO Table_Step8_ATV4 FROM Table_Step8_ATV1 GROUP BY Table_Step8_ATV1.CATEGORY, Table_Step8_ATV1.STATUS, Table_Step8_ATV1.CY, Table_Step8_ATV1.GR_Cutoff, Table_Step8_ATV1.[STRK-FUEL-TECH], Table_Step8_ATV1.HPGRP;"


'Step07_GR
'INTO Table_Step8_ATV5 FROM Table_Step8_ATV1
'Sum without model year or "GR_Cutoff"
    'Placeholders for adjustment %'s: Pollutant_G & Pollutant_R
DoCmd.RunSQL "SELECT Table_Step8_ATV1.CATEGORY, Table_Step8_ATV1.STATUS, Table_Step8_ATV1.CY, Table_Step8_ATV1.[STRK-FUEL-TECH], Table_Step8_ATV1.HPGRP, Sum(Table_Step8_ATV1.POP2) AS SumOfPOP2, Sum(Table_Step8_ATV1.[Act-Anl]) AS [SumOfAct-Anl], Sum(Table_Step8_ATV1.HC) AS SumOfHC, Sum(Table_Step8_ATV1.CO) AS SumOfCO, Sum(Table_Step8_ATV1.NOX) AS SumOfNOX, Sum(Table_Step8_ATV1.PM) AS SumOfPM, Sum(Table_Step8_ATV1.SOX) AS SumOfSOX, Sum(Table_Step8_ATV1.CO2) AS SumOfCO2,
```

Sum(Table_Step8_ATV1.[HC-HotSoak]) AS [SumOfHC-HotSoak], Sum(Table_Step8_ATV1.[HC-DIURNAL]) AS [SumOfHC-DIURNAL], Sum(Table_Step8_ATV1.[HC-RESTING]) AS [SumOfHC-RESTING], Sum(Table_Step8_ATV1.[HC-RL]) AS [SumOfHC-RL], CDbl(0) AS POP2_P, CDbl(0) AS [Act-Anl_P], CDbl(0) AS HC_P, CDbl(0) AS CO_P, CDbl(0) AS NOX_P, CDbl(0) AS PM_P, CDbl(0) AS SOX_P, CDbl(0) AS CO2_P, CDbl(0) AS [HC-HotSoak_P], CDbl(0) AS [HC-DIURNAL_P], CDbl(0) AS [HC-RESTING_P], CDbl(0) AS [HC-RL_P], CDbl(0) AS POP2_G, CDbl(0) AS [Act-Anl_G], " & _

"CDbl(0) AS HC_G, CDbl(0) AS CO_G, CDbl(0) AS NOX_G, CDbl(0) AS PM_G, CDbl(0) AS SOX_G, CDbl(0) AS CO2_G, CDbl(0) AS [HC-HotSoak_G], CDbl(0) AS [HC-DIURNAL_G], CDbl(0) AS [HC-RESTING_G], CDbl(0) AS [HC-RL_G], CDbl(0) AS Expr1, Sum(Table_Step8_ATV1.HC_Scenario) AS SumOfHC_Scenario, Sum(Table_Step8_ATV1.CO_Scenario) AS SumOfCO_Scenario, Sum(Table_Step8_ATV1.NOX_Scenario) AS SumOfNOX_Scenario, Sum(Table_Step8_ATV1.PM_Scenario) AS SumOfPM_Scenario, Sum(Table_Step8_ATV1.SOX_Scenario) AS SumOfSOX_Scenario, Sum(Table_Step8_ATV1.CO2_Scenario) AS SumOfCO2_Scenario, Sum(Table_Step8_ATV1.[HC-HotSoak_Scenario]) AS [SumOfHC-HotSoak_Scenario], Sum(Table_Step8_ATV1.[HC-DIURNAL_Scenario]) AS [SumOfHC-DIURNAL_Scenario], Sum(Table_Step8_ATV1.[HC-RESTING_Scenario]) AS [SumOfHC-RESTING_Scenario], Sum(Table_Step8_ATV1.[HC-RL_Scenario]) AS [SumOfHC-RL_Scenario], CDbl(0) AS HC_P_Scenario, CDbl(0) AS CO_P_Scenario, CDbl(0) AS NOX_P_Scenario, CDbl(0) AS PM_P_Scenario, CDbl(0) AS SOX_P_Scenario, " & _

"CDbl(0) AS CO2_P_Scenario, CDbl(0) AS [HC-HotSoak_P_Scenario], CDbl(0) AS [HC-DIURNAL_P_Scenario], CDbl(0) AS [HC-RESTING_P_Scenario], CDbl(0) AS [HC-RL_P_Scenario], CDbl(0) AS HC_G_Scenario, CDbl(0) AS CO_G_Scenario, CDbl(0) AS NOX_G_Scenario, CDbl(0) AS PM_G_Scenario, CDbl(0) AS SOX_G_Scenario, CDbl(0) AS CO2_G_Scenario, CDbl(0) AS [HC-HotSoak_G_Scenario], CDbl(0) AS [HC-DIURNAL_G_Scenario], CDbl(0) AS [HC-RESTING_G_Scenario], CDbl(0) AS [HC-RL_G_Scenario] INTO Table_Step8_ATV5 FROM Table_Step8_ATV1 GROUP BY Table_Step8_ATV1.CATEGORY, Table_Step8_ATV1.STATUS, Table_Step8_ATV1.CY, Table_Step8_ATV1.[STRK-FUEL-TECH], Table_Step8_ATV1.HPGRP, CDbl(0);"

'Step08_GR

'UPDATE Table_Step8_ATV5

'Pollutant_G = Table_Step8_ATV4 / Table_Step8_ATV5

'WHERE GR_Cutoff = 'G'

```
    DoCmd.RunSQL "UPDATE Table_Step8_ATV5 INNER JOIN Table_Step8_ATV4
ON (Table_Step8_ATV5.HPGRP = Table_Step8_ATV4.HPGRP) AND
(Table_Step8_ATV5.[STRK-FUEL-TECH] = Table_Step8_ATV4.[STRK-FUEL-TECH])
AND (Table_Step8_ATV5.CY = Table_Step8_ATV4.CY) AND
(Table_Step8_ATV5.STATUS = Table_Step8_ATV4.STATUS) AND
(Table_Step8_ATV5.CATEGORY = Table_Step8_ATV4.CATEGORY) SET
Table_Step8_ATV5.[POP2_G] =
[Table_Step8_ATV4]![SumOfPOP2]/[Table_Step8_ATV5]![SumOfPOP2], " & _

    "Table_Step8_ATV5.[Act-Anl_G] = [Table_Step8_ATV4]![SumOfAct-
Anl]/[Table_Step8_ATV5]![SumOfAct-Anl], Table_Step8_ATV5.HC_G =
[Table_Step8_ATV4]![SumOfHC]/[Table_Step8_ATV5]![SumOfHC],
Table_Step8_ATV5.CO_G =
[Table_Step8_ATV4]![SumOfCO]/[Table_Step8_ATV5]![SumOfCO],
Table_Step8_ATV5.NOX_G =
[Table_Step8_ATV4]![SumOfNOX]/[Table_Step8_ATV5]![SumOfNOX],
Table_Step8_ATV5.PM_G =
[Table_Step8_ATV4]![SumOfPM]/[Table_Step8_ATV5]![SumOfPM],
Table_Step8_ATV5.SOX_G =
[Table_Step8_ATV4]![SumOfSOX]/[Table_Step8_ATV5]![SumOfSOX],
Table_Step8_ATV5.CO2_G =
[Table_Step8_ATV4]![SumOfCO2]/[Table_Step8_ATV5]![SumOfCO2], " & _

    "Table_Step8_ATV5.[HC-HotSoak_G] = [Table_Step8_ATV4]![SumOfHC-
HotSoak]/[Table_Step8_ATV5]![SumOfHC-HotSoak], Table_Step8_ATV5.[HC-
DIURNAL_G] = [Table_Step8_ATV4]![SumOfHC-
DIURNAL]/[Table_Step8_ATV5]![SumOfHC-DIURNAL], Table_Step8_ATV5.[HC-
RESTING_G] = [Table_Step8_ATV4]![SumOfHC-
RESTING]/[Table_Step8_ATV5]![SumOfHC-RESTING], Table_Step8_ATV5.[HC-RL_G]
= [Table_Step8_ATV4]![SumOfHC-RL]/[Table_Step8_ATV5]![SumOfHC-RL],
Table_Step8_ATV5.HC_G_Scenario =
[Table_Step8_ATV4]![SumOfHC_Scenario]/[Table_Step8_ATV5]![SumOfHC_Scenario],
Table_Step8_ATV5.CO_G_Scenario =
[Table_Step8_ATV4]![SumOfCO_Scenario]/[Table_Step8_ATV5]![SumOfCO_Scenario]
, Table_Step8_ATV5.NOX_G_Scenario =
[Table_Step8_ATV4]![SumOfNOX_Scenario]/[Table_Step8_ATV5]![SumOfNOX_Scena
rio], Table_Step8_ATV5.PM_G_Scenario =
[Table_Step8_ATV4]![SumOfPM_Scenario]/[Table_Step8_ATV5]![SumOfPM_Scenario]
, Table_Step8_ATV5.SOX_G_Scenario =
[Table_Step8_ATV4]![SumOfSOX_Scenario]/[Table_Step8_ATV5]![SumOfSOX_Scenar
io], " & _

    "Table_Step8_ATV5.CO2_G_Scenario =
[Table_Step8_ATV4]![SumOfCO2_Scenario]/[Table_Step8_ATV5]![SumOfCO2_Scenar
io], Table_Step8_ATV5.[HC-HotSoak_G_Scenario] = [Table_Step8_ATV4]![SumOfHC-
HotSoak_Scenario]/[Table_Step8_ATV5]![SumOfHC-HotSoak_Scenario],
Table_Step8_ATV5.[HC-DIURNAL_G_Scenario] = [Table_Step8_ATV4]![SumOfHC-
DIURNAL_Scenario]/[Table_Step8_ATV5]![SumOfHC-DIURNAL_Scenario],
```

Table_Step8_ATV5.[HC-RESTING_G_Scenario] = [Table_Step8_ATV4]![SumOfHC-RESTING_Scenario]/[Table_Step8_ATV5]![SumOfHC-RESTING_Scenario], Table_Step8_ATV5.[HC-RL_G_Scenario] = [Table_Step8_ATV4]![SumOfHC-RL_Scenario]/[Table_Step8_ATV5]![SumOfHC-RL_Scenario] WHERE (((Table_Step8_ATV4.GR_Cutoff)='G'));"

'Step08b_GR

'UPDATE Table_Step8_ATV5

'Pollutant_P = Table_Step8_ATV4 / Table_Step8_ATV5

'WHERE GR_Cutoff = 'R'

DoCmd.RunSQL "UPDATE Table_Step8_ATV5 INNER JOIN Table_Step8_ATV4 ON (Table_Step8_ATV5.HPGRP = Table_Step8_ATV4.HPGRP) AND (Table_Step8_ATV5.[STRK-FUEL-TECH] = Table_Step8_ATV4.[STRK-FUEL-TECH]) AND (Table_Step8_ATV5.CY = Table_Step8_ATV4.CY) AND (Table_Step8_ATV5.STATUS = Table_Step8_ATV4.STATUS) AND (Table_Step8_ATV5.CATEGORY = Table_Step8_ATV4.CATEGORY) SET Table_Step8_ATV5.[POP2_P] = [Table_Step8_ATV4]![SumOfPOP2]/[Table_Step8_ATV5]![SumOfPOP2], Table_Step8_ATV5.[Act-Anl_P] = [Table_Step8_ATV4]![SumOfAct-Anl]/[Table_Step8_ATV5]![SumOfAct-Anl], Table_Step8_ATV5.HC_P = [Table_Step8_ATV4]![SumOfHC]/[Table_Step8_ATV5]![SumOfHC], Table_Step8_ATV5.CO_P = [Table_Step8_ATV4]![SumOfCO]/[Table_Step8_ATV5]![SumOfCO], Table_Step8_ATV5.NOX_P = [Table_Step8_ATV4]![SumOfNOX]/[Table_Step8_ATV5]![SumOfNOX], Table_Step8_ATV5.PM_P = [Table_Step8_ATV4]![SumOfPM]/[Table_Step8_ATV5]![SumOfPM], Table_Step8_ATV5.SOX_P = [Table_Step8_ATV4]![SumOfSOX]/[Table_Step8_ATV5]![SumOfSOX], " & _

"Table_Step8_ATV5.CO2_P = [Table_Step8_ATV4]![SumOfCO2]/[Table_Step8_ATV5]![SumOfCO2], Table_Step8_ATV5.[HC-HotSoak_P] = [Table_Step8_ATV4]![SumOfHC-HotSoak]/[Table_Step8_ATV5]![SumOfHC-HotSoak], Table_Step8_ATV5.[HC-DIURNAL_P] = [Table_Step8_ATV4]![SumOfHC-DIURNAL]/[Table_Step8_ATV5]![SumOfHC-DIURNAL], Table_Step8_ATV5.[HC-RESTING_P] = [Table_Step8_ATV4]![SumOfHC-RESTING]/[Table_Step8_ATV5]![SumOfHC-RESTING], Table_Step8_ATV5.[HC-RL_P] = [Table_Step8_ATV4]![SumOfHC-RL]/[Table_Step8_ATV5]![SumOfHC-RL], Table_Step8_ATV5.HC_P_Scenario = [Table_Step8_ATV4]![SumOfHC_Scenario]/[Table_Step8_ATV5]![SumOfHC_Scenario], Table_Step8_ATV5.CO_P_Scenario = [Table_Step8_ATV4]![SumOfCO_Scenario]/[Table_Step8_ATV5]![SumOfCO_Scenario], Table_Step8_ATV5.NOX_P_Scenario =

[Table_Step8_ATV4]![SumOfNOX_Scenario]/[Table_Step8_ATV5]![SumOfNOX_Scenario], Table_Step8_ATV5.PM_P_Scenario = [Table_Step8_ATV4]![SumOfPM_Scenario]/[Table_Step8_ATV5]![SumOfPM_Scenario], " & _

"Table_Step8_ATV5.SOX_P_Scenario = [Table_Step8_ATV4]![SumOfSOX_Scenario]/[Table_Step8_ATV5]![SumOfSOX_Scenario], Table_Step8_ATV5.CO2_P_Scenario = [Table_Step8_ATV4]![SumOfCO2_Scenario]/[Table_Step8_ATV5]![SumOfCO2_Scenario], Table_Step8_ATV5.[HC-HotSoak_P_Scenario] = [Table_Step8_ATV4]![SumOfHC-HotSoak_Scenario]/[Table_Step8_ATV5]![SumOfHC-HotSoak_Scenario], Table_Step8_ATV5.[HC-DIURNAL_P_Scenario] = [Table_Step8_ATV4]![SumOfHC-DIURNAL_Scenario]/[Table_Step8_ATV5]![SumOfHC-DIURNAL_Scenario], Table_Step8_ATV5.[HC-RESTING_P_Scenario] = [Table_Step8_ATV4]![SumOfHC-RESTING_Scenario]/[Table_Step8_ATV5]![SumOfHC-RESTING_Scenario], Table_Step8_ATV5.[HC-RL_P_Scenario] = [Table_Step8_ATV4]![SumOfHC-RL_Scenario]/[Table_Step8_ATV5]![SumOfHC-RL_Scenario] WHERE (((Table_Step8_ATV4.GR_Cutoff)='R'));"

'Step09_GR

'UPDATE Table_Step8_ATV5

'Set blank entries to 0 where null

DoCmd.RunSQL "UPDATE Table_Step8_ATV5 SET Table_Step8_ATV5.POP2_P = 0, Table_Step8_ATV5.[Act-Anl_P] = 0, Table_Step8_ATV5.HC_P = 0, Table_Step8_ATV5.CO_P = 0, Table_Step8_ATV5.NOX_P = 0, Table_Step8_ATV5.PM_P = 0, Table_Step8_ATV5.SOX_P = 0, Table_Step8_ATV5.CO2_P = 0, Table_Step8_ATV5.[HC-HotSoak_P] = 0, Table_Step8_ATV5.[HC-DIURNAL_P] = 0, Table_Step8_ATV5.[HC-RESTING_P] = 0, Table_Step8_ATV5.[HC-RL_P] = 0, Table_Step8_ATV5.POP2_G = 0, Table_Step8_ATV5.[Act-Anl_G] = 0, Table_Step8_ATV5.HC_G = 0, Table_Step8_ATV5.CO_G = 0, Table_Step8_ATV5.NOX_G = 0, Table_Step8_ATV5.PM_G = 0, Table_Step8_ATV5.SOX_G = 0, Table_Step8_ATV5.CO2_G = 0, Table_Step8_ATV5.[HC-HotSoak_G] = 0, Table_Step8_ATV5.[HC-DIURNAL_G] = 0, Table_Step8_ATV5.[HC-RESTING_G] = 0, Table_Step8_ATV5.[HC-RL_G] = 0, Table_Step8_ATV5.HC_P_Scenario = 0, Table_Step8_ATV5.CO_P_Scenario = 0, Table_Step8_ATV5.NOX_P_Scenario = 0, Table_Step8_ATV5.PM_P_Scenario = 0, " & _

"Table_Step8_ATV5.SOX_P_Scenario = 0, Table_Step8_ATV5.CO2_P_Scenario = 0, Table_Step8_ATV5.[HC-HotSoak_P_Scenario] = 0, Table_Step8_ATV5.[HC-DIURNAL_P_Scenario] = 0, Table_Step8_ATV5.[HC-RESTING_P_Scenario] = 0, Table_Step8_ATV5.[HC-RL_P_Scenario] = 0, Table_Step8_ATV5.HC_G_Scenario = 0, Table_Step8_ATV5.CO_G_Scenario = 0, Table_Step8_ATV5.NOX_G_Scenario = 0, Table_Step8_ATV5.PM_G_Scenario = 0, Table_Step8_ATV5.SOX_G_Scenario = 0, Table_Step8_ATV5.CO2_G_Scenario = 0, Table_Step8_ATV5.[HC-

HotSoak_G_Scenario] = 0, Table_Step8_ATV5.[HC-DIURNAL_G_Scenario] = 0, Table_Step8_ATV5.[HC-RESTING_G_Scenario] = 0, Table_Step8_ATV5.[HC-RL_G_Scenario] = 0 " & _

"WHERE (((Table_Step8_ATV5.POP2_P) Is Null) AND ((Table_Step8_ATV5.[Act-Anl_P]) Is Null) AND ((Table_Step8_ATV5.HC_P) Is Null) AND ((Table_Step8_ATV5.CO_P) Is Null) AND ((Table_Step8_ATV5.NOX_P) Is Null) AND ((Table_Step8_ATV5.PM_P) Is Null) AND ((Table_Step8_ATV5.SOX_P) Is Null) AND ((Table_Step8_ATV5.CO2_P) Is Null) AND ((Table_Step8_ATV5.[HC-HotSoak_P]) Is Null) AND ((Table_Step8_ATV5.[HC-DIURNAL_P]) Is Null) AND ((Table_Step8_ATV5.[HC-RESTING_P]) Is Null) AND ((Table_Step8_ATV5.[HC-RL_P]) Is Null) AND ((Table_Step8_ATV5.POP2_G) Is Null) AND ((Table_Step8_ATV5.[Act-Anl_G]) Is Null) AND ((Table_Step8_ATV5.HC_G) Is Null) AND ((Table_Step8_ATV5.CO_G) Is Null) AND ((Table_Step8_ATV5.NOX_G) Is Null) AND ((Table_Step8_ATV5.PM_G) Is Null) AND " & _

"((Table_Step8_ATV5.SOX_G) Is Null) AND ((Table_Step8_ATV5.CO2_G) Is Null) AND ((Table_Step8_ATV5.[HC-HotSoak_G]) Is Null) AND ((Table_Step8_ATV5.[HC-DIURNAL_G]) Is Null) AND ((Table_Step8_ATV5.[HC-RESTING_G]) Is Null) AND ((Table_Step8_ATV5.[HC-RL_G]) Is Null) AND ((Table_Step8_ATV5.HC_P_Scenario) Is Null) AND ((Table_Step8_ATV5.CO_P_Scenario) Is Null) AND ((Table_Step8_ATV5.NOX_P_Scenario) Is Null) AND ((Table_Step8_ATV5.PM_P_Scenario) Is Null) AND ((Table_Step8_ATV5.SOX_P_Scenario) Is Null) AND ((Table_Step8_ATV5.CO2_P_Scenario) Is Null) AND ((Table_Step8_ATV5.[HC-HotSoak_P_Scenario]) Is Null) AND " & _

"((Table_Step8_ATV5.[HC-DIURNAL_P_Scenario]) Is Null) AND ((Table_Step8_ATV5.[HC-RESTING_P_Scenario]) Is Null) AND ((Table_Step8_ATV5.[HC-RL_P_Scenario]) Is Null) AND ((Table_Step8_ATV5.HC_G_Scenario) Is Null) AND ((Table_Step8_ATV5.CO_G_Scenario) Is Null) AND ((Table_Step8_ATV5.NOX_G_Scenario) Is Null) AND ((Table_Step8_ATV5.PM_G_Scenario) Is Null) AND ((Table_Step8_ATV5.SOX_G_Scenario) Is Null) AND ((Table_Step8_ATV5.CO2_G_Scenario) Is Null) AND ((Table_Step8_ATV5.[HC-HotSoak_G_Scenario]) Is Null) AND ((Table_Step8_ATV5.[HC-DIURNAL_G_Scenario]) Is Null) AND ((Table_Step8_ATV5.[HC-RESTING_G_Scenario]) Is Null) AND ((Table_Step8_ATV5.[HC-RL_G_Scenario]) Is Null));"

'Step10_GR

'UPDATE Table_Step4

'Apply Composite GR-Adjustment to GAI emissions, GAI that do not get adjustment have composite = 1

```
'Pollutant = Pollutant * [ Pre2003Percent + ( Post2002Percent * GR_CorrectionFactor ) ]

DoCmd.RunSQL "UPDATE (Table_Step4 INNER JOIN Table_Step8_ATV5 ON (Table_Step4.HPGRP = Table_Step8_ATV5.HPGRP) AND (Table_Step4.[STRK-FUEL-TECH] = Table_Step8_ATV5.[STRK-FUEL-TECH]) AND (Table_Step4.CY = Table_Step8_ATV5.CY) AND (Table_Step4.STATUS = Table_Step8_ATV5.STATUS) AND (Table_Step4.CATEGORY = Table_Step8_ATV5.CATEGORY)) INNER JOIN GreenRed_Check ON (Table_Step4.SEASON = GreenRed_Check.SEASON) AND (Table_Step4.GAI = GreenRed_Check.GAI) SET Table_Step4.GR_ID = IIf([GreenRed_Check]![CorrectionR]=0.795,2,IIf([GreenRed_Check]![CorrectionR]=0.59,3,[Table_Step4]![GR_ID])), Table_Step4.[POP-Alloc] = [Table_Step4]![POP-Alloc]*([Table_Step8_ATV5]![POP2_G]+([Table_Step8_ATV5]![POP2_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[Act-Anl] = [Table_Step4]![Act-Anl]*([Table_Step8_ATV5]![Act-Anl_G]+([Table_Step8_ATV5]![Act-Anl_P]*[GreenRed_Check]![CorrectionR])), " & _

"Table_Step4.[HC-Exhaust] = [Table_Step4]![HC-Exhaust]*([Table_Step8_ATV5]![HC_G]+([Table_Step8_ATV5]![HC_P]*[GreenRed_Check]![CorrectionR])), " & _

"Table_Step4.[CO-Exhaust] = [Table_Step4]![CO-Exhaust]*([Table_Step8_ATV5]![CO_G]+([Table_Step8_ATV5]![CO_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[NOX-Exhaust] = [Table_Step4]![NOX-Exhaust]*([Table_Step8_ATV5]![NOX_G]+([Table_Step8_ATV5]![NOX_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[PM-Exhaust] = [Table_Step4]![PM-Exhaust]*([Table_Step8_ATV5]![PM_G]+([Table_Step8_ATV5]![PM_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[SOX-Exhaust] = [Table_Step4]![SOX-Exhaust]*([Table_Step8_ATV5]![SOX_G]+([Table_Step8_ATV5]![SOX_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[CO2-Exhaust] = [Table_Step4]![CO2-Exhaust]*([Table_Step8_ATV5]![CO2_G]+([Table_Step8_ATV5]![CO2_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[HC-EVAP-HOTSOAK] = [Table_Step4]![HC-EVAP-HOTSOAK]*([Table_Step8_ATV5]![HC-HotSoak_G]+([Table_Step8_ATV5]![HC-HotSoak_P]*[GreenRed_Check]![CorrectionR])), " & _

"Table_Step4.[HC-EVAP-RUNNINGLOSS] = [Table_Step4]![HC-EVAP-RUNNINGLOSS]*([Table_Step8_ATV5]![HC-RL_G]+([Table_Step8_ATV5]![HC-RL_P]*[GreenRed_Check]![CorrectionR])), Table_Step4.[HC-Exhaust_Scenario] = [Table_Step4]![HC-Exhaust_Scenario]*([Table_Step8_ATV5]![HC_G_Scenario]+([Table_Step8_ATV5]![HC_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[CO-Exhaust_Scenario] = [Table_Step4]![CO-Exhaust_Scenario]*([Table_Step8_ATV5]![CO_G_Scenario]+([Table_Step8_ATV5]![CO_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[NOX-Exhaust_Scenario] = [Table_Step4]![NOX-Exhaust_Scenario]*([Table_Step8_ATV5]![NOX_G_Scenario]+([Table_Step8_ATV5]![NOX_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[PM-Exhaust_Scenario] = [Table_Step4]![PM-
```

Exhaust_Scenario]*([Table_Step8_ATV5]![PM_G_Scenario]+([Table_Step8_ATV5]![PM_P_Scenario]*[GreenRed_Check]![CorrectionR])), " & _

"Table_Step4.[SOX-Exhaust_Scenario] = [Table_Step4]![SOX-Exhaust_Scenario]*([Table_Step8_ATV5]![SOX_G_Scenario]+([Table_Step8_ATV5]![SOX_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[CO2-Exhaust_Scenario] = [Table_Step4]![CO2-Exhaust_Scenario]*([Table_Step8_ATV5]![CO2_G_Scenario]+([Table_Step8_ATV5]![CO2_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[HC-EVAP-HOTSOAK_Scenario] = [Table_Step4]![HC-EVAP-HOTSOAK_Scenario]*([Table_Step8_ATV5]![HC-HotSoak_G_Scenario]+([Table_Step8_ATV5]![HC-HotSoak_P_Scenario]*[GreenRed_Check]![CorrectionR])), Table_Step4.[HC-EVAP-RUNNINGLOSS_Scenario] = [Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario]*([Table_Step8_ATV5]![HC-RL_G_Scenario]+([Table_Step8_ATV5]![HC-RL_P_Scenario]*[GreenRed_Check]![CorrectionR]));"

'Model Year Percentages

'The model year distribution of emissions is calculated as percentages so that the user interface can recalculate

'emissions by model year on the fly. The percentages are needed because the inventory does not fit in Access at the

'model year level. After these percentages are calculated the Red and Green Sticker Program adjustment needs to be applied

''

'Step11_MY

'INTO Table_Stepm_3

'Divide emissions by model year by the table with emissions without to get emissions percentage distributions

'Percentage = Table_Step2/Table_Step3

DoCmd.RunSQL "SELECT CInt(1) AS GR_ID, Table_Step2.CATEGORY, Table_Step2.STATUS, Table_Step2.CY, Table_Step2.MY, Table_Step2.AGE, Table_Step2.[STRK-FUEL-TECH], Table_Step2.HPGRP, [Table_Step2]![POP2]/[Table_Step3]![SumOfPOP2] AS POP2, [Table_Step2]![Act-Anl]/[Table_Step3]![SumOfAct-Anl] AS [Act-Anl],

[Table_Step2]![HC]/[Table_Step3]![SumOfHC] AS HC, [Table_Step2]![CO]/[Table_Step3]![SumOfCO] AS CO, [Table_Step2]![NOX]/[Table_Step3]![SumOfNOX] AS NOX, [Table_Step2]![PM]/[Table_Step3]![SumOfPM] AS PM, [Table_Step2]![SOX]/[Table_Step3]![SumOfSOX] AS SOX, [Table_Step2]![CO2]/[Table_Step3]![SumOfCO2] AS CO2, [Table_Step2]![HC-HotSoak]/[Table_Step3]![SumOfHC-HotSoak] AS [HC-HotSoak], [Table_Step2]![HC-DIURNAL]/[Table_Step3]![SumOfHC-DIURNAL] AS [HC-DIURNAL], [Table_Step2]![HC-RESTING]/[Table_Step3]![SumOfHC-RESTING] AS [HC-RESTING], [Table_Step2]![HC-RL]/[Table_Step3]![SumOfHC-RL] AS [HC-RL], [Table_Step2]![HC_Scenario]/[Table_Step3]![SumOfHC_Scenario] AS HC_Scenario, " & _

"[Table_Step2]![CO_Scenario]/[Table_Step3]![SumOfCO_Scenario] AS CO_Scenario, [Table_Step2]![NOX_Scenario]/[Table_Step3]![SumOfNOX_Scenario] AS NOX_Scenario, [Table_Step2]![PM_Scenario]/[Table_Step3]![SumOfPM_Scenario] AS PM_Scenario, [Table_Step2]![SOX_Scenario]/[Table_Step3]![SumOfSOX_Scenario] AS SOX_Scenario, [Table_Step2]![CO2_Scenario]/[Table_Step3]![SumOfCO2_Scenario] AS CO2_Scenario, [Table_Step2]![HC-HotSoak_Scenario]/[Table_Step3]![SumOfHC-HotSoak_Scenario] AS [HC-HotSoak_Scenario], [Table_Step2]![HC-DIURNAL_Scenario]/[Table_Step3]![SumOfHC-DIURNAL_Scenario] AS [HC-DIURNAL_Scenario], [Table_Step2]![HC-RESTING_Scenario]/[Table_Step3]![SumOfHC-RESTING_Scenario] AS [HC-RESTING_Scenario], [Table_Step2]![HC-RL_Scenario]/[Table_Step3]![SumOfHC-RL_Scenario] AS [HC-RL_Scenario] INTO Table_Stepm_3 " & _

"FROM Table_Step2 INNER JOIN Table_Step3 ON (Table_Step3.HPGRP = Table_Step2.HPGRP) AND (Table_Step2.[STRK-FUEL-TECH] = Table_Step3.[STRK-FUEL-TECH]) AND (Table_Step2.CY = Table_Step3.CY) AND (Table_Step2.STATUS = Table_Step3.STATUS) AND (Table_Step2.CATEGORY = Table_Step3.CATEGORY);"

'Step12_MY

'UPDATE Table_Stepm_3

'Set nulls = 0 for functionality

DoCmd.RunSQL "UPDATE Table_Stepm_3 SET Table_Stepm_3.[HC-HotSoak] = 0 WHERE (((Table_Stepm_3.[HC-HotSoak]) Is Null));"

DoCmd.RunSQL "UPDATE Table_Stepm_3 SET Table_Stepm_3.[HC-RL] = 0 WHERE (((Table_Stepm_3.[HC-RL]) Is Null));"

DoCmd.RunSQL "UPDATE Table_Stepm_3 SET Table_Stepm_3.[HC-HotSoak_Scenario] = 0 WHERE (((Table_Stepm_3.[HC-HotSoak_Scenario]) Is Null));"

DoCmd.RunSQL "UPDATE Table_Stepm_3 SET Table_Stepm_3.[HC-RL_Scenario] = 0 WHERE (((Table_Stepm_3.[HC-RL_Scenario]) Is Null));"

'Model Year Percentages: Red and Green Sticker Program

'Grab the subset of equipment which falls under the G-R sticker program

'"GR_ID" will identify equipment by season. "GR_ID" = 2 is Annual, "GR_ID" = 3 is summer, winter does not get adjusted

''

'Step13_MY

'INTO Table_Stepm_4

'Grab a duplicate for annual emissions, GR_ID = 2

'WHERE 2-stroke, ATV & OHMC, Active

DoCmd.RunSQL "SELECT 2 AS GR_ID, Table_Stepm_3.CATEGORY, Table_Stepm_3.STATUS, Table_Stepm_3.CY, Table_Stepm_3.MY, Table_Stepm_3.AGE, Table_Stepm_3.[STRK-FUEL-TECH], Table_Stepm_3.HPGRP, Table_Stepm_3.POP2, Table_Stepm_3.[Act-Anl], Table_Stepm_3.HC, Table_Stepm_3.CO, Table_Stepm_3.NOX, Table_Stepm_3.PM, Table_Stepm_3.SOX, Table_Stepm_3.CO2, Table_Stepm_3.[HC-HotSoak], Table_Stepm_3.[HC-DIURNAL], Table_Stepm_3.[HC-RESTING], Table_Stepm_3.[HC-RL], Table_Stepm_3.HC_Scenario, Table_Stepm_3.CO_Scenario, Table_Stepm_3.NOX_Scenario, Table_Stepm_3.PM_Scenario, Table_Stepm_3.SOX_Scenario, Table_Stepm_3.CO2_Scenario, Table_Stepm_3.[HC-HotSoak_Scenario], Table_Stepm_3.[HC-DIURNAL_Scenario], Table_Stepm_3.[HC-RESTING_Scenario], Table_Stepm_3.[HC-RL_Scenario] INTO Table_Stepm_4 FROM Table_Stepm_3 WHERE (((Table_Stepm_3.CATEGORY)=1 Or (Table_Stepm_3.CATEGORY)=4) AND ((Table_Stepm_3.STATUS)=1) AND ((Table_Stepm_3.[STRK-FUEL-TECH])=1 Or (Table_Stepm_3.[STRK-FUEL-TECH])=2));"

'Step14_MY

'APPEND Table_Stepm_4

'Grab a duplicate for summer emissions, GR_ID = 3

'WHERE 2-stroke, ATV & OHMC, Active

DoCmd.RunSQL "INSERT INTO Table_Stepm_4 (GR_ID, CATEGORY, STATUS, CY, MY, AGE, [STRK-FUEL-TECH], HPGRP, POP2, [Act-Anl], HC, CO, NOX, PM, SOX, CO2, [HC-HotSoak], [HC-DIURNAL], [HC-RESTING], [HC-RL], HC_Scenario, CO_Scenario, NOX_Scenario, PM_Scenario, SOX_Scenario, CO2_Scenario, [HC-HotSoak_Scenario], [HC-DIURNAL_Scenario], [HC-RESTING_Scenario], [HC-RL_Scenario]) " & _

"SELECT 3 AS GR_ID, Table_Stepm_3.CATEGORY, Table_Stepm_3.STATUS, Table_Stepm_3.CY, Table_Stepm_3.MY, Table_Stepm_3.AGE, Table_Stepm_3.[STRK-FUEL-TECH], Table_Stepm_3.HPGRP, Table_Stepm_3.POP2, Table_Stepm_3.[Act-Anl], Table_Stepm_3.HC, Table_Stepm_3.CO, Table_Stepm_3.NOX, Table_Stepm_3.PM, Table_Stepm_3.SOX, Table_Stepm_3.CO2, Table_Stepm_3.[HC-HotSoak], Table_Stepm_3.[HC-DIURNAL], Table_Stepm_3.[HC-RESTING], Table_Stepm_3.[HC-RL], Table_Stepm_3.HC_Scenario, Table_Stepm_3.CO_Scenario, Table_Stepm_3.NOX_Scenario, Table_Stepm_3.PM_Scenario, Table_Stepm_3.SOX_Scenario, Table_Stepm_3.CO2_Scenario, Table_Stepm_3.[HC-HotSoak_Scenario], Table_Stepm_3.[HC-DIURNAL_Scenario], Table_Stepm_3.[HC-RESTING_Scenario], Table_Stepm_3.[HC-RL_Scenario] FROM Table_Stepm_3 WHERE (((Table_Stepm_3.CATEGORY)=1 Or (Table_Stepm_3.CATEGORY)=4) AND ((Table_Stepm_3.STATUS)=1) AND ((Table_Stepm_3.[STRK-FUEL-TECH])=1 Or (Table_Stepm_3.[STRK-FUEL-TECH])=2));"

'Step15_MY

'UPDATE Table_Stepm_4

'Annual Red and Green Sticker adjustment to GAI emissions

'Pollutant = Pollutant * 0.735

DoCmd.RunSQL "UPDATE Table_Stepm_4 SET Table_Stepm_4.[POP2] = [Table_Stepm_4]![POP2]*0.735, Table_Stepm_4.[Act-Anl] = [Table_Stepm_4]![Act-Anl]*0.735, Table_Stepm_4.HC = [Table_Stepm_4]![HC]*0.735, Table_Stepm_4.CO = [Table_Stepm_4]![CO]*0.735, Table_Stepm_4.NOX = [Table_Stepm_4]![NOX]*0.735, Table_Stepm_4.PM = [Table_Stepm_4]![PM]*0.735, Table_Stepm_4.SOX = [Table_Stepm_4]![SOX]*0.735, Table_Stepm_4.CO2 = [Table_Stepm_4]![CO2]*0.735, Table_Stepm_4.[HC-HotSoak] = [Table_Stepm_4]![HC-HotSoak]*0.735, Table_Stepm_4.[HC-RL] = [Table_Stepm_4]![HC-RL]*0.735, Table_Stepm_4.HC_Scenario = [Table_Stepm_4]![HC_Scenario]*0.735, Table_Stepm_4.CO_Scenario = [Table_Stepm_4]![CO_Scenario]*0.735, Table_Stepm_4.NOX_Scenario = [Table_Stepm_4]![NOX_Scenario]*0.735, Table_Stepm_4.PM_Scenario = [Table_Stepm_4]![PM_Scenario]*0.735, Table_Stepm_4.SOX_Scenario = [Table_Stepm_4]![SOX_Scenario]*0.735, " & _

"Table_Stepm_4.CO2_Scenario = [Table_Stepm_4]![CO2_Scenario]*0.735, Table_Stepm_4.[HC-HotSoak_Scenario] = [Table_Stepm_4]![HC-HotSoak_Scenario]*0.735, Table_Stepm_4.[HC-RL_Scenario] = [Table_Stepm_4]![HC-

RL_Scenario]*0.735 WHERE (((Table_Stepm_4.GR_ID)=2) AND ((Table_Stepm_4.MY)>=2003));"

'Step16_MY

'UPDATE Table_Stepm_4

'Summer Red and Green Sticker Program adjustment to GAI emissions

'Pollutant = Pollutant * 0.47

DoCmd.RunSQL "UPDATE Table_Stepm_4 SET Table_Stepm_4.[POP2] = [Table_Stepm_4]![POP2]*0.47, Table_Stepm_4.[Act-Anl] = [Table_Stepm_4]![Act-Anl]*0.47, Table_Stepm_4.HC = [Table_Stepm_4]![HC]*0.47, Table_Stepm_4.CO = [Table_Stepm_4]![CO]*0.47, Table_Stepm_4.NOX = [Table_Stepm_4]![NOX]*0.47, Table_Stepm_4.PM = [Table_Stepm_4]![PM]*0.47, Table_Stepm_4.SOX = [Table_Stepm_4]![SOX]*0.47, Table_Stepm_4.CO2 = [Table_Stepm_4]![CO2]*0.47, Table_Stepm_4.[HC-HotSoak] = [Table_Stepm_4]![HC-HotSoak]*0.47, Table_Stepm_4.[HC-RL] = [Table_Stepm_4]![HC-RL]*0.47, Table_Stepm_4.HC_Scenario = [Table_Stepm_4]![HC_Scenario]*0.47, Table_Stepm_4.CO_Scenario = [Table_Stepm_4]![CO_Scenario]*0.47, Table_Stepm_4.NOX_Scenario = [Table_Stepm_4]![NOX_Scenario]*0.47, Table_Stepm_4.PM_Scenario = [Table_Stepm_4]![PM_Scenario]*0.47, Table_Stepm_4.SOX_Scenario = [Table_Stepm_4]![SOX_Scenario]*0.47, Table_Stepm_4.CO2_Scenario = [Table_Stepm_4]![CO2_Scenario]*0.47, " & _

"Table_Stepm_4.[HC-HotSoak_Scenario] = [Table_Stepm_4]![HC-HotSoak_Scenario]*0.47, Table_Stepm_4.[HC-RL_Scenario] = [Table_Stepm_4]![HC-RL_Scenario] * 0.47 WHERE (((Table_Stepm_4.GR_ID)=3) AND ((Table_Stepm_4.MY)>=2003));"

'Step17_MY

'INTO Table_Stepm_5 FROM Table_Stepm_4

'Sum emissions without model year for totals. Totals will generate model year percentages

DoCmd.RunSQL "SELECT Table_Stepm_4.GR_ID, Table_Stepm_4.CATEGORY, Table_Stepm_4.STATUS, Table_Stepm_4.CY, Table_Stepm_4.[STRK-FUEL-TECH], Table_Stepm_4.HPGRP, Sum(Table_Stepm_4.POP2) AS SumOfPOP2, Sum(Table_Stepm_4.[Act-Anl]) AS [SumOfAct-Anl], Sum(Table_Stepm_4.HC) AS SumOfHC, Sum(Table_Stepm_4.CO) AS SumOfCO, Sum(Table_Stepm_4.NOX) AS SumOfNOX, Sum(Table_Stepm_4.PM) AS SumOfPM, Sum(Table_Stepm_4.SOX) AS SumOfSOX, Sum(Table_Stepm_4.CO2) AS SumOfCO2, Sum(Table_Stepm_4.[HC-HotSoak]) AS [SumOfHC-HotSoak], Sum(Table_Stepm_4.[HC-DIURNAL]) AS [SumOfHC-DIURNAL], Sum(Table_Stepm_4.[HC-RESTING]) AS [SumOfHC-RESTING], Sum(Table_Stepm_4.[HC-RL]) AS [SumOfHC-RL], Sum(Table_Stepm_4.HC_Scenario) AS SumOfHC_Scenario, Sum(Table_Stepm_4.CO_Scenario) AS SumOfCO_Scenario, Sum(Table_Stepm_4.NOX_Scenario) AS SumOfNOX_Scenario, Sum(Table_Stepm_4.PM_Scenario) AS SumOfPM_Scenario, Sum(Table_Stepm_4.SOX_Scenario) AS SumOfSOX_Scenario, Sum(Table_Stepm_4.CO2_Scenario) AS SumOfCO2_Scenario, " & _

"Sum(Table_Stepm_4.[HC-HotSoak_Scenario]) AS [SumOfHC-HotSoak_Scenario], Sum(Table_Stepm_4.[HC-DIURNAL_Scenario]) AS [SumOfHC-DIURNAL_Scenario], Sum(Table_Stepm_4.[HC-RESTING_Scenario]) AS [SumOfHC-RESTING_Scenario], Sum(Table_Stepm_4.[HC-RL_Scenario]) AS [SumOfHC-RL_Scenario] INTO Table_Stepm_5 FROM Table_Stepm_4 GROUP BY Table_Stepm_4.GR_ID, Table_Stepm_4.CATEGORY, Table_Stepm_4.STATUS, Table_Stepm_4.CY, Table_Stepm_4.[STRK-FUEL-TECH], Table_Stepm_4.HPGRP HAVING (((Table_Stepm_4.CATEGORY)=1 Or (Table_Stepm_4.CATEGORY)=4) AND ((Table_Stepm_4.STATUS)=1) AND ((Table_Stepm_4.[STRK-FUEL-TECH])=1 Or (Table_Stepm_4.[STRK-FUEL-TECH])=2));"

'Step18_MY

'UPDATE Table_Stepm_4

'Divide model year emissions by total for percentages

'Pollutant = Table_Stepm_4 / Table_Stepm_5

DoCmd.RunSQL "UPDATE Table_Stepm_4 INNER JOIN Table_Stepm_5 ON (Table_Stepm_4.HPGRP = Table_Stepm_5.HPGRP) AND (Table_Stepm_4.[STRK-FUEL-TECH] = Table_Stepm_5.[STRK-FUEL-TECH]) AND (Table_Stepm_5.CY = Table_Stepm_4.CY) AND (Table_Stepm_4.STATUS = Table_Stepm_5.STATUS) AND (Table_Stepm_4.CATEGORY = Table_Stepm_5.CATEGORY) AND (Table_Stepm_4.GR_ID = Table_Stepm_5.GR_ID) SET Table_Stepm_4.[POP2] = [Table_Stepm_4]![POP2]/[Table_Stepm_5]![SumOfPOP2], Table_Stepm_4.[Act-Anl] = [Table_Stepm_4]![Act-Anl]/[Table_Stepm_5]![SumOfAct-Anl], Table_Stepm_4.HC = [Table_Stepm_4]![HC]/[Table_Stepm_5]![SumOfHC], Table_Stepm_4.CO = [Table_Stepm_4]![CO]/[Table_Stepm_5]![SumOfCO], Table_Stepm_4.NOX = [Table_Stepm_4]![NOX]/[Table_Stepm_5]![SumOfNOX], Table_Stepm_4.PM = [Table_Stepm_4]![PM]/[Table_Stepm_5]![SumOfPM], Table_Stepm_4.SOX = [Table_Stepm_4]![SOX]/[Table_Stepm_5]![SumOfSOX], Table_Stepm_4.CO2 = [Table_Stepm_4]![CO2]/[Table_Stepm_5]![SumOfCO2], " & _

"Table_Stepm_4.[HC-HotSoak] = [Table_Stepm_4]![HC-HotSoak]/[Table_Stepm_5]![SumOfHC-HotSoak], Table_Stepm_4.[HC-RL] = [Table_Stepm_4]![HC-RL]/[Table_Stepm_5]![SumOfHC-RL], Table_Stepm_4.HC_Scenario = [Table_Stepm_4]![HC_Scenario]/[Table_Stepm_5]![SumOfHC_Scenario], Table_Stepm_4.CO_Scenario = [Table_Stepm_4]![CO_Scenario]/[Table_Stepm_5]![SumOfCO_Scenario],

```
Table_Stepm_4.NOX_Scenario =
[Table_Stepm_4]![NOX_Scenario]/[Table_Stepm_5]![SumOfNOX_Scenario],
Table_Stepm_4.PM_Scenario =
[Table_Stepm_4]![PM_Scenario]/[Table_Stepm_5]![SumOfPM_Scenario],
Table_Stepm_4.SOX_Scenario =
[Table_Stepm_4]![SOX_Scenario]/[Table_Stepm_5]![SumOfSOX_Scenario],
Table_Stepm_4.CO2_Scenario =
[Table_Stepm_4]![CO2_Scenario]/[Table_Stepm_5]![SumOfCO2_Scenario],
Table_Stepm_4.[HC-HotSoak_Scenario] = [Table_Stepm_4]![HC-
HotSoak_Scenario]/[Table_Stepm_5]![SumOfHC-HotSoak_Scenario],
Table_Stepm_4.[HC-RL_Scenario] = [Table_Stepm_4]![HC-
RL_Scenario]/[Table_Stepm_5]![SumOfHC-RL_Scenario];"


    'Step19_MY

    'APPEND Table_Stepm_3

    'Append the G-R sticker distributions to the model year percentages table

    'GR_ID will identify which VehicleType-Season combination get appropriate
adjustment factors

    DoCmd.RunSQL "INSERT INTO Table_Stepm_3 SELECT Table_Stepm_4.*
FROM Table_Stepm_4;"


'Additional Pollutants

'The following calculates pollutants that are derived from others. For example, ROG is
calculated from HC

'using a conversion factor, PM2.5 is calculated from PM using a conversion factor.

''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''


  'Step20

  'UPDATE Table_Step4

  'Pollutant that are calculated from others

  'EX: PollutantB = PollutantA * C

  DoCmd.RunSQL "UPDATE Table_Step4 INNER JOIN FRACTIONS ON
(Table_Step4.CY = FRACTIONS.CY) AND (Table_Step4.[STRK-FUEL-TECH] =
FRACTIONS.[STRK-FUEL-TECH]) AND (Table_Step4.CATEGORY =
FRACTIONS.CATEGORY) SET Table_Step4.[THC-TOTAL] = [Table_Step4]![HC-
Exhaust]+[Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-
DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-
```

RUNNINGLOSS], Table_Step4.[TOG-EXH] = [Table_Step4]![HC-Exhaust]*[FRACTIONS]![FR-TOG], Table_Step4.[TOG-EVAP] = ([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.[TOG-TOTAL] = ([Table_Step4]![HC-Exhaust])*[FRACTIONS]![FR-TOG]+([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.[ROG-EXH] = [Table_Step4]![HC-Exhaust]*[FRACTIONS]![FR-ROG], " & _

"Table_Step4.[ROG-EVAP] = ([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.[ROG-TOTAL] = ([Table_Step4]![HC-Exhaust])*[FRACTIONS]![FR-ROG]+([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.PM10 = [Table_Step4]![PM-Exhaust]*[FRACTIONS]![FR-PM10], Table_Step4.PM25 = [Table_Step4]![PM-Exhaust]*[FRACTIONS]![FR-PM25], Table_Step4.FUELCONSUMPTION_EXH = ((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust]+(0.273)*[Table_Step4]![CO2-Exhaust])*2000/(0.854*6.17), Table_Step4.FUELCONSUMPTION_EVAP = ([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP]*2000/6.17, " & _

"Table_Step4.FUELCONSUMPTION_TOTAL = ((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust]+(0.273)*[Table_Step4]![CO2-Exhaust])*2000/(0.854*6.17)+(([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP])*2000/6.17, Table_Step4.NH3 = (((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust]+(0.273)*[Table_Step4]![CO2-Exhaust])*2000/(0.854*6.17)+(([Table_Step4]![HC-EVAP-HOTSOAK]+[Table_Step4]![HC-EVAP-DIURNAL]+[Table_Step4]![HC-EVAP-RESTING]+[Table_Step4]![HC-EVAP-RUNNINGLOSS])*[FRACTIONS]![FR-ROG-EVAP])*2000/6.17)*116/1000/454/2000, Table_Step4.[THC-TOTAL_Scenario] = [Table_Step4]![HC-Exhaust_Scenario]+[Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario], " & _

"Table_Step4.[TOG-EXH_Scenario] = [Table_Step4]![HC-Exhaust_Scenario]*[FRACTIONS]![FR-TOG], Table_Step4.[TOG-EVAP_Scenario] = ([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-

DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.[TOG-TOTAL_Scenario] = ([Table_Step4]![HC-Exhaust_Scenario])*[FRACTIONS]![FR-TOG]+([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.[ROG-EXH_Scenario] = [Table_Step4]![HC-Exhaust_Scenario]*[FRACTIONS]![FR-ROG], Table_Step4.[ROG-EVAP_Scenario] = ([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP], " & _

"Table_Step4.[ROG-TOTAL_Scenario] = ([Table_Step4]![HC-Exhaust_Scenario])*[FRACTIONS]![FR-ROG]+([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP], Table_Step4.PM10_Scenario = [Table_Step4]![PM-Exhaust_Scenario]*[FRACTIONS]![FR-PM10], Table_Step4.PM25_Scenario = [Table_Step4]![PM-Exhaust_Scenario]*[FRACTIONS]![FR-PM25], Table_Step4.FUELCONSUMPTION_EXH_Scenario = ((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust_Scenario]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust_Scenario]+(0.273)*[Table_Step4]![CO2-Exhaust_Scenario])*2000/(0.854*6.17), Table_Step4.FUELCONSUMPTION_EVAP_Scenario = ([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP]*2000/6.17, " & _

"Table_Step4.FUELCONSUMPTION_TOTAL_Scenario = ((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust_Scenario]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust_Scenario]+(0.273)*[Table_Step4]![CO2-Exhaust_Scenario])*2000/(0.854*6.17)+(([Table_Step4]![HC-EVAP-HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-RESTING_Scenario]+[Table_Step4]![HC-EVAP-RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-EVAP])*2000/6.17, Table_Step4.NH3_Scenario = (((12.011/(12.011+0.54*1.008))*([Table_Step4]![HC-Exhaust_Scenario]*[FRACTIONS]![FR-TOG])+(0.429)*[Table_Step4]![CO-Exhaust_Scenario]+(0.273)*[Table_Step4]![CO2-

```
Exhaust_Scenario])*2000/(0.854*6.17)+(([Table_Step4]![HC-EVAP-
HOTSOAK_Scenario]+[Table_Step4]![HC-EVAP-
DIURNAL_Scenario]+[Table_Step4]![HC-EVAP-
RESTING_Scenario]+[Table_Step4]![HC-EVAP-
RUNNINGLOSS_Scenario])*[FRACTIONS]![FR-ROG-
EVAP])*2000/6.17)*116/1000/454/2000;"

DoCmd.SetWarnings True

End Function
```