State of California
AIR RESOURCES BOARD

PUBLIC HEARING TO CONSIDER THE PROPOSED AMENDMENTS TO THE RED STICKER PROGRAM FOR OFF-HIGHWAY RECREATIONAL VEHICLES

STAFF REPORT: INITIAL STATEMENT OF REASONS

DATE OF RELEASE: MARCH 5, 2019
SCHEDULED FOR CONSIDERATION: APRIL 25, 2019

Location**:**

California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street
Sacramento, California 95814

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EXECUTIVE SUMMARY

BACKGROUND

The Federal Clean Air Act (CAA) uniquely preserves California to adopt and enforce rules to control mobile source emissions within the State. In order to attain the state and federal ambient air quality standards by the earliest practical date as required by the California Clean Air Act (CCAA), the California Air Resources Board (CARB or Board) seeks the maximum cost-effective emissions reductions possible from all sources, including vehicular and other mobile sources, to protect the health and welfare of all California residents.

CARB staff proposes to amend regulations for controlling emissions from off-highway recreational vehicles (OHRV). Riders primarily use OHRV to ride recreationally in public state parks, federal designated lands, or private tracks. The goal of the proposed amendments is to end the red sticker program, which allows CARB certification of OHRV that do not meet emissions standards and require all OHRV to be compliant with applicable emissions controls by 2022. The proposed amendments include provisions to end the certification of new red sticker vehicles, end riding restrictions for existing red sticker vehicles, establish new emissions standards for OHRV, and increase incentives for fleet emissions averaging and zero emission OHRV. These amendments are intended to help manufacturers transition all OHRV to meet emissions standards while also ensuring a wide range of certified OHRV models for California dealers and riders.

In 1997, CARB set exhaust standards for all OHRV. The exhaust standards were technology forcing, and additional time was needed for manufacturers to produce a full range of compliant vehicles. Dealers expressed concern that certified models would not be available and that California OHRV dealerships would go out of business. In 1998, CARB met with affected stakeholders and developed a temporary compromise that allowed for the certification of vehicles that do not meet emissions standards. This compromise was adopted into regulation in 1999 and became known as the red sticker program. It allows for certification and sale of OHRV that have no emissions control systems. In order to reduce excess emissions, red sticker OHRV cannot be operated on public lands in ozone non-attainment areas during the summer months. The red sticker program was envisioned as a temporary measure to provide stability in the market while manufacturers developed a full range of OHRV that complied with California's emissions standards. This temporary program has now been in effect for more than twenty years.

In 2013, the Board adopted evaporative standards for all OHRV. However, dealers and manufacturers presented issues and concerns with meeting the low emissions standards and warranty provisions for previously uncontrolled red sticker vehicles. The Board approved the new evaporative standards for green sticker OHRV only, and requested that staff conduct an assessment of the red sticker program and return with a comprehensive solution to reduce emissions from those vehicles. CARB staff conducted an OHMC owner survey, OHRV population analysis, and emissions testing

from 2014 through 2017 to better understand OHRV usage, emissions, and industry trends. In 2017, staff returned to the Board and presented the assessment of the red sticker program, concluding that the program did not work as intended[1]. While red sticker ATVs nearly disappeared from the marketplace by 2007, the majority of off-highway motorcycles (OHMC) sold in California continue to be red sticker models. Staff determined that OHMC models compliant with emission controls are available, but the industry has not shifted toward marketing models that incorporate these controls. Staff also found that red sticker models are operated extensively on private lands and tracks in ozone non-attainment areas during the summertime, thus undermining the emission reductions envisioned by the red sticker program seasonal riding restrictions. Therefore, staff determined the red sticker program did not work as intended and should be ended. The Board concurred with staff's assessment that the red sticker program should be eliminated at the earliest practicable date, such that all OHRV are required to meet emissions standards that help meet California's air quality goals.

Staff worked closely with OHRV stakeholders to develop a proposal to eliminate the red sticker program and apply emissions controls to all OHRV in a manner that would minimize the impact on the OHRV industry, including manufacturers, dealers, and riders, while still providing needed emissions reductions. Over the course of this rulemaking process from late 2013 through 2018, staff has made at least 16 public presentations during public workshops and meetings, as well as holding numerous conversations with individual OHRV manufacturers. The proposal presented in this report is a culmination of those efforts.

STAFF PROPOSAL

Staff is proposing amendments to the regulation that sets exhaust and evaporative emissions standards for OHRVs. Specifically, staff is proposing to end the red sticker program that allows for CARB certification of OHRV that do not meet exhaust and evaporative emissions standards. Under the proposal, beginning in model year 2022, all OHRV must either be certified as meeting the applicable emissions standards or sold and used exclusively for competition.

Based on internal CARB emissions testing and an industry-wide cost survey, staff estimates that this proposal will reduce reactive organic gas (ROG) and NOx emissions from OHRV by about six tons per day statewide in 2042, and will cost about $1 per pound of ROG + NOx reduced. These reductions will be realized by implementing proven control technologies (low permeation fuel hose, carbon canisters, advanced engine management, etc.) and ending future sales of the dirtiest OHRV models for recreational use. Furthermore, the adoption of the proposed amendments will bring CARB's OHRV certification requirements more closely in line with the United States Environmental Protection Agency (U.S. EPA) OHRV program that requires all certified

[1] See CARB staff presentation, *Informational Update on the Red Sticker Off-Highway Recreational Vehicle (OHRV) Program (June 22, 2017)* available at https://www.arb.ca.gov/board/books/2017/062217/17-6-3pres.pdf

vehicles to meet emissions standards and provides an exemption for competition vehicles.

In summary, staff proposes the following:

- End red sticker certification of new OHRV with no emissions controls beginning in model year 2022;
- Lift the seasonal riding restrictions on existing red sticker vehicles starting on January 1, 2025;
- Harmonize with U.S. EPA evaporative emissions standards for OHMC of model years 2020 through 2026;
- Harmonize with U.S. EPA exhaust emissions standards for OHMC from 2022 through 2027;
- Establish cost-effective alternative requirements for controlling evaporative emissions from OHRVs starting in 2020;
- Set more stringent exhaust emission control standards for ATVs, off-road sport vehicles, and off-road utility vehicles from 2022 through 2027;
- Amend the current emissions fleet averaging and zero emission vehicle credit provisions to provide manufacturers with flexible compliance pathways and accelerate development of zero emission OHRVs; and
- Set stringent California-specific emissions standards for all new OHRV beginning in model years 2027 (evaporative) and 2028 (exhaust).

This proposal is feasible because manufacturers can transfer proven evaporative and exhaust emissions control technologies from on-road and off-road vehicles to currently uncontrolled red sticker models. For example, on-road certified dual sport motorcycles feature evaporative emission control systems that would be well suited for use on off-road motorcycles, and low emissions two-stroke motorcycles currently marketed in Europe could be sold in California as a replacement for current red sticker models with no emission controls. The proposed amendments provide sufficient flexibility and time to allow OHRV manufacturers to incorporate these emissions control technologies and comply with applicable standards. The proposed amendments will reduce ozone-forming emissions from OHRV, furthering progress toward California's air quality goals.

EMISSIONS REDUCTIONS AND COST IMPACTS

Staff estimates that ending the certification of uncontrolled OHRV starting with model year 2022 and revising exhaust and evaporative emissions standards for OHRVs will effectively control emissions. Based on the latest OHRV emissions inventory model (RV2018), staff estimates the proposed rule will provide the following summertime ROG + NOx (Reactive Organic Gases and Oxides of Nitrogen) emissions reductions statewide, in tons per day (TPD):

Statewide Summer OHMC ROG + NOx Exhaust and Evaporative Emissions Reductions in 2031[1] and 2042[2] (TPD)

	Total
2031	3.11
2042	6.35

[1] Ozone emissions reduction target year in 2016 Ozone SIP.

[2] Target year for calculating emissions reductions, 20 years after ending red sticker certifications.

Emissions reductions for the year 2031 are shown because it represents the attainment year for the federal 8-hour ozone standard of 0.08 ppm in the 2016 State Implementation Plan (SIP). The year 2042 was chosen because it represents emissions reductions after the 20-year estimated useful lifetime of OHRVs.

Staff estimates that the proposed amendments will cost about $72.7 million over the total lifetime of the proposal. This cost will be borne by OHRV manufacturers and passed on to OHRV consumers purchasing new vehicles starting in 2022. The expected increase in retail price is $333 per vehicle for each current red sticker motorcycle that would need to be fitted with additional controls to comply with applicable emissions standards. This increase is not expected to have a significant impact on total statewide new OHRV retail sales.

The cost per pound of emissions reductions was calculated for OHRV based on an industry-wide cost survey and population analysis. Staff estimated the per-vehicle costs of developing, installing, and certifying control systems on each OHRV engine or evaporative family, then considered the emission reductions that would be realized over the life of each vehicle. The average cost-effectiveness estimate for OHRV is $1 per pound of ROG + NOx reduced. The proposed amendments for OHMC are harmonized with federal requirements, significantly reducing costs for that category. Staff's proposal is cost-effective when compared with other adopted control measures for ROG such as those for spark-ignition marine watercraft and large spark-ignited engines.

STAFF RECOMMENDATIONS

Staff recommends that the Board adopt the proposed amendments to end red sticker certification of uncontrolled OHRV starting with model year 2022, harmonize OHMC exhaust emissions standards with U.S. EPA standards from 2022 through 2027, harmonize OHMC evaporative emissions standards with U.S. EPA standards from 2020 through 2026, apply existing California-specific emissions standards for all OHMV in model year 2027 and thereafter, provide additional flexible compliance options to encourage continued model availability in California, among other changes. These proposed amendments are anticipated to help the OHRV industry transition current uncontrolled red sticker vehicles to meet emissions standards with minimal disruption, and reduce the overall ROG emissions from OHRV in California by more than 50 percent by 2040.

Staff considered alternatives to the current proposal, including requiring all OHRV to immediately comply with the current emissions standards (no alternative transitional standards) and making no changes to the current regulation. Staff has chosen not to propose requiring all new OHRV to meet current exhaust and evaporative emissions standards with no transitional period. This option would impose additional hardship on stakeholders and could affect California businesses significantly by reducing the number of certified OHRV models available for sale in dealerships in 2022. Making no changes to the regulation was not chosen because it would not reduce emissions and would allow for the continued sale and recreational use of uncontrolled red sticker OHRV in California, continuing the negative air quality impacts from these vehicles. Staff determined that adopting the current proposal is both technologically feasible and cost-effective.

Staff held multiple public workshops and presented at numerous California State Parks Off-Highway Motor Vehicle Recreation (OHMVR) Commission Meetings throughout California to allow for public input throughout the development of the proposed amendments.

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I. INTRODUCTION AND BACKGROUND

A. OFF-HIGHWAY RECREATIONAL VEHICLE (OHRV) TYPES

Off-highway recreational vehicles (OHRV) include off-highway motorcycles (OHMC) also known as dirt bikes (Figure I-1), All-Terrain Vehicles (ATV) (Figure I-2), off-road utility vehicles (UTV) (Figure I-3), side-by-sides (ROV) (Figure I-4), snowmobiles (Figure I-5), and sand cars (Figure I-6). The red sticker program, which allows for CARB certification of OHRV that have no emissions controls and do not meet emissions standards, applies only to OHMC and ATV.

The vast majority of red sticker vehicles are OHMC. OHMC are designed for both recreational and competition purposes (Figure I-1). They are specialized for a variety of styles of off-road riding, including motocross, enduro, trail, trial, and track. Generally, they vary in size from 50cc to 500cc with engines that are single-cylindered two-stroke or four-stroke units. Compared to on-road motorcycles, OHMCs are designed to be lighter, and have more rugged suspension systems with much longer travel and higher ground clearance.

Figure I-1: Recreational and Competition OHMCs (Courtesy of http://www.dirtbikes101.com/)

Figure I-2: ATV (Courtesy of http://www.atv.com)
Figure I-3: UTV (Courtesy of http://www.tractorsupply.com)
Figure I-4: Side-by-Side (Courtesy of http://www.dirtwheelsmag.com)

Figure I-5: Snowmobile (Courtesy of http://www.polaris.com)
Figure I-6: Sand Car (Courtesy of http://www.youtube.com)

CARB's current regulations distinguish between two certification classes of OHRV. Emission compliant OHRV, commonly referred to as green sticker vehicles, are certified by CARB as meeting all applicable exhaust and evaporative emissions standards. These green sticker vehicles can be used recreationally at public off-highway vehicle riding areas throughout California, regardless of season. Additionally, manufacturers are also allowed to produce red sticker OHRV, which are certified by CARB but are not subject to any emission standards. To help reduce harmful smog-forming emissions, red sticker OHRV are subject to seasonal riding restrictions on public lands in ozone non-attainment areas. While seasonal riding restrictions may help limit the impact of exhaust emissions from red sticker vehicles, the program does not prohibit operation on private lands and does nothing to mitigate evaporative emissions that occur when the vehicles are stored.

A third class of OHRVs is defined by the California Health and Safety Code (HSC) section 43001, which exempts racing or "competition" vehicles from any emissions control set by CARB. However, use of competition vehicles is limited to closed courses and competition events.

B. HISTORY AND CURRENT STATUS OF THE RED STICKER PROGRAM

California's OHMC are regulated under emissions standards developed for the OHRV category as a whole. In 1994, CARB adopted the first regulation to control exhaust emissions from OHRV (Table I-1) starting with the 1997 model year. At the time these regulations were adopted, the majority of OHMC were equipped with two-stroke engines that emitted hydrocarbons well above the newly established limit. It was anticipated that cleaner two-stroke engine technology could be developed over time that could potentially meet the standard. However, at the time of adoption it was expected that most of the compliant OHMCs sold by the 1997 compliance date would be newly designed four-stroke engines.

Table I-1: California OHMC Exhaust Emissions Standards

Model Year	HC (g/km)	CO (g/km)
Pre-1997	-	-
1997+	1.2	15.0

Prior to the 1997 implementation of the exhaust standards, OHRV dealers and stakeholders expressed concerns regarding model availability, performance of compliant OHMC, and the lack of practice areas for competition OHMC. User groups were concerned that the regulation did not provide competitive riders the opportunity to practice in preparation for events, nor compete in open-land racing events. OHRV dealers expressed concerns of economic hardship and lower

sales after manufacturers failed to produce a full line of compliant, high performance four-stroke OHMCs by the 1997 implementation date.

Concerns over the lack of compliant OHMC motivated CARB staff to propose amendments to the OHRV exhaust regulation in 1998. The 1998 rulemaking, which was formally adopted in early 1999, introduced a program to allow the registration of non-compliant OHMCs and ATVs[2]. This is commonly referred to as the red sticker program. Under this new regulatory program, vehicles that do not meet the emissions standard must have a 3 or C in the eighth digit of the VIN and are issued a red registration sticker by DMV. Vehicles with red registration stickers are permitted to operate on public lands only during the times of year where the air quality is in compliance with federal ozone standards, known as riding restrictions. The timing of usage restrictions is specific to each riding area in the State, and is dictated by the severity of ozone levels in that particular area

Usage restrictions imposed by the red sticker program were expected to serve as a significant disincentive for riders to purchase red sticker vehicles. It was further expected that riders' preference for green sticker vehicles with no riding restrictions would prompt manufacturers to quickly develop a full range of emissions-compliant models. The red sticker program was envisioned as a temporary measure that would provide additional time for the development of compliant OHRV models while not disrupting vehicle availability and OHRV dealer sales. In fact, the 1998 regulation included a requirement that CARB review the red sticker program within five years:

> *Within five years from the effective date of adoption or date of implementation, whichever comes later, the Air Resources Board, in consultation with the Secretary for Environmental Protection, shall review the provisions of this section to determine whether it should be retained, revised or repealed[3].*

In 2003, CARB staff completed a review of the red sticker program as required by regulation. It was determined that the red sticker program had not been implemented as proposed. Specifically, staff found that the Department of Motor Vehicles (DMV) was inconsistent in identifying red sticker vehicles and issuing the appropriate OHRV registration sticker. This issue was caused by erroneously formatted VINs and a delay in programming of DMV's automated computer system to recognize red sticker vehicles. The failure to issue correct OHRV registration stickers made it impossible to enforce seasonal riding restrictions that were required by the 1998 regulation, which in turn meant that the emissions reductions envisioned by those riding restrictions were not achieved. A regulatory revision was adopted in 2003 to rectify this issue by

[2] CARB, Amendments to the California Regulations for New 1997 and Later Off-highway Recreational Vehicles and Engines, available at https://www.arb.ca.gov/regact/recreat/recreat.htm
[3] California Code of Regulations, Title 13, section 2415(c), as amended in 1998.

delaying the enforcement of the red sticker program and allowing all model year 1998-2002 OHMCs to receive a green registration sticker regardless of their compliance with emissions standards[4]. Because the red sticker program had not been properly implemented prior to staff's 2003 review, it was impossible to determine at that time whether the program was effective in reducing OHRV emissions in ozone non-attainment areas and the program remained in effect.

In 2006, U.S. EPA adopted regulations to control emissions from OHRV. The test protocols and emissions requirements adopted by U.S. EPA at that time were similar to CARB's requirements, but there were several differences. Significantly, U.S. EPA rules do not include anything comparable to the red sticker program. Instead, U.S. EPA rules categorize OHRV as either compliant with applicable standards or exempt for competition use only. Under U.S. EPA rules, vehicles that are used solely for competition are exempt from emissions requirements. The 2006 U.S. EPA regulations also included provisions to reduce evaporative emissions, which CARB's OHRV regulations did not include at that time.

CARB amended California's OHRV regulations in 2006 to revise the red sticker riding calendar and harmonize with U.S. EPA standards to control evaporative emissions, which became effective in 2007[5]. These standards, shown in Table I-2, were developed to control permeation from fuel tanks and hoses, and took effect in 2008 for all green sticker OHRV but did not apply to red sticker vehicles. CARB expanded evaporative control requirements again in 2013 to include a diurnal evaporative emissions standard and new provisions for certification, labeling, enforcement, anti-tampering, recall and use restrictions[6]. Also, a new test procedure to measure evaporative emissions was approved (TP-933). The diurnal standard applies to 2018 and subsequent model year green sticker OHMC but does not apply to red sticker vehicles.

Table I-2: Evaporative Emissions Standards for Green Sticker OHMCs

Model Year	Applicable Standards
Pre-2008	None
2008 - 2017	Fuel Tank Permeation: < 1.5 g ROG/m^2/day Hose Permeation: < 15 g ROG/m^2/day
2018+	Total Evaporative Emissions: < 1g TOG/day (Diurnal)

[4] CARB, Rulemaking Documents, Off-Highway Recreational Vehicles, available at https://www.arb.ca.gov/regact/ohrv03/ohrv03.htm

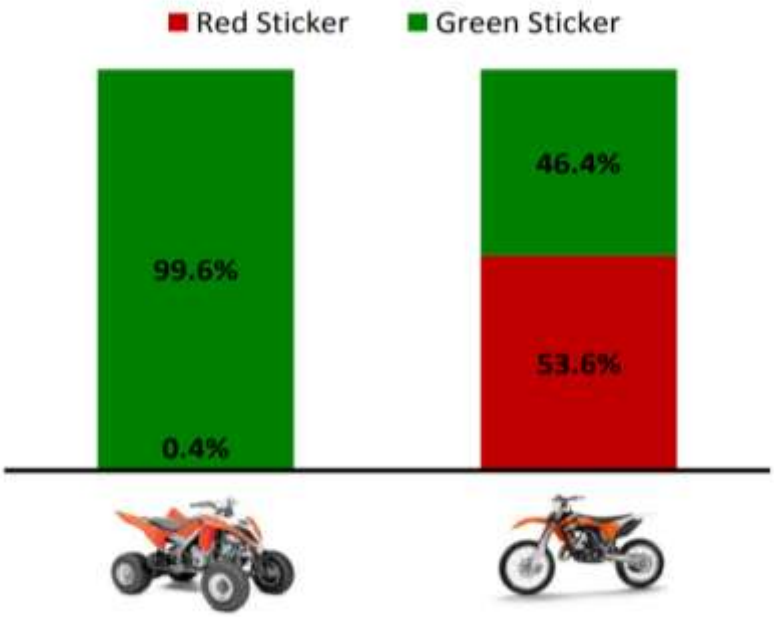
[5] CARB, Rulemaking Documents, Rulemaking to Consider Proposed Amendments to the California Regulations for New 1997 and Later Off Highway Recreational Vehicles and Engines, available at https://www.arb.ca.gov/regact/ohrv2006/ohrv2006.htm

[6] CARB, Rulemaking Documents, Off-Highway Recreational Vehicles 2013, available at https://www.arb.ca.gov/regact/2013/ohrv2013/ohrv2013.htm

Over twenty years since it was adopted as a temporary measure, the red sticker program continues today. It is implemented through the coordinated efforts of several government agencies. CARB is responsible for certifying vehicle models as emissions compliant (green sticker) or non-compliant (red sticker), ensuring that the eighth digit of the VIN is characterized correctly to represent the OHRV's compliance status, and updating the red sticker riding calendar to provide dates that each area is open to red sticker vehicles. The DMV ensures that each OHRV sold is given the correct registration based on its VIN. Public land management agencies, such as the California State Parks and the Bureau of Land Management, are responsible for enforcing the red sticker riding calendar.

When the red sticker program was adopted, it was expected that development of cleaner engine technologies would lead to a wide range of emissions-compliant OHRV being certified. It was further expected that the inconvenience of not being able to ride a red sticker OHRV year-round on public lands would prompt customers to purchase emissions-compliant models rather than red sticker models with no emissions controls. While this has largely proven to be the case with ATV, demand for red sticker motorcycles remains high in spite of developments in four-stroke OHRV engine technology that allows more high performance models to meet emissions standards. Nearly all ATV sold in California from 2012 through 2015 met emissions standards, while approximately 54 percent of all off-highway motorcycles sold in California during that period were red sticker models with no emissions controls (Figure I-7). Manufacturers have increased the number of red sticker models, with approximately 70 percent of all OHMC Executive Orders issued by CARB in 2017 being red sticker models.

Figure I-7: 2012 - 2015 OHMC and ATV Registrations* by Sticker Type

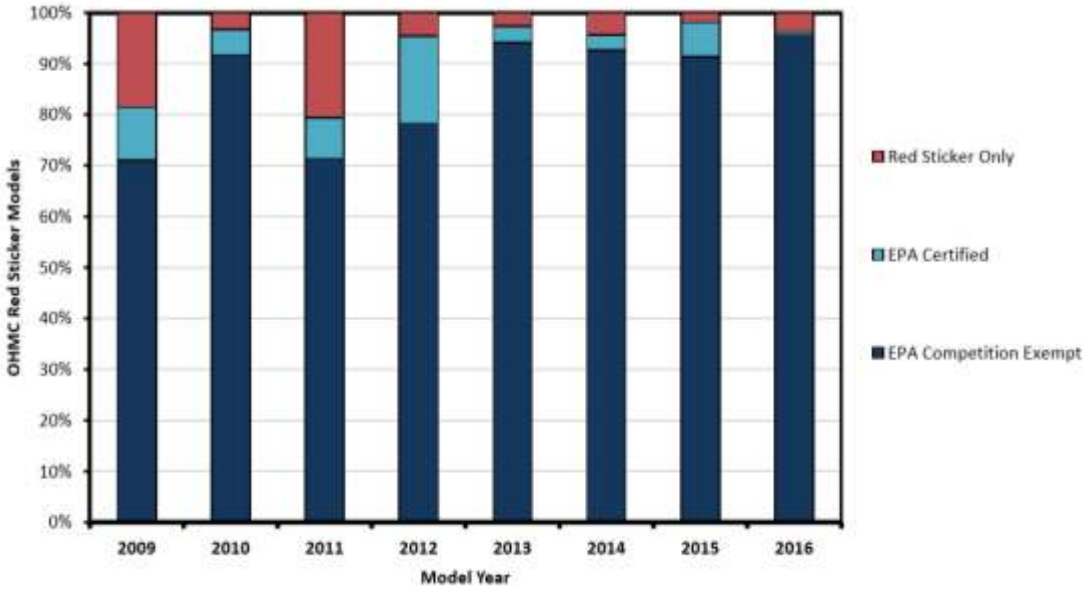


** Total registrations from 2012-2015: ATV – 31,131, OHMC – 41,481*

Source: 2016 DMV Registration Database

Figure I-8 shows the U.S. EPA certification status for each red sticker model that was certified by CARB from 2009 through 2016. Some CARB red sticker models are sold in California only (indicated in red on the chart), and some are certified by U.S. EPA as meeting federal emissions standards (shown in light blue on the chart). However, the vast majority of red sticker models certified in California since the U.S. EPA implemented federal OHRV emissions standards in 2008 are classified by U.S. EPA as competition exempt (shown in dark blue on the chart). U.S. EPA regulations limit these vehicles to competition use only, while California's red sticker program allows for seasonal recreational use. This inconsistency between CARB and U.S. EPA regulations is a concern for CARB, and addressing it is one of the primary objectives of the proposed amendments.

Figure I-8: CARB Red Sticker Certifications, 2009 - 2016



C. OVERVIEW OF PROPOSED AMENDMENTS

This section presents a broad overview of the amendments staff is proposing for the OHRV regulations. Chapter II provides a more in-depth description of the problem that the proposal is intended to address. Chapter III provides a summary, purpose, and rationale for each new or amended section of the proposed regulation order. The proposed amendments would end CARB certification of new OHRV without emissions controls starting with model year 2022, and eliminate seasonal riding restrictions for existing red sticker vehicles starting in 2025. The proposal also establishes alternative standards to help manufacturers transition their currently uncontrolled OHMC and ATV from red sticker to meeting emissions standards, while reducing overall OHRV emissions. The proposal will increase emissions credits awarded to zero emissions OHRV, which is intended to incentivize the development and sale of those vehicles.

The proposed regulations would harmonize California's evaporative standards for OHMC and ATV with U.S. EPA standards beginning in model year 2020. Starting in 2018, some manufacturers opted to certify their previously green sticker models as red sticker rather than meet the new evaporative emissions standards that went into effect starting that year. Harmonizing California's ATV and OHMC evaporative standards with U.S. EPA will allow manufacturers to resume selling those models as green sticker, which should help attract buyers to these lower emitting models rather than the traditional red sticker models with no evaporative or exhaust controls.

The proposed amendments would end certification and thus sales of new red sticker models in the 2022 model year. From 2020 through 2026, California's evaporative standards for OHMCs and ATVs will be identical to U.S. EPA standards. To help California's OHRV dealer and manufacturers comply with these requirements, the proposal includes alternative evaporative emissions standards for OHMCs and ATVs from 2020 through 2026. Beginning in model year 2022, California's exhaust standards for OHMCs and ATVs will be at least as stringent as the U.S. EPA standards. Exhaust standards for ATVs, off-road sport vehicles, and off-road utility vehicles will slowly become more stringent until 2027. Exhaust standards for OHMCs will remain identical to U.S. EPA standards until 2027. After the 2020 through 2027 transitional period, all OHRV will be subject to California-specific standards (green sticker) that are more stringent than federal standards but are technically feasible and provide cost effective emissions reductions. Staff has worked with OHMC manufacturers to provide sufficient time and certification flexibility to allow compliance with limited disruptions to the market.

If adopted, the proposal would reduce statewide summertime ROG + NOx emissions from the OHRV category by approximately 6 tons per day in 2040. The bulk of these reductions will be achieved by ending certification of the highest emitting red sticker OHRV starting in 2022. Further reductions will be achieved by gradually implementing tighter evaporative and exhaust standards in subsequent years through 2028. Because the regulation only applies to new vehicles, emissions reductions will slowly increase as California's current fleet of higher emitting OHRV reaches the end its useful life and is gradually replaced with new, cleaner vehicles starting in 2022. In total, staff estimates that the riding restrictions reduce emissions by only approximately 0.25 (1/4) of a ton per day statewide (in the summer months). When the red sticker program was adopted, CARB envisioned that there would be a total elimination of summertime riding and associated ROG and NOx emissions when the riding restrictions are in effect. This has not occurred. Instead, summertime riding is reduced by only 27 percent. During the summer months, red sticker OHRV users shift their use from public lands to private tracks or evade enforcement and continue to ride in public lands. Because the riding restrictions are not effective and provide minimal emissions reductions, staff proposes to eliminate them on January 1, 2025. Staff expect a decrease in emissions benefits in summertime ROG and NOx

emissions from implementation of the proposed emissions controls on all OHRV starting in 2022 from the lifting of the riding restrictions (0.92 TPD statewide less 0.25 TPD statewide, thus resulting in net reductions of 0.67 TPD by 2025). Projected statewide summertime ROG + NOx emissions reductions from 2020 through 2040 are shown in Figure I-9. The details of the methodology for the Recreational Vehicle Emissions Inventory (RV2018) can be found in Appendix C.

Figure I-9: Statewide Summertime OHRV Evaporative and Exhaust Emission

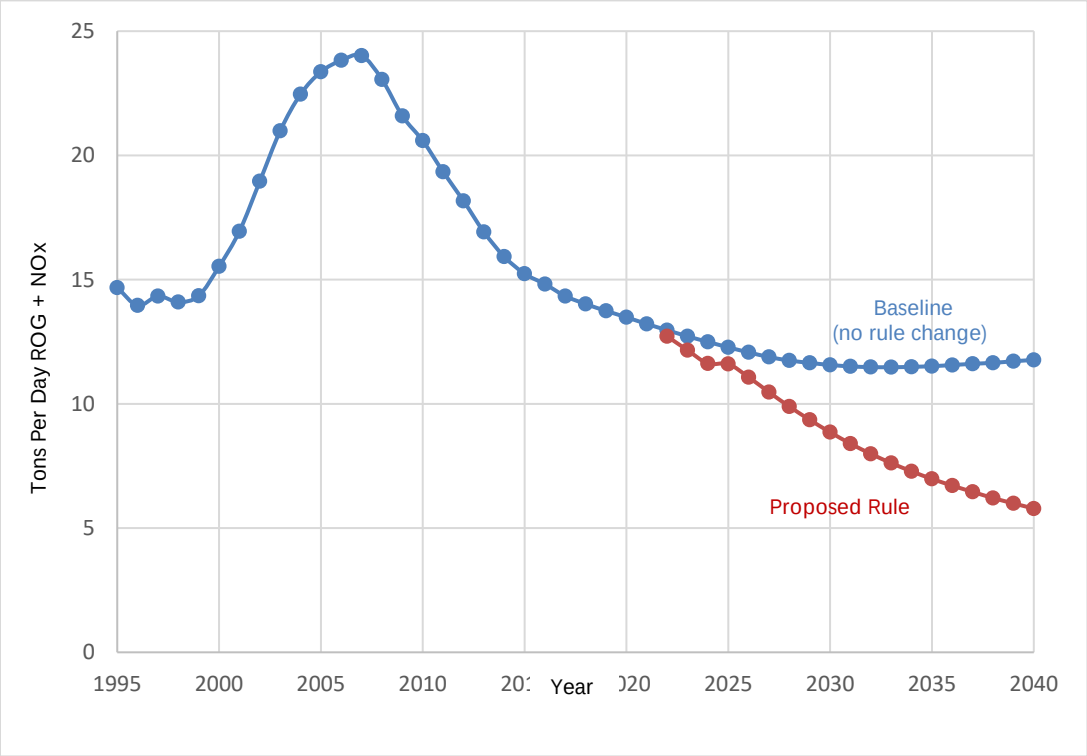


Table I-3 provides a summary of the proposed changes to the regulation, which were developed by CARB staff in coordination with OHRV stakeholders including manufacturers, dealers, riders, industry associations, land management agencies, and OHRV enthusiasts. Staff began work with stakeholders in 2014 and stayed in regular contact with stakeholders throughout the process via informal and formal interaction. Staff hosted sixteen public workshops and working group meetings from early 2014 through October 2018. The public process for this rulemaking is detailed further in Chapter XII.

Table I-3: Summary of Proposed Regulatory Amendments to the OHRV Regulation

Topic	Proposed Regulatory Updates
General	• Minor updates for typographical errors, clarifications, and organization of the regulation, that do not affect the intent of the original regulation
Compliance	• Harmonize with U.S. EPA evaporative requirements for OHMC from 2020-2026 • Harmonize with U.S. EPA exhaust requirements for OHMC from 2022-2017 • End the red sticker certification program for new OHRV with no emissions controls starting with model year 2022 • Establish alternative evaporative emission standards for OHMC and ATV from 2022 through 2026 to ease transition from red sticker to emissions-compliant • End seasonal riding restrictions for existing red sticker vehicles in 2025 • Add tighter exhaust emission standards for four-wheeled OHRV (ATVs, off-road sport vehicles, and off-road utility vehicles) until 2027 • Allow for design-based evaporative certification for certain OHRV • Establish tighter exhaust and evaporative emissions requirements for all OHMC by model year 2028
Certification	• Establish design-based certification program and procedures • Enhance fleet averaging options, including additional emissions credit for zero emissions OHRV • Further clarification for reporting requirements

II. THE PROBLEM THAT THE PROPOSAL IS INTENDED TO ADDRESS

A. The Red Sticker Program is Not Working as Intended

The OHRV exhaust emissions standards adopted by the Board in 1994 were technology forcing. Most of the OHRV at that time were two-stroke models that produced hydrocarbon emissions many times higher than allowed by the new standard. The red sticker program was adopted by the Board in 1997. It was intended to be a temporary program that would allow for continued sales of a wide variety of emissions non-compliant OHRV in California, while manufacturers developed models that complied with the newly adopted exhaust emissions standards.

The red sticker program has now been in effect for more than twenty years, and advancements in emission controls have made the 1994 standards attainable for all OHRV types. The program has served its intended purpose of allowing time for OHRV manufacturers to develop compliant vehicles. Additionally, the program has created several problems that are addressed by the proposed amendments. These problems were identified by staff after undertaking a comprehensive assessment of the red sticker program from 2014-2017, as directed by the Board during the 2013 OHRV evaporative rulemaking. Staff's assessment of the red sticker program is discussed in section II-B.

The following subsections list significant problems resulting from the current red sticker program.

1) Elevated Levels of Smog-Forming Emissions from Red Sticker Vehicles

Red sticker vehicles are not subject to exhaust or evaporative emissions standards and are allowed to emit at uncontrolled rates. ATVs are mostly compliant with emissions controls and certified as green sticker, but OHMC are not. CARB staff conducted exhaust and evaporative emissions testing on fifteen red sticker OHMC in 2014. Thirteen of the fifteen vehicles tested had hydrocarbon exhaust emissions above the 1.2 gram/kilometer standard for green sticker OHMC. All vehicles tested exceeded the 1g/day TOG evaporative emissions standard that applies to OHMC from 2018 and later. Some of the vehicles tested were fairly close to the standard while others exceeded the standard by more than ten times.

Because exhaust and evaporative emissions from red sticker vehicles are significantly higher than green sticker certified OHRV with emission controls, red sticker vehicles contribute a disproportionate amount to total statewide OHRV emissions. Figure II-1 shows California's OHRV population from 2000-2040, broken down by green sticker OHMC, red sticker OHMC, and all other OHRV types. Figure II-2 shows the statewide reactive organic gas (ROG) emissions from OHRV in California from 2000-2040. As shown in these figures, in 2020 red sticker OHMC will comprise only about 20 percent of the total OHRV population,

but contribute more than 40 percent of ROG emissions. Without ending certification of OHRV without emission controls, as allowed under current regulations, this trend would only grow worse over time as evaporative emissions from controlled vehicles decreases as new standards go into effect for model year 2018 onward. By 2040 red sticker OHMC are projected to comprise only about 15 percent of California OHRV, while contributing more than 60 percent of ROG emissions.

Figure II-1 – Estimated OHRV Population in California, 2000-2040

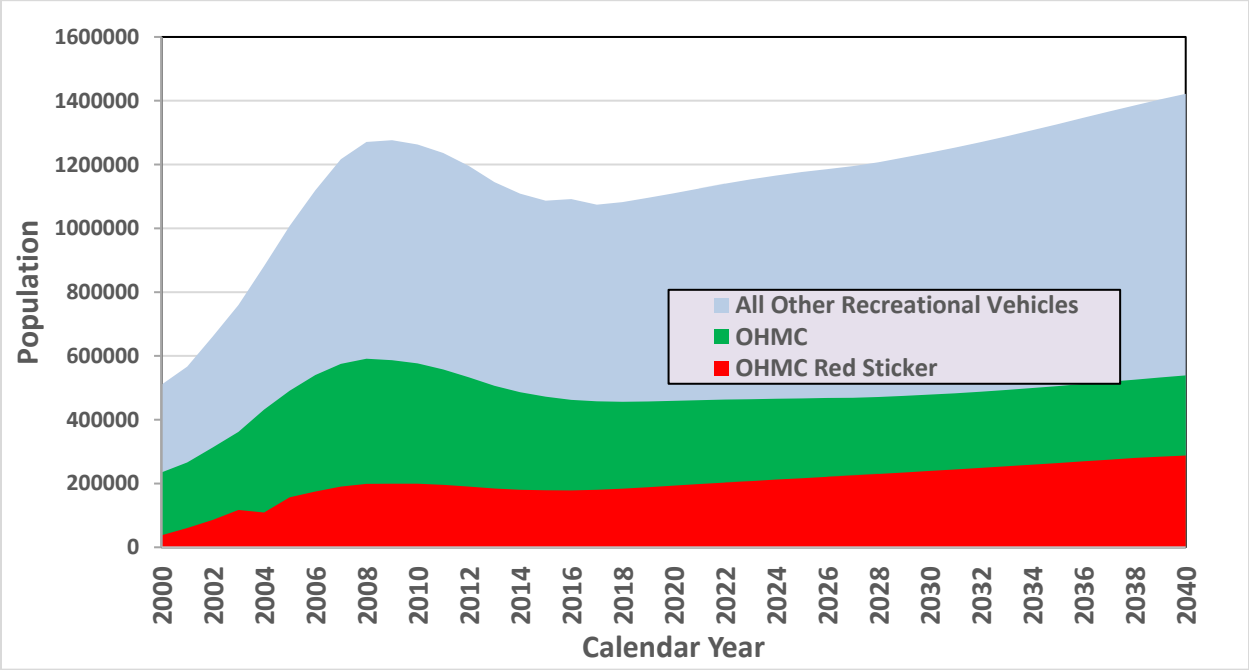
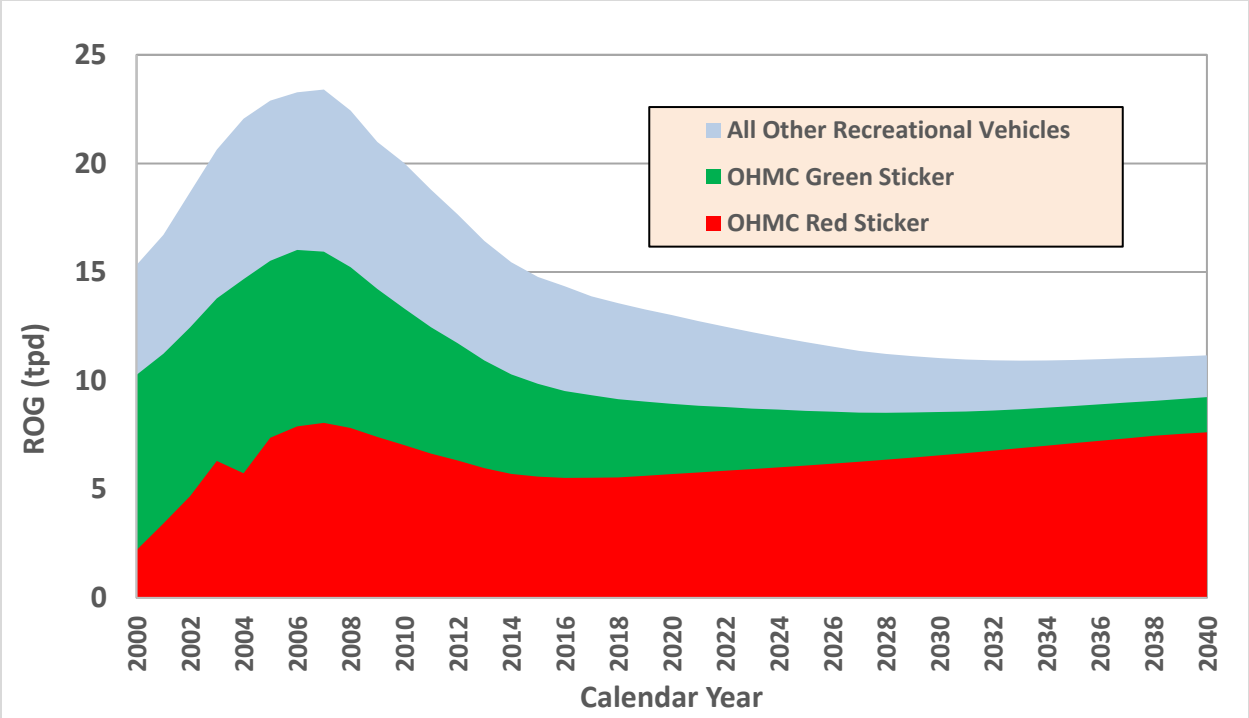


Figure II-2 – Estimated Statewide Summertime ROG Emissions from OHRV



2) Red Sticker Program Undermines Efforts to Reduce Emissions from OHRV

Staff has projected that, with no amendments to the current regulations, red sticker vehicles will contribute more than 60 percent of all statewide OHRV ROG emissions in 2040. This makes it very difficult for CARB to obtain meaningful reductions from the OHRV category without addressing red sticker vehicles. Moreover, recent experiences have indicated that the red sticker program makes it very difficult to achieve reductions from green sticker vehicles. In 2013, CARB adopted stringent evaporative emission standards for all green sticker OHRV. The new evaporative standards came into effect starting in 2018, with full implementation by 2022. Rather than develop compliant evaporative control systems for their green sticker OHMC and ATV, several manufacturers have opted to certify previously green sticker models as red sticker. This course of action is allowed under current regulations and is a rational response for manufacturers to take in lieu of meeting tighter emissions standards. However, it undermines the emissions reductions that were projected to be achieved by the 2013 evaporative emissions regulation. It is reasonable to expect that OHMC and ATV manufacturers would continue to further shift toward red sticker vehicles if CARB were to try reducing OHRV emissions in the future by adopting more stringent standards for green sticker vehicles.

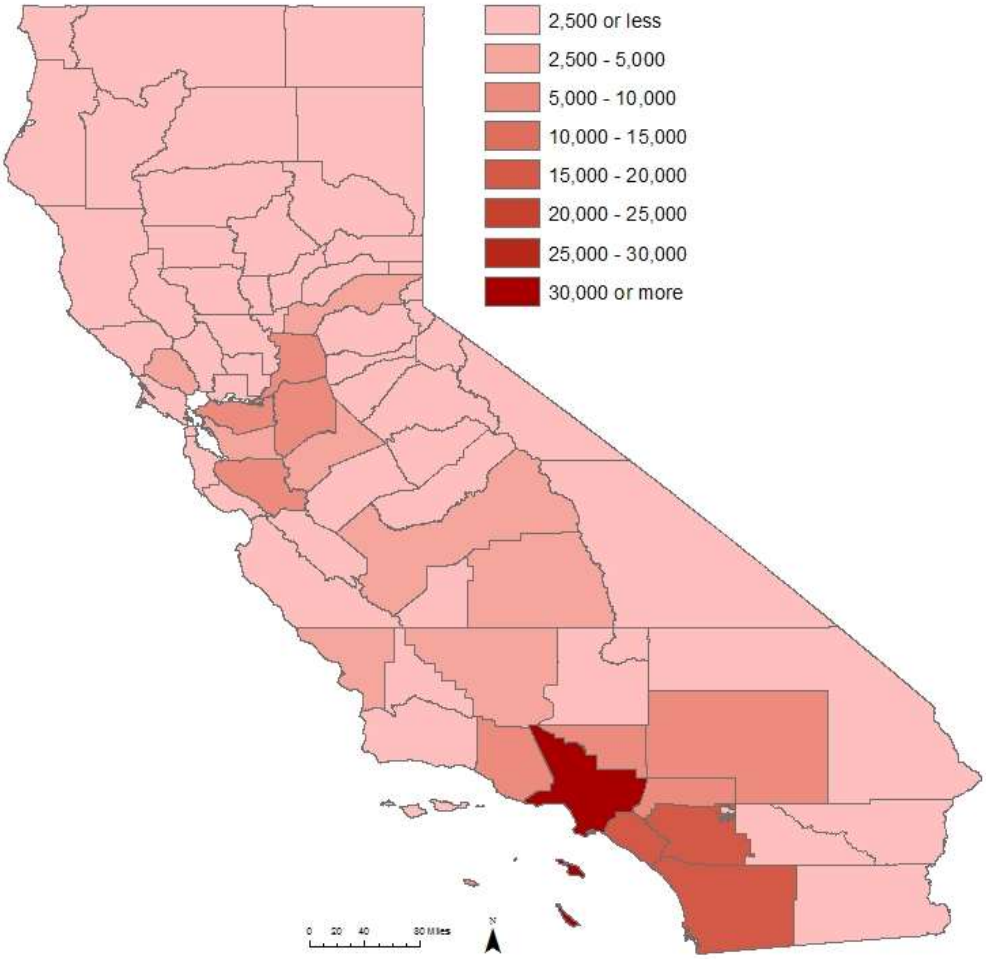
3) Red Sticker Program Does Not Adequately Limit Emissions in Ozone Non-Attainment Areas

The red sticker program intended to eliminate exhaust emissions during summertime in ozone non-attainment areas of the State by prohibiting those vehicles from operating on public lands during peak ozone season. Based on CARB staff's *2016 Survey of Registered Motorcycle Owners*, (Appendix D) the

red sticker program does not significantly reduce summertime riding in ozone non-attainment areas. While it is true that access is effectively restricted at many public OHV riding areas, the survey indicates that red sticker riders simply shift to private tracks, private property, and other riding areas where enforcement is more limited. The survey indicates that red sticker riders operate their vehicles 3.9 days per month on average during summertime, and 5.4 days per month on average during the rest of the year. This represents a 27 percent reduction in riding during summertime, rather than the near total elimination of summertime riding that was envisioned when the program was adopted. In total, staff estimates that the red sticker seasonal riding restrictions currently reduce emissions by only approximately ¼ of a ton per day statewide. (See Appendix C for further discussion of OHRV emissions.)

When the red sticker program was adopted in 1998, there were no regulations limiting evaporative emissions from OHRV. Evaporative emissions occur during vehicle storage and are independent of vehicle operation, so seasonal limitations on vehicle operation would do nothing to reduce these emissions. In 2016, staff conducted a comprehensive analysis of California's OHRV population based on DMV registration data. Staff concluded that 90 percent of OHRV in California are registered in ozone non-attainment areas. Figure II-3 shows the distribution of registered OHRV in California. Furthermore, the *2016 Survey of Registered Motorcycle Owners* indicates that at least 95 percent of OHRV are stored at the address where they are registered. This means that the vast majority of red sticker OHRV are stored in non-attainment areas, where their uncontrolled evaporative emissions contribute to the formation of ground level ozone.

Figure II-3. Distribution of Registered OHRV in California



4) Red Sticker Program is Incompatible with U.S. EPA Competition Exemption
When the red sticker program was adopted in 1998, there were no federal emissions requirements for OHRV. However, when federal regulation of OHRV emissions started with the 2006 model year, U.S. EPA guidelines made it clear that riders are not allowed to use a competition vehicle for recreational purposes if it was built in 2006 or later[7]. From this point forward, California's red sticker program essentially became a loophole that allows for the recreational use of vehicles that are only allowed to be used in competition under U.S. EPA's OHRV regulations. CARB staff's *2016 Survey of Registered Motorcycle Owners* indicates that 83 percent of all red sticker riding activity is recreational, with only 6 percent of red sticker riding time being competitive events.

It should be noted that CARB's OHRV emissions control program is more stringent than the U.S. EPA program in several ways, including tighter exhaust

[7] U.S. Environmental Protection Agency, Emission Exemption for Racing Motorcycles and Other Competition Vehicles (Sept. 2002) EPA420-F-02-045.

and evaporative standards for certified vehicles, and is at least as protective as the U.S. EPA program in aggregate. However, eliminating the red sticker program and harmonizing with U.S. EPA's standards for OHMC during a transitional period would further reduce emissions in California until more stringent California-specific OHRV standards go into effect in 2027.

5) The Red Sticker Program is Inconvenient for Riders and Government Agencies

Based on responses from CARB staff's *2016 Survey of Registered Motorcycle Owners*, OHRV riders have an overall negative impression of the red sticker program. More than 50 percent of red sticker OHMC riders in the survey indicated that the program limits the number of days they ride. More than 25 percent indicated that the program is difficult to understand, and more than 40 percent indicated that they had to travel further in the summertime to find a riding area. The open response portion of the survey included many stories of red sticker OHMC riders being turned away from riding areas when they believed they would be admitted. Sixty percent of red sticker OHMC owners also own a green sticker OHRV, and many engage in riding as a family activity with multiple riders on different vehicles. The open portion of the survey included several stories where one family member is turned away from the riding area for having a red sticker vehicle out of season, leading to the entire family cancelling their riding trip.

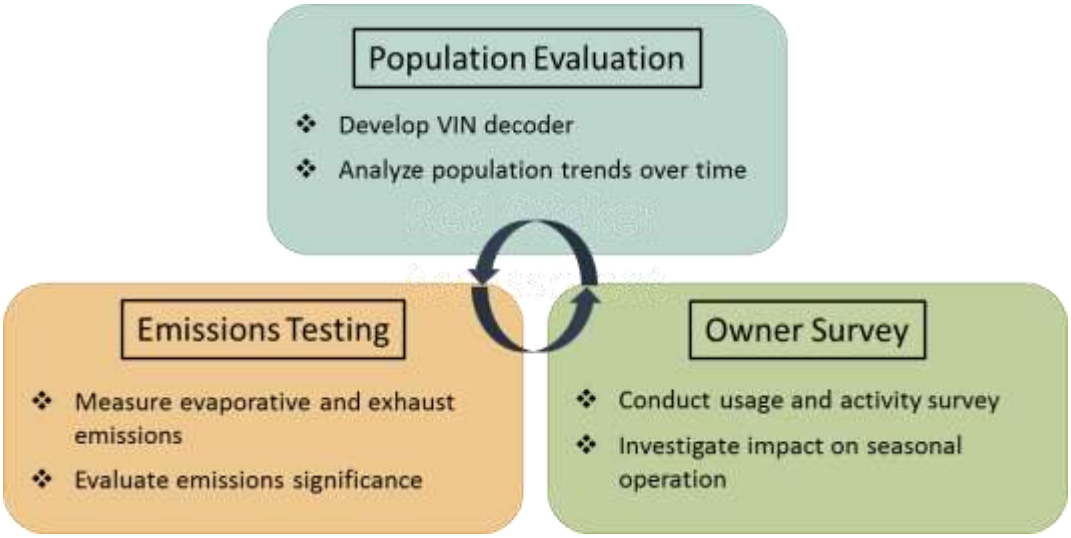
Implementing the red sticker program requires staff resources from the California Department of Motor Vehicles (DMV) to identify red and green sticker vehicles and issue the appropriate sticker. DMV agents must field inquiries and settle complaints from OHRV owners about which sticker their vehicle should receive. While the total DMV staff time allocated to this program has not been quantified, it is clear that a program with a single OHRV registration type would be simpler to implement and would require less DMV staff time.

Public off-highway vehicle riding areas in California are managed primarily by the California Department of Parks and Recreation (State Parks) and the Federal Bureau of Land Management (BLM). These agencies are responsible for enforcing the red sticker seasonal riding restrictions, which takes staff time and resources. While the total staff time allocated to this program has not been quantified, it is clear that a program with no seasonal riding restrictions would be simpler to implement.

B. Staff Assessment of the Red Sticker Program

To develop solutions that address problems with the red sticker program, staff conducted a comprehensive assessment based on three major components: population evaluation, emissions testing, and an owner survey. Each element of the assessment is discussed in the following subsections.

Figure II-4: Comprehensive Assessment of the Red Sticker program



1. Population Evaluation

To accurately estimate emissions from OHRV throughout California, it is critical to have a thorough understanding of the statewide OHRV population. It is important to consider the vehicle type (motorcycle, ATV, utility vehicle, etc.), vehicle age, engine technology (two-stroke, four-stroke, fuel injected, carbureted, etc.), engine power, and vehicle registration type (red sticker, green sticker, planned non-operation, etc.) when estimating emissions. The software previously used by CARB staff for evaluating OHRV population was the Polk VIN Decoder. However, during this assessment staff found that the Polk VIN Decoder only identifies select OHRV models, and reports a high percentage of off-road vehicles as "unknown" because it was designed primarily for on-road vehicles. Furthermore, the Polk VIN Decoder does not include any information on OHRV engine or fuel delivery type.

To provide the most robust evaluation of California's OHRV population, CARB staff developed an internal VIN Decoder as an alternative to the Polk VIN Decoder. The CARB VIN Decoder is a program that searches through lookup tables that list the first 10 digits of each VIN in California's DMV registration database and matches the correct make, model, and vehicle characteristics that influence emissions. The lookup tables used by the VIN Decoder were built on hours of staff time searching through DMV databases and matching the VINs with the correct OHRV makes and models. Staff looked through millions of DMV records and carefully dissected the make and model of OHRVs, then searched online to find additional information about the attributes of each make and model. To confirm that the VIN Decoder was working properly, staff matched the results to manually decoded values from the 2013 DMV database.
The comparison of results indicated that the VIN Decoder had found known values within approximately one percent of manually decoding. The VIN

Decoder, in general, found more values than previous estimates. Staff used results from the VIN Decoder to analyze trends in OHRV sales and technologies, which helped with development of the emissions inventory and the proposed regulatory amendments. The process of CARB's VIN Decoder development is described in detail in Appendix F.

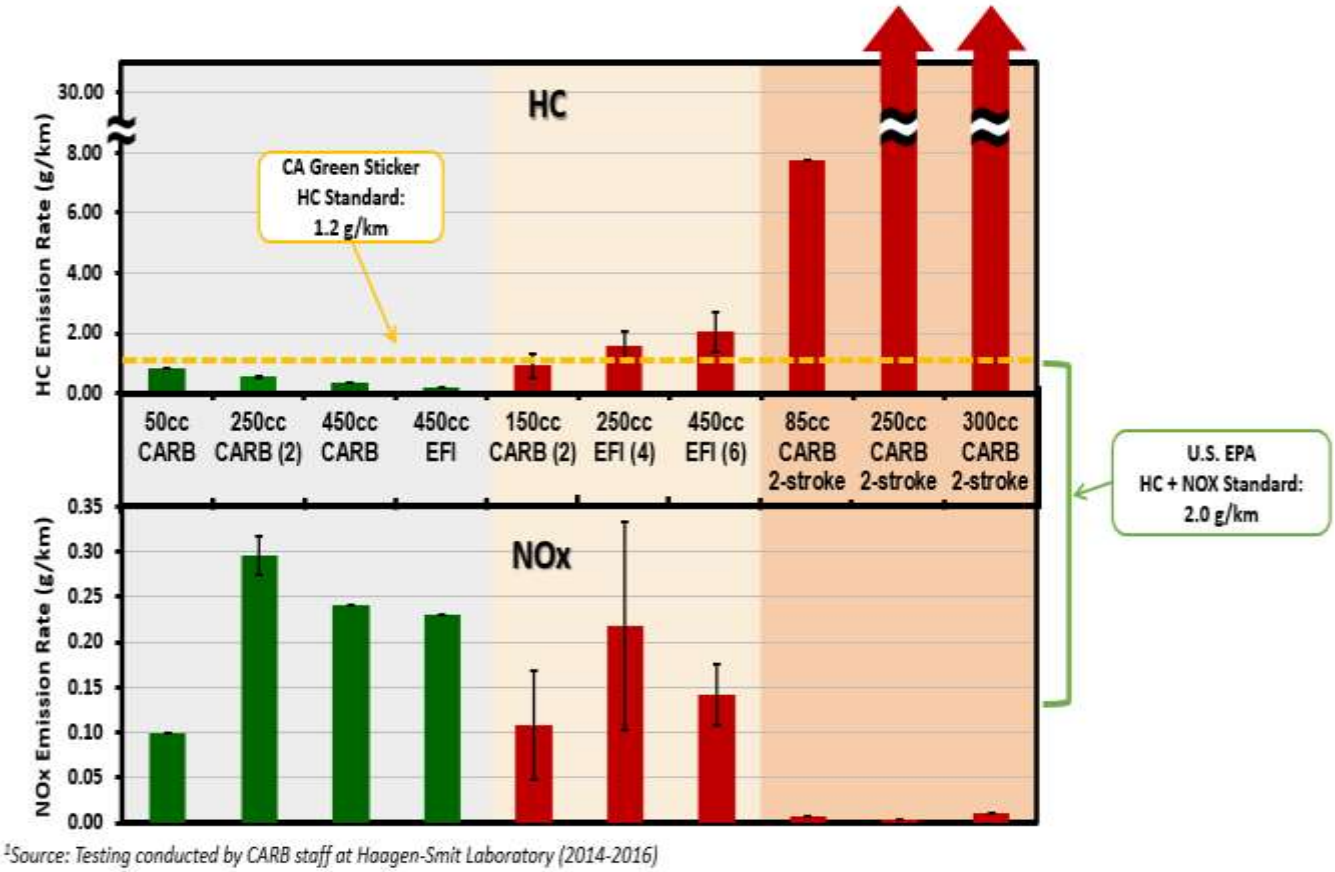
2. Emissions Testing

Because red sticker vehicles are not subject to any exhaust or evaporative emissions standards, limited emissions data is available for these vehicles. As part of the red sticker assessment, staff conducted exhaust and evaporative emissions testing on a range of green and red sticker OHMCs. Results of this testing were used to help staff better understand the various OHMC engine technologies and update emissions factors in the emissions inventory. Staff developed a test plan in coordination with manufacturers and interested stakeholders. The testing was conducted on a variety of OHMC engine technologies such as 2- and 4-stroke, as well as carbureted (CARB) and electronically fuel-injected (EFI) OHMCs. Testing was also conducted on a wide variety of engine displacements and model years (2004-2012), with specific models selected for testing based on their representation in the 2014 DMV database.

Exhaust Test Results

Exhaust testing was performed according to a three-phase Federal Test Procedure (FTP) following the speed profiles according to Code of Federal Regulations (40 C.F.R. §86.515-78). E10 certification fuel was used for testing unless specified differently by the owner. 2-stroke OHMCs were fuel-mixed according to the oil ratio as specified by the vehicle owner. Key exhaust constituents of concern for this test program were the ozone precursors: hydrocarbons (HC) and oxides of nitrogen (NOx). A summary of the test results are show below (Figure II-5). More detailed test results are presented in Appendix E and as part of the Emissions Inventory (Appendix C).

Figure II-5: OHMC Exhaust Test Results



[1]*Source: Testing conducted by CARB staff at Haagen-Smit Laboratory (2014-2016)*

The green bars represent the CARB green sticker certified OHMCs and the red bars represent the red sticker OHMCs. Results are grouped by displacement range, fuel injection type (electronic fuel injection or carbureted), and engine type (two-stroke and four-stroke). For categories where CARB tested more than one vehicle a standard deviation was calculated and error bars were added to indicate the range of emissions from vehicles within that category. The number of vehicles included in each category is indicated by the value in parenthesis on the chart.

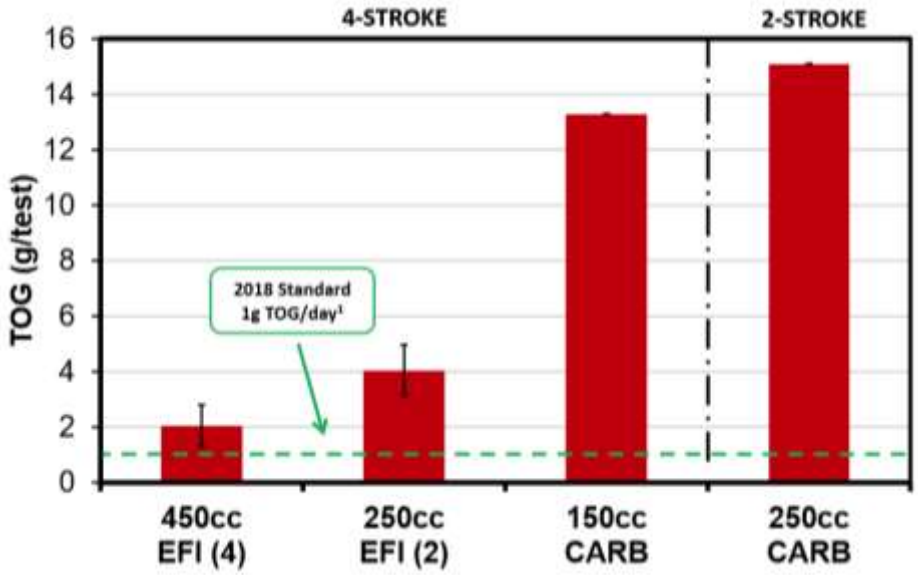
For comparison, the CARB green sticker standard is shown as a dashed yellow line shown on the graph. Test results showed that the current green sticker OHMCs were below the California emissions standard of 1.2 g/km. Red sticker OHMCs with four-stroke engines are very close to the U.S. EPA emissions standard of 2.0 g/km HC+ NOx combined, if not already meeting it. It is likely that these OHMCs will not need significant modifications to meet the U.S. EPA standard. However, additional work may need to be done to meet the current CARB emissions standard. Carbureted two-stroke OHMC were tested and demonstrated significant emissions. The emissions were so high during testing that the values exceeded the limit of the detectors (> 30 g/km). Carbureted two-

stroke engines have emissions well above the current standard, and would likely need extensive modifications to meet the U.S. EPA and CARB standards.

Evaporative Testing Results

Evaporative testing was performed according to CARB *Test Procedure to Determine Evaporative Emissions from Off-highway Recreational Vehicles* (TP-933). TP-933 is a three-day test in a sealed housing for evaporative determination (SHED) that traps and records all hydrocarbons emitted from the vehicle fuel system. CARB LEVIII fuel was used for evaporative testing. Two-stroke OHMCs were fuel-mixed according to the oil ratio as specified by the owner of the vehicle that was loaned to CARB for testing. The key evaporative constituent of concern for this test program was total organic gasses (TOG). A summary of the evaporative test results are show in Figure II-6 and presented in a table in the Emissions Inventory (Appendix C).

Figure II-6: OHMC Evaporative Test Results



Key Findings of Emissions Testing

Testing results for all green sticker vehicles in the program were below the allowable limit for hydrocarbon exhaust (1.2 g/km HC). All the four-stroke red sticker vehicles included in the test program were also fairly close to meeting the exhaust emissions standard, and either met or were very close to meeting the U.S. EPA exhaust emissions standard. Exhaust emissions from two-stroke motorcycles were all much higher than both U.S. EPA's and CARB's allowable limits.

All the vehicles tested in this program had evaporative emissions much higher than the CARB evaporative emissions standard of 1 g/day TOG. This result was not unexpected since the 1g/day standard is only applicable to model years 2018

and later, so the vehicles tested were not designed to comply with this standard. Vehicles with electronic fuel injection (EFI) were fairly close to meeting the standard, while carbureted vehicles showed much higher evaporative emissions. Although data is limited, there does not appear to be a significant difference between evaporative emissions from two-stroke and four-stroke vehicles.

Limitations of the Test Program

The objective of this test plan was to collect emissions data on vehicles that are truly representative of the OHMCs currently in use throughout California. Test vehicles were procured by renting from owners located near CARB's test labs in El Monte, California. CARB staff found it was difficult to locate vehicle owners who were willing to loan their vehicles for testing. Difficulties in procuring specific vehicle years/makes/models led to testing delays, and ultimately forced staff to amend the proposed test matrix and test fewer vehicles. Furthermore, because the selection of vehicles was limited, and each test vehicle's maintenance history is unknown, some of the vehicles tested may not have been in perfect mechanical condition. While mechanical condition can impact emissions levels, test results can generally be included in the development of a statewide emissions rate because the vehicle condition is representative of a certain subset of all OHRV throughout the State.

Exhaust emissions testing of two-stroke motorcycles for this test program proved to be particularly challenging. Ultimately, only three of the six two-strokes models planned to be included in this test program were tested. Of those three vehicles, two of them had emissions that exceeded the limits of CARB's test equipment (30 g/km HC) and as a result could not be accurately measured. Only one of the two-stroke models tested, an 85cc model, yielded results that were suitable for incorporating into the updated emissions inventory. The remainder of two-stroke exhaust emission factors in the updated inventory were derived from other test programs conducted by U.S. EPA and the Southwest Research Institute, as discussed in Appendix C.

The high emitting two-stroke models that were tested contaminated the sample train and test equipment used in CARB's laboratory with a thick, oily residue. This residue required a time consuming clean-up, which prompted CARB staff to cease any further attempts to test two-stroke vehicles. Staff considered installing an exhaust dilution system upstream of the vehicle test system to reduce contamination, but this approach was not feasible within the time allotted for this test program. An image showing how the exhaust sample collection tube was contaminated from a two-stroke motorcycle is shown in Figure II-7.

Figure II-7: Oily Residue from Two-Stroke Motorcycle Exhaust

The drive cycle used for exhaust testing was the Urban Dynamometer Driving Schedule (UDDS) as described in Title 13, California Code of Regulations, section 1958. This drive cycle was selected because it is used for certification and compliance testing under current California and U.S. EPA OHRV regulations. The UDDS was developed to represent urban passenger car driving and may not accurately represent how OHMCs are operated on public lands throughout California. Limited data is available on real world OHMC riding patterns.

3. Owner Survey

To determine usage, activity, and storage, staff also conducted an owner survey. The owner survey sought information regarding various off-highway motorcycle types including green sticker, red sticker, historic (pre-1997), and dual sport. In 2015 and 2016, in conjunction with the University of California, Davis, CARB staff conducted a web survey directed at OHMC owners, with a particular focus on red sticker vehicle owners. As an incentive, a one-day State Parks pass was offered for applicants who completed the owner survey. Staff worked directly with manufacturers and the Motorcycle Industry Council on the survey questions. The survey was sent to 46,427 OHMC owners with a total of 3,245 responses received. An analysis of the spatial distribution of OHMC owners was conducted based on vehicle registration address to ensure that each county was represented by the percentage of population by each specific county. Also, survey postcards were distributed by model year as represented in the DMV database.

The final report for the owner survey, including survey methodology and results, can be found in Appendix D. A figure of the postcard inviting off-highway motorcycle owners to participate in the survey is shown in the Figure II-8.

Figure II-8: OHMC Owner Survey Postcard

The survey produced several key findings that indicated the red sticker program was not working as intended. First, the survey showed that the red sticker program has not been effective in preventing riders from operating high-emitting red sticker vehicles in non-attainment areas during the summertime. Instead, riders simply shift summertime riding to private tracks, private lands, or public lands where riding restrictions are not effectively enforced. This shift is an inconvenience for riders, and results in increased on-road vehicle emissions since people must drive further to find a suitable riding area. Second, the survey also showed that the vast majority (83 percent) of red sticker OHMC operation is recreational riding rather than riding associated with competitive events. Finally, the survey indicated that riders of all OHMC types feel that riding opportunities are becoming increasingly limited, and they are very interested in having access to more riding areas.

Conclusion

At the June 22, 2017, Board meeting, staff provided an informational update to the Board on the findings of the red sticker program assessment. Staff presented results of OHRV population evaluation, emissions testing, and OHMC owner survey. Staff determined that the red sticker program did not work as intended. The Board accepted those results and directed staff to sunset the program and bring OHRV into compliance with applicable emissions standards at the earliest practical opportunity.

C. ESTABLISH ALTERNATIVE EMISSION STANDARDS

As stated above, the red sticker program does not work as intended and should be eliminated. If the program is ended and no new OHVR are certified as red sticker vehicles, all new OHRV would either need to be certified by CARB as meeting proposed emissions standards or be sold only for competition use. This represents a major shift for the OHRV industry in California, and stakeholders have expressed concerns about how the change could adversely impact the industry (see Chapter XI). To alleviate concerns raised by stakeholders, staff developed a proposal that provides manufacturers with sufficient time and flexibility to transition their currently uncontrolled red sticker models to comply with applicable emissions standards.

Staff is proposing to slightly relax emissions standards from the current CARB standard of 1.2 g/km of hydrocarbons to the less stringent U.S. EPA standard of 2.0 g/km of HC+NOx. Results from the recent exhaust testing program of current generation red sticker OHMC indicates that the vast majority of four-stroke red sticker models will be able to meet this standard and obtain certification in 2022 with no modifications using fleet averaging. The fleet averaging exhaust emission standards would allow for a phase-in to more stringent standards in the future as detailed in Table II-1.

Table II-1: Proposed Exhaust Emission Standards

Type	2022-2024	2025-2027	2028+
OHMC	2.0 g/km HC+NOX	2.0 g/km HC+NOX	1.2 g/km HC
ATV/UTV	1.1 g/km HC	1.0 g/km HC	0.9 g/km HC

Staff is also proposing to create alternative evaporative emissions standards from 2020 through 2026 for OHMCs and ATVs. Alternative standards include harmonizing with U.S. EPA permeation requirements (OHMC and ATV Tier III), using a certified on-road motorcycle evaporative control system (OHMC Tier I), and using a design-based evaporative control system (OHMC and ATV Tier II). Under the design-based option, each evaporative emissions control component (fuel hoses, fuel tanks, and carbon canisters) must meet applicable performance standards and be certified by CARB. OHRV manufacturers design their evaporative emissions control systems using certified components. OHRV that are certified under the design-based process are not subject to a full vehicle evaporative emissions standard, which reduces development and certification costs.

While these proposed alternative evaporative emission standards represent a relaxation from current green sticker standards, overall the proposal will significantly reduce evaporative emissions from red sticker models and OHRV as

a whole. Alternative evaporative emissions standards are shown in Table II-2 and Table II-3. The phase-in schedule is presented in Table II-4.

Table II-2: Proposed Alternative Evaporative Emission Standards for OHMC

Tier	*Fuel Tank Permeation Grams/m²/day*	*Fuel Hose Permeation Grams/m²/day*	*Fuel Injection or Automatic Fuel Shutoff(3)*	*Carbon Canister Working Capacity Grams/Liter of Nominal Fuel Tank Volume*
I	Certified per Cal. Code Regs., tit.13, § 2418(a) or 1976(b)(2)			
II	1.5 @ 28°C (82°F)(1)	15.0 @ 23°C (74°F)(1)	Required	1.0(1)(2)
III	1.5 @ 28°C (82°F)(1)	15.0 @ 23°C (74°F)(1)	None	None

(1) Certification and test procedures specified in Cal. Code Regs., tit.13, § 2418(c)(2) and (3)
(2) For motorcycles with engines greater than 110 cc displacement, the carbon canister must be actively purged during engine operation. Motorcycles with engines less than or equal to 110 cc displacement may use either actively purged or passively purged canisters. Active purge refers to ambient air being drawn through a carbon canister by a vacuum created by the intake system. Passive purge refers to ambient air being drawn through a carbon canister by the vacuum created by normal diurnal variations of the fuel tank temperature.
(3) Automatic fuel shutoff is a valve or similar mechanism that completely stops the flow of fuel to the carburetor automatically whenever the vehicle is turned off.

Table II-3: – Proposed Alternative Evaporative Emission Standards for ATVs

Tier	*Fuel Tank Permeation Grams/m²/day*	*Fuel Hose Permeation Grams/m²/day*	*Fuel Injection or Automatic Fuel Shutoff(3)*	*Carbon Canister Working Capacity Grams/Liter of Nominal Fuel Tank Volume*
I	Certified per Cal. Code Regs., tit.13, § 2418(a)			
II	1.5 @ 28°C (82°F)(1)	15.0 @ 23°C (74°F)(1)	Required	1.0(1)(2)
III	1.5 @ 28°C (82°F)(1)	15.0 @ 23°C (74°F)(1)	None	None

(1) Certification and test procedures specified in Cal. Code Regs., tit.13, § 2418(c)(2) and (3).
(2) For ATVs with engines greater than 110 cc displacement, the carbon canister must be actively purged during engine operation. ATVs with engines less than or equal to 110 cc displacement may use either actively purged or passively purged canisters. Active purge refers to ambient air being drawn through a carbon canister by a vacuum created by the intake system. Passive purge refers to ambient air being drawn through a carbon canister by the vacuum created by normal diurnal variations of the fuel tank temperature.
(3) Automatic fuel shutoff is a valve or similar mechanism that completely stops the flow of fuel to the carburetor automatically whenever the vehicle is turned off.

Table II-4: – Proposed Alternative Evaporative Tier Phase-In Schedule

Type	*Tier*	*2020-2021*	*2022-2026*	*2027+*
Off-Road Motorcycles w/ Engines > 110 cc	I	0%	0%	> 50%
	II	0%	0%	50%
	III	100%	100%	0%
Off-Road Motorcycles w/ Engines ≤ 110 cc	II	0%	0%	100%
	III	100%	100%	0%
ATV w/ Engines >110 cc	I	0%	> 80%	> 80%
	II	0%	≤ 20%	≤ 20%
	III	100%	0%	0%
ATV w/ Engines ≤ 110 cc	II	0%	0%	100%
	III	100%	100%	0%

Staff does not propose changing the evaporative emission standards for sport vehicles and utility vehicles since these vehicles were not eligible for the red sticker program and manufacturers have been planning for these vehicles to comply with evaporative emission standards since 2013. Through multiple workshops and working group meetings, staff has determined that the proposed standards are the most cost-effective and feasible to implement. The proposal provides a pathway for manufacturers to certify a wide variety of OHRV, including many models that are currently certified as red sticker vehicles. The proposal will also significantly reduce overall statewide emissions from OHRV, which will help to achieve California's air quality goals.

D. OTHER PROPOSED AMENDMENTS

Other proposed amendments are summarized and detailed in Chapter III. These amendments will facilitate the transition of current red sticker models with no emissions controls to meeting applicable exhaust and evaporative standards. For example, the proposal would relax the maximum allowable limits on individual engine and evaporative family emissions that can be included in a corporate fleet average. The proposal also establishes a streamlined process for certification of OHRV evaporative control components that can be used to create a complete evaporative system. Certification and testing of the full vehicle evaporative system as required under current regulations can be cost prohibitive for certain OHRV models, and design-based certification of evaporative components rather than the complete vehicle evaporative system can achieve emission goals while minimizing testing and certification costs for manufacturers and allowing for a wider variety of models to be available in California.

Finally, a number of minor amendments have also been made to correct typographical errors and provide clarifications that do not affect the intent of the original regulatory requirements.

III. SUMMARY AND RATIONALE FOR CARB'S DETERMINATION THAT EACH ADOPTION IS REASONABLY NECESSARY

In this section, CARB provides a summary of the amendments included in the proposed regulation and the rationale for CARB's determination that each provision of the regulation is (1) reasonably necessary to carry out the purpose of the statutes or other provisions of law that the action is implementing, interpreting, or making specific; and (2) reasonably necessary to address the problem for which the regulation is proposed.

Section 2411. Definitions.[8]

Summary of Amendments to Section 2411(a)(24)
The proposed amendments to this section sets forth that the definition for zero emissions vehicles is referring to off-road vehicles; that zero emission off-road vehicles must be comparable to their internal combustion engine powered counterparts; and that zero emission off-road vehicles does not include golf carts, bicycles, or children's toys.

Rationale of Amendments to Section 2411(a)(24)
It is necessary to set forth the amended definition of zero-emission off-road because the existing definition inadvertently does not specify that it applies to off-road vehicles only. It is necessary to remove existing vagueness in the definition, which does not explicitly preclude the inclusion of battery operated toy vehicles that are not a true equivalent to a traditional OHRV powered by an internal combustion engine. The amendments are necessary to remove this vagueness by specifying that zero-emission off-road vehicles must be comparable to their internal combustion engine powered counterparts and do not include golf carts, bicycles, and children's toys.

Section 2419.4 allows emissions credits for zero emission OHRV, which could be valuable for manufacturers that are working to meet a fleet average emission standard. Staff recognizes the possibility that manufacturers could be motivated to include high sales volume, low cost, battery powered vehicles in their fleet averaging calculations. The zero emissions credits are intended to encourage manufacturers to develop and market zero emissions OHRV that are comparable alternatives to traditional OHRV with internal combustion engines. The intention is not to award credits for scooters, electric bicycles, or children's toys that are not true OHRV. The amended definition is necessary to ensure that credits are

[8] All sections referenced hereinafter are located in California Code of Regulations, title 13.

awarded only to true zero emissions OHRV that replace a comparable internal combustion engine model.

Section 2412. Emissions Standards and Test Procedures – New Off-Highway Recreational Vehicles and Engines.

Summary of Amendments to Section 2412(b)(1)
The proposed amendments to this section modify the table describing the exhaust emissions standards that new off-highway recreational vehicles and engines must meet based on their model year. The amendments separate the existing vehicle and model year column into two columns. The amendments set forth the emissions standards for the following off-highway vehicles: OHMCs, ATVs, off-road sport vehicles, and off-road utility vehicles. The proposed amendments relax emissions standards for OHMC from 2022 through 2027. In 2028, the transition period ends and all OHMC are subject to the more stringent exhaust emissions standards that today only apply to green sticker OHRV. Exhaust standards for ATV, sport vehicles, and utility vehicles become slightly more stringent from 2022 through 2027. Due to amendments to other sections described below, these standards apply to all OHRV starting in 2022 such that going forward no OHRV could be certified as red sticker and not comply with exhaust emissions controls.

Rationale of Amendments to Section 2412(b)(1)
The proposal includes slightly lower exhaust standards for OHMC in model years 2022 through 2027, which is necessary to encourage manufacturers to certify as many models as possible rather than remove those models from the California marketplace. The proposed standards would be relaxed for off-road motorcycles from the current standard of 1.2 gram hydrocarbon per kilometer to 2.0 grams per kilometer hydrocarbon + NOx for model years 2022 through 2027. This is identical to the current U.S. EPA exhaust standard, meaning that manufacturers are already marketing a broad range of compliant vehicles nationwide. Harmonizing with U.S. EPA exhaust standards will allow OHMC manufacturers to make available in California the same models they offer in the rest of the nation. Furthermore, if manufacturers choose to redesign their current high-emitting red sticker models to meet the proposed standard, that model should also be eligible for U.S. EPA certification and sale in all 50 states.

The proposed exhaust standards for ATV, sport, and utility vehicles will become incrementally more stringent, from the current 1.2 grams per kilometer HC in 2021 to 0.9 grams per kilometer HC in 2028. These standards were proposed based on a comprehensive review of vehicle certifications from 2014-2018. Manufacturers are already meeting the proposed exhaust standards on a fleet averaged basis, so the proposal does not impose a technical or cost burden on the industry.

OHRV manufacturers confirmed to CARB staff that the proposed exhaust standards could be met with current technologies. While the proposal is not technology forcing, it will serve to prevent manufacturers from backsliding on emissions controls and marketing dirtier OHRV in future years. The small reduction in the exhaust emissions standard for ATV, sport, and utility vehicles will also help to offset the small increase in emissions that could result from raising California's OHMC exhaust emission standard for 2022 through 2027.

Summary of Amendments to Section 2412(c)(1)(B)

The proposed amendment ends the red sticker program by providing that only off-road motorcycles and all-terrain vehicles for model years 2021 or earlier are not required to perform emissions testing. Therefore, all OHRV models after 2022 must comply with applicable emissions standards and red sticker certification will no longer be an option.

Rationale of Amendments to Section 2412(c)(1)(B)

The red sticker program allows for certification of OHRV that do not meet emissions standards, which is harmful to California's air quality and presents administrative challenges as described in Section II of this report. It is necessary to end the red sticker program so that the total statewide population of non-emissions compliant red sticker vehicles will gradually decrease over time as existing vehicles wear out, break down, and are taken out of active use. As the population of red sticker vehicles decreases, the emissions benefit of enforcing seasonal riding restrictions on those vehicles decreases as well, and therefore CARB staff proposed to remove riding restrictions in proposed sections 2412(f) and 2415.

It is necessary to end the red sticker program in model year 2022 because that is the earliest practical date that the red sticker program could be eliminated without adversely affecting the OHRV industry. An earlier implementation date would not allow manufacturers adequate time to change their compliance plans for their current red sticker models, increasing the likelihood that more models would be removed from the California marketplace.

After 2022, manufacturers will have three options for their former red sticker models: 1) update a formerly red sticker OHRV model to meet applicable emissions controls and certify the model for sale in California, 2) market the model as exempt for competition use only, or 3) remove the model from the California marketplace. The removal of red sticker models from the marketplace may have a small financial impact on a large OHRV manufacturer, but could be significant for the California-based OHRV dealer who finds themselves with a reduced number of models to sell. To avoid an outcome where a significant number of models normally sold in the California marketplace could not meet emissions standards and would be removed from the marketplace, this regulation proposal includes other amendments that relax emissions standards for certain pollutants for a specified short period of time and encourage certification with

alternative test procedures and increased zero emission vehicle credits. This should allow manufacturers time to modify their fleets to meet emissions standards, thus minimizing or avoiding disruption to OHRV model availability and negative impacts on OHRV dealers.

Summary of Amendments to Section 2412(d)(1) and (d)(1)(A)
The proposed amendments establish the maximum allowable emission from an engine family that is included in a manufacturer's overall fleet emissions average. The maximum values for HC+NOx (20g/km) and carbon monoxide (50 g/km) are consistent with U.S. EPA regulations. Amendments to Section 2412(d)(1)(A) specify that zero-emission off-road vehicles shall be assigned an HC or HC + NOx exhaust emission standard of negative 1 (-1) for purposes of calculating the "corporate average" of a fleet's emissions.

Rationale of Amendments to Section 2412(d)(1) and (d)(1)(A)
It is necessary to amend Section 2412(d)(1) and (d)(1)(A) to specify maximum allowable exhaust emission values for engine families within a corporate fleet average, and to increase the value of zero emissions vehicles when calculating the corporate fleet average. These amendments will provide flexibility to manufacturers as they transition from uncontrolled red sticker vehicles to certified models with emission controls. The amendments will also encourage manufacturers to more actively develop and market zero emissions OHRV in California. Zero emissions vehicles will be assigned an emissions rate of negative one rather than zero as provided under the current regulation. This will help to ensure a wide range of certified OHRV since the negative emission rate for zero emission vehicles could be used by manufacturers to offset emissions from higher performance models that may not otherwise be eligible for certification under the current standards.

Summary of Amendments to Section 2412(f)
The proposed amendments to this section set forth that the riding restrictions in section 2415 only apply to off-road motorcycles and ATVs of model years 2003 through 2021, until January 1, 2025.

Rationale of Amendments to Section 2412(f)
Amendments to section 2412(f) are necessary to clarify that the riding restrictions applicable to red sticker off-road motorcycles and ATVs only apply to model years 2003 through 2021 and until January 1, 2025. The red sticker program is proposed to end under amendments to section 2412(c)(1)(B) for model years 2022 and thereafter, therefore the riding restrictions only apply to those red sticker models certified before that date, which are model years 2003 through 2021. Also, the riding restrictions set forth in section 2415, are proposed to be lifted starting on January 1, 2025 under amendments to that section. As such, section 2412(f) must be amended for consistency. As described in the rationale for the amendments to section 2415, the riding restrictions will no longer be

necessary to achieve air emissions goals as the use of red sticker vehicles decreases over time.

Section 2415. California Off-Highway Vehicle Areas and Riding Season for Off-Highway Recreational Vehicles and Use Restrictions.

Summary of Amendments to Section 2415
The proposed amendments to this section will lift public land seasonal riding restrictions for red sticker OHRV starting on January 1, 2025, allowing those vehicles to be operated year-round, unless restricted by the designated Public Land Management Agency. Amendments to section 2415(a) set forth that the riding restrictions apply only to red sticker vehicles model year 2003 through 2021 because the program is porposed to end under amendments to section 2412(c)(1)(B). A new subsection 2415(c) is proposed to specify that the riding restrictions set forth in section 2415 only apply through December 31, 2024, and are no longer applicable thereafter.

Rationale of Amendments to Section 2415
Amendments to section 2412(f) are necessary because red sticker riding restrictions will no longer be necessary to achieve air emissions goals as the use of red sticker vehicles decreases over time. The proposed additions to section 2415 in subsections (a) and (c) establish the end of the riding restrictions and are consistent with the language proposed in section 2412(f). Implementing seasonal riding restrictions requires resources from land management agencies, so lifting those riding restrictions will allow those agencies to reallocate staff time to other priorities. Lifting riding restrictions will also be a benefit to red sticker vehicle owners as it will provide additional recreational riding opportunities that are not available under the current regulations. Staff has estimated that lifting seasonal riding restrictions will increase statewide summertime hydrocarbon emissions by about ¼ ton per day. This increase in emissions will gradually shrink over time as existing red sticker vehicles reach the end of their useful life and are taken out of service. By January 1, 2025, the emission benefits achieved by ending red sticker certification of new models and selling cleaner OHRV starting in 2022 will outweigh the emissions increase from lifting riding restrictions for existing red sticker models.

Section 2416. Applicability.

Summary of Amendments to Sections 2416(b)(3)
The proposed amendment to this section sets forth that zero-emission *off-road* vehicles are exempt from being certified under section 2419.4, except when optionally certified to generate advanced fuel system credits.

Rationale of Amendments to Sections 2416(b)(3)
Amendment to section 2416(b)(3) is necessary because the term zero-emission vehicles is proposed to be updated in the definitions section 2412 to clarify the

definition as zero-emission *off-road* vehicles. This amendment is a non-substantive clarifying amendment.

Summary of Amendments to Section 2416(b)(4)
The proposed amendment to this section sets forth that only red sticker certified OHRV model years 2003-2021 are exempt from being certified pursuant to section 2419.4. This amendment establishes that OHRV models 2022 and thereafter must be compliant with evaporative control regulations set forth in 2419.4.

Rationale of Amendments to Section 2416(b)(4)
The amendments to section 2416(b)(4) is necessary to set forth that only OHRVs of model year 2003 through 2021 certified as red sticker are exempt from the evaporative emissions control requirements set forth in section 2419.4. Proposed amendments to sections 2412 and 2415 would end CARB certification of red sticker vehicles without emissions controls starting with model year 2022. Therefore, this amendment is necessary to establish that OHRVs of model year 2022 and thereafter must comply with evaporative emissions control requirements in section 2419.4.

Section 2418. Evaporative Emissions Standards and Test Procedures.

Summary of Amendments to Section 2418(a)(2)
The proposed amendment to this section sets forth that the term zero-emission vehicles is referring to *off-road* vehicles.

Rationale of Amendments to Section 2418(a)(2)
Amendment to section 2418(a)(2) is necessary because the term zero-emission vehicles is proposed to be updated in the definitions section 2412 to clarify the definition as zero-emission *off-road* vehicles. This amendment is a non-substantive clarifying amendment.

Summary of Amendments to Section 2418(c)
The proposed amendments to section 2418(c)(2)(i) specify that fuel hose permeation may alternatively be tested in accordance with section 2412(c)(1) for purposes of determining an OHRV's compliance with the evaporative emission standards. The proposed amendments to section 2418(c)(3) specify that compliance with the design-based standards set forth in section 2418(b) for small volume OHRV manufacturers shall be determined in accordance with section 2856(a)(3).

Rationale of Amendments to Section 2418(c)
The proposed amendments to section 2418(c)(2)(i) are necessary to reduce costs of certifying low permeation fuel hoses. The amendments allow for permeation testing to be conducted in accordance with federal test procedures that are required by U.S. EPA for certification, which is set forth in section

2412(c)(1). The applicable federal test procedures are equally stringent to the procedures currently allowed by CARB regulations, and it is therefore appropriate to allow their use for certification in California as well. This will eliminate duplicative testing requirements between CARB and U.S. EPA, which will in turn reduce testing costs for manufacturers.

The proposed amendments to section 2418(c)(3) are necessary to establish a certification procedure for the new design-based evaporative certification standard proposed in section 2418(b). (Proposed alternative standards ATV Tier II and OHMC Tier II are design-based.) Under the design-based evaporative standard, each evaporative emissions control component (fuel hoses, fuel tanks, and carbon canisters) must meet applicable performance standards and be certified by CARB. OHRV manufacturers must design their evaporative emissions control systems using certified components. OHRV that are certified under the design-based process are not subject to a full vehicle evaporative emissions standard, since the system is comprised of certified components with known performance characteristics.

Certification procedures are required to enforce a CARB regulation. Certification procedures for the current 1g/day TOG standard and the on-road motorcycle evaporative standard are well established. Staff is now proposing to add a new design-based certification option for some OHMC and small ATV, so new certification procedures must be established. The certification procedures require manufacturers to test their evaporative components and provide CARB with information ensuring that those components meet applicable standards. The proposal references the design-based certification program currently in place for Spark-Ignition Marine Watercraft (SIMW), which is described in California code of Regulations, title 13, section 2856. The SIMW evaporative component certification program is well established and can readily be applied to OHRV components.

Summary of Amendments to Section 2418(d)(7)

The proposed amendments to section 2418(d) specifies that off-road motorcycles and ATVs for model years 2020 and 2021 certified with the alternative evaporative standards under section 2418(e) may not be included in a manufacturer's phase-in calculation.

Rationale of Amendments to Section 2418(d)(7)

The proposed amendments to section 2418(d) are necessary because current OHRV evaporative control regulations require manufacturers to sell at least 75 percent of their OHRV from 2018 through 2021 that comply with the 1g/day TOG emissions standard. The remaining 25 percent of OHRV sold by each manufacturer from 2018 through 2021 can be certified even though they do not meet the 1g/day TOG standard. The proposed amendments to section 2418(e) establish alternative evaporative emissions standards. Section 2418(d)(7) clarifies that vehicles certified to the alternative standard cannot be included in

the calculation of 75 percent compliance required under the current regulation. Without this clarification, manufacturers may attempt to include vehicles certified to the new alternative standard as part of their 75 percent compliance number, which would undermine the intent of the existing regulation and result in increased evaporative emissions.

Summary of Amendments to Section 2418(e)

The proposed new subdivision 2418(e) provides a new alternative emissions standard for off-road motorcycles and ATVs that manufacturers may comply with in lieu of the standards set forth in section 2418(a). From 2020 through 2026, evaporative requirements for all OHMC will be harmonized with U.S. EPA requirements: low permeation tanks and hoses. This standard will also apply to all ATV from 2020-2021 and youth model ATV (less than or equal to 110cc engine displacement) from 2020 through 2024.

From 2020 through 2021, full sized ATV (greater than 110cc engine displacement) can certify to the "ATV Tier II" standard rather than the current 1g/day TOG standard. The Tier II ATV standard requires low permeation fuel tank, low permeation fuel hoses, fuel injection or an automatic fuel shut-off to the carburetor, and a carbon canister to capture fuel vapors. From 2022 onward, at least 80 percent of each manufacturer's full sized ATV must meet the 1g/day TOG standard. The remaining full sized ATV (up to 20 percent of the manufacturer's total full sized ATV sales for each year) can be certified to the ATV Tier II standard.

In 2027, OHMC manufacturers will need to incorporate additional evaporative controls in order to obtain CARB certification. At least 50 percent of each manufacturers' OHMC sold in each model year from 2027 onward must be equipped with "OHMC Tier I" evaporative controls: either the 1 g/day TOG standard or certified pursuant to the on-road motorcycle evaporative requirements.

Rationale of Amendments to Section 2418(e)

The proposed new subdivision 2418(e) is necessary because, under current regulations, all certified OHRV are required to comply with a full vehicle evaporative emissions limit of 1 gram per day of total organic gasses (1g/day TOG). Alternatively, manufacturers can market their OHMC and ATV as red sticker vehicles, which are exempt from the 1g/day TOG standard. The 1g/day TOG standard is applicable in California only, which is a relatively small part of the global OHRV market. Given the small market and technical challenges of meeting the 1g/day TOG standard, several manufacturers have opted to certify their formerly emissions compliant models as red sticker models rather than redesign them to meet the California-specific evaporative control requirements.

The proposed amendments will end certification of new red sticker models starting in 2022, leaving manufacturers with three options for their former red

sticker models: 1) certify the model as compliant with applicable emissions standards, 2) market the model as exempt for competition use only, or 3) remove the model from the California marketplace. Removing a significant number of models from the California marketplace could have a detrimental effect on OHRV dealers who would have limited products to sell, as well as riders who may not have access to compliant models that meet their performance expectations.

Section 2418(e) provides alternative evaporative emissions standards from 2020 through 2026 that are intended to allow for manufacturers to bring a full range of emissions compliant OHRV models to the California market when the red sticker program is ended in 2022, while still providing significant control of evaporative emissions from OHRV.

Staff discovered during 2018 regulation development workshops[9] that the significant cost of OHRV model redesigns to meet existing evaporative controls by 2022 when the red sticker program is proposed to end would likely lead to models leaving the California marketplace, affecting California dealers and consumers. To ensure adequate OHRV model availability, CARB staff developed alternative evaporative requirements that would allow for a smooth transition from red sticker while also reducing overall emissions from OHRV.The proposal allows OHMC, which comprise the vast majority of red sticker vehicles, to harmonize with existing U.S. EPA standards. California-specific evaporative standards for OHMC only come into effect starting in 2027.

Additionally, from 2027 onward, the proposal provides manufacturers with options on how to design and certify their evaporative systems, either using the current 1g/day TOG standard, the current on-road evaporative certification standard, or a component-based standard where each evaporative control component (tank, hose and carbon canister) is certified individually. These alternative approaches cost far less than the current 1g/day TOG requirement, while still resulting in control systems that significantly reduces evaporative emissions as compared to the U.S. EPA standard.

Staff worked with manufacturers through numerous workshops and meetings and determined that it was particularly challenging to meet the current 1g/day TOG evaporative standard for youth model ATV and OHMC, which typically have engines of 110cc or less. This is due to several factors. First, these smaller youth models are generally carbureted rather than fuel injected. Second, they are typically redesigned less frequently than larger models. Third, they are less expensive and sales are more sensitive to the small price increases associated with adding emissions controls. Finally, the smaller engines on these vehicles are less efficient at purging trapped fuel vapors from a carbon canister, which makes it very difficult to pass the 1g/day TOG certification test. Since these

[9] E.g., CARB Staff presentation, Red Sticker Regulatory Proposal Workshop (May 2018), available at https://www.arb.ca.gov/msprog/offroad/orrec/redsticker_proposal.pdf?_ga=2.240005057.358421209.1546440966-650131737.1508518244

youth models are a small percentage of the manufacturer's fleet, and they generally have very small fuel tanks, they do not create a significant amount of evaporative emissions as compared to larger vehicle categories. Therefore, staff has proposed less stringent evaporative standards for youth ATV and OHMC than for their full sized counterparts.

Section 2419.4. Evaporative Emissions Control System Testing and Certification Requirement.

Summary of Amendments to Section 2419.4(b)(1)(A)
The proposed amendment to this section 2419.4(b)(1)(A) sets forth that the term zero-emission vehicles is referring to off-road vehicles.

Rationale of Amendments to Section 2419.4(b)(1)(A)
Amendment to section 2419.4(b)(1)(A) is necessary because the term zero-emission vehicles is proposed to be updated in the definitions section 2412 to clarify the definition as zero-emission off-road vehicles. This amendment is a non-substantive clarifying amendment.

Summary of Amendments to Section 2419.4(c)(1)
The amendment to section 2419.4(c)(1) clarifies that an OHRV manufacturer is eligible for advanced fuel system credits for those OHRV evaporative families that are subject to section 2418(a).

Rationale of Amendments to Section 2419.4(c)(1)
The amendment to section 2419.4(c)(1) is necessary to set forth that only those OHRV that are certified to the 1g/day TOG standard of section 2418(a) can be included in the calculation of advanced fuel system credits outlined in section 2419.4(c).

Summary of Amendments to Sections 2419.4(c)(1)(A), (B) and (C)
The amendments to these sections set forth that the term zero-emission vehicles is referring to off-road vehicles.

Rationale of Amendments to Section 2419.4(c)(1)(A), (B), and (C)
These amendments to section 2419.4(c)(1)(A), (B), and (C) are necessary because the term zero-emission vehicles is proposed to be updated in the definitions section 2412 to clarify the definition as zero-emission off-road vehicles. This amendment is a non-substantive clarifying amendment.

Summary of Amendments to Section 2419.4(c)(1)(C)
The amendment to section 2419.4(c)(1)(C) establishes that the TOG diurnal credit awarded to certified zero-emission off-road vehicles will be increased from 0.75 to 1.5.

Rationale of Amendments to Section 2419.4(c)(1)(C)

The amendment to section 2419.4(c)(1)(C) is necessary to provide a modest additional credit for zero-emission OHRV to offset higher emitting models to encourage zero-emission off-road vehicle development. The credit will go from 0.75 to 1.5 TOG diurnal credit. Current OHRV evaporative regulations include provisions allowing a manufacturer to average evaporative emissions across their entire fleet of OHRV. This updated provision is intended to encourage the development of zero emissions OHRV while allowing manufacturers some flexibility in how they apply evaporative emissions to their various OHRV models in a given model year.

As of 2018, no manufacturers are taking advantage of the evaporative fleet averaging provisions. Several manufacturers have opted to shift models to the red sticker program rather than incorporate compliant evaporative emission controls. However, with the red sticker program ending in 2022, manufacturers will need to reconsider how to bring their OHRV fleet into compliance. Staff expects that fleet averaging will be valuable means for manufacturers to transition their vehicles to certified status. The proposed changes enhance the current fleet averaging program, further helping to ensure a wide range of certified OHRV once the red sticker program ends.

Summary of Amendments to Section 2419.4(c)(1)(F)

Section 2419.4(c)(1)(F) is proposed to be deleted to eliminate the existing maximum allowable limit for an individual evaporative family within a manufacturer's fleet average. The remaining subdivisions are renumbered to account for the deleted subsection 2419.4(c)(1)(F).

Rationale of Amendments to Section 2419.4(c)(1)(F)

The amendment to section 2419(c)(1)(F) is necessary to eliminate the current maximum allowable limit for an individual evaporative family within a manufacturer's fleet average. Several manufacturers have indicated that they have a small number of low sales-volume OHRV models that they are planning to remove from the California market rather than undergo the expense of bringing them into compliance with the 1g/day TOG standard. These manufacturers also have high sales-volume OHRV models that are well below the 1g/day TOG standard. By eliminating the current cap on maximum emissions allowable for an individual evaporative family, the fleet averaging provisions should allow the low sales-volume models to stay in the California marketplace while still meeting the 1g/day TOG standard overall.

IV. BENEFITS ANTICIPATED FROM THE REGULATORY ACTION, INCLUDING THE BENEFITS OR GOALS PROVIDED IN THE AUTHORIZING STATUTE

CARB staff anticipates benefits to the health and welfare of California residents and the State's environment but does not anticipate any costs or benefits to worker safety. CARB anticipates that the proposed amendments will have the following general benefits to California individuals and businesses:

- Reduced criteria pollutant and toxic air contaminants. Requiring uncontrolled red sticker OHRV to meet exhaust and evaporative emissions standards will reduce overall ROG and NOx for the OHRV category.
- Reduced greenhouse gas (GHG) emissions. By enhancing incentives for the production of zero emission vehicles in each manufacturer's fleet averaging, it is anticipated that more widespread development and marketing of zero emission OHRV will reduce fuel consumption and associated GHG emissions. Additionally, increased use of fuel injection technology and reduction of ROG emissions are also expected to reduce creation or formation of GHGs and provide climate benefits.

In the following sections, staff describes the estimated benefits of the proposed amendments.

A. REDUCED CRITERIA POLLUTANT AND TOXIC AIR CONTAMINANTS

Improvements in California air quality under the proposed amendments are anticipated to result in health benefits for California individuals. These health benefits include reduced cardiopulmonary mortality, hospitalizations for cardiovascular illness, respiratory illness, emergency room (ER) visits for respiratory illness, and ER visits for asthma. The proposed amendments will affect air quality by reducing emissions in two distinct ways: 1) tailpipe emissions from OHRV during operation and 2) diurnal evaporative emissions from OHRV during storage.

Staff estimates that requiring emissions control standards will effectively control evaporative and exhaust emissions by about 50 percent. Requiring engines to be fuel injected and applying evaporative and exhaust emissions controls will result in additional emission benefits above those already achieved through the seasonal restriction of red sticker OHMCs. California's SIP requires that all mobile sources be reduced by nearly 50 percent in 2042 for reactive organic gases (ROG). Based on the latest OHRV emissions inventory model (RV2018), staff estimates the proposed rule will provide the ozone season ROG and NOx emissions reductions shown in Table IV-1, in tons per day (TPD):

Table IV-1: Summer ROG + NOx Emissions Reductions in 2042[1]

San Joaquin Valley Air Pollution Control District	1.03 tons/day
South Coast Air Quality Management District	0.37 tons/day
Statewide	6.35 tons/day

[1] Target year for meeting reductions in South Coast and San Joaquin Valley in the mobile source strategy.

B. REDUCED GHG EMISSIONS

The proposed amendments could result in reduced GHG emissions as a result of allowing for the flexibility of fleet averaging and incentivizing zero emissions vehicles; improved engine efficiency and reduced in-use fuel consumption; and indirect effects of reduction of ROG emissions.

Manufacturers may choose to produce zero emission vehicles to offset emissions from higher emitting models. Some manufacturers may choose to keep high performance models if they expect that sales are cost efficient in their business model. The reduction of GHG emissions are dependent upon the number of zero emission vehicles sold. It is not possible to predict the exact path that manufacturers may choose to follow for certification of zero emissions vehicles, if any. Therefore, quantifying the fuel saving and corresponding GHG reductions achieved by this proposal is not possible.

Improved engine efficiency and reduced in-use fuel consumption associated with the wider use of fuel injection technology could also reduce GHG emissions. Since fuel injection engines tend to be substantially more fuel-efficient, the shift away from carburetor technology could yield substantial benefits in terms of reduced fuel consumption, and therefore, emissions of carbon dioxide, however this cannot be quantified at this time.

Additionally, indirect reduction of climate impacts could occur as a result of reduction of ROG emissions. ROG emitted into the atmosphere is oxidized within a relatively short timeframe and as a result exerts substantial climate impacts through its effects on atmospheric chemistry (Collins et al., pp.453-476). These indirect impacts are mediated through changes in the concentrations of tropospheric ozone and methane. For example, curtailment of tropospheric ozone associated with ROG emissions reductions is a climate benefit, because tropospheric ozone is currently associated with radiative forcing of approximately 0.39 Watts per square meter, W/m^2 (Shindell et al., 2005). Similarly, ROG perturbs atmospheric chemistry such that methane has a longer atmospheric lifetime. Since methane is the second most important of the relatively long-lived GHGs tabulated by the Intergovernmental Panel on Climate Change (Section 2.3.2) in terms of radiative forcing, avoiding ROG emissions and the associated

impacts on methane's atmospheric lifetime constitute a climate benefit. Though again, at this time it is not possible to quantify the climate benefits of this proposal.

V. AIR QUALITY

A. ROG EMISSIONS REDUCTIONS AND ENFORCEMENT

The primary air quality benefit associated with the proposed amendments is the reduction of ambient ozone concentration achieved by reducing emissions of ROG from red sticker OHRVs. The determination of the reduction of emissions is generated through extensive staff work of the updated emission inventory (Appendix C). The RV2018 emissions inventory was recently updated for this rulemaking, which includes an updated population, additional emission testing, and a usage and storage survey of red sticker OHMC owners.

Below are descriptions of the pollutants of interest in this chapter.

- Criteria Air Pollutants: Criteria air pollutants are determined to be hazardous to human health and are regulated under U.S. EPA's National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require U.S. EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime. Both the California and federal governments have adopted health-based standards for the criteria pollutants that include ozone, particulate matter (PM10, PM2.5), carbon monoxide (CO), oxides of nitrogen (NOx), oxides of sulfur (SOx), and volatile organic compounds (VOC).

- Toxic Air Pollutants: Toxic air pollutants (also referred to as toxic air contaminants [TAC], or air toxics) are those pollutants which may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health but are not regulated as criteria pollutants. Air toxics are usually present in minute quantities in the ambient air. However, their high toxicity or health risk may pose a threat to public health even at very low concentrations.

In this section, staff provides an overview of the air quality analysis and the major findings from the RV2018 emissions inventory. The emissions inventory includes methodologies and assumptions, which have been updated since the 2013 rulemaking emission inventory (RV2013). The RV2018 emissions inventory includes updates to population, survival rate, activity, emissions factors, allocation and other input factors. Since sales of red sticker ATVs are minimal compared to red sticker OHMCs because most ATV models have already transitioned to green sticker, the focus of the RV2018 emission inventory

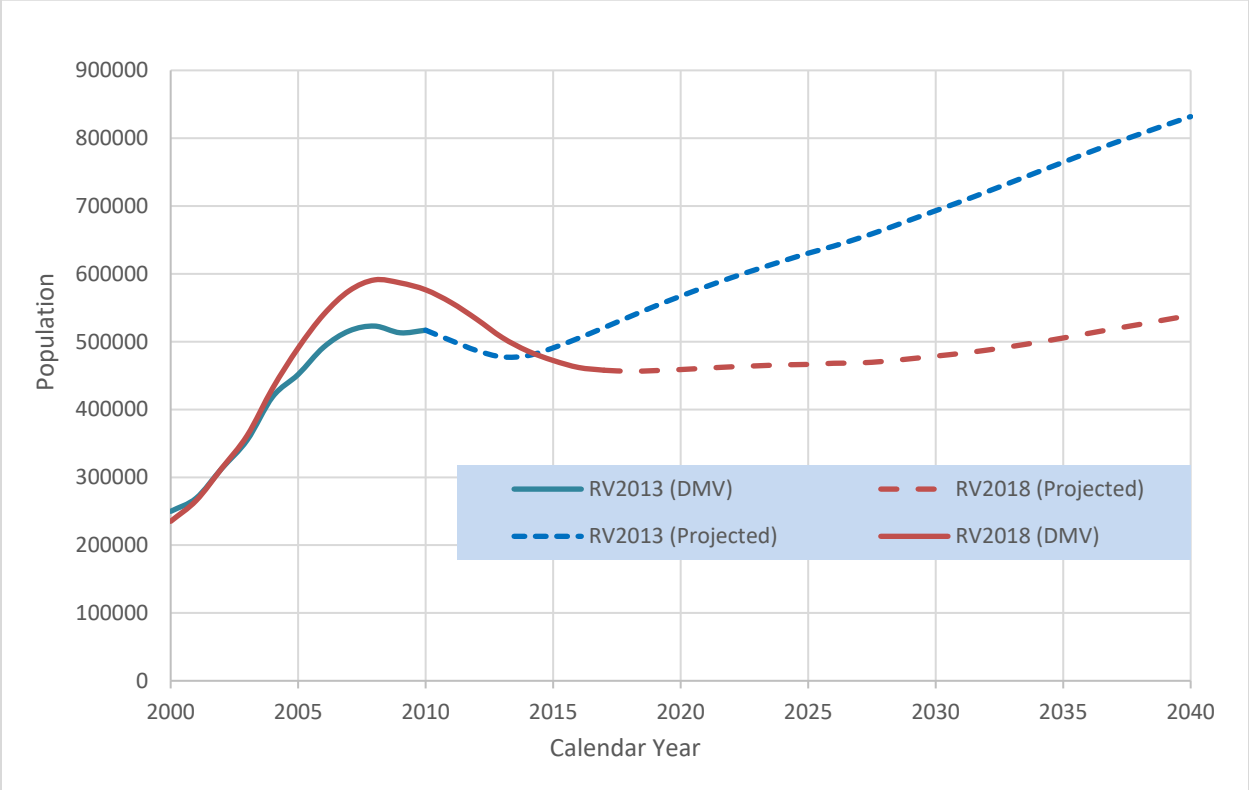
methodology is on OHMCs. The details of the emissions inventory can be found in Appendix C.

1. Population Trends

The California DMV registration database was evaluated by CARB staff to determine the population of OHRV in California, as well as vehicle attributes (engine size, fuel induction technology, etc.) that impact emissions. Staff evaluated millions of DMV records and created extensive lookup tables with detailed attributes of the newer OHRVs. Staff also created an exclusive VIN Decoder that compares the lookup tables to the DMV database to get the most robust population counts. (Refer to Chapter II and Appendix F for additional details on the VIN Decoder).

The comparison of the OHMC population from RV2013 model to the updated RV2018 version is shown in Figure V-1.

Figure V-1: Updated OHMC Population

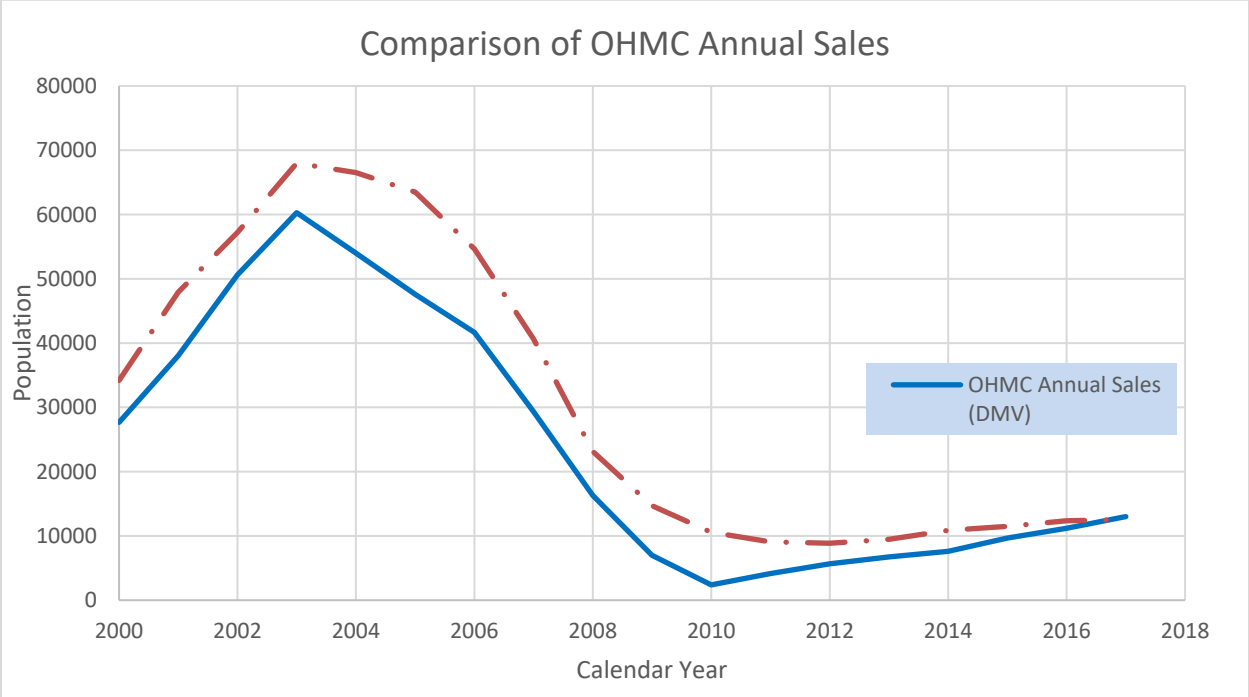


There are currently over 458,000 OHMCs registered in California. From CY 2004-2014, the population increased from the previous version of the emission inventory population. The updated in-house VIN Decoder was able to find more

OHMCs versus the past VIN Decoders utilized by Polk Associates. Staff also evaluated survival rates (rates at which the population is scrapped) to predict the population as it changes over time. Staff also used industry forecast models to predict the population growth.

To verify the model with data from other sources, staff compared the RV2018 to annual sales reported by MIC. The comparison of data from RV2018 to MIC is shown in Figure V-2. The annual sales figures from MIC are slightly higher than CARB's RV2018 estimate. Some of this difference is due to the fact that MIC's number is based on annual sales while CARB's number is based on the total count of OHRV for each model year within the registration database. For example, a model year 2017 vehicle that is sold in calendar year 2018 will show up in MIC's count as a 2018 sale, while CARB will count it as a 2017 vehicle. MIC's sales number will also include vehicles that were sold in California but were registered in other states or not registered at all.

Figure V-2: OHMC Sales (RV2018 vs MIC)



2. Emissions Factors

In order to calculate the total emissions from OHMCs in California, emission factors must be determined and evaluated. Staff used previous test data from other sources and in-house data to average emissions factors across multiple

categories and horsepower ranges. An example of RV2018 emission factors are presented in Figure V-3. A more detailed analysis of the exhaust and evaporative emission factors are presented in the updated emission inventory (Appendix C).

Figure V-3: OHMC Emission Factors

Vehicle Type	MY Group	Engine	Hot Start (g/event)	Diurnal (g/day)	Resting (g/day)	Running (g/hr)
OHMC - Green	2007 and before	CARB	3.12	12.23	6.59	1.07
	2008-2017		2.37	9.29	5.01	0.81
	2018		1.29	4.94	2.66	0.41
	2019		0.75	2.76	1.49	0.22
	2020		0.75	2.76	1.49	0.22
	2021 and after		0.21	0.58	0.31	0.02
OHMC - Red	all years	CARB	3.12	12.23	6.59	1.07
OHMC - Green	2007 and before	FI	3.12	0.86	0.46	1.07
	2008-2017		2.37	0.86	0.46	0.81
	2018		1.29	0.58	0.31	0.41
	2019		0.75	0.58	0.31	0.22
	2020		0.75	0.58	0.31	0.22
	2021 and after		0.21	0.58	0.31	0.02
OHMC - Red	all years	FI	0.56	1.72	0.92	1.07

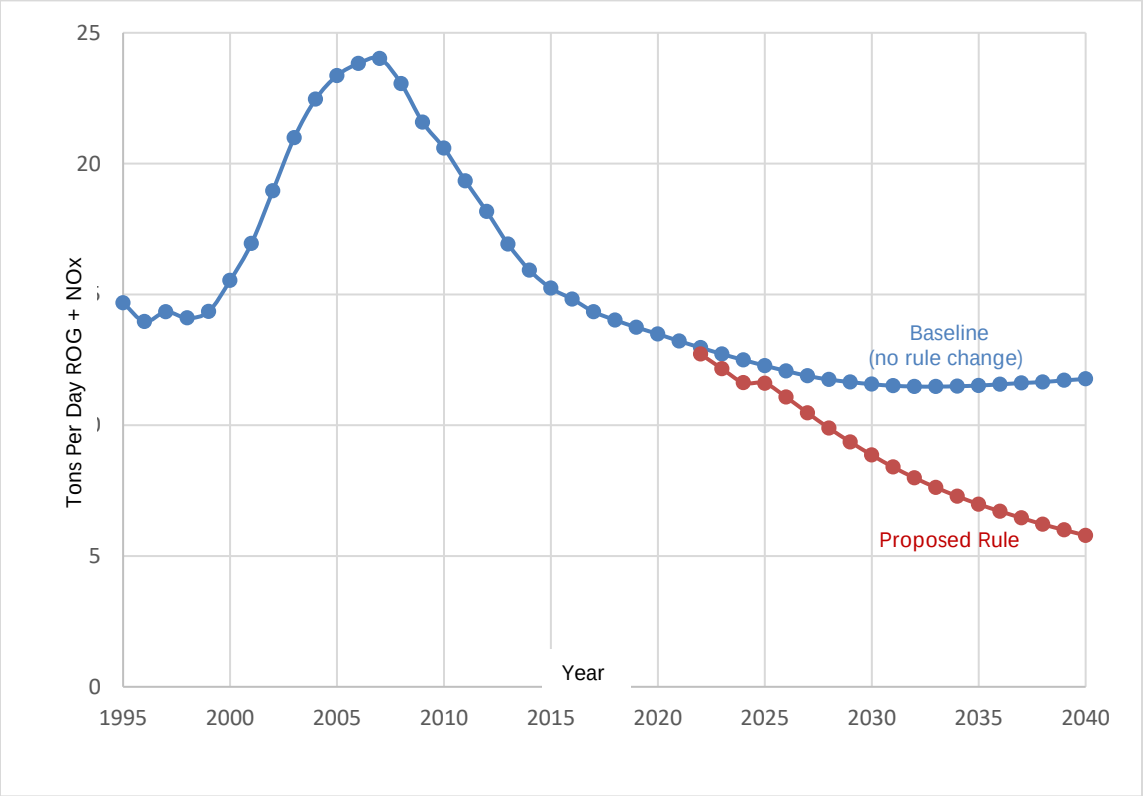
3. Baseline Emissions

In addition to the emission factors, staff evaluated other factors that affect emission rates from OHMCs. Staff investigated the OHRV activity based on over 2,300 responses from an online 2016 owner survey. Staff analyzed survey responses to estimate overall usage rates for OHRV as well as spatial allocation to determine the areas where vehicles are stored and operated throughout California. Areas where more OHRV are stored will tend to have higher evaporative emissions, while areas where OHRV are commonly operated will tend to have higher exhaust emissions. Evaporative emissions are also dependent upon temperature changes from different seasons, with increased emissions during warmer weather. Staff analyzed the activity and storage by time of year and determined the emissions in regions throughout the State during from various times of year.

Results

The proposed amendments are expected to result in improvements to California's air quality. ROG and NOx emission reductions associated with the proposed amendments are presented in Figure V-4. As shown the total emissions are estimated to be lower each year from 2023 and beyond.

Figure V-4: Estimated OHRV Statewide Summertime Emissions



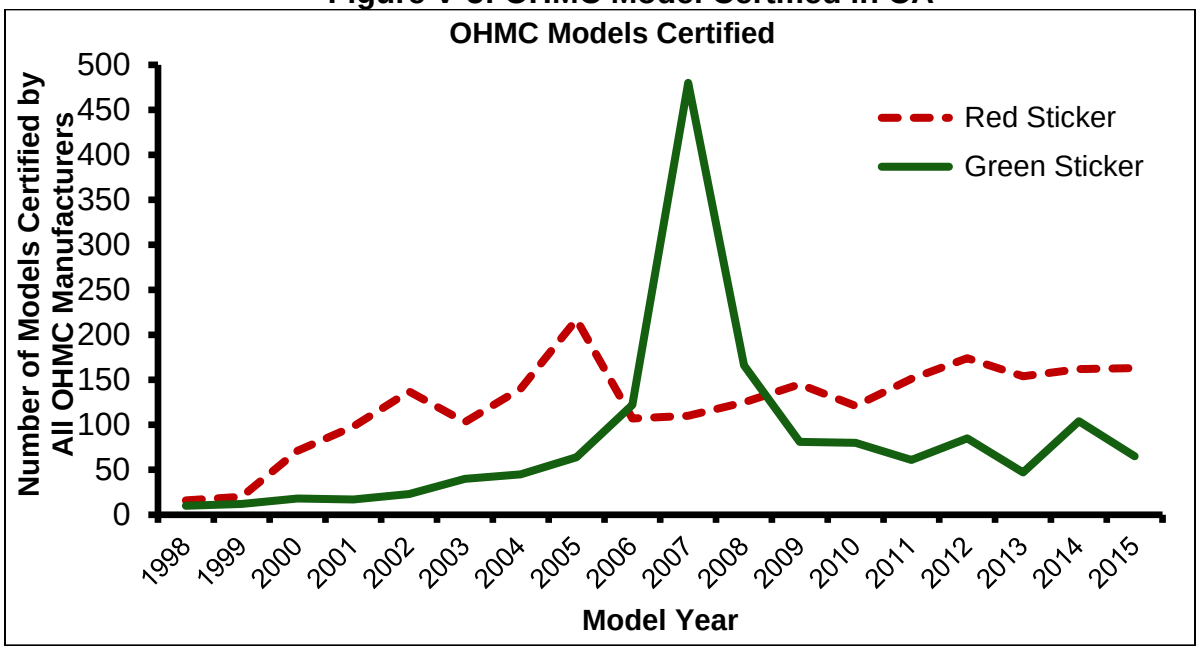
As discussed in Chapter III, air quality improvements are expected to result in statewide benefits to the California public, including avoiding hospitalizations, premature deaths, and additional emergency room visits.

4. Certification Trends

Each model of OHRV certified by CARB is issued an Executive Order (EO). CARB staff analyzed the OHRV certification database to evaluate certification trends between green and red sticker OHMCs over time (Figure V-5). When OHMC certification began in 1998, there were 32 EOs issued: 12 for emissions-compliant green sticker models and 20 for red sticker models with no emissions controls. From 1998 through 2005, the number of red sticker EOs issued grew more quickly than the number of green sticker EOs. In 2006 and 2007, there was a drop in red sticker EOs and an increase in green sticker EOs. The large increase in green sticker EOs issued in 2007 can be attributed to the increase in OHMC models from Chinese manufacturers entering the California OHRV marketplace. The decline in red sticker EOs in 2006 is likely due to manufacturers anticipating that OHMCs would be affected by the federal OHRV emissions rule that U.S. EPA was developing at that time.

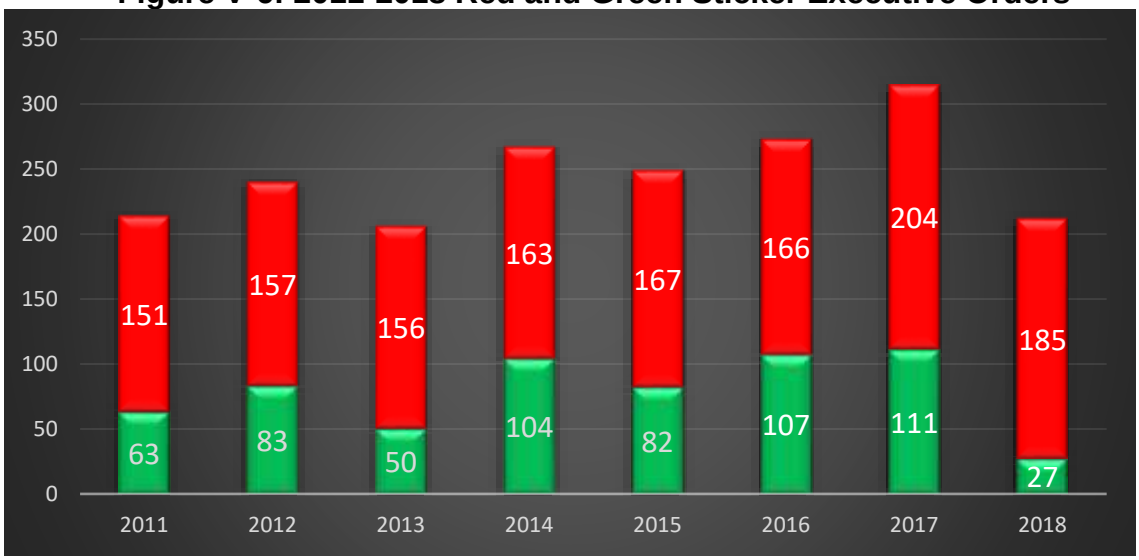
After the U.S. EPA OHRV rule was finalized, it was clear that OHMCs with no emission controls could be sold throughout the United States if they were marketed for competition use only. Following the adoption of the U.S. EPA OHRV rule, the number of green sticker OHMC models certified in California began to drop as manufacturers renewed their focus on developing models with no emissions controls.

Figure V-5: OHMC Model Certified in CA



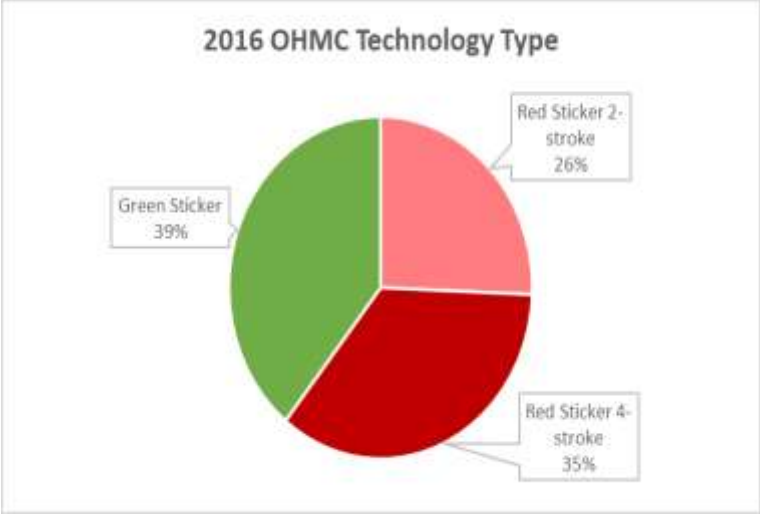
Today, the trend toward vehicles with no emissions controls continues, with fewer green sticker OHMC certifications than red sticker OHMC certifications, as shown in Figure V-6. In 2017, 204 red sticker OHMC models were certified, accounting for 65 percent of the total models certified by all the OHMC manufacturers selling vehicles in California that year. Green sticker certifications dropped even further in 2018 as manufacturers shifted previously green sticker models to either red sticker or on-road certification rather than bring them into compliance with the new 1g/day TOG evaporative standards.

Figure V-6: 2011-2018 Red and Green Sticker Executive Orders



Four-stroke engine models make up the entirety of the green sticker OHMC population. Of the 2016 model year red sticker OHMCs, 26 percent are two-stroke and 74 percent are four-stroke. A majority of the most recent model year OHMC population in California, regardless of sticker type, utilizes four-stroke engine technology as shown in Figure V-7.

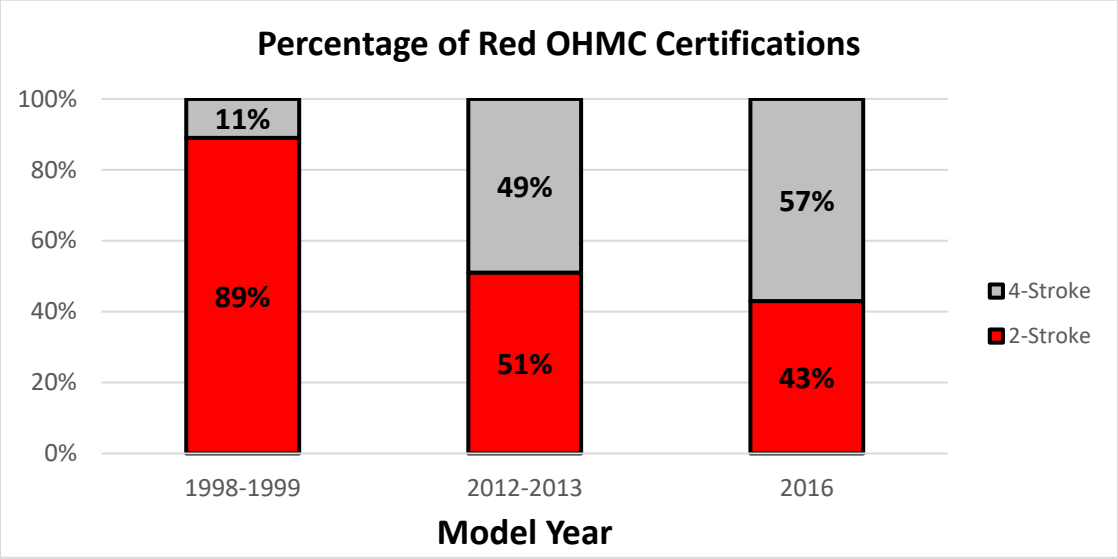
Figure V-7: 2016 MY Certifications by Technology Type



Red sticker OHMC certification data was evaluated to determine the prevalence of high emitting two-stroke engines versus cleaner four-stroke engines. This was done by comparing recent certifications to those submitted in the early years of the red sticker program. As shown in Figure V-8, 89 percent of the OHMC certifications for model years 1998-1999 were two-stroke vehicles. For 2012-2013 red sticker OHMC certifications, only 51 percent of OHMC models had two-stroke engines. This indicates that four-stroke technology has developed to the

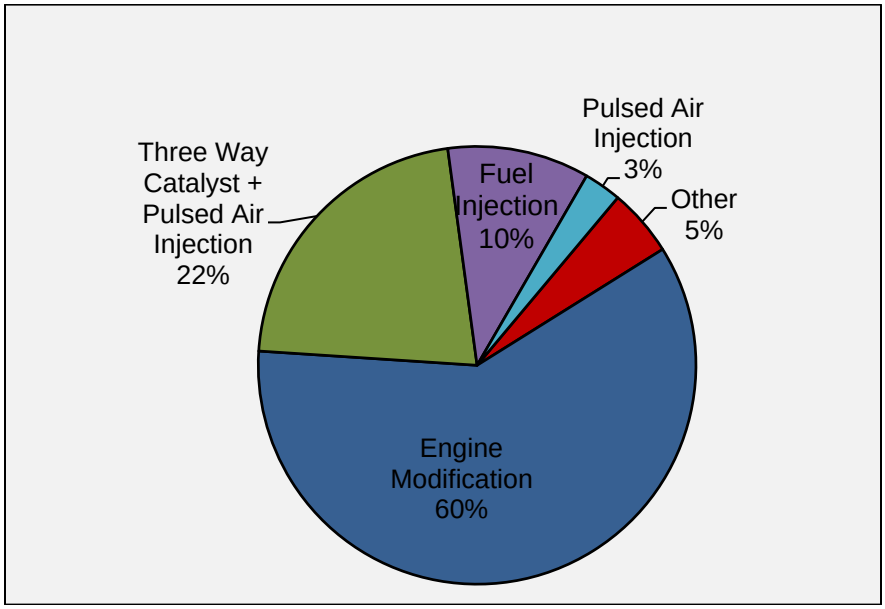
point where a complete transition from two-stroke to four-stroke engines is possible. However, in model year 2016, over 40 percent of the red sticker OHMC certified in California are high emitting two-stroke models.

Figure V-8: Engine Type of Red Sticker Certified Models



Green sticker OHMC certification data was assessed to determine predominant emissions controls utilized to meet the current exhaust emissions standards. Over 360 models of green sticker OHMCs were evaluated for model years 2011-2015. In 60 percent of the certifications, HC and CO standards were met solely by engine modification, meaning no additional emissions controls were necessary. The next most common emissions controls utilized were pulsed air injection and three-way catalysts, comprising 25 percent of the total. Finally, electronic fuel injection was used for 10 percent of the green sticker OHMC models certified, and 5 percent of the certifications used a different combination of these control strategies or oxidation catalysts (1 percent). The exhaust emissions control technologies used in OHRV are shown in Figure V-9 and discussed in Section B of this chapter.

Figure V-9: Controls Utilized to Meet Emissions Standards for MY 2011-2015 Green Sticker OHMCs



In summary, from 2012 through 2016, there were more red sticker OHMC models certified, and more red sticker OHMC sold, than green sticker OHMC in California. OHMC certifications and sales are trending further toward red sticker from 2018 onward as manufacturers certify their previously green sticker models as red sticker models rather than comply with new evaporative emissions standards. High emitting two-stroke engines remain common in the California OHMC market even though lower emitting four-stroke engines are widely available. A greater number of models are certified as red sticker in California, and these red sticker models are distributed across all engine-size categories. For example, a consumer interested in purchasing a California emissions compliant (green sticker) OHMC in model year 2017 would have 111 model options to choose from. In comparison, if the consumer was willing to purchase a noncompliant, red sticker OHMC, 204 model options would be available.

B. CONTROL TECHNOLOGY

1. Exhaust Emissions Controls in California Emissions Compliant OHMCs

Modern OHMCs compliant with the green sticker exhaust emissions standards (Table 1) generally provide motive power through a single cylinder four-stroke spark ignited internal combustion engine. As the name implies, these engines execute four distinct strokes in order to deliver power to the motorcycles rear wheel: 1) intake, 2) compression, 3) power, and 4) exhaust. Unlike conventional two-stroke engines, four-stroke engines separate the intake and exhaust functions thereby minimizing the release of raw fuel into the exhaust stream, also

known as “scavenging”. While much cleaner than most conventional two-stroke engines, four-strokes are not 100 percent efficient with respect to burning the entire air/fuel intake charge. Complete combustion dictates that only heat, carbon dioxide (CO_2) and water vapor should enter the exhaust stream. Unfortunately, most four-stroke engine exhaust pollutants include, but are not necessarily limited to, HC, CO, CO_2, and oxides of nitrogen (NO_X). The burning of ethanol-blended fuels can also result in the production of aldehydes such as formaldehyde. In recent model years, off-road motorcycle manufactures have implemented various control strategies to achieve exhaust compliance. The substantive strategies are: 1) secondary pulsed air injection, 2) open loop electronic fuel injection, and 3) three-way catalysts.

Secondary Pulsed Air Injection (PAIR)

Air injection systems mitigate unburned hydrocarbons that escape into the engine’s exhaust stream. Following the end of each exhaust stroke, springs close the cylinder head’s exhaust valves. Subsequent to each closure, upstream pressure inside the exhaust manifold dips below atmospheric as exhaust gases exit the system. The cyclical closure of the exhaust valves in conjunction with the outward flow of exhaust gases creates the “pulsed” vacuum that draws filtered air from the air box, through a control valve and into the exhaust stream near the exhaust port. The heat of the exhaust stream provides the energy necessary to carry out combustion of the hydrocarbons in the presence of the oxygen supplied by the air injection system’s fresh air charge, allowing for a fuller combustion of exhaust gases. PAIR systems are a common fixture in the powersports industry with on-highway motorcycles having used them for years. However, certain manufacturers of high performance OHMCs have adopted PAIR systems as well. Figure V-10 depicts an original equipment (OE) air injection system installed on a Honda CRF450X.

Figure V-10: Air Injection System
(Courtesy of Dirt Action)

Electronic Fuel Injection

The motorcycle industry uses two categories of electronic fuel injection (EFI): 1) closed loop, and 2) open loop. The primary physical difference between the two categories is the presence of an oxygen sensor in the exhaust stream of a closed loop system. Of the two, open loop has been the system of choice among EFI equipped OHMCs. EFI uses signals from a variety of onboard sensors to establish the length of time that a fuel injector opens to dispense fuel, known as pulse width. By controlling pulse width, manufactures can optimize engine fueling for both emissions compliance and performance more precisely than through carburetion.

Although not present in production OHMCs, closed loop systems offer the added benefit of positioning an oxygen sensor in the exhaust stream to determine the concentration of oxygen that escapes the combustion process. The transmitted voltage signal is interpreted by the ECU and used to adjust engine fueling. The presence of excessive oxygen in the exhaust stream can indicate a lean condition, and a lack of oxygen can potentially suggest a rich condition. In either case, the lack of a stoichiometric air fuel ratio results in the production of a variety of air pollutants. Lean conditions can elevate combustion temperatures and lead to increased NO_X emissions, while rich conditions can elevate HC and CO concentrations. Due in part to California's emissions standards and industry's concerns regarding crash "survivability," manufacturers have not made widespread use of closed loop EFI in their emissions certified production off-road motorcycles. However, the use of exhaust system sensors has found its way into the highest forms of professional racing for the purposes of engine tuning. Figures V-11 and V-12 depict oxygen sensors equipped exhaust head pipes from a Yamaha YZ450F campaigned during the 2011 AMA Supercross season and a second YZ450F campaigned in the same series in 2015.

Figure V-11: Oxygen Sensor
(*Courtesy of Grind TV*)

Figure V-12: Oxygen Sensor
(*Courtesy of Transworld*)

Three-Way Catalytic Converters

Based on technology originally developed for automobiles, three-way catalysts (TWCs) use heat and precious metals to conduct oxidation and reduction reactions that convert HC, CO and NO_X into compounds less likely to contribute to ozone formation and less harmful to human health. The reduction process breaks NOx into nitrogen and oxygen. Oxygen is then used in the oxidation process to convert HC and CO into CO_2 and water vapor.

TWCs consist of a metallic honeycomb substrate, with metal being the material of choice due to the vibration and high exhaust pulsations that a motorcycle catalyst is exposed to. Applied to the internal structure of the substrate is a washcoat that increases the surface area exhaust gases are exposed to. On the washcoat is a thin dispersal of precious metals consisting of platinum and/or palladium and rhodium. In conjunction with heat energy, platinum and palladium catalyze the oxidation reactions while rhodium catalyzes the reduction reactions. While TWCs have proven to be an effective control strategy in both automobiles and motorcycles, their efficiency depends on several variables that include, but are not limited to, cells per square inch (i.e. density of the honeycomb), precious metal loading, temperature, positioning in the exhaust system, backpressure, ability to maintain a near stoichiometric air/fuel ratio, and appropriate sizing. While challenges exist, OHMC manufactures have proven that TWCs are not a barrier to high performance. For instance, Husqvarna received green-sticker certification for its TXC511 (Figure V-13) during the 2011, 2012 and 2013 model years in part by using a TWC.

Figure V-13: Husqvarna TXC-511
(Courtesy of autoevolution)

2. Reduced Emission Two-Stroke Engines

Carbureted two-stroke engines were once a dominant power plant in the powersports industry. Their performance, weight, simplicity and ease of maintenance made them a staple in certain product categories including, but not limited to, personal watercraft (PWC), ATVs, and OHMCs. However, as global transportation emissions regulations grew in both complexity and stringency, the use of two-stroke engines diminished. Although manufactures still offer two-stroke OHMCs, the vast majority of its product offerings are limited to competition motorcycles designed for use in enduro and motocross racing.

The challenge faced by powersports manufacturers has been mitigation of the "scavenging" that is characteristic of carbureted two-stroke engines. These engines use an air/fuel/oil mixture that not only powers the engine, but also lubricates the crankcase. Unlike four-stroke engines, carbureted two-stroke engines do not necessarily introduce the air/fuel mixture from the intake directly into the cylinder(s). Instead, the air/fuel/oil charge is initially drawn into the crankcase and directed to the cylinder(s) via transfer port(s). During combustion, the two-stroke engine's piston is driven down, first exposing the exhaust port followed by the transfer port(s). At a certain point in the piston stroke, both ports are exposed and open simultaneously. Scavenging occurs when unburned air/fuel/oil mixture originating from the transfer port(s) escapes through the exhaust port resulting in high concentrations of hydrocarbon emissions.

In an effort to reduce two-stroke engine emissions, powersports manufacturers have introduced a number of innovative strategies that include direct fuel injection, and most recently, transfer port fuel injection.

Direct Fuel Injection (DFI)

Prior to adopting four-stroke engines, manufactures of PWCs incorporated DFI into their two-stroke engines to minimize the exhausting of raw fuel into public waterways. Electronic DFI systems reduce scavenging and hydrocarbon emissions by dosing fuel directly into the combustion chamber after the exhaust port closes in two-stroke engine applications. Although DFI proved effective in PWCs, certain OHMC manufactures determined that its engineering complexity, performance issues, and packaging requirements render it infeasible for off-road motorcycles.

Transfer Port Fuel Injection (TPI)

After prototyping and testing a DFI system of its own, KTM Motorcycles turned to TPI as an alternative. KTM's TPI engine features electronic fuel injection and electronic oil injection on separate circuits. This eliminates the need to pre-mix fuel and operate at a single fuel/oil ratio over all engine load and RPM ranges. The ECU doses two-stroke oil through the throttle body, which enters the

crankcase along with the intake air charge. Due to the efficiency of the system, fuel/oil ratios equivalent to 80:1 are possible, which translates into an estimated 50% reduction in smoke and presumably reduced particulate matter emissions. With respect to its electronic fuel injection system, KTM's TPI engine positions an up-stream facing fuel injector in each of its two transfer ports. The injectors are positioned such that the fuel is injected on a direct "collision course" with the air/oil mixture that charges through the transfer ports. The result is better atomization of the fuel for improved combustion. Due to the fuel injectors' location in the transfer ports and timing of the injector pulse, fuel can be dosed with minimal loss through the exhaust port, thereby mitigating the effects of scavenging.

KTM's TPI two-stroke engines entered the market in mid-2017. They are offered in several European models sold under both the KTM and Husqvarna brands, including enduro models that have been certified to the Euro 4 emissions standards that are much more stringent than CARB's green sticker OHRV standard. Although KTM's TPI engines are also available in OHMC models in the United States, they do not feature the same emissions controls as the European version and are currently certified as red sticker in California. The existence of two-stroke motorcycles that meet Euro 4 standards clearly indicates that clean two-stroke technology can comply with CARB's OHRV emissions requirements.

3. Technology to Control Evaporative Emissions from OHMCs

Evaporative standards for green sticker OHMCs reflect an emphasis on diurnal emissions control. Diurnal emissions, which result from evaporation of gasoline due to temperature fluctuations during the day and night, are concentrated where OHMCs are stored. Since OHMC activity patterns include long periods of time when they are not operated and many are stored in areas with poor air quality, it is critical to control diurnal emissions. In fact, diurnal processes account for 82 percent of evaporative emissions from OHRV in California (ARB 2013 Evap. ISOR).

A variety of technologies are available for manufacturers to use in order to meet the 2018 evaporative emissions standards for green sticker OHMCs (Table 2). Technologies have been developed to control evaporative emissions due to permeation, venting and leakage. Control technologies include low-permeation materials, activated carbon canisters, pressure relief valves, fuel tank insulation, and improved connectors. Many of the technologies are downsized, proven versions of evaporative control for on-road automobiles.

Permeation Controls

Permeation occurs when HC molecules diffuse through the walls of the fuel tank and fuel lines. It is a function of fuel and material properties, material thickness,

and temperature. Permeation is controlled through the use of low permeation barrier layers such as post mold barrier treatments, co-extruded barrier layers, resin based additives, and/or nylon barriers added during the manufacturing process.

Fuel tank permeation can be eliminated by using metals such as aluminum, titanium, or steel. In recent years, at least two manufacturers (Suzuki and Honda) have included OE aluminum or titanium fuel tanks in certain mass produced red sticker OHMCs (see Figures V-14 and V-15).

Where polyethylene resins are necessary, permeation rates can be mitigated through the use of post mold barrier surface treatments like fluorination. Fluorination exposes the fuel tank to fluorine gas which replaces hydrogen atoms with fluorine atoms on the tank surface. The fluorinated surface layer 'blocks' the path that hydrocarbon molecules would normally take through the resin, thereby reducing permeation rates. In addition to barrier treatments, permeation rates can be reduced using co-extruded barrier layers such as ethylene vinyl alcohol (EVOH). Co-extruded tanks using an EVOH barrier generally consist of six layers, with the EVOH layer sandwiched between layers of adhesive and High Density PolyEthylene. In the case of monolayer applications, a special additive can be blended with certain polyethylene during the blow molding process. For fuel tank production processes involving rotational molding, the introduction of nylons offer low permeation rates due to its crystalline structure. In addition to fuel tanks, low-permeation control strategies can be applied to fuel lines. Aside from running rigid non-permeable metal lines, there are several flexible fuel hoses (many contain a fluoroplastic permeation barrier) commercially available for OHMCs.

Figure V-14: 2014 Suzuki RMZ450 OE Aluminum Fuel Tank
(Courtesy of TopSpeed)

Figure V-15: 2017 Honda CRF450R OE Titanium Fuel Tank
(Courtesy of Cycle World)

Venting Controls

Vented emissions are driven by two processes: 1) a rise in the surface temperature of liquid fuel causing an increase in the HC vapor concentration of the head space, and 2) an increase in temperature causing the vapor volume to increase, as described by the ideal gas law. Vented emissions are generated by both engine heat and natural diurnal temperature variability. The HCs that are lost due to venting represent the constituents of gasoline that have the highest partial pressures and thus evaporate most quickly.

Activated carbon canisters can be used to control vented emissions by trapping HC molecules that are forced out of the fuel tank vent line. Two mechanisms are available to prevent the carbon canister from reaching its saturation point and "overflowing" into the ambient air. First, passive purging occurs when hydrocarbons are pulled back into the tank head space during the contraction associated with diurnal cooling. When properly designed, a passively purged carbon canister can be as much as 65 percent efficient at preventing vented hydrocarbons from being emitted to the ambient air. The second mechanism for unloading a carbon canister is to use intake manifold vacuum to pull hydrocarbons from the canister into the engine, where they are combusted. During storage periods, the carbon canister is only passively purged because active purging using intake manifold vacuum requires the vehicle to be in operation. Certain manufactures have demonstrated that the packaging constraints associated with installing carbon canisters on high performance OHMCs are not insurmountable. As of the 2019 model year carbon canisters have become an OE fixture on Honda's green sticker certified CRF450X (Figure V-16). Honda has gone a step further and proven the cost effective nature of transferring emission control components from on-highway certified motorcycles to OHMCs. A comparison of part numbers reveals that the 2019 Honda CRF450X shares its fuel tank, carbon canister, purge control solenoid and one way valve with its on-highway certified sibling, the 2019 Honda CRF450L.

Vented emissions can also be controlled by pressure relief valves and fuel tank insulation. A pressure relief valve placed on the vent of the fuel tank holds pressure on the fuel and prevents vapors from escaping below a predetermined pressure. Insulating the fuel tank from engine heat and ambient conditions protects the head space and fuel inside the tank from being affected by large temperature increases.

Improved carburetors and fuel injection also reduce vented emissions. Carburetors can emit vented HCs during operation or immediately after the engine is shut off. Emissions can be controlled by re-designing the carburetor to eliminate gaskets that could be exposed to fuel, improving the gasket material, or using fuel injection. Fuel injection controls vented emissions because the closed nature of the fuel system.

Figure V-16: 2019 Honda CRF450X OE Carbon Canister System (Courtesy of Ultimate Motorcycling)

Leakage Controls

Leakage includes fuel that seeps through loose connection points and spillage associated with vehicular tipping. Seeping through fuel line connection points can occur when a connection mechanism degrades and does not seal properly. Seeping from gaskets, generally from the carburetor, occurs because of poor or degrading gasket material.

Leakage emissions can be controlled by using both improved connectors and fuel injection. Better fuel line connectors such as constant tension spring clamps on properly sized hose barbs or O-ring snap connections aid in preventing leakage. Fuel injection is effective at controlling leakage because higher pressure in the fuel line renders proper use of connections imperative for safety. Utilization of fuel injection technology also eliminates carburetor leakage due to a tipped OHMC.

Automatic Shutoff

The automatic shutoff is a valve that stops the flow of fuel to the carburetor when the OHMC is shut-off. Once the OHMC is turned off, the fuel in the float bowl will begin to evaporate. Once the fuel in the float bowl evaporates, then it is replenished by fuel from the fuel line and tank, if gravity fed. By shutting of the fuel from the tank and hose to the carburetor with an automatic shutoff valve, the amount of fuel than can evaporate over time is reduced. This reduction in evaporative emissions can affect the overall emission rate from OHMCs with carburetors. The emission control from the valve could vary from OHMC because of the different designs of the fuel system and may be less effective

than other designs. Also, the automatic fuel shutoff will not be effective on OHMC with fuel injection because the system is sealed. However, OHMC manufacturers expressed concern that automatic valves could pose a safety issue for certain design of OHMCs.

4. Advanced Emission Control Technologies

Future of Low and Near-Zero Emission OHMCs

As of today, nearly all mobile sources in California are subject to emission control requirements with relatively few exemptions. Despite significantly reducing air pollution over the past several decades, California still needs additional emission reductions to fulfill the commitments outlined in the SIP (CARB, 2016) and meet air quality goals. California's stringent control of light-duty passenger cars and light-duty trucks under the Advanced Clean Car (ACC) program has become a global example of how to successfully reduce emissions from the transportation sector and encourage the growth of zero emission vehicle (ZEV) technologies. With the success of the ACC program, the emissions from light-duty vehicles are projected to be reduced to such a low level by 2050 that emissions from smaller sources, such as OHRVs and motorcycles, will represent a more significant portion of the overall air pollution from mobile sources.

The lessons learned from the ACC regulation can be applied to on- and off-road motorcycles to develop regulations supporting zero emission technology. Before developing a ZEV regulation for these categories, the market barriers, vehicle availability, and needs for expanded charging infrastructure must be addressed.

5. Control Technology Testing

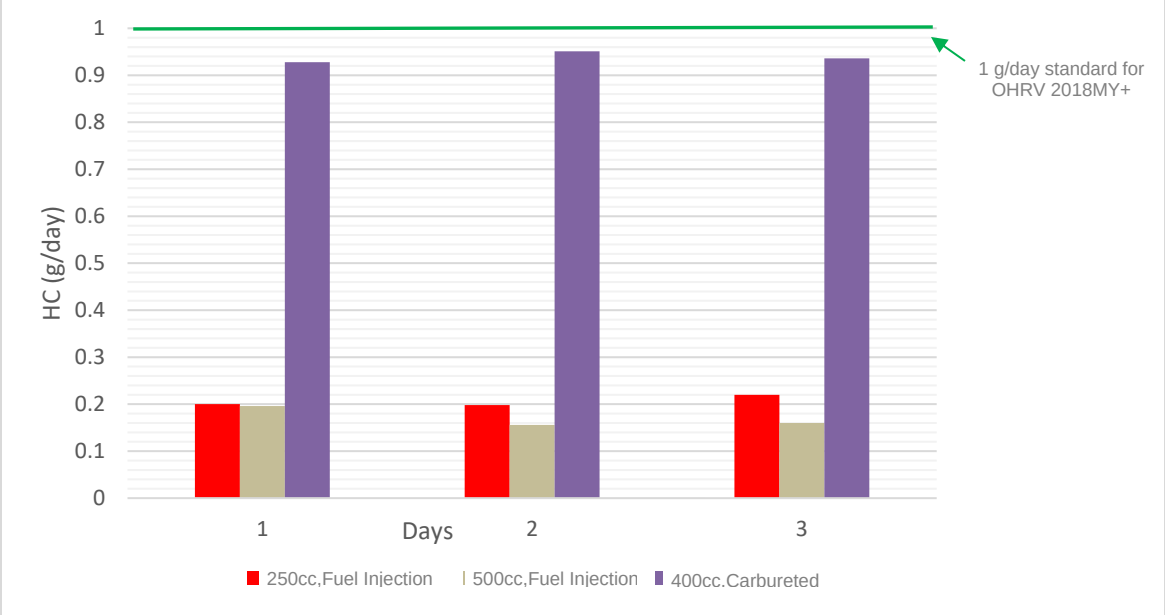
At public workshops conducted during the red sticker program assessment, OHRV manufacturers suggested that CARB staff should consider two technologies that are not allowed under current regulations but could provide cost-effective control of evaporative emissions. Those technologies were: 1) a shutoff valve that automatically stops the flow of fuel to the carburetor when the vehicles is turned off, and 2) using a certified on-road motorcycle (ONMC) evaporative emissions control system on off-road motorcycles. Staff conducted testing to evaluate the effectiveness of each of these technologies, which is discussed in the following paragraphs.

Dual Sport Comparative Testing

Staff also conducted emissions testing to evaluate control technologies on dual sport motorcycles, which are essentially OHMC with lights and other safety features required for on-road operation. Dual sport motorcycles are certified to the ONMC motorcycle evaporative emissions standard of 2 g/test, but testing had not been conducted on dual sport models see how they perform when tested in accordance with the OHRV evaporative emissions test protocol (TP-933). The

ONMC and OHRV evaporative test procedures differ in duration and temperature profile, and therefore provide different emissions results. The ONMC test requires a heating blanket to be placed on the fuel tank to simulate a heated soak condition and the emissions are measured over a 2-hour period. TP-933 requires the vehicle to be subjected to a 24-hour temperature profile of 72-96F, during which emissions are measured for three consecutive days. Test data for three certified ONMC dual sport models tested using a slightly modified version of TP-933 are presented in Figure V-17.

Figure V-17: Dual Sport Comparative Testing



The results from testing indicate that dual sport models with fuel injection that meet the ONMC evaporative standard were also able to meet the current OHRV evaporative standard of 1 gram/day. The fuel injected models were well below the standard, while the carbureted model was just below the standard. Since most dual sports have OHMC counterparts with similar characteristics influencing evaporative emissions (engine size, vehicle layout, fuel tank size, etc.), certified evaporative control systems technology can be transferred from dual sport models to OHMC without much difficulty and cost.

Carburetor/Automatic Shut-off Testing

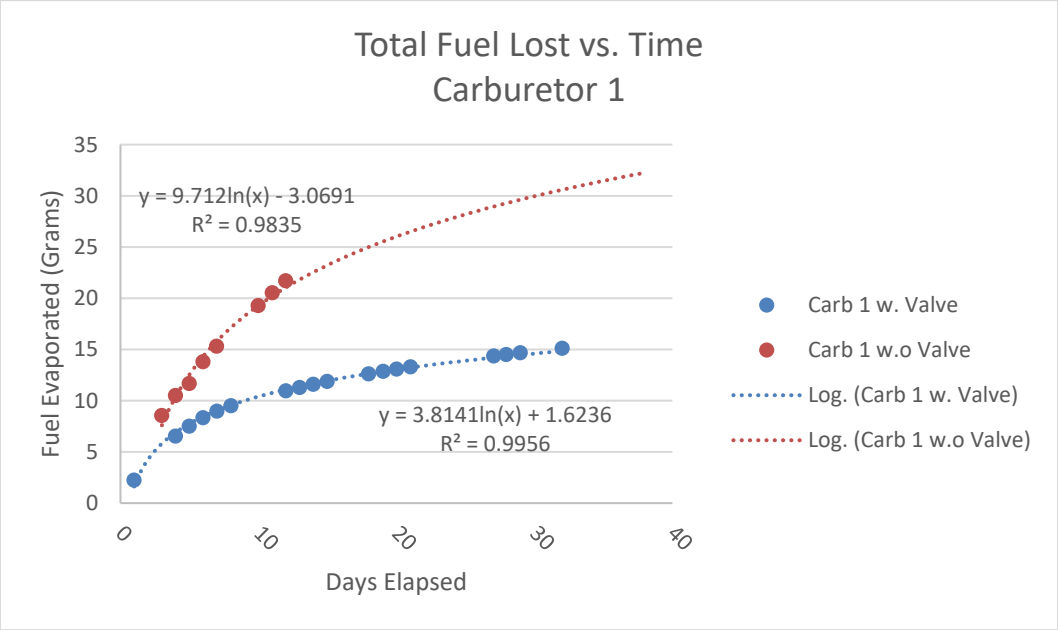
In addition to the dual sport comparative testing, staff also measured evaporative emissions from two carburetors with and without fuel delivery systems to determine the control effectiveness and feasibility of the automatic shutoff valve for OHMCs with carburetors.

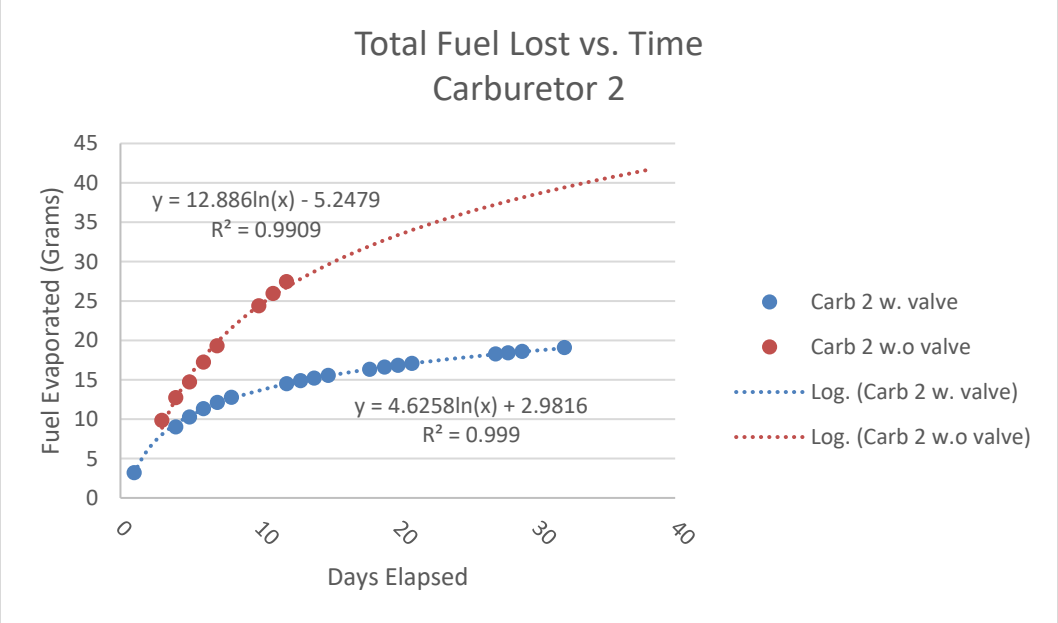
To measure the evaporative emissions from the carburetor without a fuel delivery system, two carburetor float bowls were filled with fuel and then the evaporative

emissions were measured each day based on the temperature fluctuations in a garage.

Staff then mounted a fuel tank with a fuel hose above the carburetor float bowl and gravimetrically weighed the fuel system each day. Figure V-18 shows the results with and without the gravity-fed fuel delivery system from both carburetors.

Figure V-18: Carburetor Evaporative Emissions





The results of the two tests indicate that the automatic shut-off is likely to reduce emissions from carbureted OHMC by about 50 percent over a period of 15 days The OHMC Owner Survey (Appendix D) shows that OHMC are typically only used approximately 12 to 15 times per year, so storage periods of 15 days or more are quite common. The data shows that an automatic fuel shut-off could be used as an emissions control device to effectively reduce evaporative emissions from certain OHMC fuel system designs during multi-day storage periods.

C. Climate Change Considerations

Although the focus of the proposed OHRV evaporative emissions regulations is a reduction in ambient concentrations of ground level ozone, they will also help to reduce emissions of climate change pollutants in California.

1. GHG Reductions

Manufacturers may choose to produce zero emission vehicles to offset emissions from higher emitting models. Some manufacturers may choose to keep high performance models if they expect that sales are cost efficient in their business model. The reduction of GHG emissions are dependent upon the number of zero emission vehicles sold. It is not possible to predict the exact path that manufacturers may choose to follow for certification of zero emissions vehicles, if any. Therefore, quantifying the fuel saving and corresponding GHG reductions achieved by this proposal is not possible.

Additionally, GHG emissions reductions could result from improved engine efficiency and reduced in-use fuel consumption associated with the wider use of fuel injection technology. Manufacturers are expected to comply with the proposed regulation by shifting from carburetor to fuel injection technology. Since fuel injection engines tend to be substantially more fuel-efficient, the shift away from carburetor technology could yield substantial benefits in terms of reduced fuel consumption, and therefore, emissions of carbon dioxide, however this cannot be quantified at this time.

2. Indirect Warming Impacts

This regulatory proposal is also expected to exert small, indirect climate change impacts through its effects on climate forcing pollutants in the atmosphere. Since ROG emitted into the atmosphere is oxidized within a relatively short timeframe, it exerts substantial climate impacts through its effects on atmospheric chemistry (Collins et al., pp.453-476). These indirect impacts are mediated through changes in the concentrations of tropospheric ozone and methane. For example, curtailment of tropospheric ozone associated with ROG emissions reductions is a climate benefit, because tropospheric ozone is currently associated with radiative forcing of approximately 0.39 Watts per square meter, W/m^2 (Shindell et al., 2005). Similarly, ROG perturbs atmospheric chemistry such that methane has a

longer atmospheric lifetime. Since methane is the second most important of the relatively long-lived GHGs tabulated by the Intergovernmental Panel on Climate Change (Section 2.3.2) in terms of radiative forcing, averting ROG emissions and the associated impacts on methane's atmospheric lifetime constitute a climate benefit. At this time, this climate benefit cannot be quantified.

D. Reduction of Exposure to Toxic Emissions

One of the expected co-benefits of the proposed regulation is reduced exposure to toxic air pollutants, specifically benzene, which makes up about one percent of current blends of gasoline. More than 80 percent of the evaporative emissions from the current fleet of OHRVs in California are emitted during diurnal processes, when OHRVs are stored. Oftentimes, OHRVs are stored for periods of a week or more. OHRVs equipped with evaporative emissions controls compliant with the proposed emissions standards will reduce benzene emissions. Benzene is a known carcinogen, and reducing benzene emissions can help to reduce human exposure, particularly when the OHRV is stored in a poorly ventilated garage or storage shed.

VI. ENVIRONMENTAL ANALYSIS

A. Introduction

This chapter provides the basis for CARB's determination that the proposed regulation is exempt from the requirements of CEQA. A brief explanation of this determination is provided in section B below. CARB's regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State's ambient air quality, has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of the California Environmental Quality Act (CEQA) (14 CCR 15251(d)). Public agencies with certified regulatory programs are exempt from certain CEQA requirements, including but not limited to, preparing environmental impact reports, negative declarations, and initial studies. CARB, as a lead agency, prepares a substitute environmental document (referred to as an "Environmental Analysis" or "EA") as part of the Staff Report prepared for a proposed action to comply with CEQA (17 CCR 60000-60008). If the regulation is finalized, a Notice of Exemption will be filed with the Office of the Secretary for the Natural Resources Agency and the State Clearinghouse for public inspection.

B. Analysis

CARB has determined that the proposed regulation is categorically exempt from CEQA under the "Class 8" exemption (14 CCR 15308) because it is an action taken by a regulatory agency for the protection of the environment. As stated

above in sections IV and V, the proposed amendments will result in statewide criteria, toxic air contaminant, and GHG emission decreases, which will result in beneficial air quality impacts.

The proposed amendments will harmonize with existing U.S. EPA evaporative emission requirements for OHRVs beginning in MY2022. The proposed amendments will also set more stringent exhaust and evaporative standards for OHRVs. The amendments to the OHRV standards will also set emission standards for currently uncontrolled OHRVs in the Red Sticker program. All of the proposed standards can be met by incorporating currently available technologies used on OHRVs.

The proposed amendments are not expected to require additional construction of OHRV manufacturing facilities or component facilities as existing facilities are already supplying OHRVs and components for other categories. Consequently, compliance with the proposed regulatory amendments does not involve or result in any adverse physical changes to the existing environment, such as new development, modifications to existing buildings or facilities, or new land use designations. It is not reasonably foreseeable that there will be any adverse impacts on the environment because the proposed requirements would not require any action by regulated parties that could affect these resources.

The proposed amendments will result in a beneficial impact to air quality by reducing ROG emissions, which also contain benzene. The reduction in ROG and benzene will reduce the amount of ozone formed and reduce toxic exposure near the gas stations. Ozone (created by the photochemical reaction of ROG and oxides of nitrogen) leads to harmful respiratory effects including lung damage, chest pain, coughing, and shortness of breath, especially affecting children and persons with compromised respiratory systems. Benzene is an air toxic contaminant and reducing benzene emissions is critical for protecting the health of the people who live and work near gasoline dispensing facilities. Thus, the proposed action constitutes an action taken by a regulatory agency, as authorized by state law, to ensure the maintenance, restoration, enhancement, or protection of the environment, as contemplated by the Class 8 exemption.

The proposed actions are designed to protect the environment, and CARB staff found no substantial evidence indicating the proposal could adversely affect air quality or any other environmental resource area, or that any of the exceptions to the exemption applies (14 CCR 15300.2). Therefore, this activity is exempt from CEQA.

VII. ENVIRONMENTAL JUSTICE

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and

policies. Government Code, section 65040.12, subdivision (e). CARB is committed to making environmental justice an integral part of its activities. The Board approved its Environmental Justice Policies and Actions (Policies) on December 13, 2001, to establish a framework for incorporating environmental justice into CARB's programs consistent with the directives of state law (ARB 2001). These policies apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities. Staff finds that the proposed amendments will not disproportionately impact low-income or minority communities. The anticipated air quality benefits for this proposal will occur throughout the State, wherever OHRV are stored or operated.

VIII. ECONOMIC IMPACTS ASSESSMENT

In this chapter, staff provides a summary of the economic impacts of the proposed amendments to the OHRV regulation. Staff evaluated cost information from an industry-wide cost survey from OHRV manufacturers to determine the economic impacts from the proposed amendments. Information about the specified requirements for the proposal are presented in Section II of this staff report. More details on the calculations and assumptions used to conduct the economic analysis are included in Appendix B.

Staff conducted an analysis of responses to an industry-wide cost survey of OHRV manufacturers. Staff received a total of three responses from the cost survey, two of which we determined to be relevant to the proposed amendments. The two relevant responses were used to determine the increased cost to implement the proposed amendments to current red sticker vehicles in different tiers. The details of the methodology of the economic impacts are described further in Appendix B. Staff evaluated the increased cost difference between uncontrolled red sticker to U.S. EPA controlled exhaust emissions, U.S. EPA controlled to CARB green sticker controlled exhaust emissions, and U.S. EPA evaporative to CARB green sticker evaporative controls. Staff then applied dealer and manufacturer markup of thirty percent to estimate the overall total retail price increase to OHRV consumers. A summary of the methodology and survey results is presented in Appendix B.

The proposed OHRV requirements are expected to apply exhaust and evaporative standards to red sticker vehicles over time. Based on the cost survey, overall the proposed OHRV regulation amendments are not expected to impose an unreasonable cost burden on OHRV manufacturers or consumers. Nor will they result in significant additional costs to the existing regulation.

The total estimated retail price increase for CARB emission controls on red sticker vehicles is expected to be $333 per vehicle. The total statewide lifetime cost, in 2018 dollars, of the proposed amendments are expected to be about $72.7 million. This $72.7 million cost represents a worst-case scenario under

which the highest estimated annual cost to out of state OHRV manufacturers is entirely passed to California consumers.

ATVs are mostly compliant with existing green sticker emissions controls and ATV manufacturers stated they anticipate no additional costs to meet the more stringent proposed exhaust standards. As a result, staff anticipate the costs for compliance will only fall on OHMC manufacturers.

All of the OHRV manufacturers are located outside of California, and some manufacturers are located outside of the United States. Based on the economic assessment which follows, the proposed OHRV regulation amendment is not a major regulation under the provisions of the Administrative Procedure Act because the total cost will not cause $50 million of economic impacts in any of the implementation years, as defined in California Government Code section 11346.2(b)(2)(A). Economic impacts are quantified to the extent that is feasible, but some projections are qualitative, based on facts known about industry. In addition, staff expects that the proposed amendments do not create or eliminate California jobs and do not create, expand, or eliminate businesses in California.

A. Regulatory Costs

For the cost analysis of the proposed regulation amendments, staff estimated the incremental cost increase due to the additional cost controls, sell-through costs, and the cost of certification. The highest annual cost resulting from these requirements was used to estimate a maximum price increase per OHMC, which would be passed on to California consumers. The annual cost is expected to be about $3-4 million, in 2018 dollars, over the lifetime of the regulation (2022-2042). The statewide total cost of $72.7 million, in 2018 dollars, was derived by multiplying the estimated maximum retail price increase per OHRV of $333 (Appendix B) by the estimated number of red sticker OHRVs sold in California over the lifetime of the regulation (2022-2042). Table VIII-1 shows the estimated annual cost of the proposed amendments from 2022 through 2042.

Table VIII-1. Estimates of Total Costs for Proposed Amendments, 2018$

Calendar Year	Annual OHMC Units Sold	Total Weighted Incremental Costs	Total Weighted Fixed Costs	Total Annual Costs of New Sales
2022	9204	$919,852	$2,145,557	$3,065,409
2023	9314	$930,846	$2,171,199	$3,102,045
2024	9426	$942,039	$2,197,307	$3,139,346
2025	9539	$953,333	$2,223,649	$3,176,981
2026	9654	$964,826	$2,250,457	$3,215,282
2027	9769	$976,319	$2,277,264	$3,253,583
2028	9887	$988,112	$2,304,772	$3,292,883
2029	10005	$999,905	$2,332,279	$3,332,184
2030	10125	$1,011,898	$2,360,252	$3,372,150
2031	10247	$1,024,090	$2,388,692	$3,412,782
2032	10370	$1,036,383	$2,417,364	$3,453,747
2033	10494	$1,048,776	$2,446,270	$3,495,046
2034	10620	$1,061,368	$2,475,642	$3,537,010
2035	10748	$1,074,161	$2,505,480	$3,579,641
2036	10877	$1,087,053	$2,535,552	$3,622,605
2037	11007	$1,100,045	$2,565,856	$3,665,901
2038	11139	$1,113,237	$2,596,627	$3,709,864
2039	11273	$1,126,629	$2,627,864	$3,754,493
2040	11408	$1,140,121	$2,659,334	$3,799,455
2041	11545	$1,153,813	$2,691,270	$3,845,083
2042	11684	$1,167,705	$2,723,673	$3,891,378
Average	**10917**	**$1,039,072**	**$2,423,636**	**$3,462,708**
				Total Lifetime Cost: $72,716,870

1. Additional Testing Costs

The proposed OHRV regulation amendments will result in additional direct costs to manufacturers through the additional and more costly certification fuel used for testing. Staff requested testing cost information on the industry-wide cost survey. Testing and internal certification costs are included in the overall cost estimate and details of the specific costs can be found in Appendix B.

2. Reporting Costs

It is anticipated that manufacturers of red sticker OHRV may incur costs associated with annual reporting similar to those estimated in the 2013 rulemaking. Therefore, staff is using the same methodology used for the 2013 rulemaking for annual reporting costs for OHMC manufacturers as they are essentially the same for all OHRV manufacturers. Table VIII-2 shows the estimated cost per business for the anticipated range per emissions family. As

most OHRV manufacturers are already certifying red sticker vehicles, it is likely that there will be no additional costs for certifying OHRVs.

Table VIII-2. Summary of Estimated Reporting Costs

Number of Evaporative Families per Manufacturer	Staff Hours to Apply per Evaporative Family	Estimated Pay Rate ($ per hour)	Total Estimated Reporting Cost
2 - 8	10	$60.91[1]	$1,200 – $4,900

[1] U.S. Bureau of Labor Statistics (2018)

Since most manufacturers are already certifying red sticker vehicles, the process will be the same as the proposed amendments and the costs will be negligible. However, these costs are already accounted for as part of testing and certification cost in the cost survey.

B. Cost-Effectiveness of Proposed Amendments

This section outlines the methodology used to calculate the cost-effectiveness of the proposed amendments transitioning the red sticker vehicles to be certified emission controlled vehicles. Cost-effectiveness is a measure of the increased retail cost per vehicle divided by the lifetime mass emissions reduction of ROG and NOx per vehicle. Staff estimated the costs based on an industry-wide survey (see Appendix C), and determined the expected lifetime emissions reduction per vehicle based on testing vehicles with various control technologies.

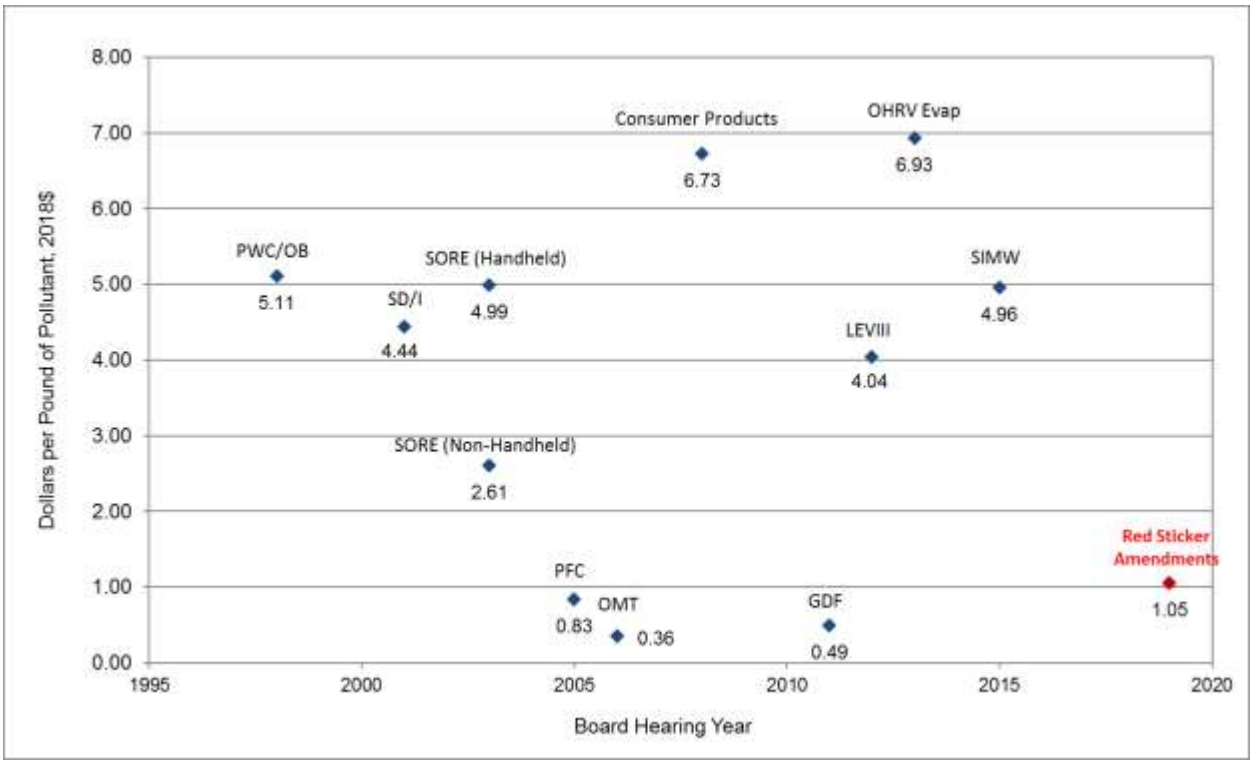
Cost-effectiveness is calculated in dollars per pound of ROG and NOx emissions reduced by dividing the total compliance cost per vehicle divided by the total emissions reductions over the lifetime of the vehicle. The cost-effectiveness of the proposed amendments are presented in Table VIII-3.

Table VIII-3: Cost-effectiveness of the Proposed Amendments per Vehicle over the 20-year OHRV Lifetime

	Total
Total Equipment and Capital Costs ($)	**$333.05**
Average Lifetime Emissions Reductions (lbs.)	**318.2**
Levelized Cost-Effectiveness ($/lb.)	**$1.05**

The proposed amendments are cost-effective compared to the cost-effectiveness of previous rulemakings (see Figure VIII-5).

Figure VIII-5: Historical Cost-effectiveness for CARB Evaporative Regulations



Abbreviation Key:

GDF – Gasoline Dispensing Facility
LEVIII – Low Emission Vehicle
LSI – Large Spark-Ignition (Average)
OB - Outboard
OHRV – Off-Highway Recreational Vehicles
OMT – Outboard Marine Tanks
PFC - Portable Fuel Container
PWC – Personal OHRV
SIMW – Spark-Ignition Marine OHRV
SD/I – Sterndrive/Inboard
SORE – Small Off-Road Engines

C. Impacts on the State Economy

The proposed amendments will require that all CARB certified OHRV must meet applicable emissions standards. However, as a result of the phase-in of emissions control requirements and other flexible compliance options, the proposal is not expected to impose a significant cost burden on OHMC manufacturers, dealers, consumers, or any other affected consumer. ATVs are most compliant with existing green sticker emissions controls and ATV manufacturers do not anticipate additional costs to meet the more stringent proposed exhaust standards for ATVs. OHMCs do have many red sticker models that will need updated control technology to meet the proposed standards. This control technology for OHMCs is already available on U.S. EPA-certified and CARB-certified OHMCs and therefore should not require a significant increase in applicable costs to implement across all models. However, it is possible that OHMC model availability will be affected if some manufacturers opt to not sell certain models in California to reduce costs. This could affect dealers, so staff

has worked with industry to provide pathways that allow for flexibility for certification and model availability. For OHMCs, the average estimated cost increase to meet the proposed standards are presented in Table VIII-4. The details of the calculations and methodologies are given in Appendix B. Based on the previous assumptions; staff expects no impact on California competitiveness and employment.

Table VIII-4: Estimated Cost Increase for Proposed Amendments

	Weighted Incremental Costs	Weighted Capital Cost[s]	Estimated Retail Price Increase
OHMC	$59.14	$137.94	$197.07
Increased Retail Costs (2x markup)			**$333.05**

The following sections present the economic analysis and impacts for stakeholders affected by the proposed regulation. Table VIII-1 summarizes the total economic impacts of the proposed amendments on California's economy.

Because all major OHRV manufacturing facilities affected by the proposed regulation are located outside of California, there will no significant statewide adverse economic impact directly affecting business, including ability to compete in California. During the initial years of implementation, the increased cost of OHRV may lead to a slight drop in demand that could result in lower profits for OHRV dealers. Dealers may carry unsold stock over to the next year, possibly incurring less profit on the sale of these units. However, these impacts have been mitigated by the flexible phase-in schedule of emission controls and the ability for manufacturers to certify vehicles using fleet average emissions. The proposal harmonizes with U.S. EPA standards for OHMC from 2020 through 2026 for evaporative standards and from 2022 through 2027 for exhaust standards, so California's OHRV dealers should have access to the same models for sale as their counterparts in the other 49 states. Staff projects there will be no noticeable change in employment, business creation, elimination or expansion, or business competitiveness in California due to the proposed regulatory action.

1. IMPACT TO INDIVIDUAL CONSUMER

Direct Impact

The increased retail cost for evaporative control, testing, and certification costs per vehicle are expected to be $333 per OHMC, which represents approximately 6 percent of the retail cost of an OHMC (assuming an average cost of $5,711 as reported by MIC). It is anticipated that the increased upfront cost will be more than offset by cost savings from fuel injection fuel efficiency and emission reductions (fuel lost from permeation and evaporation) over the lifetime of the

OHRV. Refer to Appendix B and Appendix C for further details on estimated costs and emissions reductions.

Indirect Impact

Any OHRV manufacturer that sells an evaporative family with fewer than 150 units in California may experience high per-vehicle costs which could result in model unavailability. This may affect consumers who are expecting to purchase a particular OHMC model produced by a manufacturer who can no longer support the costs to sell the model in California. The reduction of model availability would also impact dealers who sell particular models. Staff expects that a manufacturer with higher sales volumes for that segment of OHRV will offer a comparable model for sale that a consumer can purchase in lieu of the original model for sale.

2. BUSINESSES AFFECTED

Any business involved in the manufacturing of OHRV sold in California will potentially be affected by the proposed regulation. Additionally, businesses that supply parts to these manufacturers, as well as those businesses that buy and sell OHRV in California may be affected by changes in models available for sale in California. The focus of this analysis will be on the OHRV manufacturers because these businesses would be most directly impacted by the proposed amendments. ATVs are mostly compliant with existing green sticker emissions controls and ATV manufacturers stated they anticipate no additional costs to meet the more stringent proposed exhaust standards. As a result, staff anticipate the costs for compliance will only fall on those OHRV manufacturers, dealers, and users who make, sell, and buy OHMC.

OHRV Manufacturers

Based on a comprehensive review of CARB OHRV certification data from 2012 through 2017, there are approximately forty OHRV manufacturing businesses located worldwide that sell vehicles in California. None of these manufacturers are located in California, although they may have offices in the State. Five large companies control about 95 percent of the sales in California. As noted above, the proposed regulation is anticipated to add regulatory costs that CARB staff expect manufacturers to pass on to dealers and customers, resulting in a total cost increase of about $333 per vehicle.

OHRV Dealers

Most OHMC manufacturers sell their products through distributors and dealers, some of which are owned by manufacturers and some of which are independent. CARB staff expect manufacturers to upgrade their red sticker OHMC to meet the applicable emissions controls and to pass on that cost to dealers, who will pass

the cost on to consumers, as described above. It is possible that OHMC manufacturers will choose to not certify certain models and will instead sell them as competition vehicles or not sell them at all. If that happens, some dealers may be impacted by having less models to sell. A potential indirect impact could be that dealers, distributors, or importers downsize their staff due to a decrease in OHMC sales associated with the increase in costs or decreased availability of OHMC models.

To avoid this outcome, staff worked with manufacturers to provide flexibility to allow low volume models to continue to be sold in California. Evaporative emissions standards for OHMC from 2020 through 2026 are identical to U.S. EPA standards, and exhaust emissions standards for OHMC are also identical to federal standards from 2022 through 2027. This puts California's OHMC dealers on a level playing field with dealers nationwide, and is expected to minimize or avoid a reduction in available models to sell. While it is difficult to predict market trends, CARB staff do not expect manufacturers to reduce their available models available to dealers in California given the certification pathways staff has provided for manufacturers to maintain model availability.

3. IMPACT ON SMALL BUSINESSES

While no OHRV manufacturers are based in California, there are approximately 200 OHRV dealers, service centers, and parts retailers throughout the State. These dealers and service centers are primarily self-employed businesses or small businesses with less than 100 employees. The proposed amendments only apply directly to OHRV manufacturers, but there will be a secondary impact to California small businesses that sell and service OHRVs. Refer to the "OHRV Dealers" discussion immediately above for details.

4. POTENTIAL IMPACT ON BUSINESS COMPETITIVENESS

The proposed regulation would have no significant impact on the ability of California OHRV manufacturers to compete with manufacturers of similar products in other states. The reason for this is because all manufacturers that produce OHMC for sale in California are subject to the proposed amendments regardless of their location. Furthermore, all of the OHRV manufacturers, except for satellite office locations, are located outside of California.

5. POTENTIAL IMPACT ON EMPLOYMENT

The proposed regulation is not expected to affect California employment because the retail price increases attributable to the proposed regulation are too small to significantly impact new OHRV sales. An average estimated increase of approximately five percent in the retail price of an OHRV is not expected to significantly affect sales of OHRV and businesses, which is not likely to affect employment. However, in the unlikely event that certain OHRV models are not

available, employment for small businesses may be affected as dealers will be able to sell fewer models and may lose business.

6. BUSINESS CREATION, ELIMINATION, OR EXPANSION

The proposed regulation is not expected to have a noticeable impact on California OHRV manufacturers. On average, the manufacturer cost to comply with this regulation is about $333 per OHRV. This will result in about a six percent increase in the average retail price for new OHRV. No business creation, elimination or expansion is expected as a result of this proposed regulation.

7. POTENTIAL IMPACT ON LOCAL AND STATE AGENCIES

Local and state agencies would be affected by a price increase in the cost of new OHRV bought in California to the extent that they purchase red sticker OHRVs. The number of OHRV purchased by all local agencies and most state agencies is unknown. To the extent that it occurs, it is expected to be small (Appendix B). Specifically, the California Department of Parks and Recreation anticipates annually purchasing up to five emissions-compliant OHRV after 2022 and thus their annual costs as a result of this proposed regulation are estimated to be approximately $8,500 (i.e., $333 price increase per OHMC x 5) beginning in the 2021-2022 fiscal year.

Three state agencies have roles in implementing this proposed regulation, however, CARB is the only agency anticipated to incur any costs. CARB anticipates the need for 0.64 PY for an Air Pollution Specialist in FY 2019-2020; and 0.64 PY for an Air Pollution Specialist for implementation and 0.5 PY for an Air Pollution Specialist for implementation in FY 2020-2021, and every year thereafter. This would be a total cost of $321,040 for the first three years of implementation, and $205,840 annually thereafter. These implementation and enforcement costs include certifying evaporative emissions control components, certifying OHRV, inspecting evaporative emissions control components and OHRV, and emissions testing OHRV in-use for evaporative emissions compliance. The Department of Motor Vehicles (DMV) will need to change their OHRV registration system to issue only green stickers after 2022, but this cost can be absorbed according to DMV. State Parks anticipates spending the same amount of time to ensure only certified OHRV are used on their public lands and thus this cost remains the same according to State Parks.

Additional cost information relevant to the impact on state agencies is presented in Appendix B.

IX. EVALUATION OF REGULATORY ALTERNATIVES

Government Code section 11346.2, subdivision (b)(4) requires CARB to consider and evaluate reasonable alternatives to the proposed regulatory action and provide reasons for rejecting those alternatives. This section discusses alternatives evaluated and provides reasons why these alternatives were not included in the proposal. As explained below, no alternative proposed was found to be less burdensome and equally effective in achieving the purposes of the proposed regulation in a manner than ensures full compliance with the authorizing law. The Board has not identified any reasonable alternatives that would lessen any adverse impact on small business.

No Action (Small Business Alternative)

CARB staff considered the alternative to take no action, leaving in place the emissions exemption for red sticker OHRV. Manufacturers and dealers would not be affected by this option. However, adverse effects from continuing NOx and ROG emissions would continue to contribute to the overall mobile source emissions in California. Red sticker OHRVs are a high-emitting mobile source category that must be controlled for California to meet its federally and state-required emissions reductions limits. Failing to reduce emissions from this category does not support California's efforts to meet its air quality goals. Failing to take action also allows uncontrolled red sticker vehicles to be used recreationally in California on public lands while they are limited to competition use under U.S. EPA rules. This option was not chosen because it achieves no emissions reductions and does not appropriately align the California and U.S. EPA OHRV programs.

Impose Standards Immediately

CARB staff also considered the alternative of applying the green sticker standards without a phase-in period or alternative emissions standards. The green sticker exhaust and evaporative standards would apply immediately in 2022. Without the phase-in period, manufacturers would need to immediately begin redesign, research, and development of their current red sticker certified vehicles. Manufacturers would be forced to choose to spend the money to continue with their current models or choose not to sell their products in California. Models that do not make enough profit to warrant a redesign would likely be removed from the California market by their manufacturers. This would likely result in a reduced range of OHRV model variety, which could lead to reduced OHRV sales. The reduction in sales may be manageable for manufacturers, which in many cases are large multi-national corporations. However, reduced sales could be significant to dealers, which are generally California-based small businesses. Staff did not choose this option due to the risk of adverse financial impact on California OHRV dealers.

Small Business Alternative

Most of the small businesses affected by the proposed amendments are likely to be OHRV dealers in California. If OHRV model availability is significantly reduced because emissions standards are too stringent, dealers throughout California could be affected by reduced sales. The only alternative to avoid any effect on small businesses (dealers) would be to choose no action. However, as described above under the no action alternative, this would not be an effective alternative because it would not reduce OHRV emissions or address California's air quality concerns. Instead, staff crafted the proposal to achieve significant emissions reductions while minimizing or avoiding the likelihood of reduced model availability.

Health and Safety Code Section 57005 Major Regulation Alternatives

The proposed regulation will not result in a total economic impact on state businesses of more than $10 million in one or more years of implementation. Therefore, this proposal is not a major regulation as defined by Health and Safety Code section 57005.

X. JUSTIFICATION FOR ADOPTION OF REGULATIONS DIFFERENT FROM FEDERAL REGULATIONS CONTAINED IN THE CODE OF FEDERAL REGULATIONS

Under section 213(a)(3) of the Clean Air Act (42 U.S.C. §§ 7547) U.S. EPA is authorized to regulate emissions from nonroad vehicles in engines. As a result, in 2006, U.S. EPA implemented emissions controls for off-highway recreational vehicles, including OHMC and ATVs. (40 C.F.R. Part 1051 et seq.)

Under section 209(e)(2) of the Clean Air Act (42 U.S.C. § 7543(e)(2)), California is authorized to adopt regulations regarding new off-road vehicles and engines if certain standards are met and provided that California receives authorization from the Administrator of U.S. EPA prior to enforcing its regulations. These standards include that the California determines its emissions standards will be, in the aggregate, at least as protective of public health and welfare as applicable federal standards.

Under the proposed regulation, California's exhaust and evaporative emissions standards for certain OHRV (OHMCs) will be harmonized with (identical to) U.S. EPA standards for a transition period before California's existing exhaust and evaporative emissions standards for OHRV will be implemented. Therefore, California's standards will be at least as protective of public health and welfare as applicable standards. The proposed regulation imposes exhaust and evaporative standards for certain OHRV that are more stringent than the corresponding federal standards and therefore at least as protective of public health and welfare as applicable federal standards. For example, the proposed exhaust standard

for ATV and utility vehicles in 2028 is 0.9 g/km HC while the federal standard is 2.0 g/km HC + NOx. The emission reductions achieved by the more stringent standards are needed in order to help address California's unique air quality challenges. In each case where the proposed amendments are more stringent than comparable U.S. EPA standards, staff has determined that the requirements are technically feasible and cost effective.

CARB will seek authorization from U.S. EPA as appropriate to comply with section 209(e)(2) of the Clean Air Act, described above, before enforcement of this proposed regulation.

XI. PUBLIC PROCESS FOR DEVELOPMENT OF THE PROPOSED ACTION (PRE-REGULATORY INFORMATION)

Consistent with Government Code sections 11346, subdivision (b), and 11346.45, subdivision (a), and with the Board's long-standing practice, CARB staff held public workshops and had other meetings with interested persons during the development of the proposed regulation. These informal pre-rulemaking discussions provided staff with useful information that was considered during development of the regulation that is now being proposed for formal public comment.

Staff held numerous meetings with OHRV manufacturers, both face-to-face and via teleconference. Staff also held multiple public workshops with stakeholders and presented at the Off-Highway Motor Vehicle Recreation Commission (OHMVR) meetings throughout California. Table XI-1 summarizes the public workshops and other significant outreach events that staff participated in during the red sticker program assessment and rule development process.

Table XI-1: Summary of Public Outreach Events

Date	Location	Venue	Topics
12/10/2013	Sacramento	Workshop	Overview of Red Sticker Assessment Plan
12/16/2013	Fresno	Workshop	Overview of Red Sticker Assessment Plan
12/17/2013	Diamond Bar	Workshop	Overview of Red Sticker Assessment Plan
2/27/2014	El Monte	Workshop	Draft Survey and Emissions Test Plan
3/6/2014	Sacramento	Workshop	Draft Survey and Emissions Test Plan
5/2/2014	Victorville	Workshop	Draft Survey and Emissions Test Plan
9/26/2014	Lake Tahoe	OHMVR Commission	Update on Red Sticker Assessment

7/15/2015	Sacramento	OHRV Work Group	Review Results of Pilot Survey
9/25/2015	Mammoth Lakes	OHMVR Commission	Update on Red Sticker Assessment
9/9/2016	Folsom	OHMVR Commission	Update on Red Sticker Assessment
4/18/2017	Sacramento / El Monte	Workshop	Survey and Emissions Testing Results, Proposal to End Red Sticker Program
6/22/2017	Sacramento	Board Hearing	Summary of Red Sticker Assessment, Proposal to End Red Sticker Program
4/11/2018	El Monte	Workshop	Draft Updated OHRV Emissions Inventory
5/16/2018	El Monte	Workshop	Draft Regulatory Proposal
5/17/2018	Sacramento	Workshop	Draft Regulatory Proposal
10/23/2018	El Monte	Workshop	Updated Draft Regulatory Proposal

Public Workshop notices were sent to all interested parties via CARB's e-mail services: listserv and GovDelivery. Interested parties generally include OHRV manufacturers, dealers, riders, environmental organizations, and trade associations, as well as other interested parties. Staff considered all oral and written comments received during each workshop. As a result of the comments received throughout the regulatory development process, staff made significant changes to the proposed regulation, which are reflected in the final proposal.

Table XI-2 lists the major issues brought up by the OHRV industry and stakeholders during the course of regulatory development that have been resolved prior to presenting the regulation to the Board.

Table XI-2: Summary of the Major Issues Raised by OHRV Stakeholders

Issue	Staff Response
OHRV category is a very small contributor to air pollution, too small to justify further regulation.	California's State Implementation Plan (SIP) outlines CARB's commitments to establishing compliance with federal and state ambient air quality standards. To meet these standards, the SIP requires that emissions are reduced from all categories (large and small), including mobile sources such as OHRV.
Further regulation of OHRV will result in reduced model availability, adversely impacting dealers and riders.	The proposed amendments include relaxed standards and flexibility so that manufacturers can maintain model availability. Significantly, CARB's OHMC standards are harmonized with U.S. EPA standards from 2022 through 2027.
Regional air quality standards should be considered rather than a single statewide standard for OHRV.	CARB develops statewide regulations for all mobile sources across California. Regional standards are not feasible for this type of mobile source that owners use throughout the State.
The OHMC rider survey response rate is too small, and results are not representative of California's OHMC riders as a whole.	The OHMC rider survey is the largest survey of off-road riders ever conducted. The response rate was determined to be statistically significant by CARB staff and our survey partners at UC Davis. Staff evaluated the DMV database and determined the spatial allocation based on representatives from each county (Appendix D).
OHRV manufacturers need relief from the costly evaporative standard adopted in 2013.	The proposed amendments relax the evaporative standards for OHMC, and provide additional time for manufacturers to develop compliant emission controls.
Emissions testing for this assessment was not representative or complete.	Staff developed a test plan that included representative OHRV throughout California. All reasonable efforts were taken to complete the test plan. Tests that were invalid were not included in the emission factor analysis. Where planned testing was not possible (e.g., high-emitting 2-stroke models), staff used the most conservative values from other recognized test labs to supplement the assessment test data.
Ending the red sticker program will increase the population of competition-only OHRV.	CARB is working with OHRV manufacturers, DMV, and land management agencies on strategies for managing competition-only OHRV once the red sticker program ends, including providing opportunities to practice for competitive events.

XII. REFERENCES

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XIII. APPENDICES

Appendix A: Proposed Regulation Order

Appendix B: Economic Analysis

Appendix C: Emissions Inventory

Appendix D: Off-Highway Motorcycle Owner Survey Report

Appendix E: Emissions Test Plan and Test Results

Appendix F: Development of Automated VIN Decoder for Evaluating California's OHRV Population