

**Appendix B:
Red Sticker
Economic Analysis Methodology**

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California Air Resources Board
Monitoring and Laboratory Division

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I. METHODOLOGY TO DETERMINE ECONOMIC IMPACTS

To determine the economic impacts of the proposed amendments to the Red Sticker program for Off-Highway Recreational Vehicles (OHRV), staff evaluated the increase in retail prices to the consumer to implement evaporative and exhaust emission controls. The proposed amendments include the changes in emission controls from an uncontrolled red sticker OHRV to United States Environmental Agency (U.S. EPA) emission controls, as well as the cost to California Air Resources Board (CARB) emission controls using a design-based control certification program (Table I-1). These changes will increase costs for each of these categories that were determined from an industry-wide cost survey (see attachment A). The cost survey was distributed to OHRV manufacturers, and included questions that requested the cost increase for each of these categories. In addition to the increased incremental costs based on components, staff also requested research and development costs. The research and development costs were weight-averaged over all the applicable off-highway motorcycles (OHMCs) and the lifetime of the regulation to determine the amortized capital costs per OHRV. The total average cost was then calculated based on the average increased component costs and the amortized capital costs, then given a dealer and manufacturer markup to determine the total incremental cost to the consumer. The cost survey focused mainly on off-highway motorcycles (OHMC) since the red sticker program only applies to OHMCs and All-Terrain Vehicles (ATV) and, based on the DMV database and CARB Executive Order (EO) certifications, staff found that nearly all the ATVs were already certified to green sticker and any additional costs would be negligible.

Table I-1: Requested Costs from Industry-Wide Cost Survey

OHMC Category	Uncontrolled to U.S. EPA	U.S. EPA to CARB	Design-Control Components
Evaporative Emissions	X	X	X
Exhaust Emissions	X	X	

Since green sticker certified OHMCs with emission controls are currently available in motorsport dealerships, it is likely that OHMC manufacturers will transfer control technology from green sticker certified vehicles to red sticker uncontrolled vehicles. In these cases, control component technology, manufacturing equipment, and materials will require only small changes to meet the more stringent CARB requirements. In some cases, component manufacturers have noted no change in cost because their products already meet CARB's proposed emissions standards.

Staff based the cost impact analysis of the incremental costs incurred to meet CARB compliance, above and beyond the costs to meet the additional categories described in Table I-1. Staff conducted an industry-wide CARB cost survey to determine the incremental cost increase. The maximum of all the costs reported by survey respondents was applied to the average OHMC engine and evaporative family to estimate an incremental cost increase to the OHMC manufacturers and the resulting retail price increase to the consumer to meeting the proposed amendments.

At the workshops, manufacturers stated that additional costs may be necessary to modify OHMC models currently certified as red sticker to meet the emission standards. In some cases, costs would be too expensive to produce low volume models. OHRV manufacturers state that there would be research, redesign, and testing costs to meet the proposed standards. So, in addition to the component costs, staff requested that research and development costs be included in the overall cost estimate. Staff then averaged the total research and development costs over the entire OHMC fleet to determine the amortized capital cost increase for research and development.

To meet the design-based control standard for model year (MY) 2022 and later, staff did not include a cost increase for fittings because hose and tank manufacturers are likely to use the same as those that are currently used to meet other standards. Testing costs were also requested from the cost survey to determine the total testing costs per evaporative family. Staff determine that average 1-2 evaporative families would most likely be needed to certify an OHMC manufacturer fleet. The additional cost for testing was averaged over the entire fleet and included in the reported capital costs.

Although additional testing costs could include the cost for meeting more stringent standards in a Sealed Housing for Evaporative Determination (SHED), it is likely that low volume models will certify by design and will not need to have SHED testing for the determination of evaporative emissions. Staff anticipates that OHMC manufacturers will likely choose to certify by design to avoid additional SHED testing costs.

Lastly, staff relied upon industry reports, the DMV registration database, and association reports to identify and assess the economic impacts on businesses and the potential impact on the economy of the state. Staff anticipates that the OHRV industry will most likely to pass on to consumers additional costs for emission controls. Although industry provided low and high cost estimates, staff used the most conservative approach and evaluated the maximum cost to stakeholders.

A. COMPLIANCE EQUIPMENT COST

Staff conducted an industry-wide cost survey to determine the increased cost to implement the standards set by the proposed amendments. As described in the methodology, categories for additional costs were presented in Table I-1. Any cost increases attributable to the difference between CARB and U.S. EPA emissions standards were calculated. The normal markups for OHRV manufacturers and dealers

were then added to the increased compliance cost to estimate the retail price to the consumer. Staff used the cost markup increase from the 2013 rulemaking to account for the OHRV markup. The markup presented in this Appendix was found in the Risk Management Assessment Studies (RMA, 2017). The markups for OHRV manufacturers and dealers are presented in Table I-2.

Table I-2: OHRV and Dealer Markup

	Markup (%)
OHRV Manufacturer	30
Dealer*	30

*Risk Management Assessment Studies (2017)

Cost Survey

CARB sent surveys to OHRV Manufacturers through the Motorcycle Industry Council (MIC), which represents all the major OHRV manufacturers. However, staff received only 2 responses from the survey of the top 5 manufacturers that make up more than 95 percent of OHMC sales in California. These responses were used to develop cost estimates for meeting the proposed amendments. The survey form allowed manufacturers to provide estimates of meeting the proposed standards based on various configurations of their OHRVs. The standards were presented in the cost survey as various options with different control proposed configurations for all the different types of OHMCs (4-stroke carbureted and 4-stroke fuel injection). These configurations include various types of emissions controls including, fuel injection, low permeation fuel tanks, low permeation fuel hoses, carbon canisters, automatic shut-off valves, and engine management systems. In addition to these types of controls, staff also presented a portion for emission controls systems that the manufacturer could choose from as it pertains to their business model. The cost survey also requested cost information of configuration for both evaporative and exhaust emission controls. Additional costs such as one-time costs to implement the additional standards and the research and development costs were also included. Staff also requested cost information for costs associated with internal verification of meeting the proposed standards. Testing costs were also requested. For evaporative emissions, staff requested information pertaining to the cost of each potential evaporative emission component. The most commonly listed components are presented but the OHMC manufacturer was allowed to propose a new component and the cost associated with it. Samples of the cost survey forms and the cost letter are shown in the Appendix (Figure VII-1 through Figure VII-10).

In order to evaluate the cost to low volume models, staff requested that manufacturers provide estimated costs for high and low volume models. Staff only evaluated the maximum costs reported by survey respondents since new OHMC product development sensitive to increased costs and staff wanted to evaluate the most conservative approach.

Results of the Cost Survey

Five manufacturers account for more than 95 percent of OHMC sales in California. Staff received responses from two of these five manufacturers. The cost information was used to determine the regulatory cost increases to meet the proposed amendments. Incomplete fields were not included in the cost analysis. In some cases, incomplete fields could indicate the manufacturers did not anticipate increase costs for these vehicles or they did not apply. However, since this was not explicitly stated, staff could not determine the intent of an incomplete (blank) response. All information sent to CARB was given under the intent of confidentiality and the cost information was evaluated as representing the typical costs for the industry. The number of OHRV models that would be subject to increased costs as a result of the proposed regulation was determined from the 2017 DMV database. Staff evaluated which models already meet the current standard through the CARB EO database and did not include additional costs for these vehicles. However, for vehicles that did not meet the final phase-in standards, staff used the highest costs given in the survey and applied these costs over the remaining category for each manufacturer that provided cost information. The average life of a typical OHRV was determined as described in the methodology, the cost survey was sent only to OHMC manufactures, and the data corresponds only to that segment of the OHRV industry.

Table I-3. Cost Analysis Data for OHRV Emission Control, 2018\$

Mfr Code	Total Incremental Cost/OHRV	Weighted Incremental Cost	Capital Costs per Year per Year	Capital Costs per Year per Vehicle	Weighted Capital Cost	Total Annual Cost per Vehicle		Weighted Incremental Costs	Weighted Capital Costs
							Average Life of Vehicle, years	20	20
EVA	\$43.00	\$ -	\$ 104,315	\$ -	\$ -	\$ 43	Total Size of All Families in this Category	2,676	2,676
EVA	\$75.00	\$ 23.12	\$ 120,364	\$ 145.90	\$ 44.98	\$ 221	Weighted Cost for OHMCs	\$ 59.14	\$ 137.94
EVA	N/A	N/A	N/A	N/A	N/A	N/A			
							Total	\$ 197.07	
EVB	\$86.00	\$ -	\$ 152,461	\$ -	\$ -	\$ 86	Total (with 2x markup)	\$ 333.05	
EVB	\$86.00	\$ 34.16	\$ 152,461	\$ 143.43	\$ 56.97	\$ 229	Total pounds over 20 year life	318.2	
EVB	\$7.00	\$ 1.85	\$ -	\$ -	\$ -	\$ 7	Estimated Cost Effectiveness	\$ 1.05	
EXA	\$0.00	\$ -	\$ 96,291	\$ -	\$ 35.98	\$ -			

A. Cost Estimate Equations

The following cost estimate equations are used to develop values in each of the cells in the columns of Table I-3.

1. Total Incremental Cost

The OHRV manufacturers in the cost survey provided low and high values for total incremental cost per vehicle. To be conservative, staff used the highest values provided by survey respondents.

2. Weighted Incremental Cost

$$WIC = TICV \times \frac{FS}{SFS}$$

Where,

WIC = Weighted Incremental Cost

TICV = Total Incremental Costs per Vehicle

FS = Family Size

SFS = Sum of All Family Sizes in a given category

3. Amortized Capital Costs per Year

$$CCY = (RD \times TC) \div \left(\frac{1 - (1 + IR)^{-FL}}{IR} \right)$$

Where,

CCY = Capital Costs per Year

RD = Redesign Costs

TC = Testing Costs

IR = Interest Rate (5 percent)

FL = Family Lifespan (20 Years)

4. Total Annual Cost per Vehicle

$$TACV = TICV \times \frac{CCY}{FS}$$

Where,

TACV = Total Annual Cost per Vehicle

TICV = Total Incremental Cost per Vehicle

CCY = Amortized Capital Costs per Year per Vehicle

FS = Family Size

5. Weighted Fixed Costs per Year

$$WFCY = (CCY \times FS) \div SFS$$

Where,

WFCY = Weighted Fixed Costs per Year

CCY = Amortized Capital Costs per Year

FS = Family Size

SFS = Sum of all Family Sizes in Survey

6. Weighted Fixed Cost per OHRV

$$WFCV = WFCY \div FS$$

Where,

WFCV = Weighted Fixed Cost per OHRV

WFCY = Weighted Fixed Cost per Year

FS = Family Size

7. Total Costs per Vehicle per Family

$$TCV = ATIC + \frac{ATFCY}{FS}$$

Where,

TCV = Total Costs per Vehicle per Family

ATIC = Adjusted Total Incremental Costs

ATFCY = Adjusted Total Fixed Cost per Year

FS = Family Size

8. Estimated Cost-Effectiveness (per OHRV per Pound ROG)

$$CE = TCV \div PR$$

Where,

CE = Cost-Effectiveness per OHRV per Pound

TCV = Total Costs per Vehicle per Family

PR = Lifetime Pounds Reduced per Controlled Vehicle

B. Cost per Vehicle

The total weighted cost per vehicle is the sum of the weighted average incremental costs and fixed costs.

$$TWC = TWIC + TWFC$$

$$TWIC = \sum(WIC)$$

$$TWFC = \sum(WFC_{OHRV})$$

Where,

TWC = Total Weighted Cost

TWIC = Total Weighted Incremental Cost

TWFC = Total Weighted Fixed Cost

WFC_{OHRV} = Weighted Fixed Cost per OHRV

WIC = Weighted Incremental Cost

The estimates for the total costs of the proposed amendments are presented in Table I-4. Staff used the projected annual OHRV units sold and multiplied the units to the total incremental and fixed costs per OHRV (including markup). The total annual sales were then added to determine the total costs over the lifetime of the OHRV.

Table I-4. Estimates of Total Costs for Proposed Amendments, 2018\$

Calendar Year	Annual OHMC Units Sold	Total Weighted Incremental Costs	Total Weighted Fixed Costs	Total Annual Retail 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

Annual OHRV units sold represent the projected sales of the OHMC sold for that given year. These values are determined from the emission inventory as described in Appendix C.

1. Total Weighted Incremental Costs

$$TWIC = AUS \times TWICV$$

Where,

TWIC = Total Weighted Incremental Costs = \$59.14 x 1.3 x 1.3

AUS = Annual Units Sold

TWICV = Total Weighted Incremental Costs per Vehicle

2. Total Weighted Fixed Costs

$$TWFC = AUS \times WFCV$$

Where,

TWFC = Total Weighted Fixed Costs = \$137.94 x 1.3 x 1.3

AUS = Annual Units Sold

WFCV = Weighted Fixed Costs per Vehicle

3. Annual Cost for New Sales

$$ACNS = TWIC + TWFC$$

Where,

ACNS = Annual Cost for New Sales

TWIC = Total Weighted Incremental Costs

TWFC = Total Weighted Fixed Costs

The proposed amendments will require that red sticker OHMCs meet evaporative and exhaust standards. Increased compliance costs are based on different tiers of emission controls as part of the proposal.

The increased manufacturers cost (from cost survey) is averaged over all models per manufacturer. The average estimated price increase is multiplied by two levels of markup of 30 percent each for OHMC manufacturer (unless specified) and dealer consistent with the markups used in the 2013 rulemaking as follows:

$$EPI = \Sigma [(WC) \times 1.30 \times 1.30]$$

Where,

EPI = Average Price Increase

WC = Weighted Cost

The proposed amendments require that new OHRV meet emission standards which are consistent with U.S. EPA standards initially in MY2021/2 and then apply more stringent

standards in MY2027/8. Using the most conservative approach, staff assumed the highest costs from the survey for meeting the stringent standards and have estimated the average increased costs to be for meeting the MY2027/8 standards. Table I-3 summarizes the average retail price increase based on the cost survey responses assuming that affected OHRV manufacturers and dealers are able to pass on any cost increase entirely to the consumer. In order to meet the proposed amendments, the average estimated retail price increase is expected to be \$333 per vehicle.

Based on the proposed standards for design-based certification, staff estimated the evaporative emission control component costs increase and summed each category to achieve the total costs associated with the proposed amendments. As in the proposed amendments, staff is proposing multiple tiers of emission controls that apply to various types of models. The distribution of the tiers and models affect the total estimated costs for manufacturers to meet each tier. The emission tiers include different levels of exhaust and evaporative control going from uncontrolled red sticker vehicles to U.S. EPA controls, then to current CARB green sticker controls, and tighter exhaust emission standards. The proposal allows for design-emission controls for low volume models. It is likely that OHMC manufacturers will take advantage of the design certification pathway as it will result in lower research and development costs if they apply the technology used on dual sports and green sticker OHMCs. This will reduce testing costs but would lead to additional component testing and costs which can be considerably cheaper than the costs estimated by staff.

Staff presented these assumptions at an October 23, 2018 workshop.

OHMC Warranty

The proposed amendments include emission controls for all OHRVs. Currently, there are no warranties required or provided for the red sticker vehicles. All certified OHRV need to adhere to the current 2013 regulation for evaporative components. That rulemaking included a 30 month warranty for evaporative emission-related parts that cost less than \$200 which is similar to the warranty for exhaust parts. In addition, the current regulation extends the warranty to 60 months for repairs that cost more than \$200. The warranty costs for components are expected to be negligible because manufacturers are already using these components for green sticker certified vehicles and are covered by the current regulations.

B. COST ESTIMATES TO REDUCE EXHAUST EMISSIONS

The proposed amendments provide a fleet wide averaging of exhaust emissions standards that begin with U.S. EPA harmonization and increase in stringency over time until the current CARB exhaust standard is achieved. Staff anticipates that costs from the exhaust emission fleet averaging tiers will be negligible. The change from exhaust emissions to the U.S. EPA tier is expected to not be significant as OHMC manufacturers are currently meeting both standards and the emission controls are readily available in

the remaining 49 states. For the tighter exhaust emission standard CARB tier, staff also anticipates that the costs will be negligible since most OHMCs are already meeting or are close to the current standard. The only OHMC that will require significant change are 2-stroke vehicles. As the current population trend is towards 4-stroke vehicles and the redesign costs are too expensive for 2-stroke OHMCs, it is likely that 2-stroke OHMCs will be discontinued or be sold as competition-only vehicles.

Information from the cost survey also indicated that costs to meet the emission controls for the tighter emission standard would be negligible. Manufacturers stated that the bulk of the costs to meet the exhaust standards will come from redesign of the engine and fuel management system. The estimated cost for redesign to meet the additional exhaust standards is expected to be about \$1.2 million. This cost will be averaged over the estimated number of OHMCs that are anticipated to need the redesign and the cost of the lifetime of the OHMC. The amortized capital cost is about \$138 per vehicle (see Table I-3).

C. COST ESTIMATES TO REDUCE EVAPORATIVE EMISSIONS

Manufacturers will need to use low emission components to meet the proposed standards. These components will need to reduce permeation and diurnal venting emissions. Most manufacturers will likely use a low permeation fuel tank, low permeation fuel hose, and a carbon canister. However, other emission controls such as a pressure relief valve could be used as well as engine modification. The cost survey listed these evaporative components as well as an open field for additional components costs if necessary. Staff also requested any additional testing costs needed to evaluate the performance of these components. The costs for evaporative controls were not given for a specific evaporative component but for the total costs of all the components necessary to meet the proposed requirements. The total costs for the evaporative system components are given in Table I-5.

Table I-5: Evaporative Component Increased Manufacturing Costs

OHRV Category	Increased Manufacturing Costs		
	Low Estimate	High Estimate	Weighted Average
OHMC	\$43	\$86	\$59.14

In addition to the evaporative component costs, manufacturers stated that additional costs may be necessary to meet the requirements. These costs include re-design, testing, and certification costs. The additional high and low costs are presented in Table I-6.

Table I-4 shows that all OHMC manufactures are expected to sell 10,917 new vehicles annually, on average, from MY 2022 through MY 2042. Since there are 5 OHMC

manufacturers that account for 95 percent of the market share in California, each manufacturer is expected to sell 2,075 (i.e., $10,917 \times 0.95 / 5$) new vehicles annually on average. The on-going incremental compliance cost for a typical manufacturer, then, is about \$123,000 (i.e., 2,075 new sales \times \$59.14 average per unit cost).

Table I-6: Evaporative Research and Development Increased Manufacturing Costs

OHRV Category	Increased Manufacturing Costs		
	Re-design	Testing and Certification	Total
High	\$1,400,000	\$500,000	\$1,900,000
Low	\$1,000,000	\$300,000	\$1,300,000

1. LOW PERMEATION FUEL HOSES

There may be additional costs for the requirement of low permeation fuel hoses. Many OHRVs already meet the U.S. EPA standards for fuel lines and will not have increased costs during the harmonization period until MY2027/8. An increased cost may be needed to meet the additional stringent standard for MY2028 for design standard of 5 g/m²/day @ 35°C from the U.S. EPA standard of 15 g/m²/day @ 23°C. Industry provided cost estimates for producing a hose that would meet these requirements. These costs are included in the total evaporative emission costs from the cost survey.

2. LOW PERMEATION FUEL TANKS

In addition to low permeation fuel hoses, staff anticipates that low permeation fuel tanks will also be used to comply with the proposed evaporative standards. Most manufacturers are already meeting the current U.S. EPA fuel tank standard and need to make little or no modifications, which reduces the overall cost of producing compliant low permeating fuel tanks for the harmonization period. Staff anticipated the compliance cost to be minimal to no cost increase. Manufacturers that are using metal tanks will incur no additional cost because they already have low or no permeation characteristics.

3. CANISTER SYSTEMS

To meet the diurnal venting requirements based on the proposed amendments, staff assumes that OHMC manufacturers will primarily use carbon canisters. Since the U.S. EPA does not require carbon canisters for OHRVs, there will be no cost increase for diurnal requirements during the U.S. EPA harmonization period until MY 2027/8. Staff anticipates there will be a cost increase for the canister components and the research and development of actively purging a carbon canister through the intake. Since an

active purge canister can affect the performance of an OHRV, the additional research and testing are necessary to ensure proper sizing and performance. Staff has also provided a certification pathway for passive purging canisters, which would reduce additional research costs. The cost increase for the components and the research and development costs are included in the overall costs of the system in Table I-5 and Table I-6.

4. NON-CANISTER SYSTEM

In addition to using carbon canisters as a form of diurnal venting control, other components may be used. Manufacturers may use pressure relief valves or a combination of components. The costs for a non-canister system are included in the total evaporative components costs in Table I-5.

5. FUEL INJECTION

Referring back to the OHRV certification database, there are a mix of red sticker OHMCs with and without fuel injection. The cost increase for OHMCs with fuel injection are likely going to be minimal, as most manufacturers will need minor modifications to meet the standards. As for red sticker OHMCs with carburetors, manufacturers may choose to eliminate carbureted red sticker OHMCs from the market or may choose to incorporate fuel injection. Since manufacturers already make fuel injection version of their carbureted red sticker OHMCs, the increase in cost for fuel injection is reflected in the research and development costs to meet the standard as presented in Table I-6.

D. COST ESTIMATES TO REDUCE CARBURETOR EMISSIONS

Based on the OHMC certification database (2017), there are about 5,700 carbureted engines. This is 49 percent of the total population of the total OHMC certification database. The proposed amendments allow fleet averaging that could potentially allow for a few carbureted engines as long as they would require little or no modifications to meet lower emission standards. For the engines that would not need to be modified, there would be no additional costs for the engine. For engine that need updates, minor engine modification may be required that could be less than the cost for fuel injection. So, staff assumed the most conservative case where the costs would be near the cost for fuel injection.

1. AUTOMATIC SHUTOFF VALVE COSTS

As an option for controlling evaporative emissions from the carburetor, OHMC manufacturers proposed the use of an automatic shut-off valve. Staff evaluated the automatic shutoff valve as a feasible emissions control and has made provisions for its use in the proposed amendments. Staff also requested cost information from this emissions control in the industry-wide cost survey. From the cost survey, one OHMC

manufacturer reported the cost for an automatic shut-off valve. The increased cost for an automatic shut off is expected to be \$7 per unit as shown in Table I-7.

The increased costs based on the more stringent standard for CARB evaporative emissions controls are presented in Table I-5 and included in the primary compliance cost analysis in section I, above.

Table I-7: Increased Cost for Carburetor Automatic Shutoff

Category	Additional Cost for Automatic Shutoff
OHMC	\$7.00

Automatic shutoff valve costs only apply carbureted systems since fuel injection is a closed system that is not anticipated evaporative fuel from its system. Details of the automatic shutoff technology are presented in the staff report.

Based on the average OHMC retail price of \$5,711 (as reported from MIC), the average estimated retail price increase of \$333 (i.e., \$197.08 x 1.30 x 1.30) per OHRV represents approximately 6 percent of the retail price to the consumer if manufacturers and dealers are able to pass on the increased costs to the consumer entirely.

Table I-8 summarizes the average estimated retail price increase that individuals could incur if manufacturers and dealers are able to pass on all cost increase entirely to the consumer. As shown above, the proposed amendments are estimated to increase the retail price of an affected OHMC by \$333 per vehicle or an average price of 6 percent per vehicle.

Table I-8: Retail Price Increase to California Consumers per OHRV Vehicle

Description	Costs in Dollars
OHMC Manufacturer Average Compliance Costs	\$197.07
OHMC Manufacturer Mark-up of 30 percent	\$59.12
OHMC Dealer Mark-up of 30 percent	\$76.86
Total	\$333

Based on all the anticipated costs for the evaporative and exhaust emission costs to meet the proposed amendments, staff has determined the total costs including redesign, research and development costs, and manufacturer and dealer markups if are passed on to the consumer entirely to be about \$333 per vehicle.

II. IMPACT ON THE STATE ECONOMY

The proposed amendments will establish emission requirements for red sticker off-highway vehicles, which are currently uncontrolled vehicles.

Staff estimates an average incremental retail price increase of \$333 for a current red sticker OHMC to be certified in California. The proposed amendments are not expected to impose a significant cost burden to manufacturers, dealers, or their consumers. With the flexibility that the fleet averaging provides, manufacturers are allowed to keep producing low volume models while CARB is still able to meet its air quality goals (Appendix C – Emissions Inventory).

Based on an assessment of the cost survey, the total compliance cost of the rulemaking is anticipated to be \$72.7 million from MY 2022 to MY 2042. This cost estimate represents the total cost increase at retail level because staff assumed that affected businesses are able to pass the entire costs for emission control on to consumers.

In addition, there are no major manufacturers located in California, but there are about 200 dealers that could potentially be impacted by the increased costs of OHMCs. It is possible the increased production costs may reduce the number of models that manufacturers bring to the OHRV market and the increased retail prices may reduce OHRV sales. In order to reduce the impact to dealers and OHRV manufacturers, staff worked with industry to develop amendments that would be conducive to model availability and reduced costs to OHMC manufacturers while meeting California's air quality objectives. It is anticipated that dealers and OHMC manufacturers are able to pass the additional costs on to the consumer. Overall, staff does not anticipate significant impacts to California businesses. Additionally, reporting costs are not expected to be significant as OHMC manufacturers are already certifying red sticker vehicles. Additional reporting costs, if any, could come from certification of components from component manufacturers. Total annual reporting costs are expected to be \$5,711 on average for a typical OHRV manufacturer. This cost was included as part of certification and testing cost in the cost survey. However, since the components used on equipment (i.e., low permeation hoses, carbon canisters, etc.) have already been used on small off-road equipment (less than 25 horsepower) and manufacturers already certify OHRVs for red sticker, the increased costs for reporting are expected to be minimal. Staff is allowing that the certified components from these categories to be used on OHMCs and therefore additional testing will not be necessary for these components.

Using the information obtained from the DMV database and analyzing scrappage rates, staff determined the average lifetime of the OHMC to be about 20 years (Appendix C). Staff was then able to calculate the total emissions that the OHMC would emit over the lifetime of the vehicle and the emission reductions associated with the proposed amendments. With the information from the cost survey and the emission inventory, staff was able to determine the overall cost effectiveness of the proposed amendments.

Manufacturers normally follow a redesign cycle of 5-10 years. The proposed amendments have been designed to allow additional time for manufacturers to use these redesign cycles to incorporate the requirements of the proposed amendments. Also, it is likely that manufacturers will redesign once for the proposed standards and therefore the costs will be spread over the life of the vehicle.

The following table (Table II-1) shows the estimates of the costs of the equipment as provided by the manufacturers. Any additional costs such as reporting or testing costs are included in the overall costs analysis.

Table II-1 presents the regulatory cost-effectiveness of OHMCs based on the proposed amendments.

Table II-1: Regulatory Cost-Effectiveness (2018 Dollars)

	Total
Estimated Total Cost (\$)	\$333
Lifetime Emissions Reductions (lbs.)	318.2
Cost-Effectiveness (\$/lb.)	\$1.05

III. ESTIMATED ANNUAL REPORTING COSTS FOR CALIFORNIA BUSINESSES

At the time of this rulemaking, there are no fees in applying for component or vehicle certification for off-road vehicles. Additional costs for certification include the costs for testing, filling out the application, and handling the application process. Component manufacturers will only need to certify their component once for the life cycle of the component, while OHMC manufacturers will need to certify their OHMC annually as well as fill out and end-of-model year report.

The reporting costs for the OHMC manufacturers have been included in the 2013 rulemaking and are not expected to change significantly for the proposed amendments. Table III-1 presents the costs for reporting for OHMC manufacturers.

Based on similar programs that require reporting activities, staff estimated that 10 hours would be needed to complete one OHRV Executive Order of Certification application.

Table III-1: Estimated Time to Complete Reporting for OHRV Certification

Reporting Tasks	Hours Estimated
Getting Started (EPA 3 Digit Code, Intro Letter)	2 Hours
Fill Out Application (Approximately 5 Pages)	5 Hours
Submit Information Electronically	3 Hours
Total Estimated Time:	10 Hours

Finally, this adjusted pay rate was multiplied by the total hours needed for an OHRV manufacturer with five evaporative families to complete the reporting process. The estimated annual reporting cost would range from \$1,218 to \$4,873 or an average of \$3,000 per OHMC business.

Table III-2: Estimated Annual Reporting Costs for OHMC Businesses (2018 Dollars)

Number of Evaporative Families	Time to Apply, Hours	Adjusted Pay Rate*, \$ per Hour	Estimated Total Cost
2-8	10	\$60.91	\$1,200-4,900

* – 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, this cost is already accounted for as part of testing and certification cost in the cost survey.

IV. POTENTIAL FISCAL IMPACT TO STATE AND LOCAL AGENCIES

A. FISCAL IMPACT ON STATE GOVERNMENT (CARB), FISCAL YEARS: 2014-2015 2015-2016, 2016-2017

The proposed amendments will only require that OHMC manufacturers submit test data and minimal model information for certification. Therefore, staff does not anticipate significant workload from certification of red sticker OHMCs that are currently certified by CARB.

However, since the proposed amendments are allowing for design-based certification for specific vehicles, component certification will be required. Staff estimated that about a total of 1.14 person-year (PY) will be required for the first three years after adoption to

implement the proposed amendments for design-based certification. An Executive Order will need to be issued for components before an OHMC can be certified for sale in California. Component manufacturers will need to obtain an Executive Order for each component. This will include low permeation tanks, low permeation fuel hoses, and carbon canisters.

For each component certification, staff estimates about seven hours will be needed to review and analyze the data, draft the Component Executive Order of Certification, and communicate with manufacturers. As shown in Table IV-1, 0.64 PY would be needed for component certification.

Table IV-1: Component Certification PY Work Matrix

Total Works Hours per Year:		1904
Estimated Number of Component Manufacturers:		175
Tasks for Component Certifications	Estimated Hours per Application	Estimated Total Hours per Year
Review Application	1.5	262.5
Communicate with Manufacturer	1.0	175.0
Draft Executive Order	1.0	175.0
Review Data	1.0	175.0
Perform Statistical Analysis	1.0	175.0
Correspond with ECARS	0.5	87.5
Process Application to Completion	1.0	175.0
Component Certification Total Estimate:		1225 Hours/Year (or 0.64 PY)

Staff does not anticipate a significant increase in certification resources required for full OHRVs. Since OHMC manufacturers already certify red sticker vehicles, minimal additional work will be needed to process information associated with certifying vehicles complying with emission standards.

Staff estimated an additional 0.5 PY will be required to enforce the proposed amendments. This PY estimate is based on expanding the enforcement duties associated with the OHRV regulation for controlling exhaust and evaporative emissions control for OHRV (Table VI-2). OHRV enforcement for the exhaust regulation currently accounts for 20 percent of the enforcement field duty for 4 staff members who must conduct about 452 inspections yearly. Of those OHRV selected for exhaust inspection, enforcement staff plans to inspect 10 percent for compliance with the proposed evaporative emissions standards. No enforcement duties would be required during the current year, FY 2019-2020, or the FY thereafter. Enforcement staff plans to start inspections 1 year prior to implementation of the OHRV regulation. The reason for this

is that OHRV manufacturers typically pre-sell OHRV 1 year in advance. An additional 0.5 PY is needed beginning with FY 2021-2022 and would be required every year thereafter.

Table IV-2: Enforcement PY Work Matrix

Total Work Hours per Year:		1904
Estimated Number of OHRV Inspections:		452
Enforcement Division Tasks for Inspections and Violations	Estimated Hours per Inspection or Case	Estimated Total Hours per Year
Conduct Full Inspection of Evaporative Emissions Systems on 10 % of inspections (about 45 inspections)	8	360
10 % Projected to Result in Violations (about 5 cases)	120	600
Enforcement Total Estimate:		960 Hours/Year (or 0.5 PY)

Based on the following assumptions, experience from other programs, and work matrices from existing programs, staff estimated a total of 1.14 PYs will be needed to implement the proposed regulation over the first three FYs, resulting in an increase cost to the state of \$306,160. The fiscal impact on the State government is presented in Table VI-3.

Table IV-3: Fiscal Impact on State Government (2018 Dollars)

Fiscal Year	# PYs	Unit PY Cost¹	Travel	Equipment	Other Costs	Total
Current Year, 2019-2020	0.0	N/A	\$0	\$0	\$0	\$0
FY 2020-2021	0.64	\$172,000	\$0	\$0	\$0	\$110,080
FY 2021-2022	1.14 ²	\$172,000	\$0	\$0	\$0	\$196,080
					Total:	\$306,160

¹ Reflects the average annual cost of a new CARB employee.

² Continuation of PYs to be requested for FY 2019-2021 and after MY 2022 OHRV regulation implementation.

Assumptions:

- 1904 hours = Actual hours working on the job. 2088 payable hours per year, less 104 holiday hours per year, and less 80 hours of vacation per year, equals 1904 actual work hours. (Source: Attachment C of PY Calculator Package from Greenhouse Gas Enforcement Section)
- \$173,000 = Total average annual cost for a new CARB employee (PY) first year, \$172,000 for following years.

B. POTENTIAL FISCAL IMPACTS TO STATE AGENCIES (NON-CARB)

As required by section 11346.5 of the Government Code, research was done to determine the extent of potential fiscal impacts on non-CARB state and local agencies. Staff contacted the Department of General Services (DGS) where they directed staff to research the State Contract & Procurement Registration System (SCPRS) website. The SCPRS website tracks all the contracts within the State of California. Staff evaluated the purchases for the current Fiscal Year (FY) 2017 and FY2016 and found no OHMCs were purchased in these periods. Therefore, the impacts to state agencies are expected to minimal.

Staff also discussed potential costs to the Department of Motor Vehicles (DMV). Since the proposed amendments will require red sticker vehicles to be processed as green sticker, there will need to be a change to the DMV registration system. It was determined that the costs of the change would be absorbed by DMV within its current budget and no significant changes would be needed. Staff anticipates that no additional costs will be necessary for the DMV or any of its users.

Staff also worked with California Department of Parks and Recreation (State Parks) to evaluate the increased costs that would be necessary to enforce the updated green sticker program. State Parks commented that the process of identifying the Vehicle Identification Number (VIN) on red sticker vehicles be similar to the current system used for enforcement at State Park entrances. Staff agreed and is working to ensure that this process continue with the new amendments moving forward. Since State Parks already

assigns staff to look out for red sticker vehicles by the VIN, the new amendments would require a similar procedure for enforcement. There is no anticipated additional costs necessary to enforce the certified vehicles as the State Parks is already enforcing these restrictions at State Parks gates. Therefore, staff does not anticipate significant costs to State Parks from the proposed amendments. It is possible that there might be a slight increase to costs of OHMCs and that these costs could be passed on to State Parks as they purchase OHMCs for training and use in the field. A listing of the number of OHRV purchases to State Parks is presented in Table VI-4.

Table VI-4: Additional OHRVs to be purchased by State Parks

	2015-16	2016-17	2017-18	2018-19	Average
ATV	16	0	15	0	7.75
ROV	10	1	8	10	7.25
MTC*	14	0	5	1	5.0
UTC	-	-	3	-	3.0

* - MTC = Off-highway Motorcycle

The costs to the State of California based on the proposed amendments is expected to be about an additional \$8,500 (i.e., \$333 price increase per OHMC x 5 MTC) per year. Staff anticipates that the additional costs to State Parks would be negligible.

C. POTENTIAL FISCAL IMPACTS TO LOCAL AGENCIES

Most local law enforcement agencies purchase new OHMCs through their county procurement process and with the aid of grant money from the California State Parks and Recreation. These local law enforcement agencies request aid through State Parks for the purchase of OHMCs as an on-need basis or necessary to perform enforcement duties. State Parks has provided an estimate of the current number of vehicles purchased within a 3-year period. These vehicles will also be provided for local agencies.

Under the proposed red sticker amendments, this small number of purchases would add an additional cost to each local agency of about \$333 per OHMC. Any cost to local government is not reimbursable by the State, pursuant to Government Code, title 2, division 4, part 7 (commencing with section 17500) because the additional costs associated with the proposed amendments apply generally to all entities that purchase affected vehicles, private owners as well as state and local agencies.

V. REFERENCES

1. DMV, 2017. Department of Motor Vehicle Registration Data for 2006 to 2017. Confidential.
2. Risk Assessment Studies, The Retailers Owners Institute, 2017, <https://retailowner.com/Benchmarks/Motor-Vehicles-Parts-Dealers/Motorcycle-Dealers#2910122-gross-margin> (accessed December 21, 2018)

VI. APPENDIX

Figure VII-1 – CARB Cost Survey Form (Page 1)

State of California
Air Resources Board

Treat source of
information as confidential
 Yes No

Cost Survey to Implement Evaporative and Exhaust Emission Controls on
Off-Highway Motorcycles

Potential Alternative Evaporative Standards

Off-Highway Motorcycle Evaporative Emissions		
Option 1		
Control Type	Current Specification	Possible Specification
Transfer certified on-road evaporative control system to off-road motorcycles	Uncontrolled	Meet control requirement for on-road motorcycles specified in Cal. Code Regs., tit. 13, § 1976(b)(2). Evaporative Emissions of HC: 2.0 grams/test
Option 2		
Control Type	Current Specification	Possible Specification
Certify new low permeation tanks, low permeation hoses, and carbon canisters	Fuel injection No evaporative controls	Meet control requirements as specified in Cal. Code Regs., tit. 13, § 2418(b)(1). Permeation Rates (grams/m ² /day): Fuel Tank: 1.5 @ 28°C (82°F) Fuel Hose: 5.0 @ 35°C (95°F) Carbon Canister Working Capacity: 1.0 gram/liter
Option 3		
Control Type	Current Specification	Possible Specification
Implement an automatic shut-off valve on carbureted motorcycles with low permeation tanks and hoses	Carburetor No evaporative controls	Automatic shut-off valve Also meet permeation requirements as specified in Cal. Code Regs., tit. 13, § 2418(b)(1). Permeation Rates (grams/m ² /day): Fuel Tank: 1.5 @ 28°C (82°F) Fuel Hose: 5.0 @ 35°C (95°F)

Figure VII-2 – CARB Cost Survey Form (Page 2)

State of California
Air Resources Board

Potential Alternative Exhaust Standards

Off-Highway Motorcycle (<i>4 Stroke, Fuel Injection</i>) Exhaust Emissions		
Red Sticker to Category 2		
Control Type	Current Specification	Requested Specification
To be determined by manufacturer	4 Stroke, Fuel Injection No emissions standard	2.0 g/km HC + NO _x
Category 2 to Category 1		
Control Type	Current Specification	Requested Specification
To be determined by manufacturer	4 Stroke, Fuel Injection 2.0 g/km HC + NO _x	1.2 g/km HC

Off-Highway Motorcycle (<i>4 Stroke, Carburetor</i>) Exhaust Emissions		
Red Sticker to Category 2		
Control Type	Current Specification	Requested Specification
To be determined by manufacturer	4 Stroke, Carburetor No emissions standard	2.0 g/km HC + NO _x
Category 2 to Category 1		
Control Type	Current Specification	Requested Specification
To be determined by manufacturer	4 Stroke, Carburetor 2.0 g/km HC + NO _x	1.2 g/km HC

Figure VII-3 – CARB Cost Survey Form (Page 3)

State of California
Air Resources Board

Please fill out the following tables to provide estimated costs of implementing the described emissions controls that are being considered as potential alternatives to evaporative and exhaust emissions standards for off-highway motorcycles. If anything is non-applicable, please write "N/A." If anything else is necessary but not listed as a category, please provide information in the "Other (please specify)" boxes.

Estimated Evaporative Emission Costs

Estimated Incremental Manufacturer Cost Increase for Option 1		Increased Manufacturer's Cost
Transfer certified on-road evaporative control system to off-road motorcycles		
Describe controls:		
One-Time Development Costs		
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Component cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Per Unit Cost:		\$

Existing models that might be certified using this alternative: _____

Figure VII-4 – CARB Cost Survey Form (Page 4)

Estimated Incremental Manufacturer Cost Increase for Option 2		Increased Manufacturer's Cost
Certify new low permeation tanks, hoses, and carbon canisters		
Describe controls:		
One-Time Development Costs		
Research/ Development	High Volume Models	\$
	Low Volume Models	
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Low permeation tank cost per unit	High Volume Models	\$
	Low Volume Models	\$
Low permeation hose cost per unit	High Volume Models	\$
	Low Volume Models	\$
Carbon canister cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Existing models that might be certified using this alternative: _____

Figure VII-5 – CARB Cost Survey Form (Page 5)

Estimated Incremental Manufacturer Cost Increase for Option 3		Increased Manufacturer's Cost
Implement automatic shut-off valve on carbureted motorcycles with low permeation tanks and hoses		
Describe controls:		
One-Time Development Costs		
Research/Development	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Shut-off valve cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Existing models that might be certified using this alternative: _____

Figure VII-6 – CARB Cost Survey Form (Page 6)

Estimated Exhaust Emission Costs—4 Stroke, Fuel Injection

Estimated Incremental Manufacturer Cost Increase for Red Sticker to Category 2		Increased Manufacturer's Cost
4 Stroke, Fuel Injection, 2.0 g/km HC + NO _x		
Describe controls:		
One-Time Development Costs		
Research/ Development	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Component cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Figure VII-7 – CARB Cost Survey Form (Page 7)

Estimated Incremental Manufacturer Cost Increase for Category 2 to Category 1		Increased Manufacturer's Cost
4 Stroke, Fuel Injection, 1.2 g/km HC		
Describe controls:		
One-Time Development Costs		
Research/ Development	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Component cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Figure VII-8 – CARB Cost Survey Form (Page 8)

Estimated Exhaust Emission Costs—4 Stroke, Carburetor

Estimated Incremental Manufacturer Cost Increase for Red Sticker to Category 2		Increased Manufacturer's Cost
4 Stroke, Carburetor, 2.0 g/km HC + NO _x		
Describe controls:		
One-Time Development Costs		
Research/ Development	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Component cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Figure VII-9 – CARB Cost Survey Form (Page 9)

Estimated Incremental Manufacturer Cost Increase for Category 2 to Category 1		Increased Manufacturer's Cost
4 Stroke, Carburetor, 1.2 g/km HC		
Describe controls:		
One-Time Development Costs		
Research/ Development	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Internal Verification	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Certification (Testing/ Administrative/ Warranty)	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Development Cost:		\$
Per Unit Production Costs		
Component cost per unit	High Volume Models	\$
	Low Volume Models	\$
Other (please specify):		\$
Total Production Cost Per Unit		\$

Attach additional pages to this document if needed in order to accurately describe the increased manufacturing costs for the proposed amendments being considered.

Date: _____ Contact Name: _____ Telephone Number: _____

Please return this survey by August 31, 2018

Mail to: Scott Monday, ARB/MLD
P.O. Box 2815
Sacramento, CA 95812

Email to: Scott Monday
smonday@arb.ca.gov