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8th April 2016

Vehicle Emissions Working Group
The Department of Infrastructure and Regional Development
GPO Box 594
Canberra ACT 2601 By email vemissions@infrastructure.gov.au

Dear Ministers Fletcher, Frydenberg and Hunt,

Submission – Vehicle Emissions Discussions Paper

The Vehicle Emissions Discussions Paper essentially dismisses motorcycles as significant contributors to air pollution in Australia. Motorcycles account for around 1% of vehicle kilometres but significantly more than 10% of the vehicle emissions that cause smog and health concerns. CARB advises that motorcycles produce around ten times the emissions of a car.

It would be a very poor decision for Australia to continue to exempt motorcycles from emissions standards.

The arguments for ignoring the air pollution contribution of motorcycles are specious. By their own admission the authors of the discussion paper have conducted no research on the relative emissions of motorcycles, despite a wealth of readily available research. A Google search of “Motorcycle emissions” reveals half a million articles. The sixth and seventh articles both refer to a UC Berkley study which shows that *“Long story short: Motorcycles, even small ones, are more polluting than Hummers”*

It would be myopic to continue to exempt motorcycles from emissions standards, when the Cost Benefit Analysis produced by the US EPA and similar work in the EU, Canada and other jurisdictions have shown a positive result for regulations.

A decision to exempt motorcycles would undermine the Commonwealth’s support for Minister Hunt’s National Clean Air Agreement.

Squeezing more emissions reductions out of sources which are already legislated is perhaps administratively convenient, but inevitably more costly for the economy. A better option, the “low hanging fruit” are unregulated engines where the hard work of developing standards has already been prepared for us by other jurisdictions. The obvious and easy targets for emissions reductions are motorcycles, and non-road engines including lawn mowers and outboard engines. These are high emitters, unregulated in Australia yet regulated standards are well established in other countries.

Finally, it is discriminatory to grant an exemption to motorcycles, when Minister Hunt will soon put before Parliament a Bill to limit the emissions of Non Road Spark Ignition Engines and Equipment (NRSIEE) including lawn mowers, outboards, jet skis, chainsaws and brushcutters.

Background and Experience

The writer is an academic and has been involved in small engine emissions regulations since 2005. I sat on the Environment Minister's Expert Panel in 2016/7 and have taken on a leadership role since that time. I have published a number of articles, presented at conferences and maintain a database of engines and their certified emissions levels.

I have assisted the Great Barrier Reef Marine Park Authority, Eco Tourism Australia and authorities such as Purchasing Queensland, Inland Fisheries Tasmania and Wide Bay Water Corporation with their policies and responses to the issue of small engine emissions.

In 2007 I received a Healthy Waterways award and more recently was appointed as the first of five Clean Air Champions by Minister Hunt.

While my expertise is not directly in motorcycle engines the technology is identical. For some companies such as Yamaha and Honda, (who are market leaders in motorcycles, outboards and power equipment engines) many of their engines are used across these segments. That is, a core engine design will find application in say, a motorcycle and an outboard. My intimate knowledge of non-road engines can therefore shed light on the question of motorcycle emissions.

The Assumptions of the Discussion Paper

3.2.3 Motorcycles

There are currently no standards that regulate noxious or greenhouse gas emissions from motorcycles in Australia. Motorcycles account for less than one per cent of total vehicle kilometres travelled and are estimated to account for a comparable share of vehicle emissions.

The assumption that unregulated motorcycles have a comparable level of emissions to cars is not supported by the facts. There are many studies confirming that motorcycles have significantly more emissions than cars. According to the California Air Resources Board (CARB 2008) a comparison of *emissions-compliant* vehicles:

- the average motorbike is about 10 times more polluting per mile than a passenger car
- bikes make up 3.6% of registered vehicles and 1% of vehicle miles traveled, yet they account for 10% of passenger vehicles' smog-forming emissions in the state. ¹

I am, however, not arguing that Motorcycles account for an astounding 10% of vehicle smog in Australia. It is much worse than that. I say the excessive emissions from motorcycles in Australia **will be much higher than 10%**. The reasons are simple: The CARB numbers are based on motorcycles sold in that jurisdiction, which meet CARB and US EPA emissions standards. Australian Motorcycles are even more polluting. Some will meet US emissions levels, the majority will be around 20% higher in HC+NOx emissions and some will be 1100% more polluting.

...rather than being more environmentally-friendly, motorbikes emit 16 times the amount of hydrocarbons, including greenhouse gases, three times the carbon monoxide and a "disproportionately high" amount of other pollutants, compared to cars. (The Guardian 2005)

How does this compare internationally?

Standards regulating noxious emissions for motorcycles have been adopted in the US, EU, Japan, Canada, China, Korea, India and Vietnam, with China the only country to have adopted standards for motorcycle efficiency (CO₂).

I pose the rhetorical question to the Ministerial Forum: *Given that a Cost Benefit Analysis showed a positive benefit from regulating motorcycle emissions for the people of the USA, Canada and the EU, would we not also expect to see a CBA show a similar positive benefit for Australians?*

As most motorcycles sold in Australia are imported from countries with standards, it is likely that some motorcycles sold in Australia have been designed to meet standards that apply in these countries. Further understanding of the emission levels of the current motorcycle fleet would be required in order to determine the costs and benefits of adopting noxious and fuel efficiency (CO₂) standards in Australia.

While some motorcycles imported into Australia may meet international standards, there is no evidence to suggest that this is true in any significant numbers. Certainly a further understanding of the emissions levels of the motorcycle fleet is demanded by the evidence in this submission.

Based on the writer's experience in the small engine sector it is rarely the case that the products imported into Australia meet the emissions standards of the USA, EU etc. While the machines look essentially the same I have learned that Australia most often imports a variant designed for unregulated markets.

Originally I assumed that manufacturers would ship the identical model variant to Australia that was retailed in say, the USA. After all, production economies and logistics would dictate that it should be cheaper to make a single variant for the world. I was mistaken.

Instead, manufacturers produce an international variant so that they can offer a better performing engine without the limitations of emissions standards. Without the requirement to meet emissions standards, manufacturers can deliver a product with easier starting, more torque or better fuel economy. It may also be lower cost. For one importer the cost of the non-compliant variant is 2% lower.

As Australian importers scramble to get ready for NRSIEE Standards I am aware of seven companies in the identical position: they need to change their imports from the International variant to the USA EPA spec product. Each have concerns that the US product does not perform as well as their current Australian offering.

Further, the International variant has emissions levels that are 11% to 27% higher (HC+NO_x) than the US variant.

I can perhaps provide more detail on a Commercial in Confidence basis, but I can say that the above is not is rare. It is the case with seven market leading manufacturers, several of whom also produce motorcycles sold in Australia. I can confidently predict, therefore, that the majority of motorcycles sold in Australia are variants with even higher emissions than the near identical product sold in California. Therefore, the assumption of the Discussion Paper that Australian motorcycles are as low emitting as USA models is not supported by the facts.

In addition, there are motorcycles and scooters sold in Australia which cannot be sold in regulated markets, in any variant. I refer mostly to products with a two stroke engine.

Comparing new two stroke engines to USA EPA complaint engines:

- HC+ NOx levels range from 11 to 28 g/kW/hr for compliant engines
- HC+ NOx levels for two stroke engines range from 111 to over 330 g/kW/hr (the mean is 11 times that of than complaint engines)
- For example, an 8hp two stroke produces 59% more emissions per hour than a 150hp complaint engine of the same brand.
- A two stroke brush cutter has ten (10) times the emissions per hour of a car. DEWHA 2016)
- A two stroke lawn mower has forty (40) times the emissions of a car. (DEH 2004)

Given the above analysis is based on the audited USA EPA engine certification data, we can reliably assume that two stroke motorcycles have around eleven times the emissions of similar machine which meets the USA EPA standards.

In conclusion, we cannot assume that the motorcycles sold in Australia are as clean as those sold in the USA or EU. This is because Australia imports product variants that are significantly higher emitters and we also import two strokes which are 1,100% higher emitters.

The California Air Board has shown that while motorcycles account for 1% of the vehicle mileage (similar to Australia) they account for 10% of chemical smog in California. Given the Australian motorcycle fleet does not meet the US EPA standard, we can see that motorcycles in Australia no doubt account for significantly more than 10% of vehicle smog emissions.

Conclusion: While this submission is very brief, sufficient doubt has been raised to dismiss the un-researched assumptions of the Vehicle Emissions Discussion Paper and to trigger an investigation into the facts of motorcycle emissions.

Australia should implement motorcycle emissions standards bases on the world's best standards, irrespective of any decision on automobile emissions standards.

I thank the Working Group for considering this submission and offer to expand on this or assist in any other way they deem appropriate.

Sincerely yours

A handwritten signature in blue ink that reads "G Fooks". The signature is written in a cursive, flowing style.

Gary Fooks

ENCL

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Inconvenient truths about motorcycles and smog

June 11, 2008 | SUSAN CARPENTER | THROTTLE JOCKEY

I'D LIKE to begin this column with an apology. I'm sorry for ruining your day.

This story is about emissions. More specifically, it's about the surprising level of emissions spewing from on-road motorcycles and scooters. In California, such bikes make up 3.6% of registered vehicles and 1% of vehicle miles traveled, yet they account for 10% of passenger vehicles' smog-forming emissions in the state. In fact, the average motorbike is about 10 times more polluting per mile than a passenger car, light truck or SUV, according to a California Air Resources Board comparison of emissions-compliant vehicles.

For those of you who are wondering why I'm being such a killjoy, my reason is this: I've been hearing from an increasing number of readers who want to know if two-wheelers, which consume far less fuel, are also smog busters. Because scientific questions tend to come with complicated answers, I thought I'd do my best to explain what pollutants a gas-powered motorbike emits and why.

Motorcycles and scooters are, on average, about twice as fuel efficient as cars. Compact and lightweight, their internal-combustion engines do a better job of converting fuel into energy that makes the vehicle move. But extracting more energy from the fuel has a downside. It produces greater amounts of a smog-forming emission called oxides of nitrogen.

Oxides of nitrogen are one of three pollutants the Environmental Protection Agency and the Air Resources Board measure to see whether vehicles meet acceptable emissions levels and can be sold legally. Smog-forming hydrocarbons -- unburned compounds in fuel that escape through the tailpipe, fuel lines and gas tank -- are also measured, as is carbon monoxide. Carbon dioxide, a greenhouse gas, isn't measured by either agency, but motorcycles are generally better than other vehicles in this regard since they use less fuel per mile.

As with other passenger vehicles, there are technologies to offset motorcycle emissions, such as catalytic converters, but those technologies tend to be too big, too heavy or too hot to fit on a motorcycle and work as effectively as similar systems on larger, enclosed vehicles that have more space to accommodate them. That's why the EPA and the air board are more lenient on bikes than they are on other passenger vehicles.

"The emissions picture [for motorcycles] is fairly grim," said John Swanton of the Air Resources Board, "but we think it's fair for where motorcycles are today."

Emissions standards for motorcycles are already more forgiving than they are for cars, light trucks and SUVs. Not only are motorcycles allowed to emit more than cars, they are also tested at lower speeds, which pollutes less. And motorcycle manufacturers only have to ensure that their vehicles of 179 cc and above meet governmental emissions criteria for the first 18,600 miles of a bike's life, compared with 150,000 miles for cars.

Five years ago, the EPA tightened its emissions standards for on-road motorcycles with a two-tier system, the first of which tightened requirements for the 2006 model year. The second, even stricter phase kicks in for 2010.

California is the only state in the country with its own emissions standards, which are the same as the EPA standards except they've been fast-tracked to kick in two years earlier. In effect, the stricter standard has already been met for many of the on-highway motorcycles on the market because any 2008 model year bike that is sold in California already meets the EPA standard for 2010.

Right now, there are no plans for the air board or the EPA to further tighten motorcycle emissions requirements because:

- * Motorcycles account for such a small portion of vehicle miles traveled.
- * There haven't been enough advances in motorcycle emissions technologies to enable further pollution reduction to any significant degree.
- * There are other, even bigger polluters to deal with, such as diesel trucks, construction equipment and non-emissions-compliant products from China.

Noncompliant Chinese vehicles have become such a pollution issue in California, in fact, that the Air Resources Board has just added a new motorcycle emissions facility at its Haagen-Smit Lab in El Monte to test them. The board estimates as many as 20,000 all-terrain vehicles, dirt bikes and scooters are shipped into California from China each month, many of them with emissions that are at least 10 times higher than the state's requirements.

Long story short: Motorcycles, even small ones, are more polluting than Hummers, but it's the best that can be done for now. If you want to make a difference, consider an electric two-wheeler for your next bike or a gas-powered model with fuel injection and a 3-way catalytic converter.

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Regulatory Announcement

EPA Finalizes Emission Standards for New Highway Motorcycles

The U.S. Environmental Protection Agency (EPA) is adopting more stringent emission standards for new highway motorcycles. Under the current standards, which are over 20 years old, today's motorcycles produce more harmful emissions per mile than a car or even a large sport utility vehicle (SUV). These new standards will reduce the combined hydrocarbon and nitrogen oxide emissions in the exhaust by 50 percent as well as the harmful health effects of mobile source air toxics.

Final Rule Highlights

EPA has been working to reduce emissions from motor vehicles for over thirty years, including emissions standards for highway motorcycles that we adopted in 1978. In this final rule, EPA is adopting new emission standards for exhaust and evaporative emissions from highway motorcycles. The standards are based on comparable requirements adopted in California. The final rule extends the California requirements nationwide two years after they initially take effect in California. In addition to updating exhaust emission standards for currently regulated motorcycles, the new emission standards will include previously unregulated motorcycles with engines of less than 50 cubic centimeters displacement (scooters and mopeds). We are also adopting new evaporative emission standards to control the loss of gasoline (described as "permeation") through the walls of fuel hoses and fuel tanks. The permeation standards apply to all classes of highway motorcycles.

Background

This final rule follows EPA's Notice of Proposed Rulemaking (NPRM) published on August 14, 2002 (67 FR 53050) and supplemented by a notice dated October 30, 2002 (67 FR 66097). We received comments on the NPRM from a wide variety of stakeholders, including the motorcycle manufacturing industry, motorcycle user groups, various governmental bodies, environmental groups, and the general public. In the August 2002 NPRM, we also proposed new evaporative emission controls for spark-ignition marine vessels. Spark-ignition marine vessels will be the subject of a separate final action.

Federal regulations currently define a motorcycle as "any motor vehicle with a headlight, taillight, and stoplight and having: two wheels, or three wheels and a curb mass less than or equal to 793 kilograms (1749 pounds)" (see 40 CFR 86.402-98). Note that any motorcycle or motorcycle-like vehicle that falls outside that definition would be considered a nonroad vehicle and be subject to different requirements.

Emission Limits

The following table shows the new exhaust standards for highway motorcycles, including scooters and mopeds.

Highway Motorcycle Exhaust Emission Standards

Class	Engine Size (cc)	Implementation Date	HC (g/km)	HC+NOx (g/km)	CO (g/km)
Class I	less than 170	2006	1.0	—	12.0
Class II	170-279	2006	1.0	—	12.0
Class III	280 and above	2006	—	1.4	12.0
		2010	—	0.8	12.0

We expect these standards to be met through an increased use of technologies already demonstrated as being effective on 4-stroke motorcycle engines, such as secondary air injection, electronic fuel injection systems, and catalytic converters. The standards are not expected to result in the universal use of catalytic converters.

Health and Environmental Benefits

Nationwide, highway motorcycles are significant contributors to mobile-source air pollution and produce more harmful emissions per mile than a car or even a large SUV. Motorcycles currently account for 0.6 percent of mobile-source hydrocarbon (HC) emissions, 0.1 percent of mobile-source oxides of nitrogen (NO_x) emissions, and less than 0.1 percent of mobile-source particulate matter (PM) emissions. The highway motorcycle standards will reduce the combined emissions of HC and NO_x in the exhaust by 50 percent. Without these further regulations, highway motorcycles would account for 2.2 percent of mobile source HC and 0.3 percent of mobile source NO_x by 2020.

These standards will help reduce the public's exposure to these emissions and help avoid a range of adverse health effects associated with ambient ozone and PM levels, especially in terms of respiratory impairment and related illnesses. In addition, the standards will help reduce acute exposure to air toxics and PM for persons who operate or who work with or are otherwise active in close proximity to these sources. They will also help address other environmental problems associated with these sources, such as visibility impairment in our national parks and other wilderness areas.

It has been 20 years since EPA revised the motorcycle standards. In that time, there have been many vehicle emission control technology advances. Since EPA has recently adopted emission standards for off-road motorcycles as the result of a court order, this is an appropriate time to update the highway motorcycle requirements.

The current federal motorcycle standard for hydrocarbon emissions is about 90 times higher than the hydrocarbon standard for today's passenger cars. Although many of today's motorcycles will meet the current California standards, the current California hydrocarbon standard is still 18 to 24 times greater than the current federal passenger car limits, depending on the displacement of the motorcycle engine.

Beginning in 2004, all passenger cars, light trucks, and SUVs will be required to meet even more stringent standards. When these standards become effective, new SUVs will be meeting hydrocarbon standards about 95 percent cleaner than today's typical motorcycle.

Costs

We project average costs of \$30 per highway motorcycle to meet the 2006 standards and \$45 to meet the 2010 standards. This increased cost is partially offset by a discounted fuel savings of about \$6.50 per motorcycle due to keeping more gasoline in the fuel tank.

For More Information

You can access documents on this rulemaking on EPA's Office of Transportation and Air Quality Web site at:

www.epa.gov/otaq/roadbike.htm

For further information, please contact the Assessment and Standards Division at:

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Motorbikes '16 times worse than cars for pollution'

Ian Sample, science correspondent

Wednesday 21 December 2005 23.26 AEDT

Motorbikes are churning out more pollution than cars, even though they make up only a small fraction of vehicles on the roads, according to a report.

Tests on a selection of modern motorbikes and private cars revealed that rather than being more environmentally-friendly, motorbikes emit 16 times the amount of hydrocarbons, including greenhouse gases, three times the carbon monoxide and a "disproportionately high" amount of other pollutants, compared to cars. Ana-Marija Vasic at the Swiss Federal Laboratories for Materials Testing and Research, who led the research, said the need to legislate on emissions from motorbikes has been overlooked because there are so few on the roads. The oversight has led to a paucity of research into ways of making their engines run more cleanly.

In Britain, there are 1,060,000 motorbikes on the road but more than 25m private cars.

Dr Vasic's tests showed that, especially in urban traffic, when motorcyclists frequently accelerated quickly, motorbike engines burned fuel inefficiently, giving a sharp peak in emissions. The yearly hydrocarbon emissions of the average two-wheeler in urban traffic measured up to 49 times higher than that of the average car, according to the study, due to be published in the journal *Environmental Science and Technology*.

"The importance of [motorbike] emissions has been underestimated in legislation, giving manufacturers little motivation to improve aftertreatment systems," said Dr Vasic. The tests were carried out on a variety of Yamaha, Piaggio and Honda 50cc scooters and Suzuki, Honda and BMW motorbikes with engine sizes ranging from 800cc to 1150cc.

Topics

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Motorcycles Create More Greenhouse Gas Emissions than SUVs

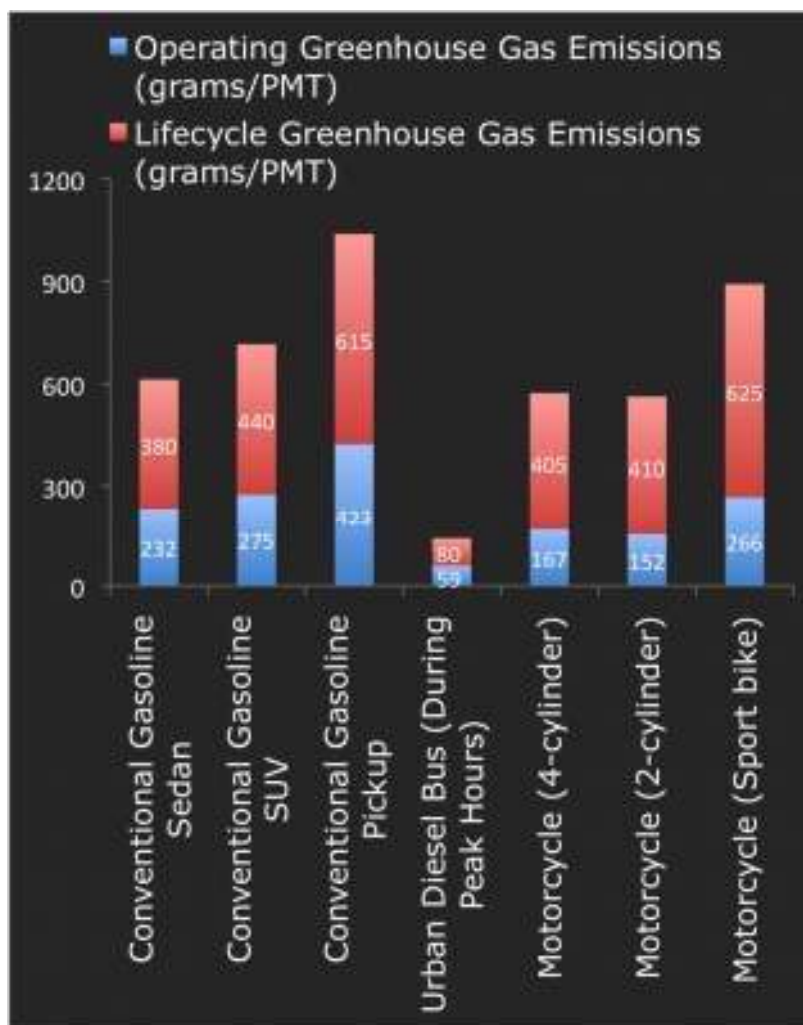
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If you thought that Hummer drivers were bad, think again. According to a study by the University of California Berkeley, emissions from motorcycles dwarf that of SUVs. In fact, a sport bike can be responsible for 1.5 times the total greenhouse gas emissions of a typical SUV over the lifetime of the vehicles. The fact that Hummer drivers were given such grief by the environmental community and motorcycle drivers are getting off relatively scott free is surprising.

HOW MUCH GREENHOUSE GAS EMISSIONS (CO2) DO MOTORCYCLES EMIT COMPARED TO CARS AND TRUCKS?

The following chart shows the amount of greenhouse gas emissions per passenger mile traveled (PMT) for seven classes of vehicles including sedans, SUVs, pickup trucks, diesel buses, and motorcycles (2-cyl, 4-cyl, and sport bikes).

Lifecycle GHG Emissions by Vehicle Class



Adapted From: UC Berkeley Center for Future of Urban Transport Report: Life-cycle Energy and Emissions Inventories for Motorcycles, Diesel Automobiles, School Buses, Electric Buses, Chicago Rail, and New York City Rail

Federal regulations help to control motorcycle emissions, but the regulations don't do enough to make them emissions competitive with a hybrid car, which, if it were represented in this chart above, would easily

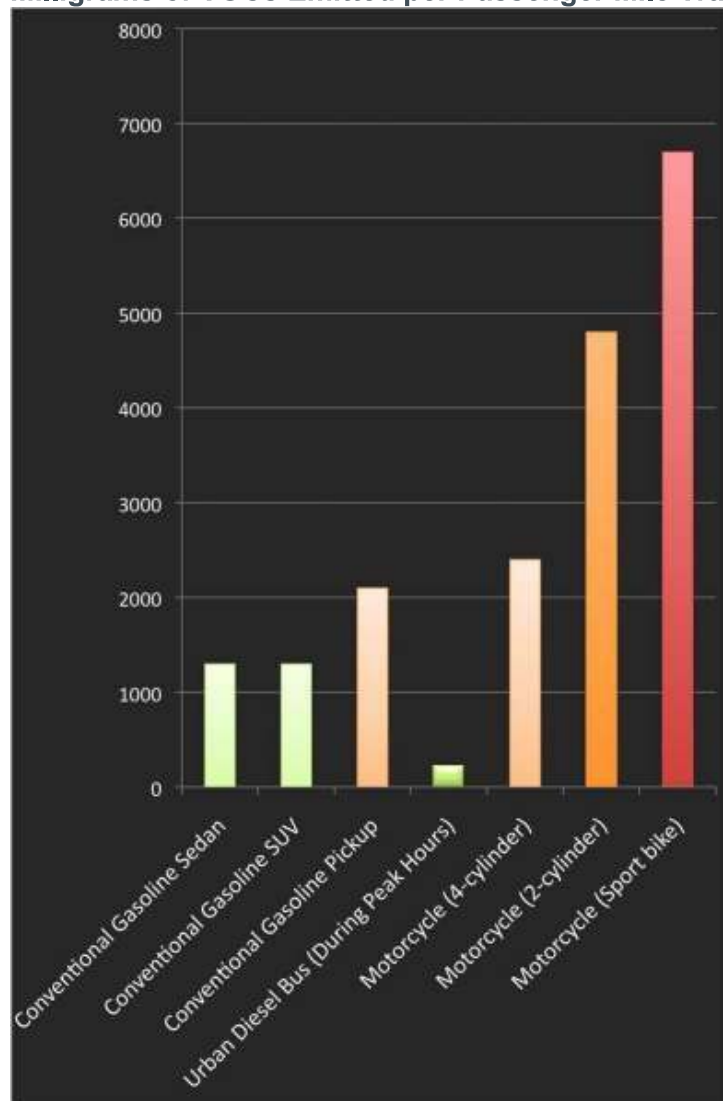
prevail as the most efficient vehicle per PMT. Looking up the exact amount of emissions that are generated from a specific model of motorcycle is quite difficult because manufacturers aren't required to test and register the fuel economy with the Environmental Protection Agency. Auto manufactures, on the other hand, have to test every make and model and report the fuel economy.

The Los Angeles Times recently covered the topic that motorcycles mileage and emissions are not reported in the government fuel economy guides in the article [The Measure of Motorcycles' MPG](#).

ARE MOTORCYCLE EMISSIONS REGULATED?

Yes. The Federal Government has been trying to get a handle on motorcycle emissions for years because they are also responsible for high levels of other nasty "criteria air pollutants" like Volatile Organic Compounds (VOCs), PM10, SOx, and NOx. You can find the current EPA regulations here: <http://www.epa.gov/otaq/roadbike.htm>

Milligrams of VOCs Emitted per Passenger Mile Traveled



Adapted From: UC Berkeley Center for Future of Urban Transport Report referenced in previous figure.

DOES THIS MEAN THAT MOTORCYCLES ARE BAD FOR THE ENVIRONMENT?

In short, yes; especially sport bikes. The amount of environmental impact and greenhouse gas emissions that motorcycles emit over the course of their lifetimes is very large compared to alternate modes of transportation. If you want to reduce your impact, then you should take the bus during peak hours (i.e. rush hour) because, according to the information published by UC Berkeley, that is the least harmful way to cover ground in a motor vehicle.