ECI Fuel Systems
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November 29, 2021

To: California Air Resources Board
FR: Dustin Hamm, Director of Compliance and Standards
RE: December 9, 2021 Hearing (SORE)

As the leading manufacturer of RV generator EVAP fuel systems, and Director of Compliance and Standards for our company, I must voice my concerns about the upcoming proposals that are being considered for 2024. Currently, when testing to EVAP standards, a formula is used to consider the gram per day limit. This formula considers the size of the fuel tank. Using this formula, on average, ECI comes in around 83% under the daily limit across our six (6) EVAP families.

We have been EVAP testing for CARB certifications for 15 years and of the 27 tests we have conducted, only 1 of the tests could come anywhere near the new .7g/day emissions limits that are being proposed. Each of these previous tests took into consideration the size of the tank.

ECI asks the board to consider any change in the emissions limit to take into account the size of the fuel tank based on the intended application.

CARB wishes to re-designate the grams per day limit for ≥225cc to 0.7g/day regardless of the tank size. Not only are they suggesting lowering the standard without considering the size of the tank, they wish to add the hot soak testing results into the diurnal test results. Please see attached page 35 of *Public Hearing to Consider Proposed Amendments to the Small Off-Road Engine Regulations: Transition to Zero Emissions Staff Report: Initial Statement of Reasons Date of Release: October 12, 2021 Scheduled for Consideration: December 9, 2021* for newly suggested grams per day limit.

When asked how the .7g/day limit was reached, CARB staff directed us to an ISOR document (*2020 Emissions Model or Small Off-Road Engines – SORE2020*) that stated their research found that most EVAP applications could reach this new daily standard. Upon further research, I found in their own document mentioned above (page 42, attached), that during their validation studies only a select few of the smaller applications could ever reach this new daily emissions standard.

Please see highlighted attachments.

Thank you,

Dustin Hamm
Director of Compliance and Standards
ECI Fuel Systems

New Standards without taking tank size into account

Table II-2. Current SORE evaporative emission standards and evaporative emission standards under the Proposed Amendments.

Displacement category	**Current diurnal emission standard** ($g \cdot day^{-1}$)	**Proposed hot soak plus diurnal emission standard[i] for MY 2024-2027 generators** ($g \cdot test^{-1}$)	**Proposed hot soak plus diurnal emission standard for all other SORE for MYs 2024 and later** ($g \cdot test^{-1}$)
≤ 80 cc	N/A	0.50	0.00
> 80 cc - < 225 cc except walk-behind mowers	0.95 + 0.056 × nominal capacity (liters)	0.60	0.00
> 80 cc - < 225 cc walk-behind mowers	1.0	N/A	0.00
≥ 225 cc	1.20 + 0.056 × nominal capacity (liters)	0.70	0.00

The Proposed Amendments include revisions to the following SORE regulations:

- Amend CCR §§ 2400, 2401, 2402, 2403, 2404, 2405, 2405.1, 2405.2, 2405.3, 2406, 2407, 2408, 2408.1, 2750, 2752, 2753, 2754, 2754.1, 2754.2, 2755, 2756, 2757, 2758, 2759, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2767.1, and 2771
- Adopt CCR §§ 2408.2 and 2754.3
- Repeal CCR § 2768

To provide consistency with the proposed changes to the emission standards, the Proposed Amendments also include revisions to the test and certification procedures included in the above SORE regulations and in the following procedures incorporated by reference:

- CARB. Small Off-Road Engine Evaporative Emissions Test Procedure, TP-901, Test Procedure for Determining Permeation Emissions from Small Off-Road Engine Fuel Tanks. Adopted July 26, 2004, and last amended [insert amendment date].

[i] For MY 2028 and subsequent model years, the proposed evaporative emission standards for generators are 0.00 $g \cdot test^{-1}$.

Highlight in green would NOT meet new standards

4.9.3 Evaporative Emission Factors

Table 25 shows the updated evaporative emission factors (hot soak and diurnal) utilized by the SORE2020 Model.

Table 25. Hot Soak and Diurnal Emission Factors (SORE2020)

Category	Equipment	Tech Type	HP	Evap Emission Factors	
				Hot Soak (g/start)	24-hr Diurnal (g/day)
Lawn & Garden	Chainsaws	G2-Carb	2	0.129	0.390
			5	0.129	0.390
	Chainsaws Preempt	G2-Carb	2	0.129	0.390
			5	0.129	0.390
	Chippers/Stump Grinders/Shredders	G4-Carb	2	0.160	1.488
			5	0.160	1.488
			15	0.177	0.896
	Lawn Mowers	G4-Carb	2	0.157	0.823
			5	0.157	0.823
			15	0.195	0.796
			25	0.195	0.796
	Leaf Blowers/Vacuums	G2-Carb	2	0.138	0.460
			5	0.138	0.460
		G4-Carb	2	0.126	0.529
			5	0.126	0.529
			15	0.378	3.278
			25	0.378	3.278
		G4-FI	25	0.378	3.278
	Other Lawn & Garden Equipment	G4-Carb	5	0.157	0.823
			15	0.195	0.796
			25	0.195	0.796
	Riding Mowers/Tractors	G4-Carb	5	0.135	0.965
			15	0.135	0.965
			25	0.480	1.945
		G4-FI	25	0.480	1.945
	Snow Blowers	G4-Carb	5	0.126	0.529
			15	0.378	3.278
			25	0.378	3.278
	Tillers	G2-Carb	2	0.724	2.624
		G4-Carb	2	0.157	0.823
			5	0.157	0.823
			15	0.195	0.796
	Trimmers/Edgers/Brush Cutters	G2-Carb	2	0.086	0.431
			5	0.086	0.431
		G4-Carb	2	0.078	0.593
			5	0.082	0.545
			15	0.378	3.278
	Wood Splitters	G4-Carb	2	0.160	1.488
			5	0.160	1.488
			15	0.177	0.896
			25	0.177	0.896

Category	Equipment	Tech Type	HP	Evap Emission Factors	
				Hot Soak (g/start)	24-hr Diurnal (g/day)
Light Commercial	Air Compressors Preempt	G4-Carb	5	0.537	1.881
			15	0.411	8.178
			25	0.411	8.178
		G4-FI	25	0.411	8.178
	Generator Sets	G2-Carb	2	1.031	1.931
		G4-Carb	2	1.297	4.350
			5	1.387	2.747
			15	0.831	2.922
			25	0.831	2.922
		G4-FI	15	0.320	2.460
			25	0.320	2.460
	Pressure Washers	G4-Carb	2	0.136	0.608
			5	0.136	0.608
			15	0.164	1.171
			25	0.164	1.171
	Pumps	G2-Carb	2	0.724	2.624
	Pumps Preempt	G4-Carb	2	0.537	1.881
			5	0.537	1.881
			15	0.397	1.629
			25	0.397	1.629
	Welders Preempt	G4-Carb	15	0.397	1.629

*Note: 24-hr Diurnal is diurnal + resting loss; Carb = Carburetor FI = Fuel Injection G2 = 2 stroke G4 = 4 stroke
Preempt refers to 49 states

The basis for the update was derived from the CARB compliance and validation evaporative emission test found in Table 20. The test program did not test all equipment types included in the SORE2020 Model, therefore some equipment utilized a surrogate or the average of several equipment types to derive an updated evaporative emission factor. In addition, since running loss data were not collected, the emission factors were carried over from OFFROAD2007. Table 26 contains the assumptions utilized.

Table 26. Surrogates for Evaporative Emission Factors (SORE2020)

Category	Equipment	Type	HP	Surrogates
Lawn & Garden	Chainsaw Preempt	G2-Carb	All	Chainsaw test data
	Chippers/Stump Grinders/Shredders	G4-Carb	2	5hp Chippers/Stump Grinders test data
	Lawn Mowers	G4-Carb	2,25	Lawn Mower test data
	Leaf Blowers	G4-Carb G4-FI	15,25	Average of Compressor, Generator, Tiller, and Pressure Washer
	Other Lawn & Garden	G4-Carb	All	Lawn Mower test data
	Riding Mowers	G4-Carb	15	Riding Mower test data
	Riding Mowers	G4-Carb	25	Average of Riding Mower and Tractor test data
	Snow Blowers	G4-Carb	All	Same as Leaf Blower
	Tillers	G4-Carb	2,5	Lawn Mower test data
	Trimmers	G4-Carb	15	Same as Leaf Blower

Category	Equipment	Type	HP	Surrogates
	Wood Splitters	G4-Carb	All	Same as Chippers/Stump Grinders/Shredders
Light Commercial	Air Compressor Preempt	G4-Carb	5	Generator (49-State) test data
	Air Compressor Preempt	G4-Carb	15,25	Air Compressor test data
	Air Compressors Preempt	G4-FI	25	Air Compressor test data
	Generator Set	G4-FI	All	Estimates from OFFROAD2007
	Generator Set*	G4-Carb	2	Weighted average of 2 and 5 hp bin Generator test data
	Generator Set	G4-Carb	25	15 hp Generator test data
	Pressure Washer	G4-Carb	2,25	Pressure Washer test data
	Pumps Preempt	G2-Carb	2	Tiller test surrogate
	Pumps Preempt	G4-Carb	2,5	Generator (49-State) test data
	Pumps Preempt	G4-Carb	15,25	Average of Pressure Washer, Lawn Mower, and Generator tests
	Welders Preempt	G4-Carb	15	Average of Pressure Washer, Lawn Mower, and Generator tests

* Considering that only one engine family is tested for G4-Carb 2 hp bin Generator, staff decided to use a weighted average (using number of test data) of 2hp and 5hp bin generator test data to represent evaporative emissions for 2hp bin generators.

4.9.4 Evaporative Deterioration Factors

Evaporative deterioration rates are typically derived from emissions test data collected for in-use equipment. Since certification test data does not include a deterioration factor for evaporative emissions and there is a lack of evaporative emissions test data for small off-road gasoline engines, no major update has been made to the evaporative deterioration factors included in the SORE2020 Model. However, a few modifications were incorporated, including proportioning the deterioration rate to reflect the new, zero-hour evaporative emission rates and the inclusion of two deterioration rates (a slower rate from the zero hour to its useful life and a sharper slope from the useful life and beyond) for lawn mowers[12] exclusively. Please note that useful lives of 5 years, 4 years, and 9 years are assumed for commercial, vendor, and residential lawn mower categories, respectively. The useful life is the age at which only 50% of the number of equipment sold has remained in the fleet and differs from the median life.

According to the CARB Technical Memo (2003) titled, “Addition of Evaporative Emissions for Small Off-Road Engines”, test data from 23 in-use lawn mowers were used to estimate the zero hour emission rate of lawn mowers. The used lawn mowers were randomly obtained from dealer customer service departments and were assumed to be representative of the in-use lawn mower fleet. The test results of these mowers were averaged to establish a deterioration factor. Finally, the emission rates of the old lawn mowers were averaged to estimate the evaporative emissions from lawn mowers at the end of their lives. The evaporative emissions estimate at 14 years was the average of the emissions from two lawn mowers (mowers 20 and 23), of which one was

[12] In accordance to CARB’s 2003 technical memo titled “Addition of Evaporative Emissions for Small Off-Road Engines” at: https://www.arb.ca.gov/msei/offroad/techmemo/SORE_Evaporative1.doc