

Lawrence Berkeley National Laboratory
Lawrence Berkeley National Laboratory

Title

Flipper Vehicles in Triplicate IM147 Tests from Arizona Random Sample

Permalink

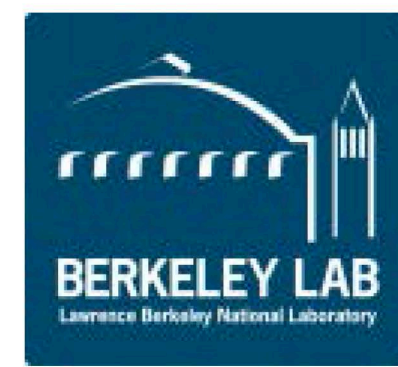
<https://escholarship.org/uc/item/5kz6v45f>

Author

Wenzel, Tom

Publication Date

2013-04-07



Flipper vehicles in triplicate IM147 tests from Arizona random sample

Tom Wenzel, Lawrence Berkeley National Laboratory, TPWenzel@lbl.gov



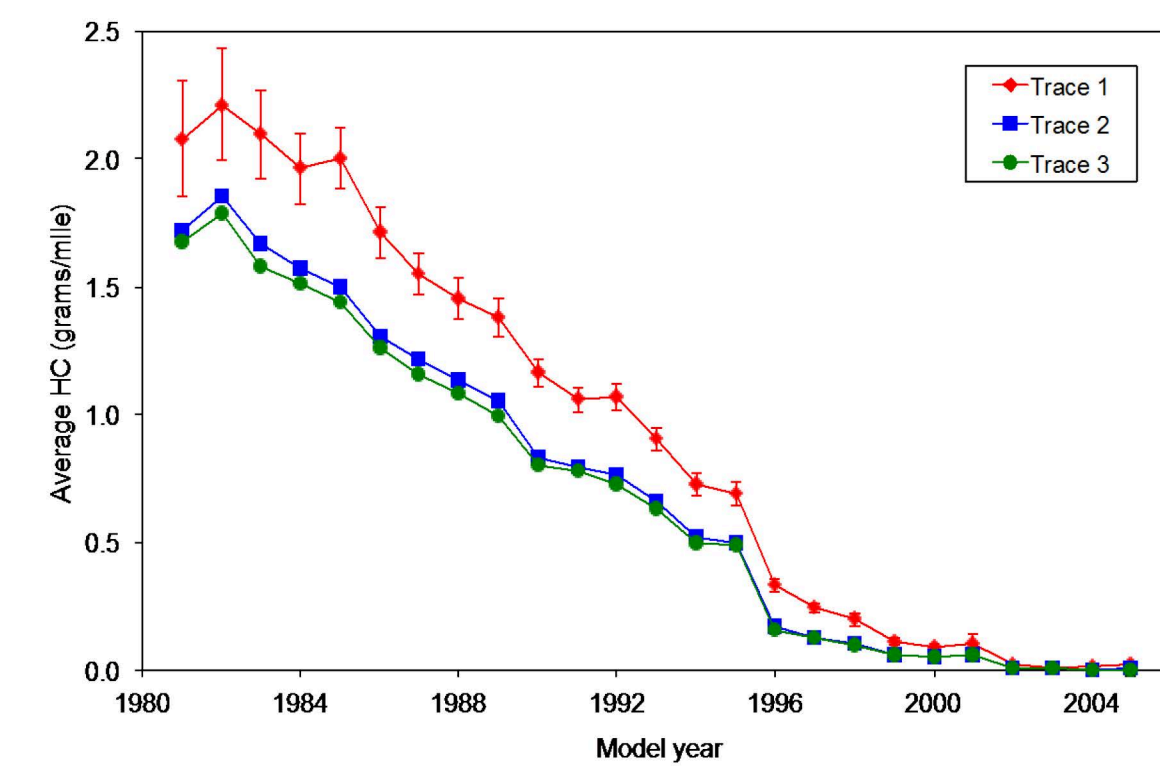
Problem: Intermittent equipment malfunctions cause some vehicles to fail an emissions test shortly after passing their previous test. As a result, some vehicles are falsely passed in state I/M programs.

Data: Second-by-second emissions from three triplicate 147-second traces (IM147) on a stratified random sample of Phoenix vehicles:

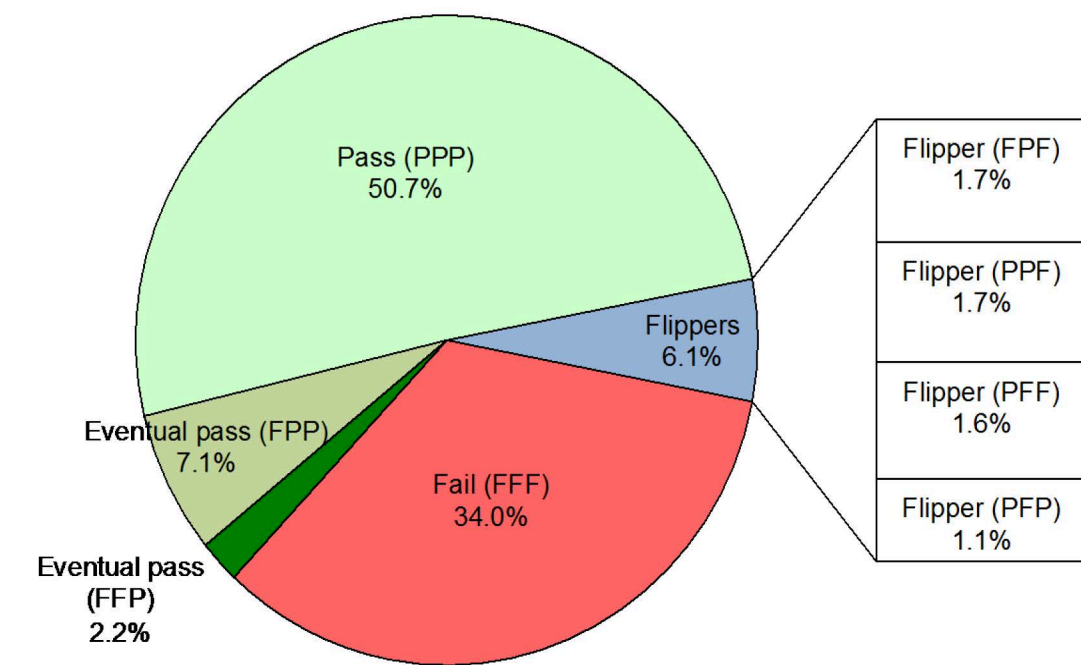
- a random sample of passing vehicles;
- a similar-sized sample of random failing vehicles;
- once a failing vehicle was included, all subsequent tests of that vehicle were also given a full IM147 test until it passed a retest.

Method: Analysis of tests conducted between Sep 2002 and Feb 2007, on 42,000 1981+ vehicles.

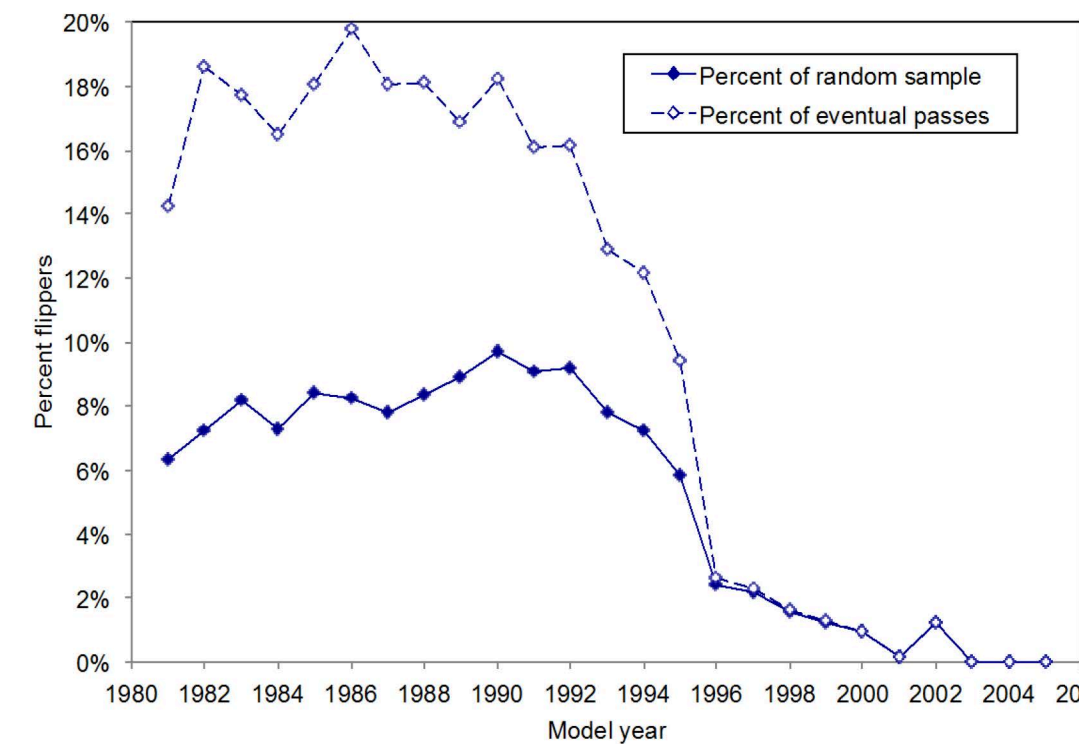
Results: 6% of all vehicles, and 9% of all passing vehicles, failed a trace within minutes of passing a previous trace.



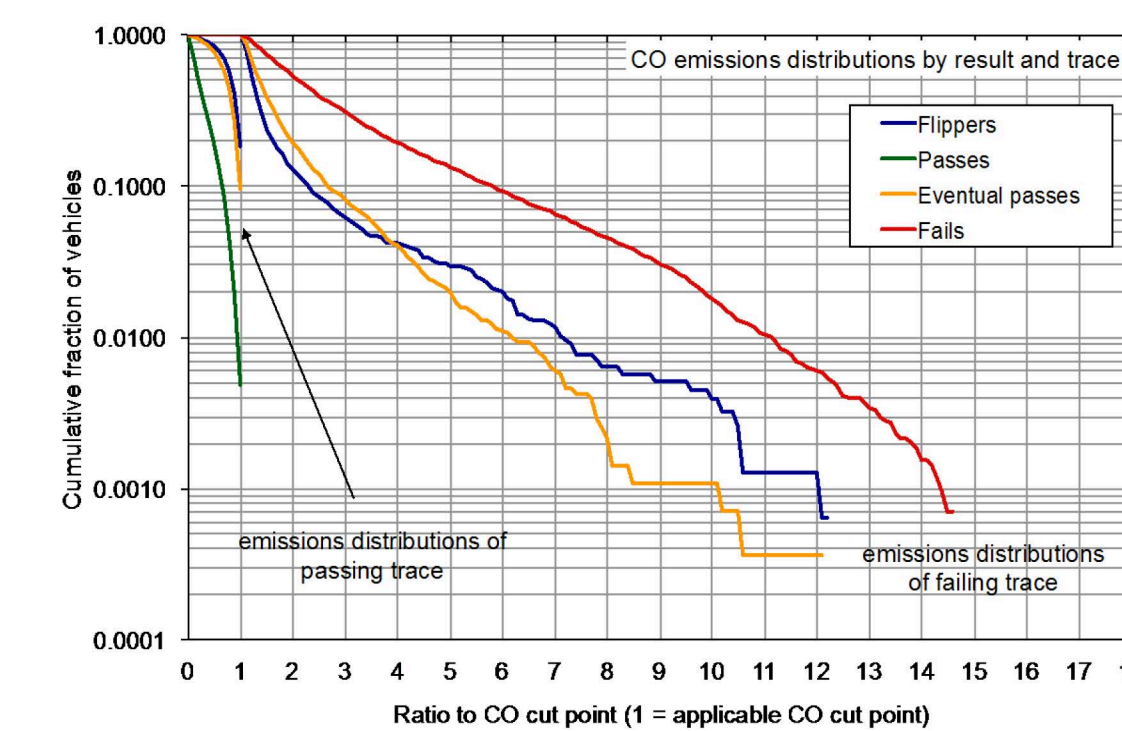
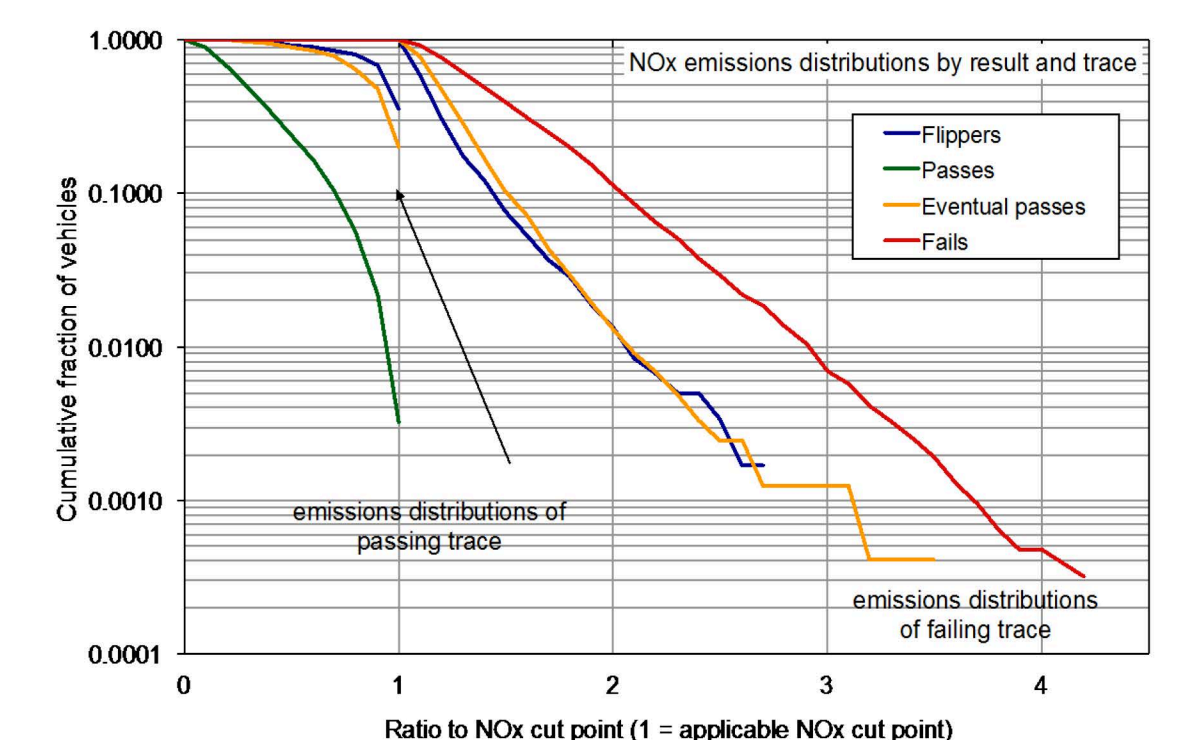
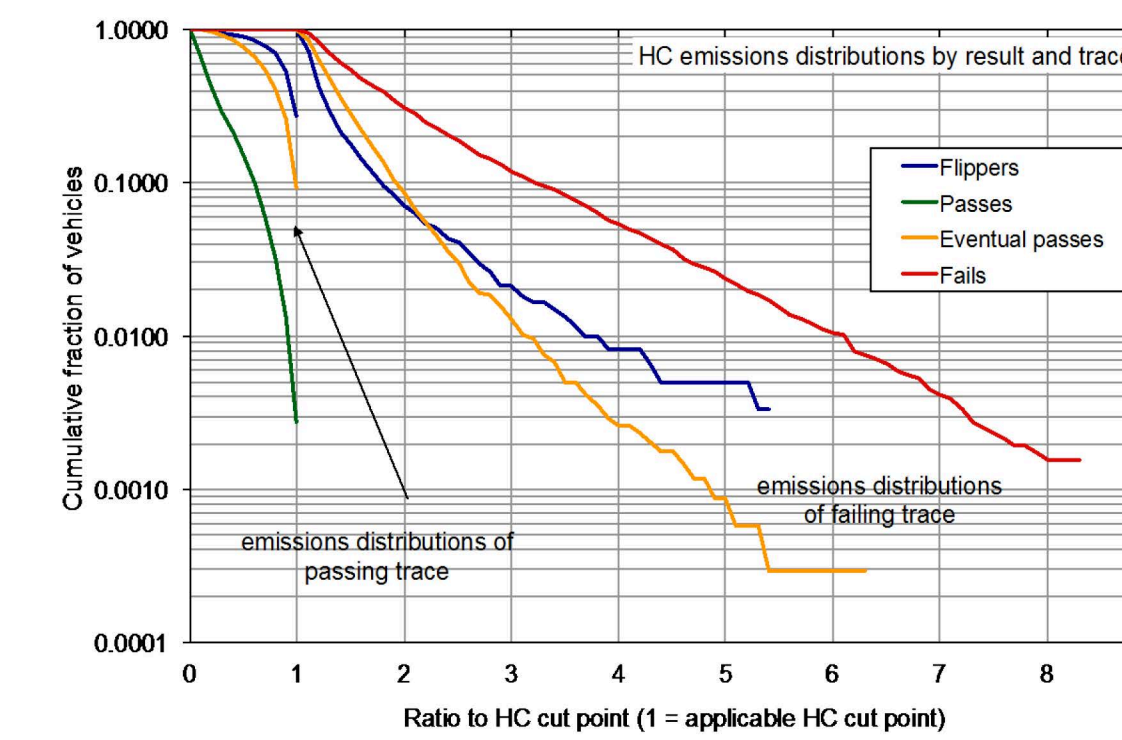
- ↑ Emissions are 10% to 25% lower on second trace than on first trace, and 1% to 5% lower on third trace than on second trace
- Likely due to engine and catalyst fully warming up and lighting off during previous traces



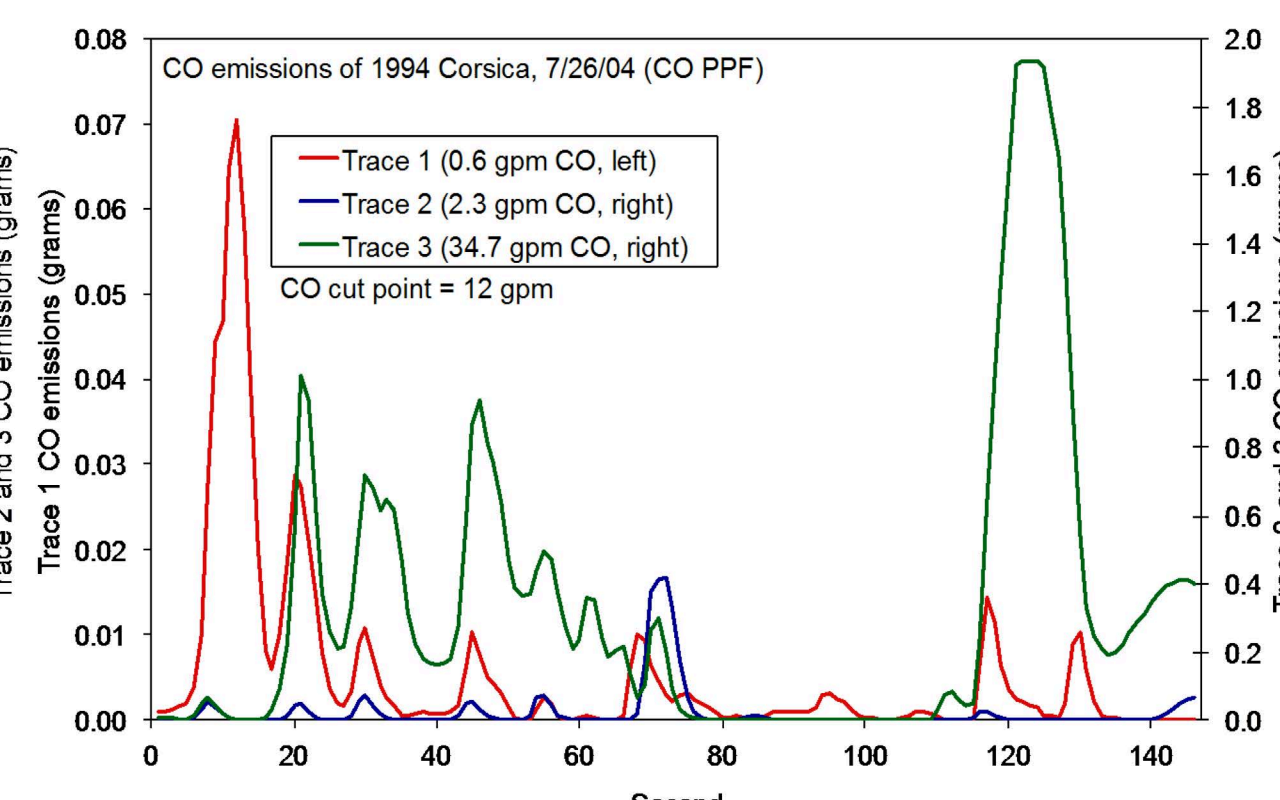
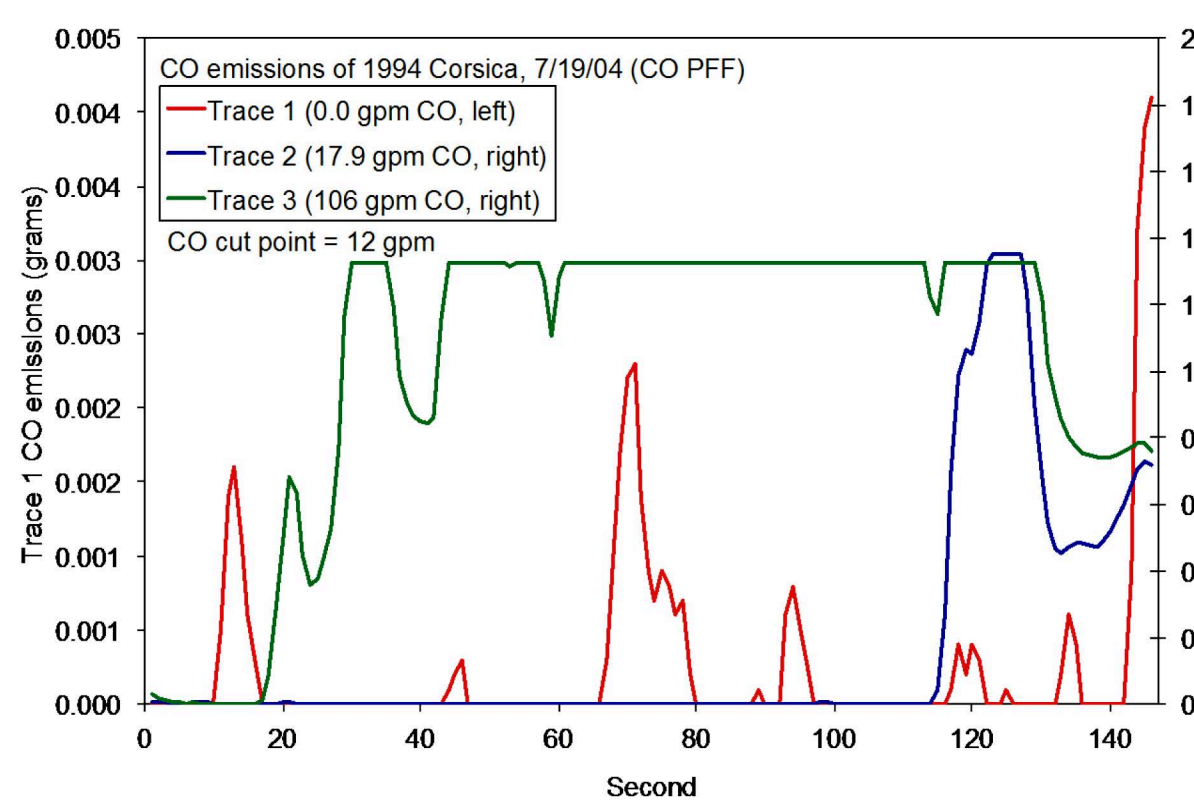
- ↑ 51% of vehicles passed all three traces (PPP); 34% failed all three traces (FFF)
- 9.3% of vehicles failed initial trace, but passed subsequent trace (eventual pass)
- 6.1% failed a trace within minutes of passing a subsequent trace (flippers)
- Sample is weighted towards failing vehicles: 9.2% of all vehicles that passed a previous trace are flippers



- ↑ Percent of vehicles that eventually passed that are flippers:
 - 17% of MY81 to 92 vehicles
 - 12% of MY93 to 95 vehicles
 - only 2% of MY96+ (OBD-II) vehicles
- Fraction of OBDII vehicles that are flippers does not increase much as they age, from 1.9% of all MY96 vehicles in 2002 to 3.7% of MY96 in 2006



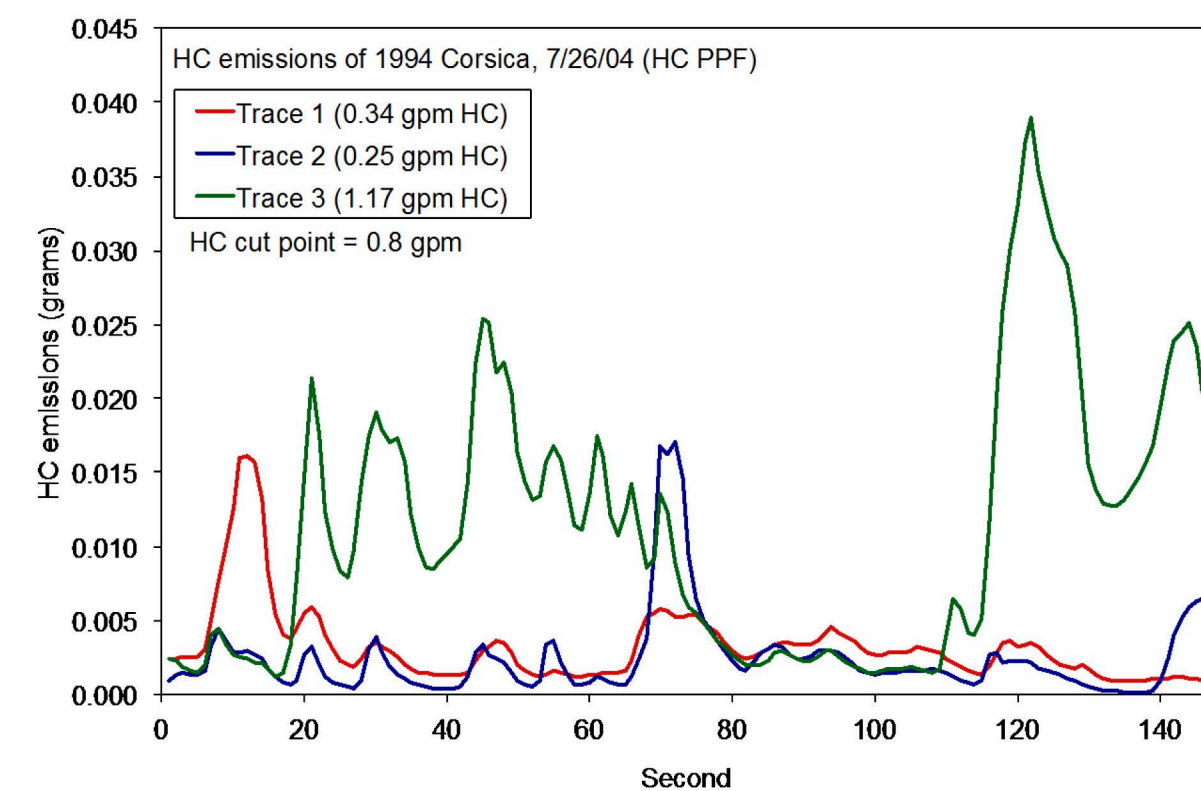
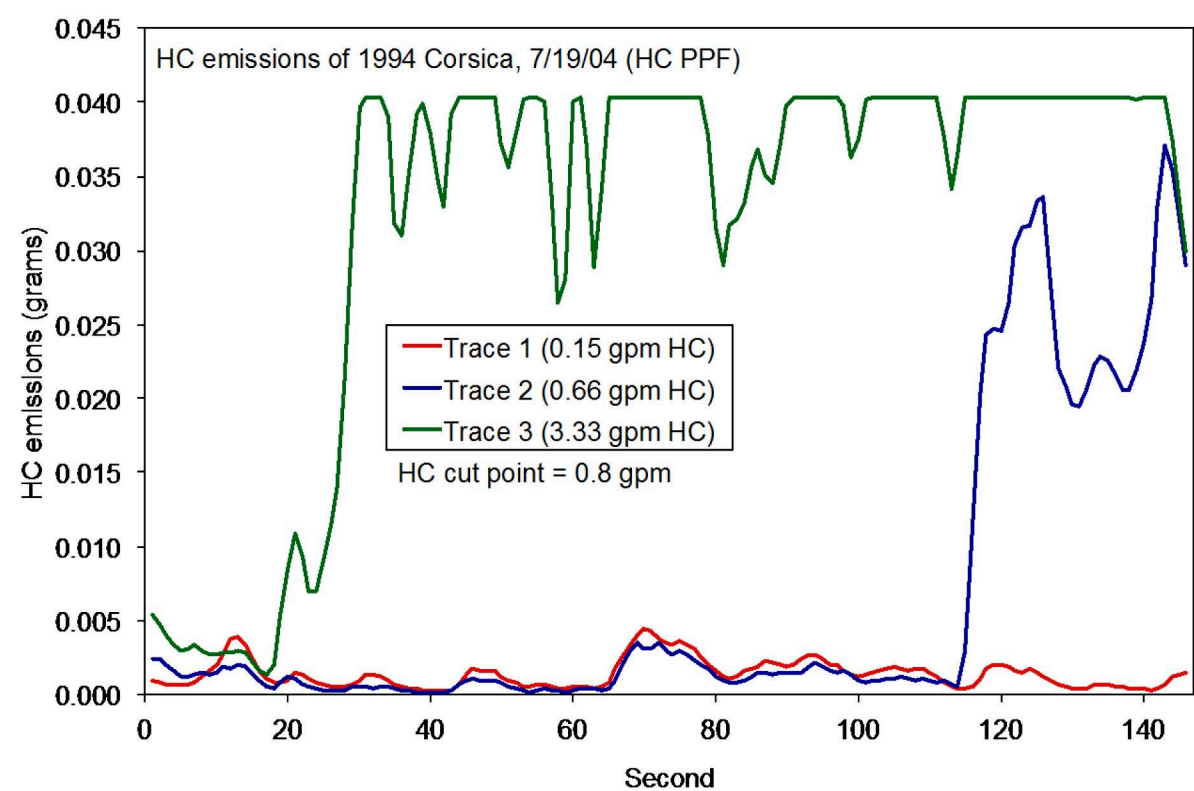
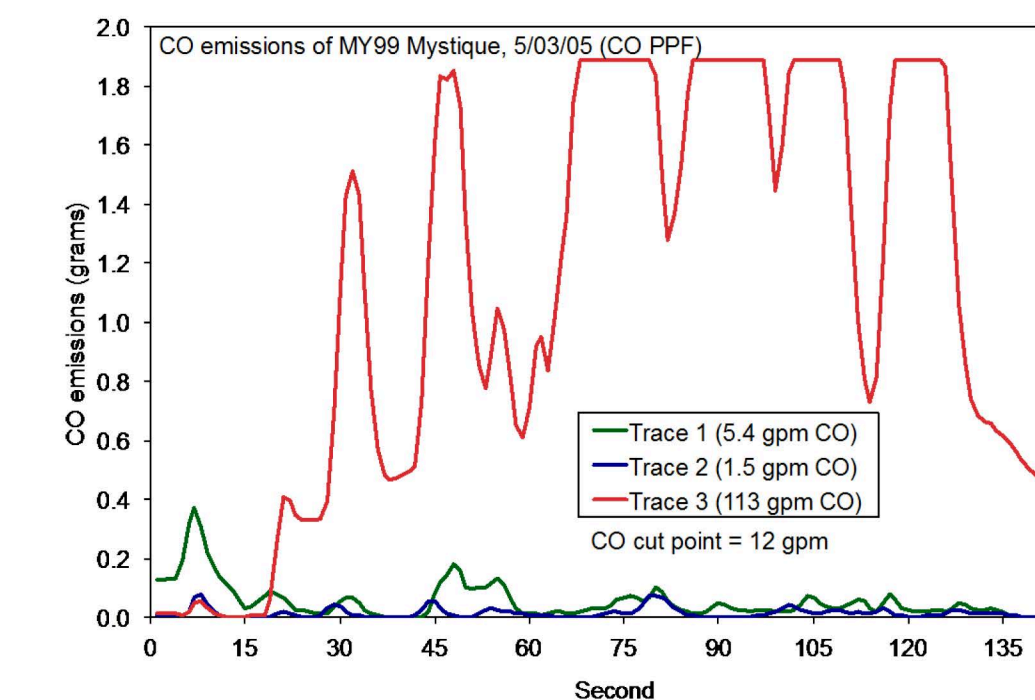
- ← Vehicles that passed all three traces (green) have much lower emissions than those that failed all three traces (red)
- Flippers have comparable emissions on their failing trace as vehicles that eventually passed: about 95% have slightly lower emissions, while 5% have substantially higher emissions, than vehicles that eventually passed
- Flippers are not passing and failing because of marginally low or high emissions.



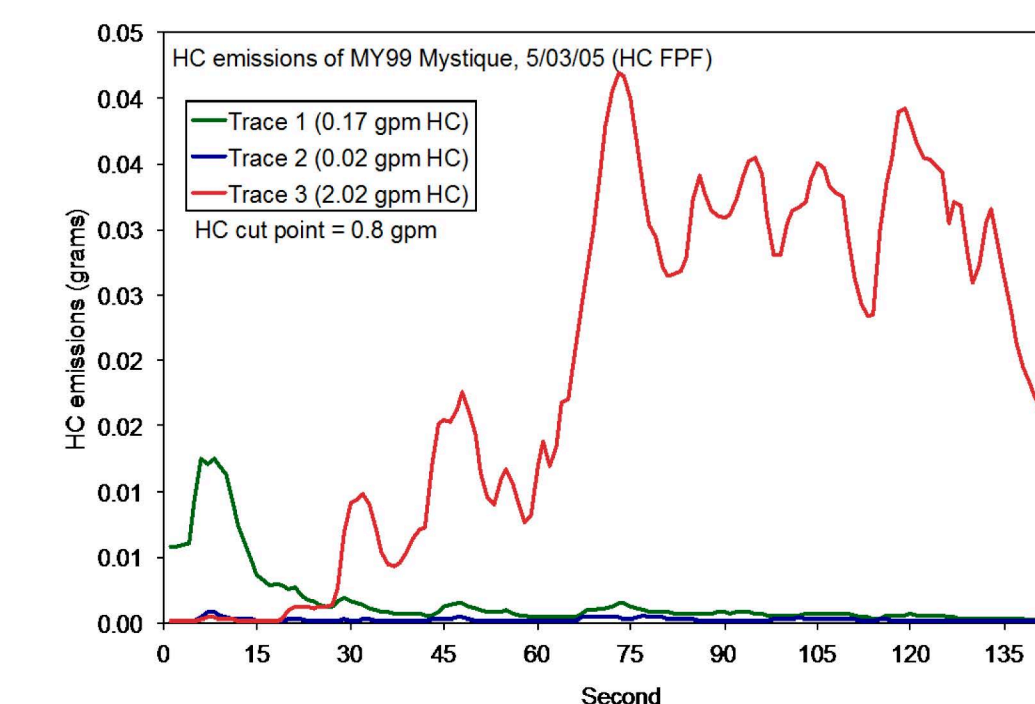
- ↓ Table shows three flipper vehicles tested twice within two weeks (presumably after repair) with same emissions pattern
- Increases in CO and HC accompanied by decreases in NOx

MY	Date	Time			Pass/fail CO			CO grams per mile		
		1	2	3	1	2	3	1	2	3
1994	7/19/04	15:01	15:03	15:06	P	F	F	0.03	17.9	106.0
1994	7/26/04	12:55	12:58	13:00	P	P	F	0.57	2.33	34.6
1995	8/30/04	16:08	16:11	16:13	P	P	F	1.93	10.0	77.
1995	9/2/04	12:42	12:46	12:48	P	F	F	11.0	53.1	126.2
1999	5/3/05	9:28	9:31	9:34	P	P	F	5.43	1.49	113.5
1999	5/6/05	7:59	8:02	8:05	P	P	F	2.24	1.84	88.2

- ↓ Although rare, OBD vehicles can also be flippers



- ← Four figures show CO (top) and HC (bottom) emissions of same MY94 vehicle tested on 7/19 (left) and 7/26 (right)
- Trace 3 emissions (green) decreased from previous inspection, but still high and a PPF flipper
- Analyzer saturation causes emission "plateaus" in first inspection trace 3, which understates actual emissions of failing vehicles



Conclusions

Estimated 9% of all vehicles that pass an I/M test would fail a subsequent test minutes later.

Flippers are more prevalent in older vehicles, but can occur in OBDII vehicles.

These results confirm other findings regarding flippers based on roadside pullover and off-cycle change-of-ownership tests.

Recommendation

EPA and states should develop strategies to better quantify the prevalence and causes of vehicles whose emissions flip from low to high within minutes of passing I/M emission tests.

Acknowledgement

This work was supported by the Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Program of the US DOE under Contract No. DE-AC02-05CH11231

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

DE-AC02-05CH11231