July 1998

RSTi Comments:

Page 1, Section 1.0 para 1 and section 1.1 para 1

The document discusses 'excusing vehicles from inspection'. We would like EPA to draw the distinction early on that RSD Clean Screening excuses clean vehicles from testing at inspection stations by inspecting each individual vehicle's emissions on-road. Low emitter profiling (LEP) and mode year exemption (MYE) excuse vehicles based solely on statistics, e.g. new vehicles are clean old vehicles are not, without regard to individual vehicle performance. We feel this is an important difference between RSD Clean Screening and the other two approaches which are really just exemptions of preferred groups of vehicles.

Page 2, para 2

The phrase "no real world experience, just pilot programs" could be clarified. The Colorado RSD pilot program is 'real world' - it is just not full-scale. For the purpose of estimating effectiveness, it has been operated and evaluated in the same way a full scale RSD program would operate. On-road vehicles are measured by RSD and evaluated in a window of time prior to their I/M 240 inspection.

Page 5 para 1

RSTi has run some preliminary tests on RSD identification of running losses using a controlled release of propane within the engine compartment. These suggest that at release rates much in excess of 2.5 grams per mile vehicles will not pass the clean screen threshold of 200 ppm HC. This is documented in the attached note.

We would like to obtain data from EPA on the sources and distributions of gram per mile running losses among vehicles and work with EPA to refine estimates of the percentages of evaporative emissions that may be clean-screened.

Page 6, section 1.3.3 paragraphs 1 and 2.

As an example of why this approach can be problematic, in Taiwan, the ROCEPA noticed that the RSD system for a pilot study was tagging a certain class of new vehicles having above normal emission readings. On further investigation and when the manufacturer of that certain class of vehicle was approached, it was determined that they had already known that these vehicles were manufactured with defective catalytic converters. It is important that these kinds of defects, which may occur on only batches of vehicles, are detected and corrected early during the vehicle’s life.

Section 1.6.1 Page 11, para 1

The guidance indicates, 'a state may depend on tighter RSD cutpoints for 1990 and newer vehicles than for older cars, as a way to reduce the credit loss in future years'. As an example, the Colorado Enhanced I/M Program 0.5% Sample Annual Report, in section IV.D.1, Table IV-10 shows the projected excess emissions retained for 36% of the 1990+ model years exempted are:93% for HC, 95% for CO and 100% for NOx.

Section 1.6.1 Page 11, para 2

The language should be changed to allow a single valid NOx measurement between the two RSD tests. This is the basis of the effectiveness tables in reference [4], 'The Colorado Enhanced I/M Program 0.5% Sample Annual Report'.

In section 1.6.1, the document discusses the qualities of the remote sensing units and references the California Bureau of Automotive Repair (BAR) regarding material for quality control in RSD testing. It should perhaps be pointed out that only after considerable work on the analysis of exhaust plumes has RSTi been able to effect the more reliable RSD results reported in reference [4]. Since the audit vehicle used by BAR to certify RSD equipment trails only a simulated exhaust plume of calibration gas that has characteristics significantly different to those of actual exhaust plumes, there is no guarantee that a unit meeting the current BAR RSD certification will perform at the same level as the RSTi equipment when measuring on-road vehicles

Section 2.1 Page 16, paragraph 3

Regarding the potential impact on the evaluation of owners pre-emptively repairing vehicles prior to I/M testing. To the extent I/M results are biased towards being cleaner that the on-road fleet, this may also affect low emitter profiling and model year exemption estimates. With respect to RSD evaluation, pre-I/M repairs could make RSD Clean Screening look less effective by creating the appearance that RSD is not passing as many vehicles as it should have judged on their subsequent I/M results.

An unmeasured benefit of an RSD clean screen program is the incentive to owners to keep a vehicle clean all year long since the RSD measurements are not tied to a specific test date as the stationary test. The vehicle owner is rewarded for having a clean vehicle by not having to take the vehicle to the stationary test and therefore saving both time and possibly money.

A vehicle owner is much more likely not to a repair a vehicle under an LEP or Model Year Exemption program than a RSD clean screen program. Both the LEP and MYE have no practical enforcement component and there would be difficulty in detecting their influence on vehicle owner behavior with respect to vehicle maintenance.

General Comments

RSD Clean Screening has a number of benefits not available with other clean screening methods:

1. RSD is 'fair'. It does not penalize the conscientious owner of a particular make model of vehicle that may be prone to failure.
2. Because vehicle emissions are measured, pattern failures in any model vehicle will be detected early and will allow rapid corrective action to be taken.
3. It provides an incentive to owners to keep their vehicles maintained at all times.
4. RSD can continuously monitor progress in reducing mobile source emissions.
5. RSD can identify very high emitting vehicles that fail between I/M tests.
6. The huge volume of RSD data from a comprehensive Clean Screen program will provide a wealth of information regarding the on-road fleet that is currently very hard to obtain. For example, by measuring individual vehicle performance many times per year it should be possible to plot individual vehicle emission trends as well as trends for different vehicle groups. This can help measure the durability and effectiveness of particular repairs and identify any weaknesses or gaps in I/M programs.

Because RSD measures all the vehicles on the road, it does not cost materially more to include all model years in the program. RSTi would be pleased to support, or provide information to support, the design of clean screen programs tailored to a state's unique requirements.

RSD Identification of Simulated Running Losses

To determine the feasibility of detecting running losses, RSTi equipped a 1986 Cadillac de Ville with a propane cylinder mounted in the engine compartment. The cylinder was set to release propane through a tube at various flow rates while the vehicle made a number of passes of an RSD unit at approximately 15 miles per hour. The propane flow rate through the tube was measured using a Dwyer flowmeter that measures from 0 to 20 litres per minute. It is expected that most running losses will originate either in the engine compartment or the fuel lines and will be swept under the car to emerge at the rear of the vehicle where they will intersect the path of an RSD infrared beam. The results are tabulated in Table 1.

At high flow rates, the correlation of HC with tailpipe CO2 is sufficiently poor that the RSD unit flags the reading as invalid (X) or suspect (S). At a release rate of 0.5 liters per minute the resulting increase in HC emissions behind the vehicle is clearly measurable.

The propane release rates in liters per minute were converted to approximate HC grams per mile using the formula: HC gpm = liters per minute x 60 mins x 1.84 grams per liter / vehicle mph

Figure 1 below illustrates the relationship between the simulated running loss grams per mile and the measured RSD HC in hexane ppm.

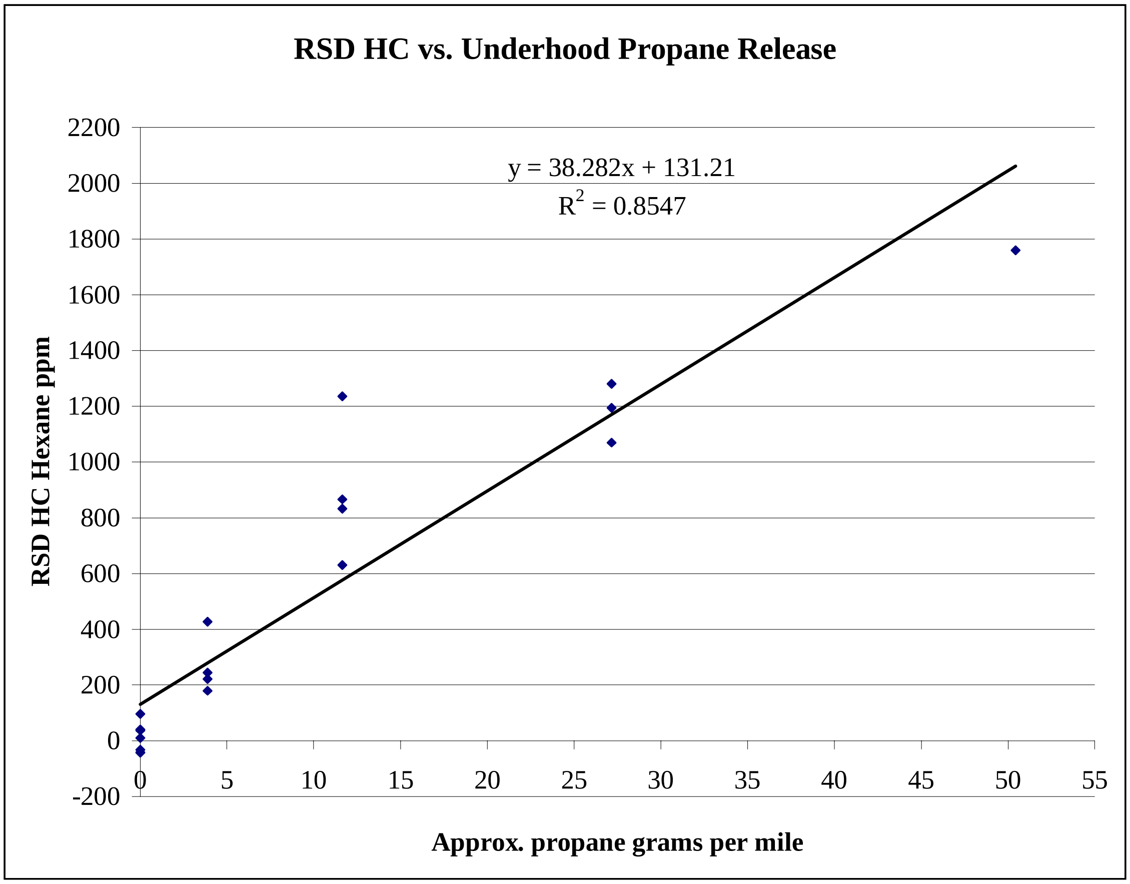
RSD HC vs. Underhood Propane Release
y = 38.282x + 131.21
R2 = 0.8547
RSD HC Hexane ppm
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
0
5
10
15
20
25
30
35
40
45
50
55
Approx. propane grams per mile

Table 1

RSD Detection of Simulated Running Losses

1986 Cadilac Deville - speed of 14-16 mph

engine: 8 cylinder 4.1 liter

V = Valid measurement, X = Invalid measurement, S = Suspect

Unit	Run	Date	Time	CO %	CO-status	CO2 %	CO2-status	HC ppm hexane	HC status
Runs 38 - 45		**Cold start to stablized readings - No Propane**							
535	38	1/7/98	14:44:09	1.97	V	13.62	V	**40**	**V**
535	39	1/7/98	14:44:31	0.23	V	14.84	V	**-32**	**V**
535	40	1/7/98	14:44:54	0.13	V	14.94	V	**38**	**V**
535	41	1/7/98	14:45:17	0.08	V	14.97	V	**-42**	**V**
535	42	1/7/98	14:45:40	0.06	V	15	V	**97**	**V**
535	43	1/7/98	14:46:02	0.1	V	14.97	V	**41**	**V**
535	44	1/7/98	14:46:24	0.06	V	15	V	**-43**	**V**
535	45	1/7/98	14:46:46	0.04	V	15	V	**11**	**V**
Average of HC V & S readings								**13.75**	
Runs 46 - 50		**100 % Propane at 6-7 liters per min**							
535	46	1/7/98	14:53:29	0.05	V	14.99	V	**-889**	**X**
535	47	1/7/98	14:54:01	0.04	V	15.02	V	**-889**	**X**
535	48	1/7/98	14:54:29	0.03	V	14.98	V	**1759**	**V**
535	49	1/7/98	14:54:57	0.03	V	15.03	V	**-889**	**X**
535	50	1/7/98	14:55:24	0.03	V	15.03	V	**-889**	**X**
Average of HC V & S readings									
Runs 51 - 55		**100 % Propane at 3-4 liters per min**							
535	51	1/7/98	14:59:56	0.01	V	14.96	V	**1280**	**S**
535	52	1/7/98	15:00:21	0.04	V	14.95	V	**1194**	**S**
535	53	1/7/98	15:00:46	0.03	V	15	V	**1069**	**V**
535	54	1/7/98	15:01:11	0.05	V	15.01	V	**-889**	**X**
535	55	1/7/98	15:01:36	0.04	V	15.02	V	**-889**	**X**
Average of HC V & S readings								**1181**	
Runs 55 - 59		**100 % Propane at 1.5 liters per min**							
535	56	1/7/98	15:02:02	0.02	V	15.01	V	**867**	**V**
535	57	1/7/98	15:02:26	0.06	V	14.99	V	**631**	**V**
535	58	1/7/98	15:02:51	0.05	V	14.99	V	**832**	**V**
535	59	1/7/98	15:03:15	0.05	V	14.97	V	**1236**	**V**
Average of HC V & S readings								**891.5**	
Runs 60 - 63		**100% Propane at 0.5 liters per min**							
535	60	1/7/98	15:03:41	0.03	V	15.02	V	**179**	**V**
535	61	1/7/98	15:04:07	0.04	V	15.01	V	**221**	**V**
535	62	1/7/98	15:04:31	0.02	V	15.03	V	**245**	**V**
535	63	1/7/98	15:04:54	0.05	V	15	V	**428**	**V**
Average of HC V & S readings								**268.25**	