

I/M—Why is Your Program Going in the Direction that it is?

RSD – A Complement to OBD I/M Programs

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Acknowledgements

- Colorado Department of Public Health and Environment
- Environmental Systems Products
- Indiana Department of Environmental Management
- South Coast Air Quality Management District
- Virginia Department of Environment Quality

Presentation Outline

- ❑ Real World Emissions Inventory Trends
- ❑ Evaporative Emissions
- ❑ How RSD can help I/M Programs

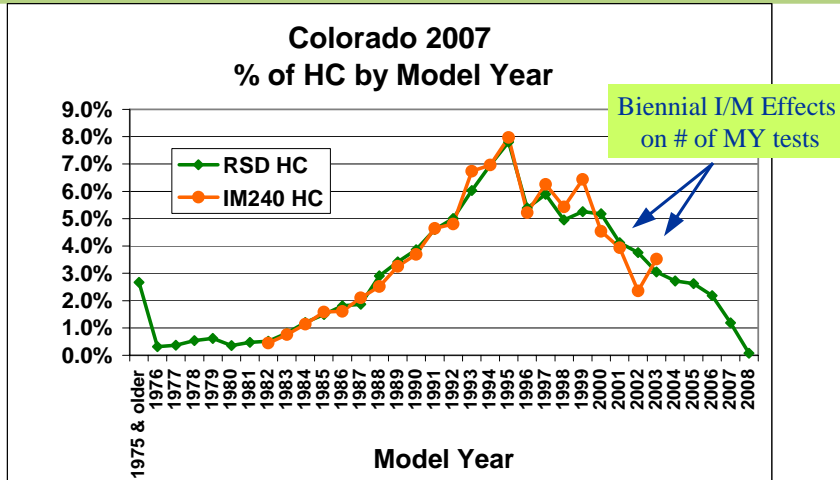
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Real World Emissions Inventory Trends

- ❑ Discussion of light vehicle emissions inventory distributions by age
 - ❑ Colorado RSD & IM240 Inventories:
 - ❖ Model Year Share of Inventory from IM240:
= IM240 Emissions X Vehicles X M6 VMT
 - ❖ Model Year Share of Inventory from RSD:
= RSD Emissions X RSD Measurements
- RSD Measurements proportional to Vehicles X VMT

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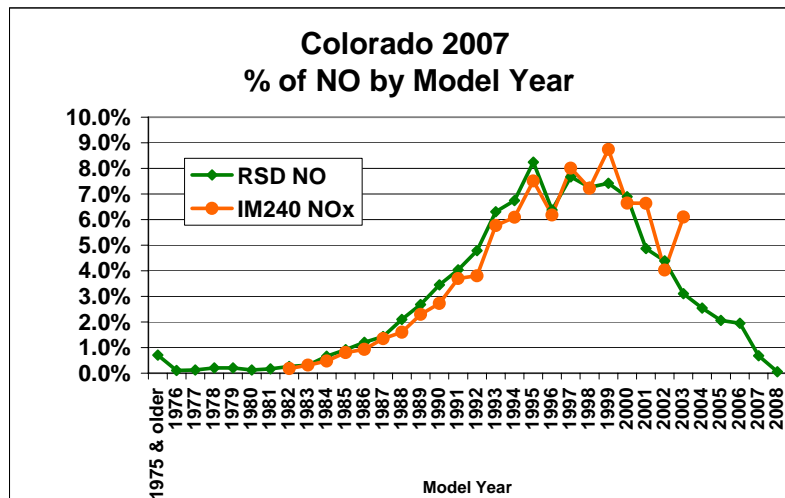
Real World Emissions Inventory Trends



□ Two independent sets of measurements agree

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Real World Emissions Inventory Trends



□ IM240 NOx skewed more towards newer models

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Real World Emissions Inventory Trends

In 2007, MY 1982-1995 / All IM240 tested:

- ❖ 56% of IM240 HC
- ❖ 54% of RSD HC

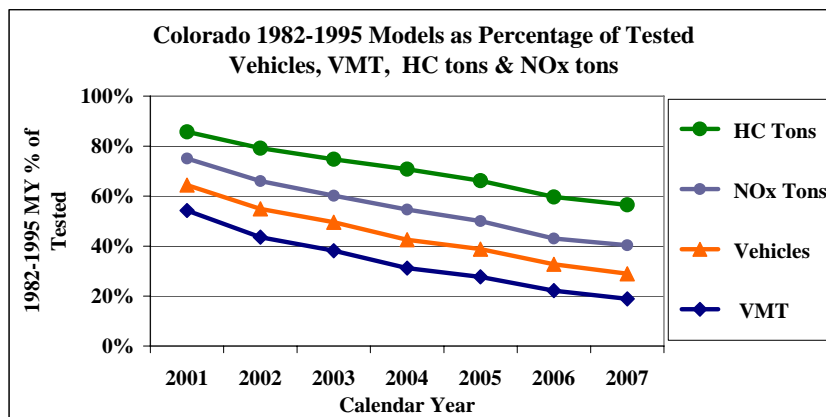
- ❖ 48% of IM240 CO
- ❖ 51% of RSD CO

- ❖ 40% IM240 NO_x
- ❖ 46% of RSD NO_x

- ❖ Does not include 1981 & older models
- ❖ Light vehicles

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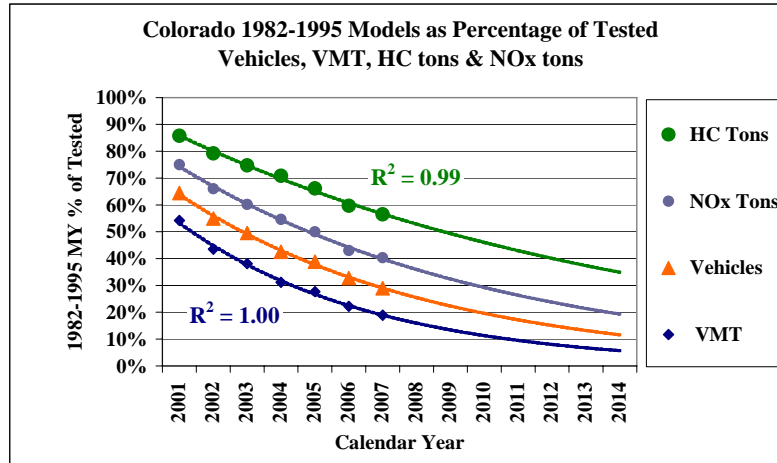
Real World Emissions Inventory Trends



IM240 Trends

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Real World Emissions Inventory Trends



2014: MY 1982-1995 / Tested vehicles:

~35% of tested HC and ~20% of NOx

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Real World Emissions Inventory Trends

2007 RSD Emissions Inventory Split: 1995 & Older / All Model Years

Includes 1981 & older and all 2004-2007

VMT HC NOx

<input type="checkbox"/> Denver, Colorado:	15%	54%	45%
<input type="checkbox"/> California AQMD:	17%	58%	53%
<input type="checkbox"/> Northern Virginia:	10%	45%	42%

What are the real numbers for your region?

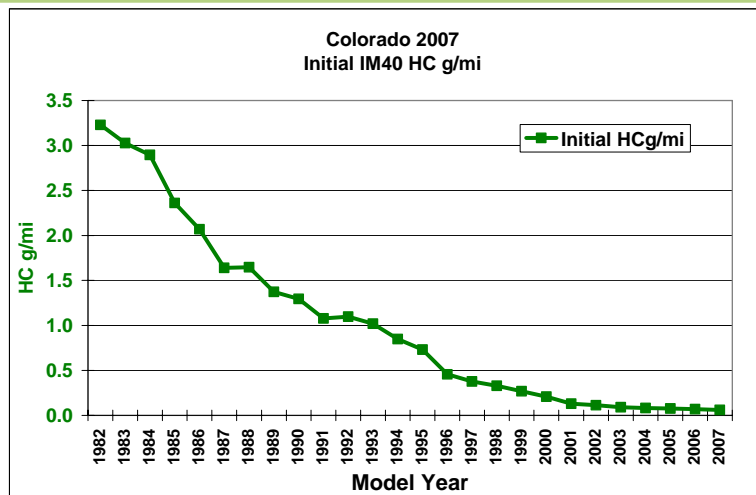
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Real World Emissions Inventory Trends

- ❑ That was inventory.
- ❑ What about reparable emissions?

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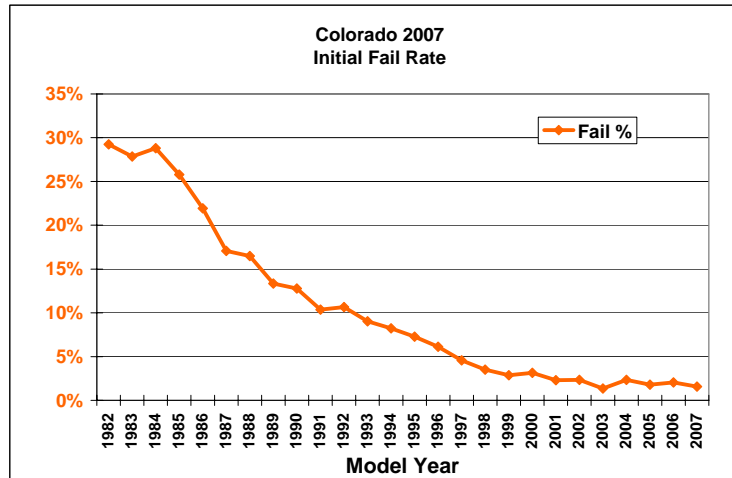
Real World Emissions Inventory Trends



Old vehicles have much higher emissions, and ...

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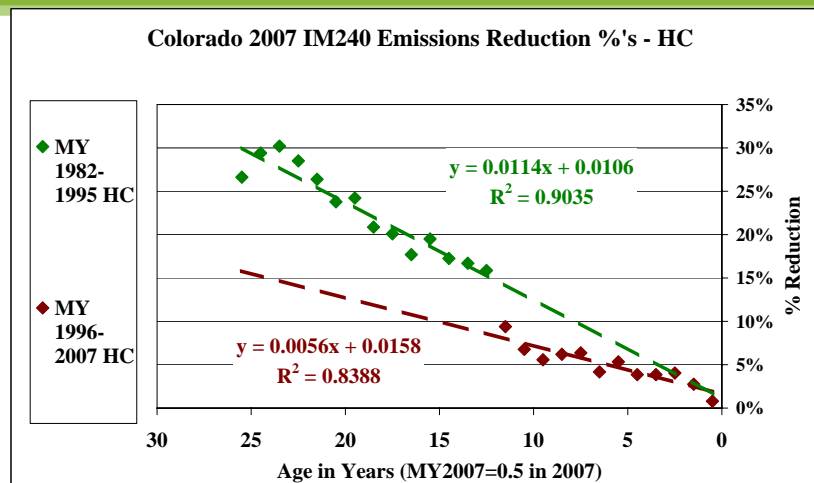
Real World Emissions Inventory Trends



Older vehicles have much higher fail rates.

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Real World Emissions Inventory Trends



% Reductions within each Model Year by age:

- OBD %'s increase at half the rate of pre-OBD
- owners respond to MIL before inspection? Or, durability?

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Real World Emissions Inventory Trends

❑ Assume:

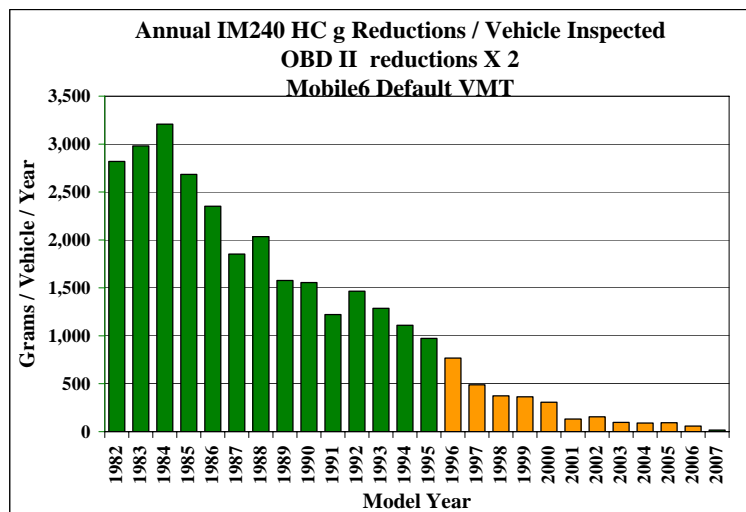
- ❖ OBD II owners respond to MIL before I/M
- ❖ % reductions for OBD II are 2X measured I/M
- ❖ OBD MY % reductions increase with age like 1995 & older models

❑ I/M reductions per vehicle increase with model year age:

- ❖ Increasing failure rates
- ❖ Increasing average emissions
- ❖ Partly offset by decreasing VMT

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Real World Emissions Inventory Trends



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Real World Emissions Inventory Trends

☐ Annual HC reductions per vehicle inspected:

❖ MY 1982-1995: ~1,428 g/year/vehicle

❖ MY 1996 & newer* ~ 276 g/year/vehicle

*4 year exemption but includes some 2004-2007 models

☐ Colorado IM240 repairable emissions in 2007, MY 1982-1995 / All IM240 tested:

❖ 68% of IM240 HC reductions

❖ 65% of IM240 CO reductions

❖ Not including 1981 & older models

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Real World Emissions Inventory Trends

☐ Apply Colorado reduction %'s by age to the RSD inventory for ALL model years

☐ Includes 1981 & older and all 2004-2007

☐ Cap the % for vehicles over 23 years old

☐ Repairable emissions in 2007,

MY 1995 & all older / All model years

	HC	CO
Denver, Colorado:	73%	73%
California AQMD:	79%	82%
Northern Virginia:	64%	61%

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Real World Emissions Inventory Trends

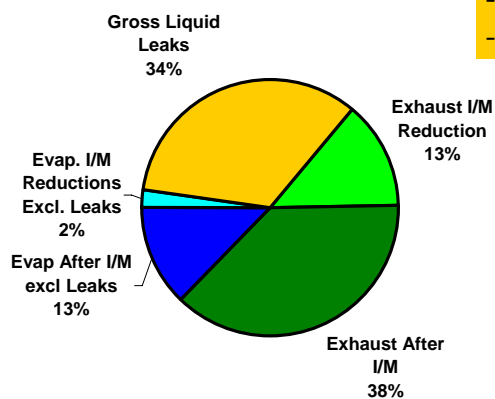
- ❑ Headed towards OBD but not yet there!
- ❑ Pre-OBD II vehicles still account for a majority of HC and CO repairable emissions
- ❑ And will remain significant over at least the next five years.

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Evaporative Emissions and Liquid Leaks

July 2010

Mobile6.2 Light Vehicle VOC



Gross Liquid Leakers:
-Small % of Vehicles
-Very High Emissions
-No Mobile6 I/M Credit

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Evaporative Emissions and Liquid Leaks

- ❑ Per Mobile6:
 - ❑ Evap half of total HC
 - ❑ Of which, gross liquid leakers 70-80%
 - ❑ Gross Liquid Leakers:
 - ❖ Mostly vehicles over 10 years old
 - ❖ No I/M benefits
 - ❖ Increased time to fail for OBD vehicles

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Evaporative Emissions and Liquid Leaks

- ❑ Gross Liquid Leakers – defined as:
 - ❖ Resting loss: > 2 grams/hour, or
 - ❖ Hot soak test: > 10 grams/hour, or
 - ❖ Running loss: > 7 grams/mile on LA-4
 - ❖ Not always liquid
- ❑ Typical sources:
 - ❖ vent hoses, canisters, tanks, pumps
 - ❖ connectors, fuel rails, injectors, carburetors
- ❑ Gaseous leaks identified by:
 - ❖ OBD or tank pressure test
- ❑ Liquid leaks identified by:
 - ❖ Visual, smell, sniffers – probably not by OBD

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Evaporative Emissions and Liquid Leaks

- ❑ 2005 Colorado OBD II Study:
 - ❖ Some high evap emitters fail IM240 HC
 - ❖ Polluted excess air drawn by CVS
- ❑ 2007 Indiana Study:
 - ❖ Many vehicles with evap in pre-OBD failing I/M HC
 - ❖ Most liquid leaks are underhood or underbody
- ❑ Colorado I/M program:
 - ❖ Evidence of evap vehicles with high RSD HC
- ❑ Ongoing EPA MOVES / CDPHE / ERG study:
 - ❖ Use of RSD to quantify evaporative emissions

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Evaporative Emissions and Liquid Leaks

- ❑ Few I/M Programs looking for liquid leaks:
 - ❖ California: visual and tank pressure test
 - ❖ Indiana: check of all 1995 & older HC fails
 - helps owners/shops diagnose fails
 - ❖ Others ?
- ❑ Liquid leaks are a large source of light vehicle HC:
 - ❖ Relatively easy to detect and repair

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Evaporative Emissions and Liquid Leaks

The rugged MiniRAE 2000 is the smallest pumped handheld volatile organic compound (VOC) monitor on the market. Its Photoionization Detector's (PID) extended range of 0 to 10,000 ppm makes it an ideal instrument for applications from environmental site surveying to HazMat/Homeland Security.



Key Features

- **Proven PID technology** The patented sensor provides a 3-second response up to 10,000 ppm and sets a new standard for resistance to moisture and dirt.
- **Wireless communication enabled and certified**
- **Self-cleaning lamp and sensor** The patented self-cleaning lamp and sensor minimize the need for maintenance and calibration.
- **The MiniRAE 2000 lamp and sensor** can be taken apart in seconds for easy maintenance without tools!
- **Measure more chemicals than with any other PID.** With over 100 Correction Factors built into the MiniRAE 2000 memory and the largest printed list of Correction Factors in the world (200+), RAE Systems offers the ability to accurately measure more ionizable chemicals than any other PID. When a gas is selected from the MiniRAE 2000's library, the alarm points are automatically loaded into the meter.
- **User friendly screens** make it easy to use for simple applications and flexible enough for sophisticated operations.
- **Drop-in battery** When work schedules require putting in more than the 10 hours supplied by the standard NiMH battery, the drop-in alkaline pack supplied with every MiniRAE 2000 lets you finish the job.
- **Rugged Rubber Boot** The standard rubber boot helps ensure that the MiniRAE 2000 survives the bumps and knocks of tough field use.
- **Strong, built-in sample pump** draws up to 100 feet (30 m) horizontally or vertically.
- **Tough, flexible inlet probe**
- **Large keys** operable with 3 layers of gloves.
- **Easy-to-read display** with backlight.
- **Stores up to 267 hours** of data at one-minute intervals for downloading to PC.
- **3-year 10.6 eV lamp warranty**

Applications

- HazMat/Homeland Security**
 - Initial PPE (personal protective equipment) assessment
 - Leak detection
 - Safety perimeter establishment and maintenance
 - Spill delineation
 - Decontamination
 - Remediation
- Industrial Hygiene/Safety**
 - Confined Space Entry (CSE)
 - Indoor Air Quality (IAQ)
 - Worker exposure studies
- Environmental**
 - Soil and water headspace analysis
 - Leaking underground storage tanks
 - Perimeter fence-line monitoring
 - Fugitive emissions (EPA Method 21)
 - Vapor recovery breakthrough
 - Landfill monitoring

- Handheld
- ppm readout
- Fast response
- Audible alarm
- Auto backlight
- Rechargeable
- Self calibrating/ diagnostics

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How RSD Can Help I/M

❑ RSD I/M Applications:

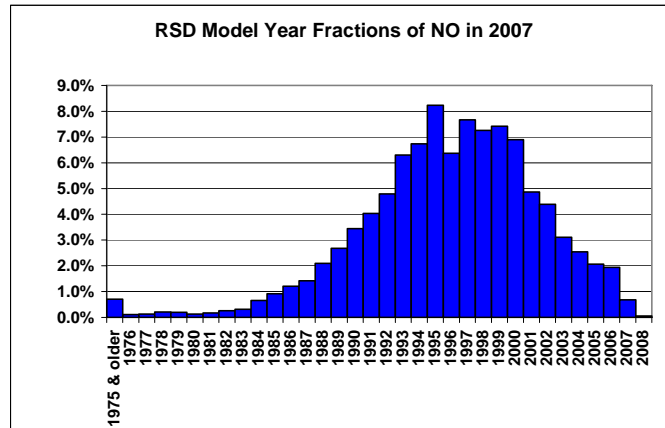
- ❖ Monitor elements of a regional fleet and their emissions
- ❖ Target individual high emitters for repair/retirement:
 - Exhaust, evaporative & high PM/smoke
 - Help plug I/M gaps
- ❖ Decentralized: Monitor inspection station performance
 - Reduce improper testing / repair
- ❖ Centralized: Exempt low emitters from station testing
 - Improve convenience, reduce cost

Some examples . . .

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How RSD Can Help I/M – Fleet Monitoring

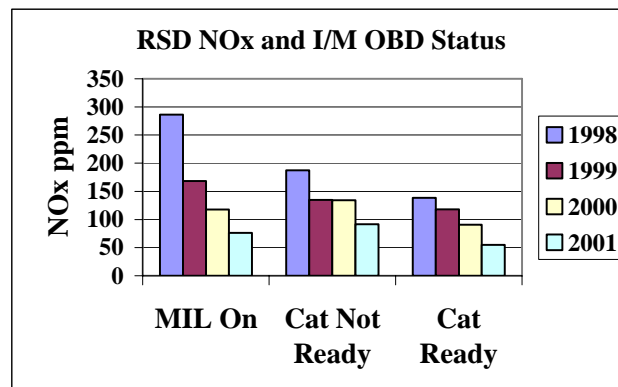
Which models contribute most emissions:



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How RSD Can Help I/M – Fleet Monitoring

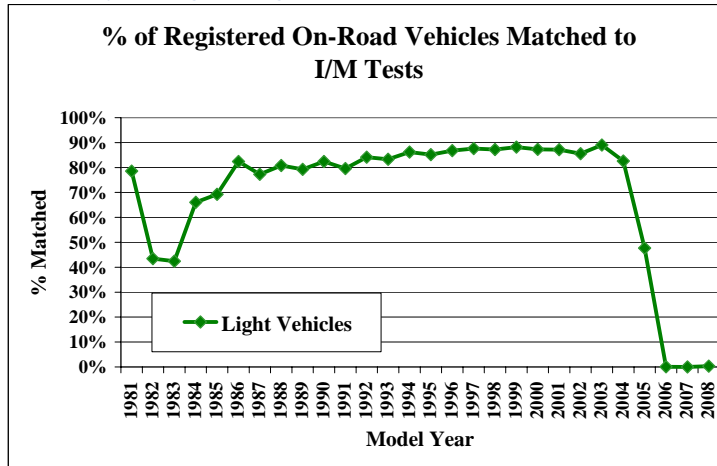
Does OBD readiness matter:



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How RSD Can Help I/M – Fleet Monitoring

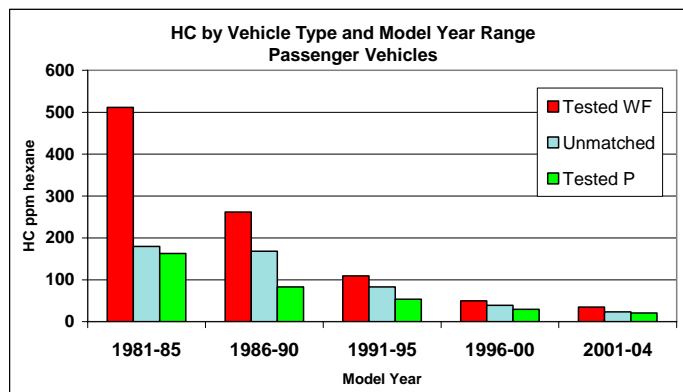
Is everyone getting tested:



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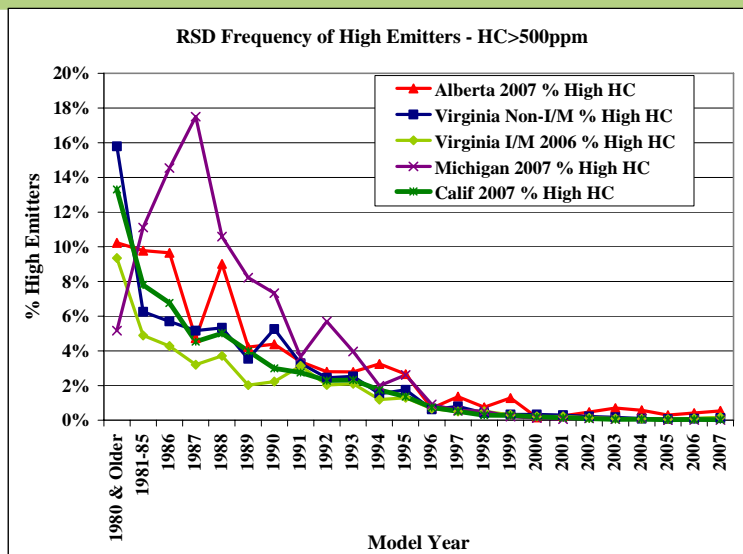
How RSD Can Help I/M – Fleet Monitoring

How dirty are vehicles with no passing result:



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How RSD Can Help I/M – High Emitter Identification



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How RSD Can Help I/M – High Emitter Identification

Smoking Gasoline Vehicles

1989 Civic RSD Smoke: 5.4



1995 Aspire RSD Smoke: 2.85



1995 Camaro RSD Smoke: 2.8



Old Ford RSD Smoke: 2.8



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How RSD Can Help I/M – High Emitter Identification

Smoking Diesels

2004 C2500 RSD Smoke: 4.1



2003 C3500 RSD Smoke: 2.6

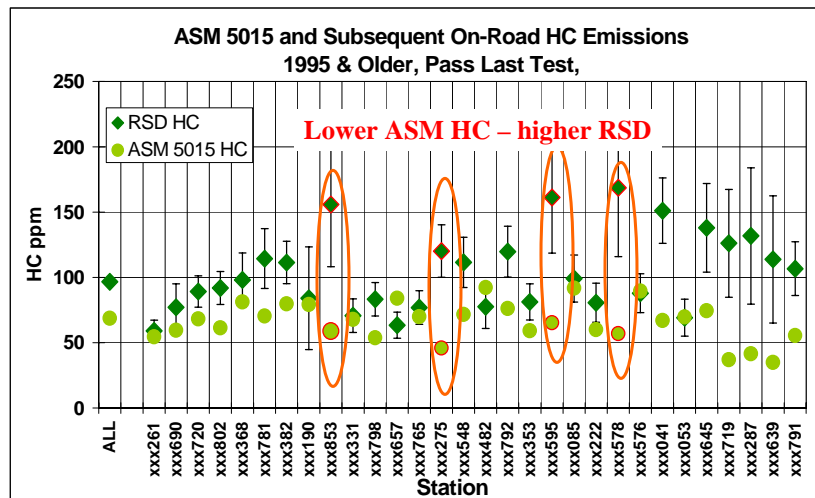


2000 C3500 RSD Smoke: 2.6



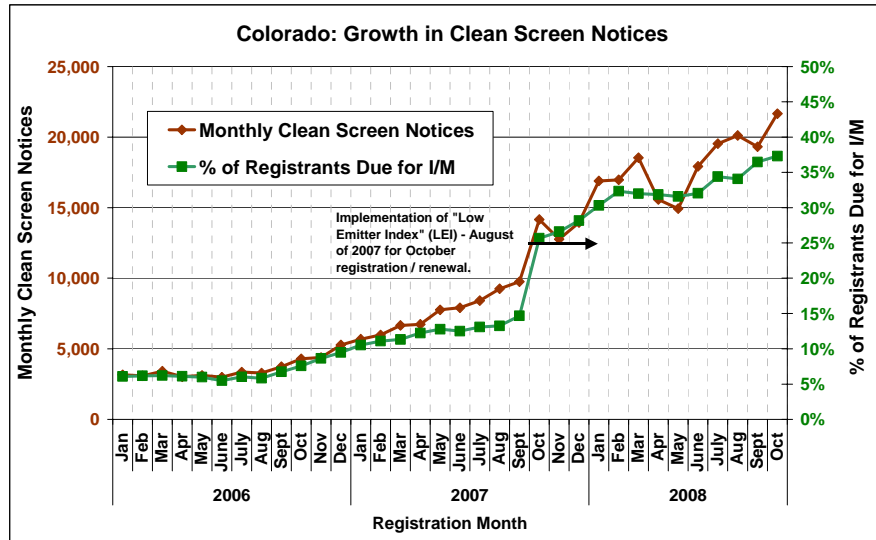
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How RSD Can Help I/M – Station Performance



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How RSD Can Help I/M – Clean Screen



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How RSD Can Help I/M – Plugging I/M Gaps

RSD High Emitter ID Complementing OBD I/M

Plug Potential I/M Gaps:

- 1995 & older models
- Non-compliant vehicles
- Vehicles with unset readiness monitors
- Liquid leaks
- Diesels
- Tampered vehicles
- Gasoline Smokers
- Incomplete repairs / "cheap" components
- 1996-1998 models w/o OBD evap monitor
- Urban bus and utility fleets

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How RSD Can Help I/M – Plugging I/M Gaps

RSD High Emitter ID Complementing OBD I/M

Ways to Implement:

- Advisory to motorist – save gas
- Require diagnosis / repair at a licensed station
- Require extra annual inspection
- Require off-cycle inspection
- Low income repair assistance
- Early retirement incentives

Best repair for an old model high emitter – retire it!

20% of owners may retire/trade a vehicle w/o incentives

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Conclusions

- ☐ **Keep inspecting 1995 & older vehicles**
 - five times the HC reductions per vehicle
- ☐ **Look for evaporative & liquid leaks**
- ☐ **Strengthen I/M programs by adding RSD**

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Thank You