Relative Effectiveness of Remote Sensing, Low Emitter Profiling and Model Year Exemptions for I&M Clean Screening

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Participants

- EPA (funding and oversight)
- Arizona DEQ
- Gordon-Darby
- Hughes
- Sierra Research

Objectives

- Evaluate the relative effectiveness of three clean screening techniques
- Review EPA guidance on Clean Screening
- Analyze data from Arizona on remote sensing and IM240 tests for 1981 to 1996 vehicles
- Compare to results from Colorado remote sensing and IM240 studies of clean screening
- Analyze Arizona IM240 repair effectiveness sample to better evaluate emissions reductions
- Analyze Wisconsin IM240 data for model year exemptions for 1968 to 1995 vehicles

Background

- Vehicle testing convenience is important
- Capacity of older test networks is being consumed, potentially increasing wait times
- Switching to final standards will increase test times, thus decreasing capacity and potentially increasing wait times
- Clean screening being proposed for use or being used in several programs
- May 1998 EPA Guidance on Clean Screening

EPA Clean Screen Guidance
Remote Sensing

- Based on CDH study of 594 vehicles with two remote sensing measurements
- 80% fleet coverage with more than one reading
- Exempt 51% of vehicles
- Emissions losses (CDH figure IV-10):
  - HC - 9%
  - CO - 7%
  - NOx - 28%
- 50% loss of HC evaporative benefits for exempted vehicles
- Cost-effectiveness based on extrapolation of fleet coverage, assumes constant 10% new vehicle coverage

EPA Clean Screen Guidance (continued) Low Emitter Profiling

- Based on vehicle age, make, engine family
- Results based on Radian report to ADEQ
- Exempt 50% of vehicles
- Emissions losses same as for remote sensing
- Emissions losses for AZ fleet:
  - HC - 5.5%
  - CO - 5.7%
  - NOx - 6.8%
- 50% loss of HC evaporative benefits for exempted vehicles

EPA Clean Screen Guidance (continued) Model Year Exemptions

- Based on vehicle age
- Results based on MOBILE 5
- Exempt up to first five years
- Emissions losses:
  - HC - less than 10%
  - CO - ?%
  - NOx - ?%
- Losses could be less in MOBILE 6
- Low losses in evaporative emissions

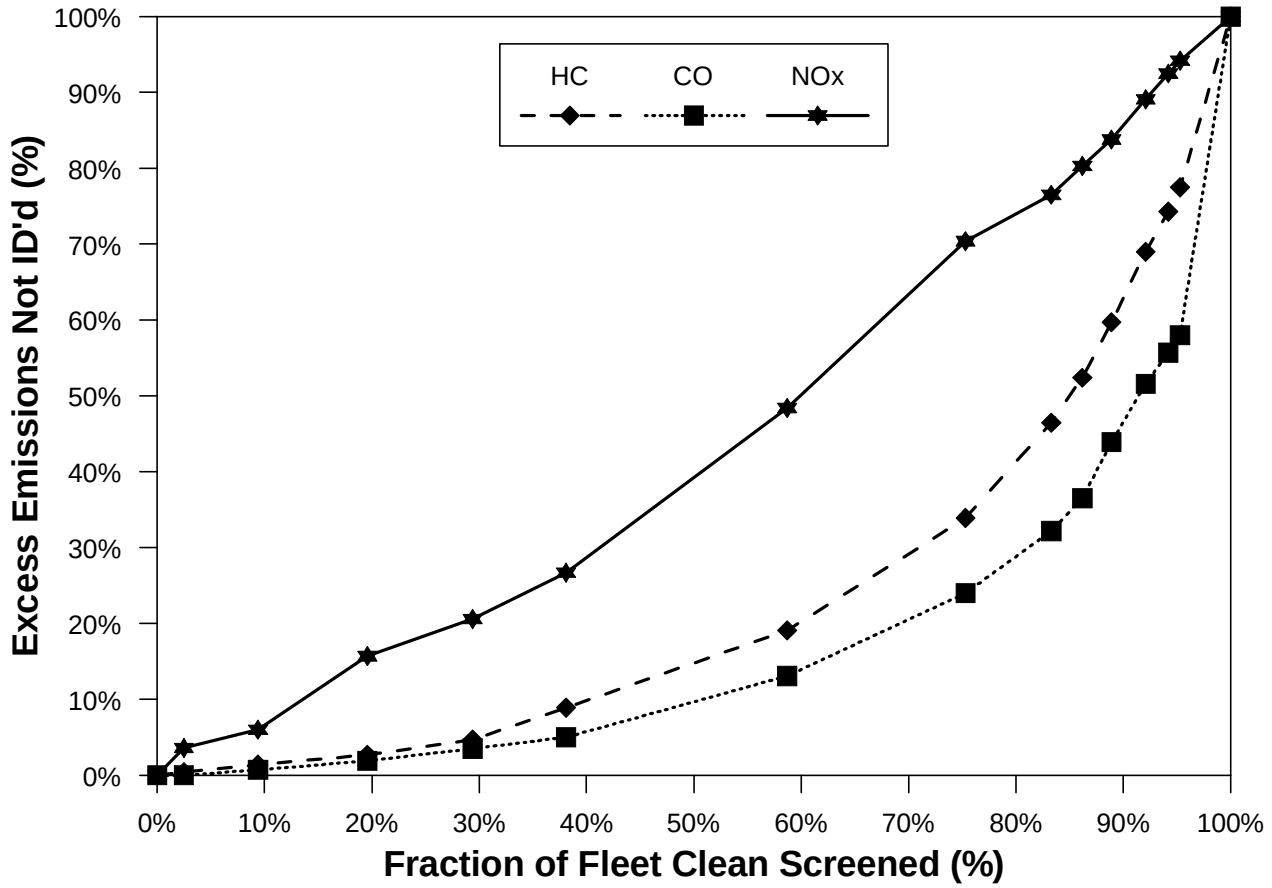
Sierra Clean Screen Study

- Testing conducted September 16 to October 31, 1996 in AZ
- Remote sensors placed along roadways leading to two IM240 test centers
- Two remote sensors placed at each location
- Full IM240 tests conducted during study period
- 2,000 matching remote sensing and IM240 tests

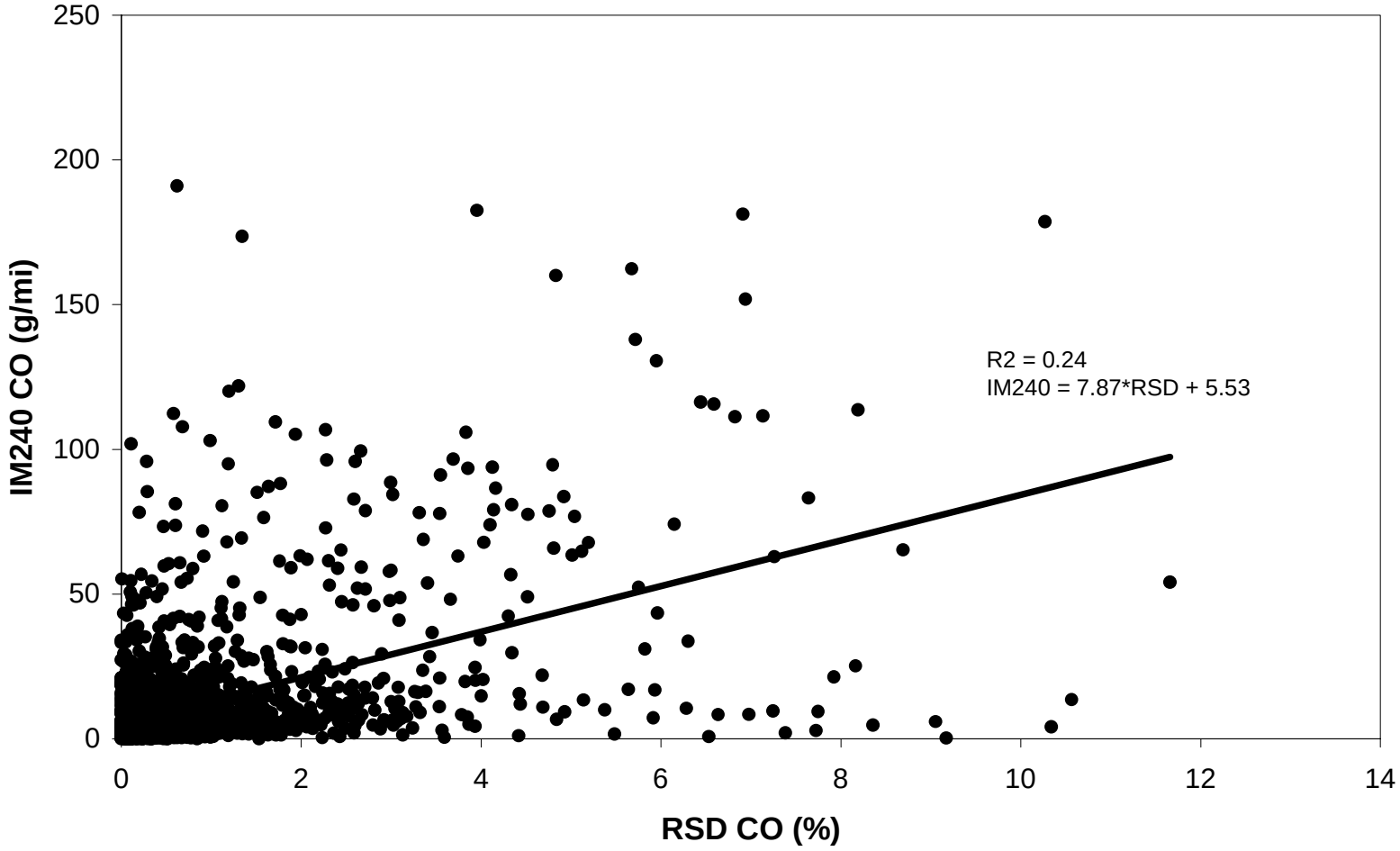
Remote Sensing Versus Model Year Analysis

- Only remote sensing data with multiple readings
- Remote sensing readings segregated by CO bins (0-0.05%, 0.05-0.10%…)
- Excess emissions calculated for HC, CO, and NOx
- Excess emissions based on final standards
- Repair data evaluated in later study to determine actual emissions reductions

Clean Screening with Remote Sensing



IM240 CO Versus Remote Sensing CO
Arizona Clean Screen Pilot Project



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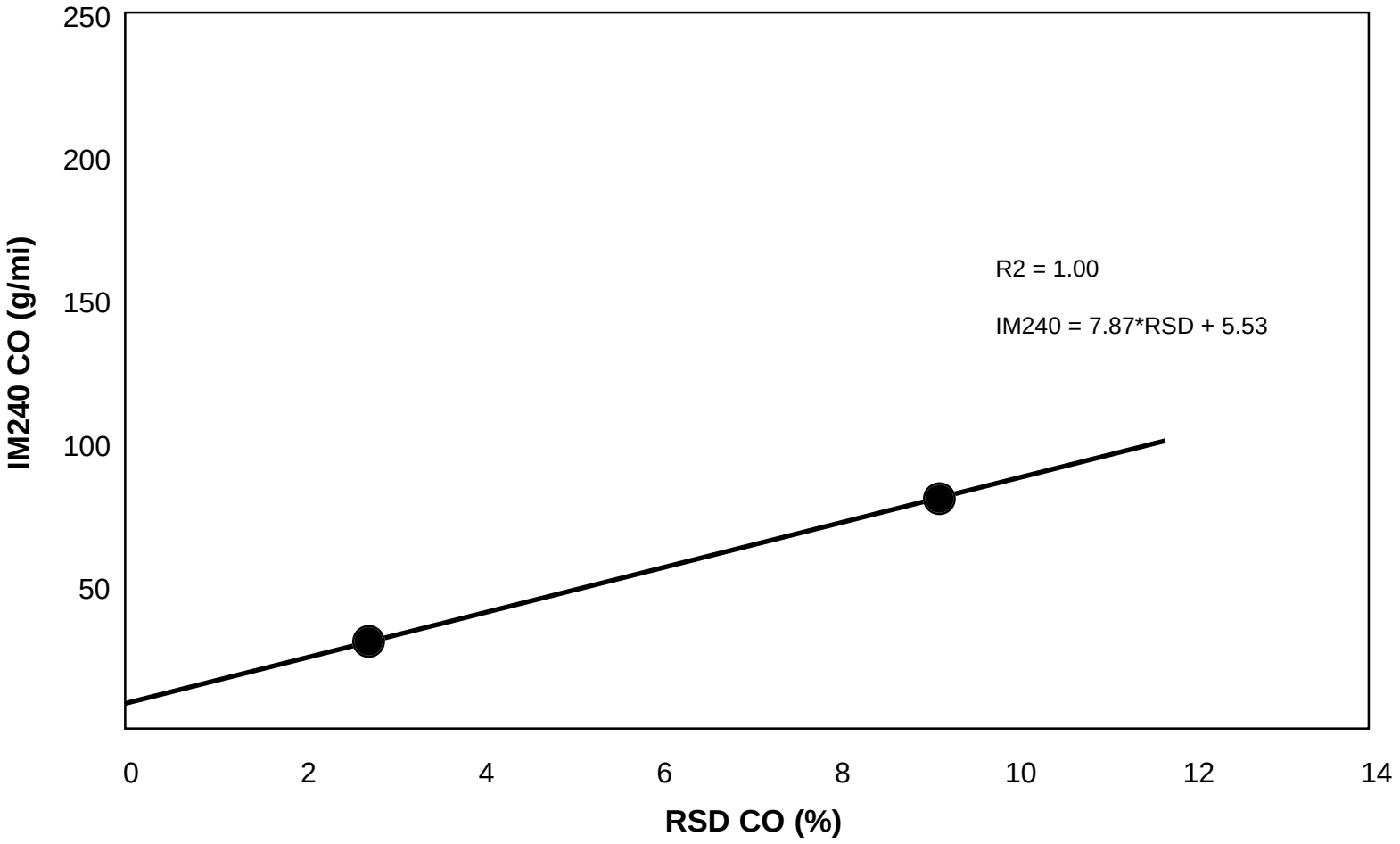
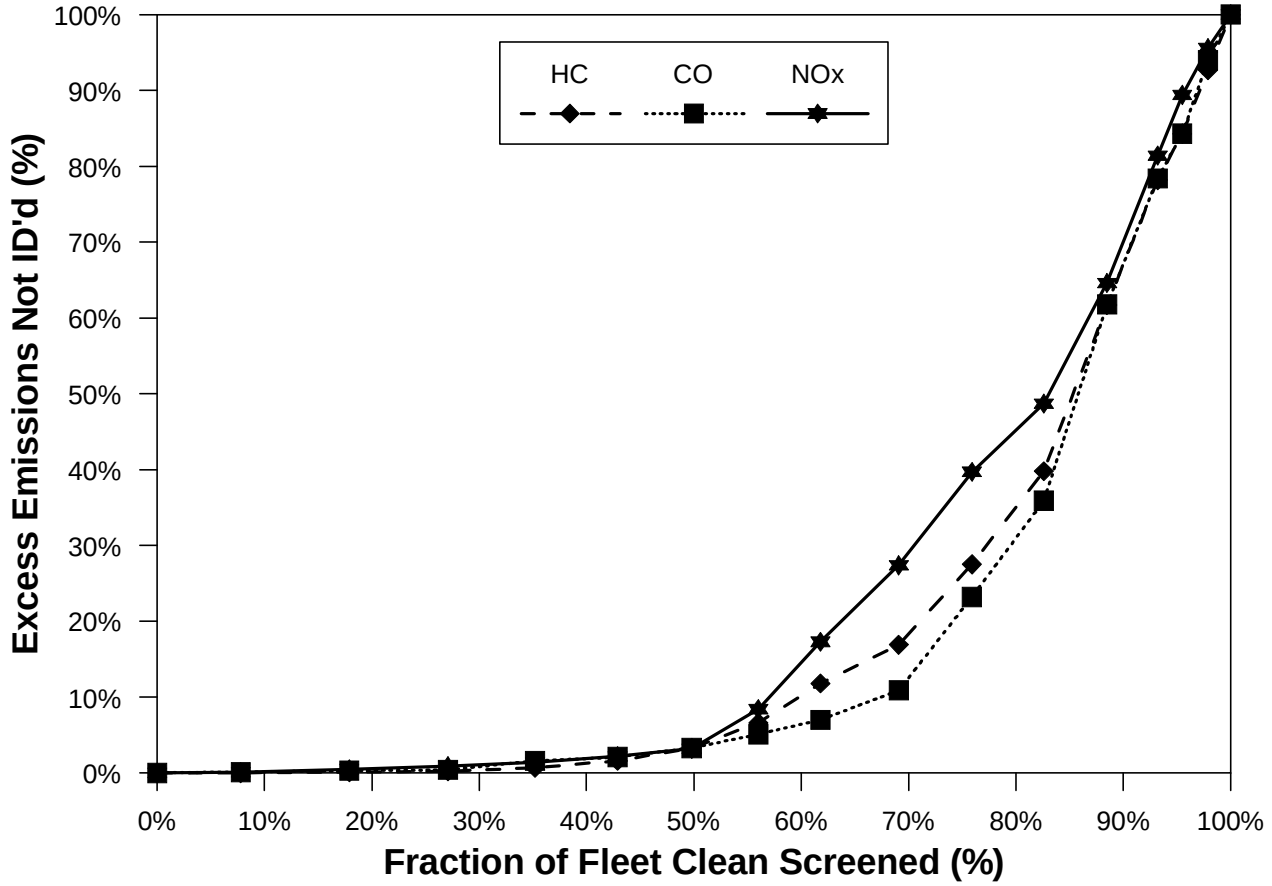
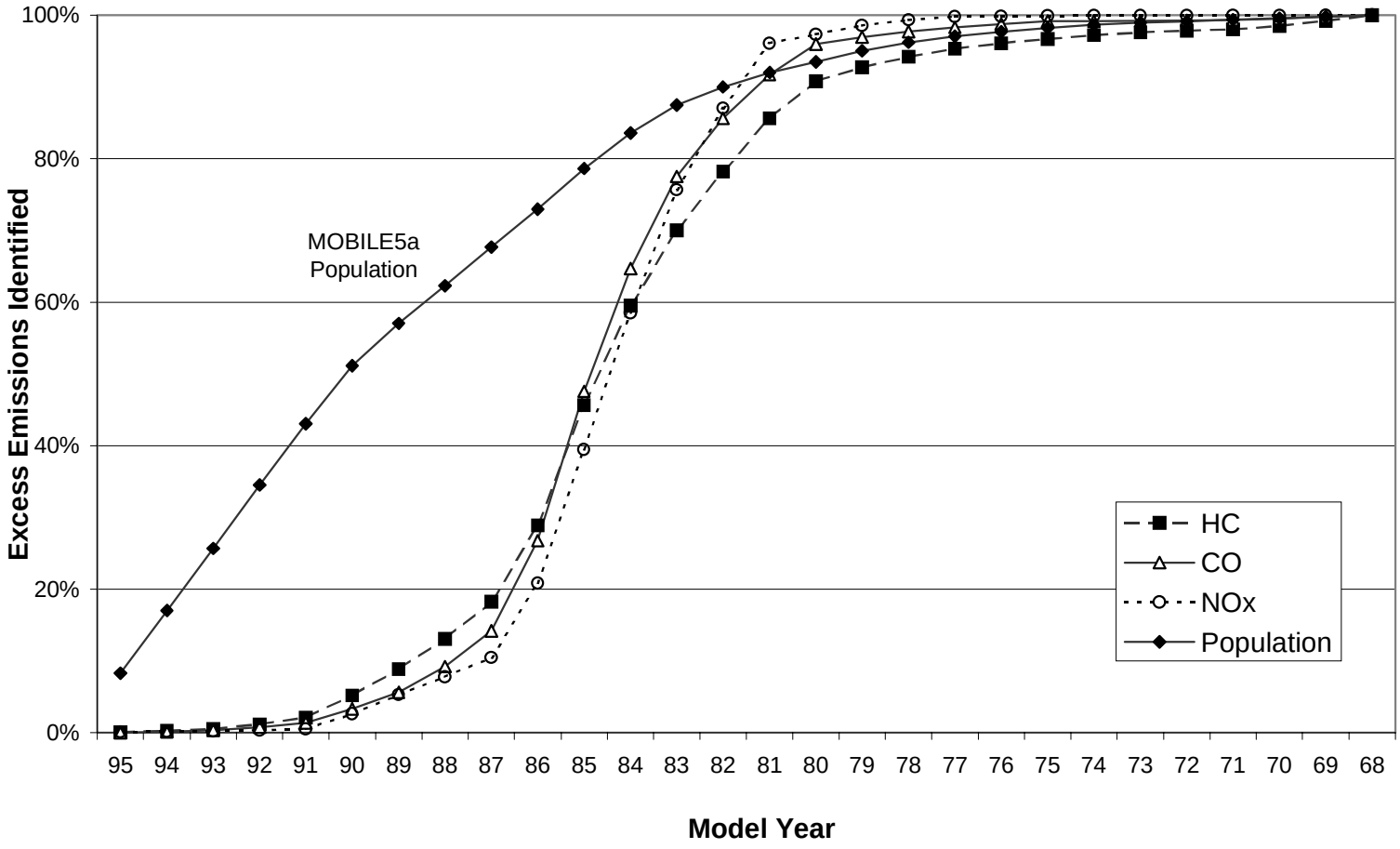


Clean Screening by Model Year Only (Arizona IM240 Data)



Clean Screening by Model Year Only (Wisconsin IM240 Data)



Remote Sensing Limitations

- Operational costs are significant
- Evaporative emissions problems are not captured
- Emission losses found in Sierra study for 50% exemption
  - HC - 15%
  - CO - 10%
  - NOx - 40%
- EPA effectiveness analysis included the use of a low emitter profile
- Low emitter profile masks inaccuracies associated with remote sensing

Emissions Losses From Model Year Exemptions Based on Repair Data

- 26,000 records from 2% “random sample”
- Full IM240 tests in Arizona test lanes
- June 1995 though April 1997
- Only considered first 15 model years
- Merged data by VIN of first and last test
- Includes vehicles that never passed test

Initial versus After Repair Light-Duty Vehicle Emissions for Model Year Exemptions

		HC	CO	NOx
Grams/mile	Initial Test	0.53	8.38	1.08
	After repair no exemptions	0.34	5.50	0.88
	After repair 5 model years	0.35	5.69	0.89
	After repair 6 model years	0.36	5.82	0.90
Reduction After Repair	After repair	35.9%	34.4%	18.5%
	5 model years	34.0%	32.1%	17.6%
	6 model years	32.1%	30.6%	16.7%
Loss in I/M Benefits	5 model years	5.26%	6.60%	5.00%
	6 model years	10.5%	11.1%	10.0%

Comparison of Clean Screening Techniques

	Remote Sensing CDH / Sierra	Low Emitter Profiling	Model Year Exemptions
Percent Exempted	**50%**	**50%**	**≈ 36% (5 years)**
HC losses	**9% / 15%**	**5.5%**	**5.3%**
CO losses	**7% / 10%**	**5.7%**	**6.6%**
Evaporative HC losses	**50% of vehicles exempted**	**50% of vehicles exempted**	**Minimal**
NOx losses	**28% / 40%**	**6.8%**	**5%**
Cost	**High**	**Lower**	**Free**

Conclusions

- Remote sensing is the least effective and most expensive clean screen option
- Model year exemptions based on standards and real repair data show low losses in benefits for exempting first 4 or 5 years of 15 years
- Even lower losses in benefits are indicated when full in-use fleet is considered in model year exemptions