

1997: Solectria Sunrise

- Tested at ARB in March of 1997
- Very different from MOA EVs,
- “EV1-like”, but with more seating capacity
- 5 passenger/ lightweight/ efficient design
- Equipped with Nickel-metal hydride
- Range: 155/ 204 miles (city/ hwy)
- Never went into production

1998: ARB LEV II

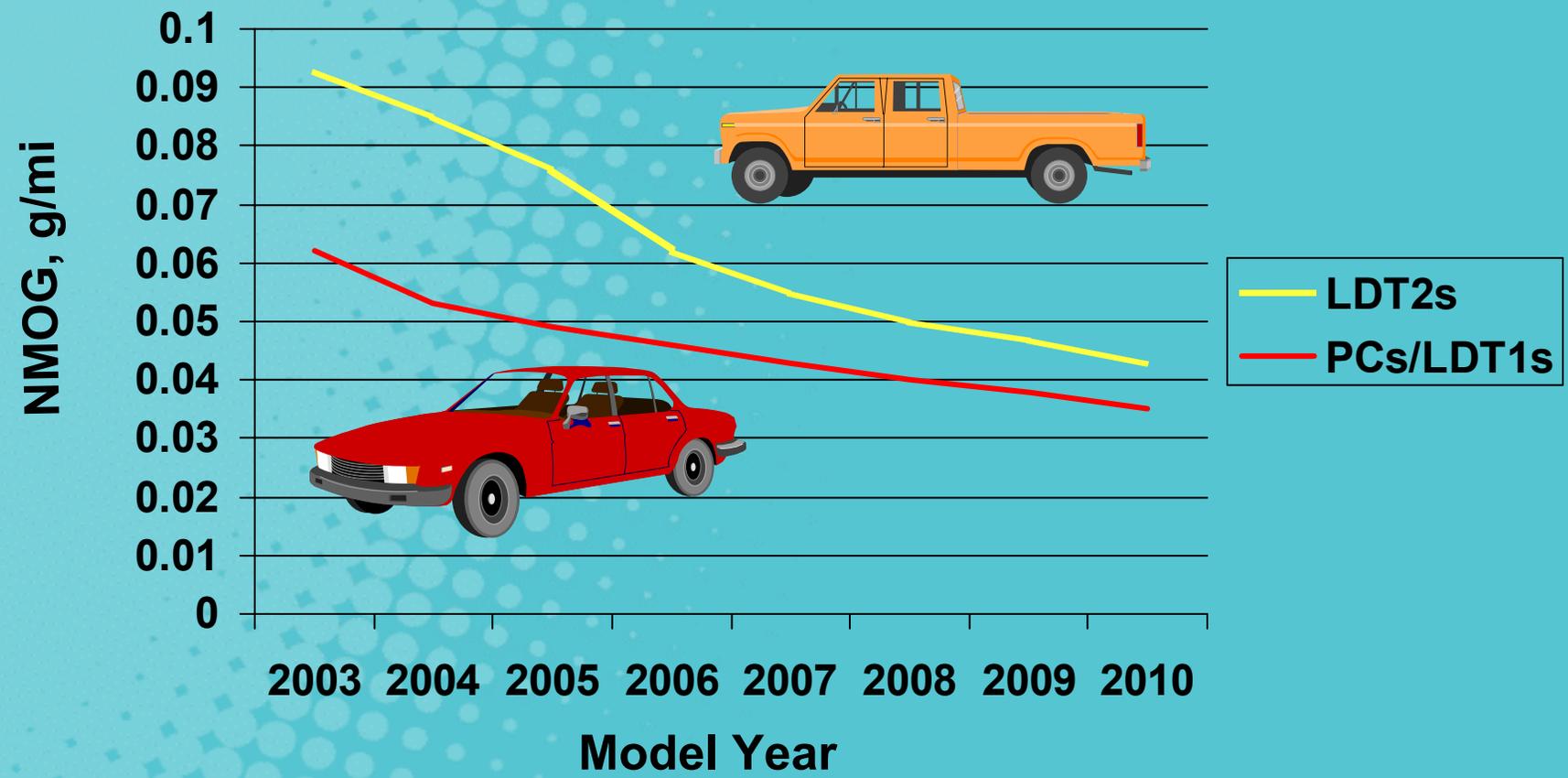
- **Adopted 1998, implementation 2004-2010**
- **Sport Utility Vehicles (SUVs) and pick-up trucks must meet passenger car standards**
- **Lower emission standards for all vehicle categories**
- **New SULEV emissions standard**
- **Elimination of TLEV category**
- **Near- and zero-evaporative requirements**

1998: LEV II Exhaust Emission Standards*

Category	Durability Basis	NMOG	CO	NOx
LEV	50,000 miles	0.075	1.7	0.05
ULEV	50,000 miles	0.040	1.7	0.05
SULEV	120,000 miles	0.010	1.0	0.02
ZEV		zero	zero	zero

* grams per mile

Fleet Average Provides Flexibility

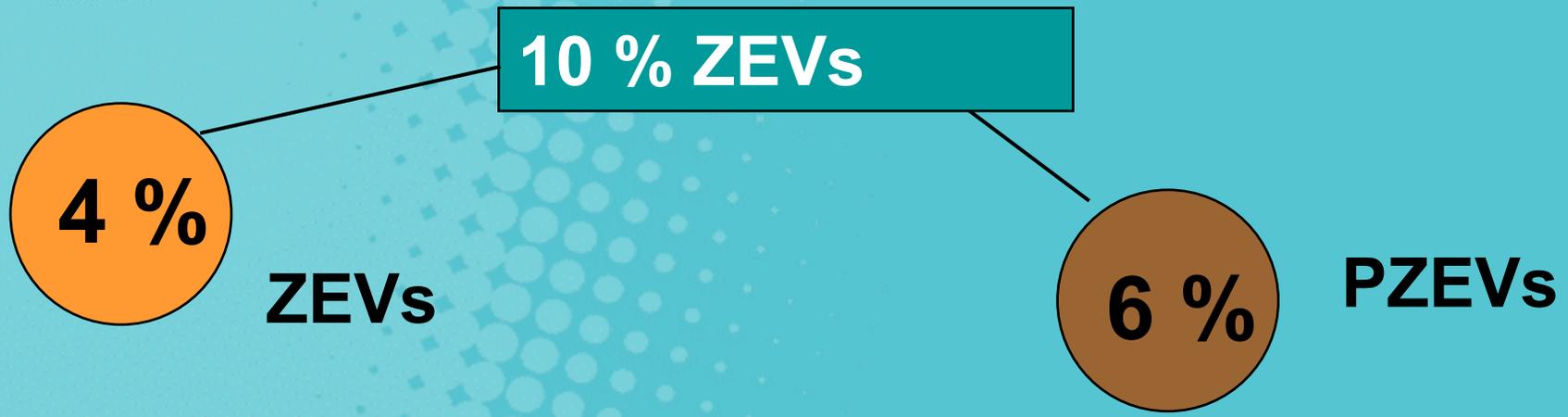


NMOG credits from PC/LDT1 can be used to offset LDT2 NMOG emissions

1998: ZEV Regulation

- ZEV regulation moved to its own separate section (1962)
- Partial ZEV credits for qualifying technologies
- Allowed PZEV substitution:
 - up to 6 percent for large automakers
 - up to 10 percent for intermediate automakers
- ZEV regulation now up to ~8 pages long

1998 ZEV Regulation



1998: “Partial Credit” ZEV

- **SULEV exhaust emissions**
- **Zero evaporative emissions**
- **15 year/ 150,000 mile emissions warranty**
- **On-board diagnostics (OBD)**
- **ZEV credit = 0.2**
(6% / 0.2 credit
=30% of new cars sold)
- **Additional credit for**
 - **HEVs**
 - **Alt. fuels**



PZEV Technology

Tailpipe Emissions

- **Dual wall (insulated) exhaust manifolds**
- **Close coupled catalyst plus downstream catalysts w/integral adsorber(s)**
- **Linear O₂ sensor**
- **Substantial retarded timing at cold start**
- **Electric air injection at cold start**
- **Enhanced durability - greater catalyst loading**

PZEV Technology

Evaporative Emissions

- **Additional trap on canister vent**
- **Carbon trap on engine inlet**
- **Improved seals at joints/ junctions**
- **Consolidation of parts to minimize junctions**
- **Better materials**
 - **less permeation (steel, improved plastics)**
 - **greater durability**

PZEV Emissions Reduction “Durability”

- **Vehicle lifetime trend increasing- cars are lasting longer**
- **While vehicles may last longer, emissions systems may not necessarily remain effective**
- **“Emission reduction durability” is an intrinsic advantage of ZEVs (no tailpipe) and is why the extended warranty is part of PZEV**
- **Implications of 15year / 150k mile emissions warranty**